U.S. Department of the Interior
Bureau of Land Management

February 1989

Western Oregon Program-Management of Competing Vegetation

Final Environmental Impact Statement

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NOTE TO READER

Appendix L, Human Health Risk Assessment, was prepared under contract for use in both the Bureau of Land Management and U.S. Forest Service Vegetation Management EISs for Oregon. The Forest Service equivalent is identified as Appendix D in that document. Because most readers have access to both EISs, Appendix L will not be printed and distributed as a separate BLM volume. This approach will substantially reduce expenses for typesetting, printing and postage. Those who do not have the Forest Service EIS and want a copy of BLM Appendix L (USFS Appendix D) may obtain a copy through Oregon BLM offices in Portland, Salem, Tillamook, Eugene, Roseburg, Medford, Klamath Falls and Coos Bay.

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United States Department of the Interior

BUREAU OF LAND MANAGEMENT
OREGON STATE OFFICE
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PORTLAND, OREGON 97208

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:

February 10, 1989

Dear Reader:

This is the Final Environmental Impact Statement (FEIS) for the control of competing vegetation in western Oregon. The statement analyzes the impacts that would result from the proposed action and seven alternatives. The purpose of the statement is to examine probable environmental impacts and ensure that these impacts are considered along with economic, technical and other factors in the decisionmaking process. The analysis in this FEIS is distinct from the decision process and document to be prepared later.

The analysis provided here has been refined and updated using available new information, public comment, peer review, and internal review of the Draft EIS (DEIS) and DEIS Supplement. Thirty letters received during the DEIS comment period and 49 letters received during the DEIS Supplement comment period are printed in the FEIS, along with our responses.

To ensure adequate opportunity for public involvement, a 60-day review period is provided for this FEIS. You are encouraged to use this extended review period to prepare and submit comments to help us develop a proposed decision. We plan to make the resulting proposed decision available to the public for review and comment later this spring prior to preparation and issuance of a final decision document.

Comments may be sent to:

Oregon State Director
c/o Tom Aufenthie
Bureau of Land Management (931)
P.O. Box 2965
Portland, Oregon 97208

Thank you for your past and future assistance in our efforts to best manage public lands to meet the many and diverse public needs and desires.

Sincerely,

Charles W. Luscher

Charles W. Luscher
State Director, Oregon and Washington

Final

Western Oregon Program-Management of Competing Vegetation

Environmental Impact Statement

Prepared by
U.S. Department of the Interior
Bureau of Land Management

Charles W. Luecker
State Director, Oregon State Office
Portland, Oregon

Proposed Western Oregon Program for the Management of Competing Vegetation

Draft ( ) Final (X) Environmental Impact Statement

U.S. Department of the Interior, Bureau of Land Management

1. **Type of Action: Administrative (X) Legislative ( )**

2. **Abstract:** This Final Environmental Impact Statement describes and analyzes the environmental impacts of implementing any of the alternatives proposed for the management of vegetation in Western Oregon. The alternatives analyzed include: 1) The Proposed Action, 2) Emphasis on Use of Herbicides, 3) Use of All Vegetation Management Treatments Except Prescribed Burning, 4) Emphasis on Use of Effective Labor-Intensive Methods, 5) Restricted Aerial Application of Herbicides, 6) Use of All Vegetation Management Treatments Except the Aerial Application of Herbicides, 7) Use of All Vegetation Management Treatments Except the Application of Herbicides, 8) No Management of Competing Vegetation. Alternative 1 (Proposed Action) is the preferred alternative.

Vegetation management is a necessary component of forest management to achieve desired timber production on lands within the timber base. Prompt reforestation resulting from site preparation and plantation maintenance, in conjunction with the release of young seedlings from competing vegetation, ensures enhanced timber production. In addition, the roadside vegetation control and recreation site weed control are important aspects of forest management.

3. The draft statement was filed with the Environmental Protection Agency (EPA) and made available to the public on June 15, 1983. The supplement to the draft was filed with the EPA and made available to the public on February 28, 1986. The final statement is expected to be filed with EPA and published on February 10, 1989.

4. **For further information contact:**

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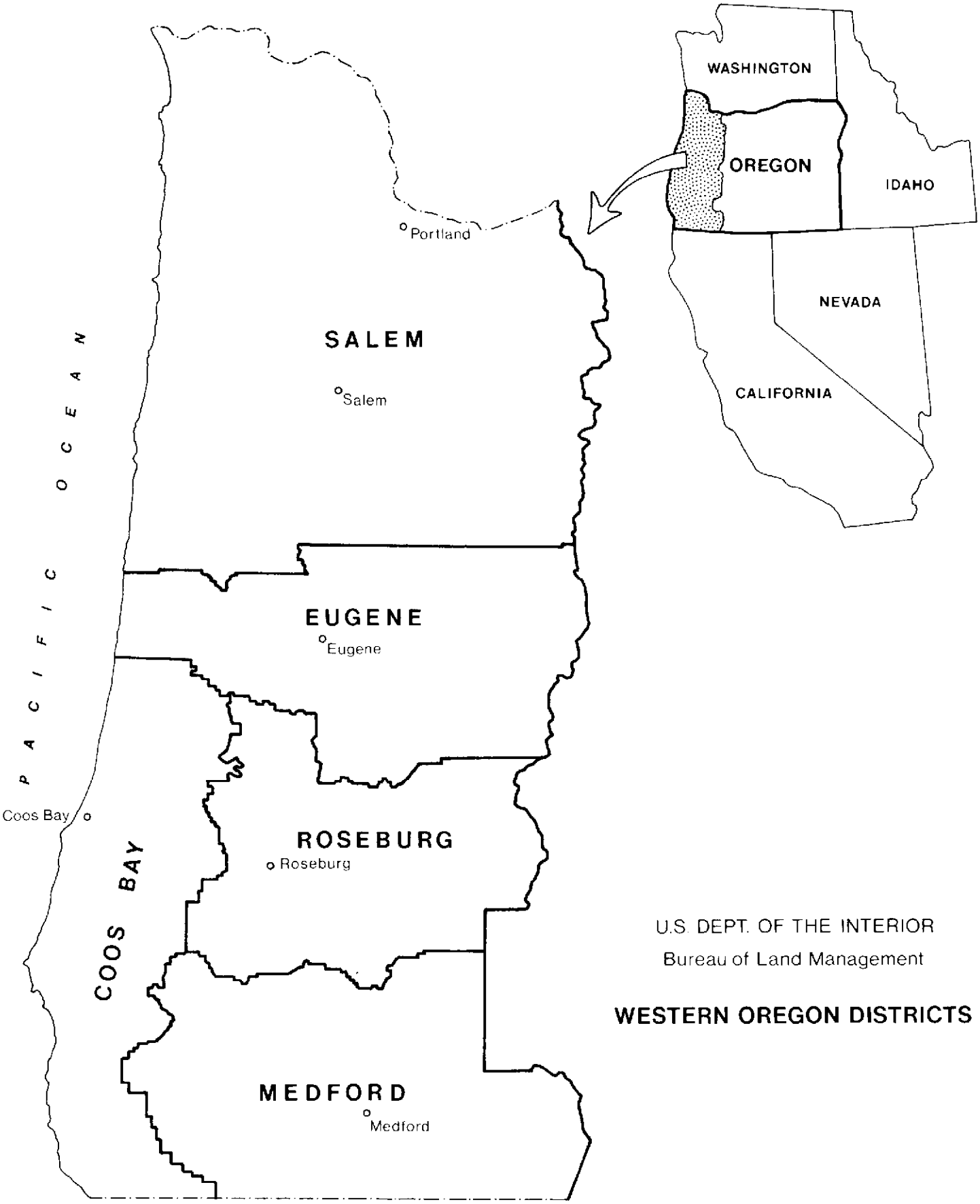

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WESTERN OREGON DISTRICTS

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Summary

Introduction

The Draft Environmental Impact Statement (DEIS) for the Western Oregon Program for the Management of Competing Vegetation, was released for public review and comment in June-1983. That DEIS described and analyzed the environmental impacts of implementing an integrated pest management (IPM) program (see Glossary) for managing vegetation which interferes with the survival and growth of commercial tree species, adversely affects wildlife or encroaches upon recreation sites and roads. It applied to all Bureau of Land Management (BLM)-administered land in the Coos Bay, Eugene, Medford, Roseburg, Salem and portions of the lands that were within the Medford District but are now in the Lakeview District as a result of the 1987 reorganization. Public comment on the DEIS emphasized potential health effects from herbicide use; therefore, based upon these comments and judicial opinion, BLM, in cooperation with the USDA Forest Service (USFS), conducted a Risk Analysis of the impacts of herbicide use on human health. This Risk Analysis was released to the public by BLM as a supplement to the DEIS in February 1986. Through the process of preparing this final EIS (FEIS), additional information has been solicited and incorporated into the document. The FEIS is an update of the material in the DEIS, the Supplemental Statement, response to public comments, and this additional information. Further information will be requested during a 60-day comment period for the FEIS to ensure continued public involvement.

During July-1982, public scoping meetings were held throughout western Oregon. Various concerns relating to the environmental impacts of vegetation management on air quality, soils, water, vegetation, fish/wildlife, social factors, economic conditions, human health and ecology were raised. These concerns are discussed in the environmental consequences section of this summary. Specific scoping information is located in Appendix-A.

The 1982 scoping process identified herbicide use and prescribed burning (see Glossary) as controversial vegetation management methods because of potential human health effects. A review of the USDA Forest Service Vegetation Management EIS scoping which occurred in 1986 indicated no new issues but again stressed herbicide use and prescribed burning as controversial due to potential human health effects. The alternatives considered in this FEIS address known public concerns and continue to reflect current issues.

In accordance with the National Environmental Policy Act (NEPA), this FEIS identifies impacts on the natural and human environment associated with eight alternatives, providing a wide range of options for review and consideration. Alternative-1, The Proposed Action, is the preferred alternative.

The DEIS proposed the use of 14-herbicides. The FEIS proposes to use 10 herbicides, formulated as various commercial products, containing as their active ingredient either atrazine, asulam, dicamba

diuron, fosamine ammonium, glyphosate, hexazinone, picloram, triclopyr, or 2,4-D. Ammonium sulfamate (ammate), diquat, MSMA, and dalapon, proposed for use in the DEIS, are not considered for use in the FEIS. Dalapon was not considered for use in this FEIS because its producer, Dow Chemical, did not renew its label with the EPA. The other three herbicides listed in the DEIS but not discussed in the FEIS were inadvertently omitted from the risk analysis. To prevent further delay of this document, these four herbicides were removed from proposal and analysis in the FEIS under the assumption that reasonable alternatives to their use exist.

Alternatives

The proposed program for managing competing vegetation is for the purpose of preparing sites for prompt and effective reforestation (site preparation), controlling vegetation which competes with planted seedlings to ensure seedling survival (maintenance) and increased tree growth (release), precommercial thinning, control of roadside vegetation for driver safety and protection of road investments (roadside maintenance), and weed control (see Glossary for expanded definitions of site preparation, etc.). Integrated Pest Management consisting of prescribed burning, mechanical, manual, herbicide and biological methods of control, applied singly or in combination, would be available for use under the proposed program and most alternatives. Variables among alternatives include types and amounts of treatments applied to control competing vegetation and constraints on the use of some methods. All alternatives except Alternative 2 require standard operating procedures to minimize environmental impacts according to BLM policy. These procedures include constraints on season of operation, untreated buffer strips, piling of treated material, etc., which are performed in response to environmental aspects, i.e., soil and weather conditions, and sensitive animal and plant species.

Sustained yield timber harvest levels (allowable cuts) for Alternatives 1 and 2 are consistent with harvest goals set in the western Oregon BLM timber management EIS's or decision documents. Alternatives 3 through 7 would require reductions in harvest levels because fully effective treatments would not always be available to substitute for treatments restricted or excluded under these alternatives. Alternative 8 would reduce harvest levels because competing vegetation would either decrease conifer growth or reduce conifer stocking levels on many sites. The alternatives are as follows:

1. **The Proposed Action**. All effective methods of vegetation control would be available for use in an Integrated Pest Management (IPM) program approach for the control of competing vegetation. Annual treatments would include approximately 18,000 acres of prescribed burning, 42,000 acres of herbicide application (including backpack spraying) 12,000 acres of mechanical treatments, 17,000 acres of manual treatments and 600 acres of biological treatments. Streamside, residential, and other buffers would be provided in accordance with BLM policy (see Appendix D).

2. **Emphasis on Use of Herbicides**. Approved herbicides would be used for vegetation management in all cases where they would effectively meet the objectives of specific treatments. In order to reduce costs, herbicides would be applied aerially instead of manually wherever aircraft could reasonably be used. Streamside, residential and other buffers would be provided in accordance with the Oregon Forest Practices Act. (See Appendix E.) Alternative 2 includes the same treatments as Alternative 1 (Proposed action). Treatment acreages between the two alternatives differ in that Alternative 2 has more herbicide treatment proposed and less prescribed burning, mechanical, manual and biological treatments. Annual treatments would include approximately 17,000 acres of prescribed burning; 57,000 acres of herbicide application; 10,000 acres of mechanical treatments; 12,000 acres of manual treatments and 100 acres of biological control.

3. **Use of All Vegetation Management Treatments Except Prescribed Burning**. All approved methods of vegetation control except prescribed burning would be proposed for use in an integrated program. With the exclusion of prescribed burning, Alternative 3 includes the same treatments as Alternative 1; however, the acreage of herbicide application is greater and mechanical treatment is almost doubled in Alternative 3. Other treatment acreages for the two alternatives are relatively similar. Annual treatments would include approximately 60,000 acres of herbicide application; 22,000 acres of mechanical treatments; 24,000 acres of manual treatments and 400 acres of biological control. Streamside, residential, and other buffers would be provided in accordance with BLM policy (see Appendix D).

4. **Emphasis on Use of Effective Labor-Intensive Methods**. Labor-Intensive manual and chemical methods such as hand clearing, hand cutting and backpack spraying would be used in all cases where they could effectively prepare sites or control competing vegetation. Prescribed burning, mechanical, biological and aerial methods would be used for other cases. Alternative 4 has the same treatments proposed as Alternative 1. The acreage for manual treatment is almost doubled in Alternative 4, the acreage for prescribed burning is the same in both alternatives, and the acreage for other treatments decline. Annual treatments would include approximately 18,000 acres of prescribed burning; 36,000 acres of herbicide application; 10,000 acres of mechanical treatments; 28,000 acres of manual treatments and 400 acres of biological control. Streamside, residential, and other buffers would be provided in accordance with BLM policy (see Appendix D).

5. **Restricted Aerial Application of Herbicides**. All approved methods of vegetation control would be available for use in an integrated program. Aerial application of herbicides would be prohibited within one-quarter mile of residences or domestic water diversions. Herbicides could be applied aerially within this one-quarter-mile zone if residents and water users concurred. Aside from the aerial application restriction on streams, other stream buffers would be provided in accordance with BLM policy (see Appendix D). Alternative 5 includes the same treatments proposed as Alternative 1, the main difference being that the acreage proposed in Alternative 5 for herbicide application is less. Other treatments have similar acreages between the two alternatives. Annual treatments would include approximately 18,000 acres of prescribed burning, 39,000 acres of herbicide application, 12,000 acres of mechanical treatments, 18,000 acres of manual treatments and 400 acres of biological control.

6. **Use of All Vegetation Management Treatments Except the Aerial Application of Herbicides**. All approved methods of vegetation control would be available for use in an integrated program, except aerial herbicide application. Alternative 6 has the same treatments as Alternative 1. The treatment acres between the two alternatives differ in that herbicide treatment for Alternative 6 is considerably less and for manual treatment considerably more.Annual treatments would include approximately 19,000 acres of prescribed burning, 27,000 acres of herbicide application, 12,000 acres of mechanical treatments, 31,000 acres of manual treatments and 400 acres of biological control. Streamside, residential and other buffers would be provided in accordance with BLM policy (see Appendix D).

7. **Use of All Vegetation Management Treatments Except the Application of Herbicides**. Competing vegetation would be controlled through prescribed burning and mechanical, manual, and biological methods. Herbicides would not be used under any circumstances. Except for the exclusion of herbicide application, Alternative 7 includes the same treatments as Alternative 1. The acres for the various treatments are similar between the two alternatives with the exception that manual treatment for Alternative 7 is almost three times greater than that proposed for Alternative 1. Annual treatments would include approximately 20,000 acres of prescribed burning, 13,000 acres of mechanical treatments, 48,000 acres of manual treatments and 400 acres of biological control. Streamside buffers would be provided in accordance with BLM policy (Appendix D).

8. **No Management of Competing Vegetation**. Vegetative management would be restricted to site preparation to reduce slash through prescribed burning, mechanical, and manual methods. No scarification would be used. No treatments to control competing vegetation would take place after planting. No roadside maintenance or recreation site weed control would be done. Alternative 8 has only three treatments (prescribed burning, mechanical and manual) compared to Alternative 1 which also has herbicides and biological treatments in addition to these. Similar acreages are proposed for burning and mechanical treatments between the two alternatives; however, manual treatment for Alternative 8 is 50 percent less than proposed for Alternative 1. Annual treatments would include approximately 14,000 acres of prescribed burning, 9,000 acres of mechanical treatments, and 900 acres of manual treatments. Streamside buffers would be provided in accordance with BLM policy (Appendix D).

The eight alternatives were designed to address areas of controversy and issues to be resolved. Effects on human health due to prescribed fire and herbicide use were identified as significant public concerns. In the FEIS, these concerns have been assessed along with other environmental and social impacts associated with a vegetation management program. Each of the alternatives presents the decisionmaker (in conjunction with the environmental consequences associated with an

action) choices or combinations of choices to be used in selecting a final decision.

Environmental Consequences

Air Quality

The major impacts on air quality from prescribed burning would be increases in particulates (see Glossary) and visible smoke. (Human health effects are discussed later in this summary.) Particulate emissions would range from none under Alternative 3 (No Burning) to 8,325 tons per year under Alternative 7 (No Herbicide). Particulate emissions under all alternatives are less than during the 1976-79 baseline period. Particulate levels from BLM prescribed burning would not be expected to exceed the National Ambient Air Quality Standards (see Glossary) for particulates under any alternative. Some residential areas would likely be impacted by visible smoke intrusions under all alternatives except Alternative 3. Visible smoke could also intrude into Class I areas. The probability of visible intrusion would be highest under Alternative 7, which has the highest number of acres proposed for burning. The probability of any visible intrusion will be kept to a minimum by compliance with the Oregon Smoke Management Plan and the Oregon Department of Environmental Quality (ODEQ) guidelines.

Soils

Burning and/or scarification would cause some soil compaction, topsoil removal, dry ravelling or nutrient depletion. These losses would not be significant because of treatment prescription requirements, i.e., seasonal restrictions, soil ripping and low consumption burning. Herbicide use could change the nature of micro-organisms in the soil. The extent of change is unknown as many micro-organisms increase while others decrease. A loss of some soil productivity would occur from these impacts under all alternatives. Soil productivity losses would be greatest under Alternative 7 and least under Alternatives 3 and 8.

Water Resources

Suspended sediment and dissolved solids (see Glossary) concentrations would be most likely to increase under Alternative 7. Potential for herbicides entering surface water would be greatest under Alternative 3. Water temperatures of small headwater streams would be most likely to increase under Alternatives 1, 2 and 5. None of the alternatives are expected to significantly affect regional water quality, streamflow or groundwater movement.

Vegetation

The overall impact of all alternatives would be to suppress competing vegetation, thereby increasing conifer survival and growth. The greatest levels of vegetation control would be provided under Alternatives 1 and 2, which would include the full range of vegetation management practices and would treat the largest number of acres through burning and/or herbicide application. Less impact on competing vegetation would occur under Alternatives 3 through 7, which emphasize or preclude some treatments. Alternative 8 would least impact competing vegetation, resulting in the lowest level of conifer survival, slowest growth, and lowest yield. Estimated impacts on timber harvest levels range from a reduction of 2 million board feet in Alternative 2 to a reduction of 367 million board feet in Alternative 8.

Animals

Terrestrial animal populations and diversity would probably decrease under Alternatives 1 through 5 due to the reduction of timber lands that would be in the early seral stages. However, short-term benefits to some terrestrial animals would occur under all alternatives. Alternatives 1, 2 and 5 would have moderately adverse impacts on animal populations, particularly big game and song birds, because these alternatives would result in the most acres treated and would use the full range of treatment practices. Alternatives 3 and 4 would slightly decrease most terrestrial animal populations. Alternatives 6 and 7 would probably not reduce animal populations below present levels. Alternative 8 would maintain or slightly increase wildlife diversity by maintaining unaltered early seral stages. Most game fish populations would be expected to decline slightly under Alternative 2 due to reduced requirements for streamside buffers, but fish populations would not be significantly impacted under the remaining alternatives.

Cultural Resources

Appropriate measures would be taken to identify and protect cultural sites prior to ground-disturbing activities under all alternatives. Undiscovered cultural sites would be susceptible to damage. Once a site is found, however, measures would be

taken to minimize or avoid damage. Under all alternatives, sites identified before disturbance would be managed to protect significant scientific and/or interpretive values.

Recreation and Visual Resources

Impacts on recreation and visual resources would be low under all alternatives. Treatments would adversely affect recreational opportunities in some areas, resulting in reduced visitor use.

Special Areas

Vegetation management treatments applied near designated or proposed Research Natural Areas, Outstanding Natural Areas, National Wild, Scenic or Recreation Rivers, National Scenic or Recreation Trails, State Scenic Waterways, State Recreation Trails or Areas of Critical Environmental Concern would incorporate standard operating design features to avoid or minimize impacts on important resource values. (See Glossary for descriptions of individual special areas, e.g., Research Natural Areas.)

Human Health

Smoke from prescribed burning would not be expected to significantly impact human health under any alternative. Prolonged exposure to smoke can cause eye, throat or lung irritation. It is unlikely that the general public would incur serious injury although there is evidence that toxic constituents in fire smoke can cause injury if concentrations exceed state air quality standards. Forest workers are more at risk from exposure to smoke or from physical injury such as severe burns.

Physical injuries such as strains, cuts and fractures may result from manual treatments such as manual ignition, backpack herbicide use and using chainsaws for vegetation control. Injuries would most likely occur under those alternatives which emphasize manual treatments.

Herbicide use poses some risk to human health. The probability of the general public being exposed to herbicides is, however, low. The laboratory dosages at which reproductive effects have been detected or at which carcinogenic and mutagenic effects have been noted are much greater in concentration and duration than any expected exposure that would occur to the general public as a result of this program. Because of the low potential for exposure, the likelihood of adverse impacts on the general public's health is low. People working with herbicides will have a higher risk of adverse human health effects, but, under routine settings, the risk is low. Under the worst case assumptions, however, the risk is higher and in these scenarios, worker health is of concern. It is also noted that these same margins of safety improve approximately two to fourfold through the incorporation of simple design features such as requiring workers to wear protective clothing. Direct exposure of forest workers to herbicides which occurs with ground application would be most likely under Alternative 6, and progressively less likely under Alternatives 2, 4, 1, 5, 3, 7 and 8. The probability that the general public would be exposed to herbicides would be greatest under Alternative 3, and progressively less under Alternatives 2, 1, 5, 4, 6, 7 and 8.

Economic Conditions

Compared to current program direction, Alternative 1 would cause no change in total employment. Alternatives 2, 3, 5, 7 and 8 would result in employment decreases. The decreases under Alternatives 7 and 8 would be substantially greater than for the other alternatives. Most of these decreases would be due to reductions in timber harvest as described in the Vegetation Impacts Section. Alternatives 4 and 6 would result in employment increases.

Social Environment

Some unsettling social effects will occur under all alternatives. Alternatives 2, 3, 6, 7 and 8, which emphasize particular uses or restrictions, are likely to generate some strongly polarized reactions. Alternatives 1, 4 and 5, which incorporate a variety of vegetation management practices attempt to respond to a wide range of public concerns and should generate more constructive social impacts.

Conclusion

This summary outlines the vegetation management program, the issues, and the alternatives and provides an overview of the environmental effects of the alternatives. In determining environmental effects, standard operating procedures which "mitigate" (minimize) impacts are considered. Specific details on standard operating procedures can be found in the FEIS and its appendices.

Chapter 1 Description of Alternatives Including the Proposed Action

Ponderosa pine

Purpose of and Need for Action

BLM proposes to implement a program for managing vegetation that adversely affects its timber harvest program, wildlife, road maintenance, or recreation site maintenance in western Oregon. The program will apply to all BLM-administered land in Coos Bay, Eugene, Medford, Roseburg and Salem Districts and those portions of the Lakeview District in Klamath County which were recently transferred from the Medford District as a result of the 1987 State reorganization, affecting 18 counties as shown in Table 1-1. These are primarily revested Oregon and California Railroad (O&C, see Glossary) and reconveyed Coos Bay Wagon Road (CBWR, see Glossary) lands. Vegetation management practices proposed in this environmental impact statement (EIS) will be applied to lands which are in the timber base (see Glossary) and lands which are added to the timber base in the future (e.g., through plan revision or reforestation of brushfields). Those riparian areas which are withdrawn from the timber base will not be treated. Vegetation will also be controlled along roadsides and in recreation sites. Where required for research or operational field trials, vegetation management practices would be applied on withdrawn forest lands under the umbrella of this EIS. Since environmental conditions

on these sites do not significantly differ from the timber base lands, no separate discussion or analysis is necessary.

Description of Purpose and Need

The extent of competing vegetation problems in the Pacific Northwest has been documented by Walstad and Kuch (1987). Natural succession in the forest types eventually results in conifers dominating the site. However, successional plant communities stages following a disturbance such as logging or fire are comprised of many species of herbs, shrubs and hardwoods which are capable of seriously delaying or interrupting the dominance of the conifers (Walstad and Kuch, 1987). Vegetation management practices, including site preparation, maintenance and release are required for economical production of conifers. Surveys conducted in the early 1970's indicated that more than 9 million acres were dominated by noncommercial brush species or were so poorly stocked with conifers that they were essentially nonproductive with respect to wood products (Gratkowski et al. 1974). A more recent analysis of forest land conditions in a 27,000-acre area of the central Oregon Coast Range showed that 38% of the potential conifer site land is dominated by low value hardwoods and noncommercial brush (McCreight 1984). BLM lands are most likely represented by these surveys. Benefits to Douglas-fir stands from release are substantial over a wide range of vegetation types and conditions (Walstad, Brodie and McGinley, 1986; Petersen, 1984, Hobbs and Wearstler, 1985). BLM estimates indicate a potential 31 percent reduction in its current timber harvest (allowable cut) program if no effort was expended to control competing vegetation (Alternative 8).

The BLM has approximately 1.7 million acres of land in the timber base in western Oregon. Of this, 51 percent is in the Western Hemlock zone (867,000 acres), 30 percent in the Mixed Conifer zone (510,000 acres), 15 percent in the Mixed Evergreen zone (255,000 acres), 4 percent in the Interior Valley zone (68,000 acres) and less than 1 percent in each of the other zones (refer to Table 2-1). Table 1-1a lists competing species, associated vegetation zones, herbicides proposed for use, and herbicide effectiveness.

Overall program size is displayed in Table 1-2 which compares average annual program acres by treatment type under all alternatives.

Results from several studies suggest that conifer volume growth in young plantations can be doubled where trees and shrubs that are competing with conifers are controlled (Stewart et al., 1984). A recent survey of BLM lands showed that a majority of the acres of young plantations had conifers that were experiencing significant competition (expressed as both mortality and growth reduction) from grasses/forbs, shrubs, and hardwood trees (White, 1988 personal communication).

Reduced stocking or growth rates result in extended periods for a conifer crop to be produced. This would reduce the annual allowable harvest as indicated in Table 1-4.

Management of competing vegetation is necessary on sites where grass, brush or trees compete with commercial conifers for light, nutrients and/or moisture (Walstad and Kuch 1987). The amount and type of competition vary widely throughout western Oregon due to differences in climate, soils, and vegetation (Walstad, Newton and Boyd, 1987). Methods of managing competing vegetation vary accordingly, but the need for such management exists throughout the EIS area. This need may also include commercial hardwood lands as they are developed by BLM. Any references to conifer crop trees in this EIS could also include hardwoods on designated commercial hardwood lands.

To achieve a high level of timber production on lands in the timber base, harvested lands must be reforested promptly. Control of competing vegetation increases light, water and nutrient availability to conifers. This, in turn, increases conifer growth and chances for survival of an acceptable number of well-spaced trees per acre on as many acres as possible (refer to BLM Manual Supplement 5705 for target stocking standards).

Also addressed in the EIS is vegetation which encroaches upon seed orchards, progeny test sites, research sites, recreation sites, wildlife habitat and roads. Controlling such vegetation is necessary to maintain uniform growing conditions, maintain vigor of seed trees, improve visibility, maintain public access, prevent road damage, reduce fire and safety hazards, enhance wildlife, and maintain the appearance of recreation sites.

In accordance with NEPA, this EIS identifies impacts on the natural and human environment

Table 1-1a Target Species by Vegetation Zone on BLM Lands. Chemical and Effectiveness on Each Target Species

Target Species	Vegetation Zones[1]	Chemical	Effectiveness
Annual grasses	2, 10	Diuron	Excellent
		Atrazine	Excellent
		Hexazinone	Excellent
		Glyphosate	Excellent
Perennial grasses	2, 10	Atrazine	Good
		Hexazinone	Good
		Glyphosate	Excellent
		Dicamba	Excellent
Forbs	1, 2	2,4-D	Excellent
		Dicamba	Excellent
		Diuron	Excellent
		Glyphosate	Excellent
		Hexazinone	Good
Blackberry	1, 2, 3, 8	Glyphosate	Excellent
		Triclopyr	Excellent
Willow	1	Picloram	Excellent
		2,4-D	Good
		Glyphosate	Good
Fern	1, 2, 3, 5	Asulam	Excellent
		Glyphosate	Excellent
Ceanothus sp	1, 2, 3, 4, 8, 10	Triclopyr	Excellent
		Picloram & Triclopyr	Excellent
		2,4-D	Fair
Ocean spray	1, 2, 8	Glyphosate	Excellent
		Picloram & Triclopyr	Excellent
		2,4-D	Good
Salal	1, 2, 3, 5, 6	Picloram & Triclopyr	Good
		Triclopyr	Fair
Snowberry	1, 2, 9	2,4-D	Excellent
		Glyphosate	Excellent
		Triclopyr	Good
Poison oak	2, 3, 4	Picloram & Triclopyr	Excellent
		Glyphosate	Good
		Triclopyr	Good
Red alder	1, 5	2,4-D	Excellent
		Triclopyr	Excellent
		Glyphosate	Good
Bigleaf maple	1, 2, 3	Triclopyr	Good
		Glyphosate	Good

Table 1-1a Target Species by Vegetation Zone on BLM Lands. Chemical and Effectiveness on Each Target Species (continued)

Target Species	Vegetation Zones[1]	Chemical	Effectiveness
Cherry	1, 2, 8	Glyphosate	Excellent
		Triclopyr & 2,4-D	Excellent
Chinkapin	1, 3, 4, 8	Triclopyr	Excellent
		2,4-D	Fair
		Picloram & Triclopyr	Good
Oak sp	2, 3, 4, 10	Triclopyr	Good
		2,4-D	Fair
		Picloram & 2,4-D	Fair
Tanoak	1, 3, 4	Triclopyr	Good
		2,4-D	Good
		Picloram & Triclopyr	Good
Madrone	3, 4	2,4-D	Excellent
		Triclopyr	Excellent
		Picloram & Triclopyr	Good
Ribes sp	3	Triclopyr	Good
		2,4-D	Fair
		Glyphosate	Fair
Elderberry	1	Glyphosate	Excellent
		Triclopyr	Excellent
		Picloram & Triclopyr	Excellent
Vine maple	1, 2, 3, 8	Glyphosate	Excellent
		Triclopyr	Good
		Picloram & 2,4-D	Good
Hazel	1, 2, 3, 8	Glyphosate	Good
		2,4-D	Good
		Triclopyr	Good
Salmonberry	1	Glyphosate	Excellent
		Fosamine	Excellent
		Picloram & Triclopyr	Excellent
Thimbleberry	1	Glyphosate	Excellent
		Picloram & Triclopyr	Excellent
		Picloram & 2,4-D	Good
Manzanita	2, 3, 4, 8, 10	2,4-D	Excellent
		Triclopyr	Good
		Picloram & Triclopyr	Excellent
Rhododendron	1, 5, 6	Triclopyr	Good
		2,4-D	Fair

Table 1-1a Target Species by Vegetation Zone on BLM Lands. Chemical and Effectiveness on Each Target Species (continued)

Target Species	Vegetation Zones[1]	Chemical	Effectiveness
Rabbit-brush	2, 10	2,4-D	Good
		Triclopyr	Good
Huckleberry	1, 5, 6, 7	Triclopyr	Good
		2,4-D	Fair
		Glyphosate	Fair
Scotch broom		Triclopyr	Excellent
		Picloram & 2,4-D	Excellent
		2, 4-D	Good
California laurel	1, 5	2, 4-D	Good
		Triclopyr	Good

[1] Vegetation zones, 1 = Western Hemlock; 2 = Interior Valley; 3 = Mixed Conifer; 4 = Mixed Evergreen; 5 = Sitka Spruce; 6 = Pacific Silverfir; 7 = Mountain Hemlock; 8 = White Fir; 9 = Shasta Red Fir; 10 = Ponderosa Pine

Table 1-1 Counties Affected by Action. Acreage[1] and Status of Land Administered by the Bureau of Land Management

County	0&C	Public Domain	Coos Bay Wagon Road	Total BLM
Benton	51,640	6,027	0	57,667
Clackamas	50,007	16,925	0	66,932
Columbia	11,080	0	0	11,080
Coos	99,262	10,347	59,914	169,523
Curry	36,437	31,832	0	68,269
Douglas	488,744	22,760	14,633	526,137
Jackson	393,709	54,317	0	448,026
Josephine	255,232	39,325	0	294,557
Klamath	46,332	4,279[2]	0	50,611[2]
Lane	278,766	7,635	0	286,401
Lincoln	8,773	11,294	0	20,067
Linn	85,448	3,463	0	88,911
Marion	20,786	219	0	21,005
Multnomah	4,247	0	0	4,247
Polk	41,026	242	0	41,268
Tillamook	27,459	21,901	0	49,360
Washington	11,693	320	0	12,013
Yamhill	41,440	1,255	0	42,695
Eighteen-County Region	1,952,081	232,141	74,547	2,258,769

[1] Includes all BLM acres. Approximately 1.7 million of these acres are in the timber base and would be subject to vegetation management under this EIS.

[2] Acres previously administered by Medford District but now administered by Lakeview District. Excludes acres originally administered by Lakeview District.

Source: BLM records.

associated with the proposed action and other alternatives.

The BLM's principal authority and direction to manage the O&C and CBWR grant lands is found in the O&C Act of 1937 (50 stat. 874; 43 U.S.C. 1181a., et seq.). The disposition of funds derived from the CBWR grant lands is described in an Act approved on May 24, 1939 (43 USC 1181f-1 et seq.). Under these Acts, O&C and CBWR lands classified as timberlands are to be managed under sustained yield principles in order to provide a permanent source of timber supply, watershed protection, stream flow regulation and recreational facilities. Intermingled public domain lands were brought under sustained yield management principles by the BLM's 1969 application to withdraw these lands from entry under all public land laws except certain disposal acts. Withdrawal was completed by Public Land Order 5490 (40 FR 7450 (1975)). In addition, many activities of the BLM are governed by the Federal Land Policy and Management Act of 1976 (90 Stat. 2743, 43 U.S.C. 1701). This law, often referred to as FLPMA, established policy for BLM administration of public land under its jurisdiction.

Notwithstanding any provision of FLPMA, in the event of conflict with or inconsistency between FLPMA and the O&C Act of August 28, 1937 (50 Stat. 874; 43 U.S.C. 1181a-1181j), and the Act of May 24, 1939 (43 USC 1181f-1 et seq.), insofar as they relate to management of timber resources and disposition of revenues from lands and resources, the 1937 and 1939 Acts shall prevail.

During EIS scoping meetings held in Grants Pass, Medford, Coos Bay, Roseburg, Eugene and Salem, Oregon (between July 7 and July 15, 1982), participants were asked to identify issues and alternatives to be addressed in this EIS. The following section describes alternatives considered appropriate for full analysis. Alternatives identified but not determined appropriate for full analysis, along with the rationale for these determinations, are presented in Appendix A, which summarizes the scoping meetings.

Alternatives Including the Proposed Action

There are eight alternatives including the proposed action (Alternative 1, the preferred alternative) for which impacts are analyzed in Chapter 3. Differences between alternatives include types of treatments, treatment levels, program costs, harvest levels, and constraints on vegetation management to benefit other resource values. These relationships are displayed in Table 1-2. Harvest levels discussed in this EIS are allowable cut levels and are used for comparison purposes only. Actual harvest levels may differ. Descriptions of the alternatives and estimates of treatment acres were developed under the assumption that all alternatives would be attainable (e.g., adequate work force would be available and weather conditions would not preclude treatment). Treatments and standard operating design features applicable to each alternative are discussed in the Vegetation Management Treatments and Design Features section of this chapter.

Sustained yield harvest levels (see Appendix C) for Alternative 1 would be consistent with harvest (allowable cut) goals set in the current western Oregon BLM timber management EIS's or decision documents. Effective substitute treatments, if available, would be used where needed. Where alternative treatments would not be feasible or would not meet program objectives, allowable cut estimates would be revised to reflect lower anticipated yields.

Alternative 1: The Proposed Action (PA)

Under this alternative, managers could utilize all approved methods of vegetation management in an integrated program to achieve desired goals (see Table 1-2). This would be the most flexible of the alternatives for making site-specific prescriptions. Prescribed burning, herbicide application, scarification (see Glossary) and manual treatments could be used for site preparation. All chemical, manual and biological maintenance and release treatments would be available. Chemical and manual methods for precommercial thinning could be utilized. Roadside vegetation and weeds would be controlled by mechanical, chemical, manual and biological methods. Streamside, residential and other buffers would be provided in accordance with Oregon BLM policy (see Appendix D). This alternative would provide a balanced approach using Integrated Pest Management (see Glossary).

Alternative 2: Emphasis on Use of Herbicides (Emph. Herb.)

Approved herbicides could be used for site preparation, maintenance and release, precommercial thinning, roadside maintenance, and weed control in all cases where herbicides would effectively meet the objectives of specific treatments. In order to reduce costs and forest worker exposure, herbicides would be applied

Table 1-2 Comparison of Alternatives by Treatment (Annual Estimates)

	Alt. 1[1] (PA)	Alt. 2 (Emph. Herb.)	Alt. 3 (No Burn)	Alt. 4 (Lab.-Int.)	Alt. 5 (Res. Aerial)	Alt. 6 (No Aerial)	Alt. 7 (No Herb.)	Alt. 8 (No Action)
Program Cost ($ millions)[2]	12.0	11.9	13.8	13.2	11.6	14.3	13.8	8.2
Achieve Target Stocking (1,000 ac.)[3]	1,377	1,392	1,231	1,375	1,357	1,174	813	496
Achieve Minimum Stocking(1,000 ac.)[3]	268	253	389	270	284	405	595	730
Below Minimum Stocking (1,000 ac.)[3]	0	0	25	0	4	66	237	419
Treatments (acres)								
Site Preparation								
Mechanical								
Scarification	2,511	2,101	2,559	1,921	2,521	2,621	2,751	0
Piling	420	320	1,460	320	320	400	400	140
Gross Yarding	5,515	5,385	15,009	5,506	5,485	5,485	5,535	8,415
Manual								
Cutting	1,810	1,590	1,070	2,210	1,720	2,520	2,860	520
Spot Clearing/Scalping	295	270	7,578	1,535	425	450	940	405
Chemical								
Aerial	8,660	11,770	16,111	5,625	7,668	0	0	0
Ground	3,440	3,585	1,882	5,277	1,720	9,001	0	0
Prescribed Burning	18,026	17,271	0	18,171	18,021	18,666	18,716	13,911
Maintenance and Release								
Manual								
Cutting	1,265	436	1,448	6,054	1,656	13,364	20,486	0
Mulching	288	50	288	648	348	478	5,645	0
Pulling	160	100	180	265	170	240	510	0
Chemical								
Aerial	24,30	27,342	35,962	15,051	21,627	0	0	0
Ground	3,910	7,624	4,169	8,774	5,242	15,708	0	0
Biological								
Seeding	300	0	45	35	35	35	15	0
Animals	330	130	330	330	330	330	330	0
Precommercial Thinning								
Manual	12,528	9,173	12,588	12,628	12,588	12,588	10,961	0
Chemical	0	3,520	0	0	0	0	0	0
Roadside Maintenance								
Mechanical	3,354	2,058	3,354	1,787	3,354	3,354	3,817	0
Manual	824	616	824	4,091	824	824	2,224	0
Chemical	2,029	3,209	2,029	977	2,029	2,029	0	0

[1]*The current program and Alternative 1 have the same balance of practices.*
[2]No budget ceiling: each alternative is funded in an effort to achieve allowable cut (see Appendix B).
[3]Acres included in the current timber base.
Note: Treatment levels represent estimated average annual acreages for the five western Oregon districts combined. Treatments could be applied on all commercial forest lands. Acres in columns are not additive because some acres would receive multiple treatments.

aerially instead of manually wherever aircraft could reasonably be used. Streamside buffers would be those required by the Oregon Forest Practices Act (see Appendix E). Mechanical, manual, prescribed burning and biological treatments would be available, but their use would be to a lesser degree than the proposed action.

Alternative 3: Use of All Vegetation Management Treatments Except Prescribed Burning (No Burn)

Prescribed burning would be eliminated as a site preparation method for this alternative. Use of manual, mechanical and herbicide methods would be increased to prepare sites and control competing vegetation. Biological methods would also be utilized.

Alternative 4: Emphasis on Use of Effective Labor-Intensive Methods (Lab.-Int.)

Labor-Intensive manual and herbicide methods such as hand clearing, hand cutting and backpack spraying would be used in all cases where they would effectively prepare sites or control competing vegetation. Where treatment objectives could not be met by manual methods, mechanical and aerial herbicide application would be used. Buffers would be the same as Alternative 1. Prescribed burning and biological treatments would also be available.

Alternative 5: Restricted Aerial Application of Herbicides (Res. Aer.)

This alternative would prohibit aerial application of herbicides within one-quarter mile of residences or domestic water diversions in treated drainages. Herbicides could be applied aerially within this one-quarter-mile zone if residents and water users concurred. This one-quarter-mile restriction would not apply to ground methods of herbicide application. Mechanical, manual, prescribed burning and biological treatments would be available for use under this alternative.

Alternative 6: Use of All Vegetation Management Treatments Except the Aerial Application of Herbicides (No Aerial)

Herbicide application would be limited to ground methods under this alternative. Increased use of treatments such as backpack spraying and manual cutting would be necessary to meet management objectives. Mechanical, manual, prescribed burning and biological treatments would be available for use under this alternative.

Alternative 7: Use of All Vegetation Management Treatments Except the Application of Herbicides (No Herb.)

Herbicides would not be used under any circumstances under this alternative. Site preparation would be accomplished by prescribed burning, scarification, or manual methods. Trees would be planted, and maintenance treatments such as grass/forb seeding, scalping, hand pulling, cutting, and mulching would be used. Conifer release, including precommercial thinning, would be limited to manual methods. Recreation site maintenance, roadside vegetation control, and weed control would be accomplished by manual or mechanical methods.

Alternative 8: No Management of Competing Vegetation (No Action)

Sites would be prepared by reducing slash sufficiently to alleviate fire hazards and by clearing sufficiently for planting seedlings. This would be accomplished with piling, gross yarding, manual cutting and spot clearing/scalping. Scarification would not be used. No treatments to control competing vegetation, including precommercial thinning (see Glossary), would take place after planting. No roadside or recreation site weed control would be done under this alternative.

Vegetation Management Treatments and Standard Operating Design Features

The purpose of this section is to discuss available treatment methods and protective measures (standard operating design features) which will be used in conjunction with them. Table 1-2 displays the types of treatment and treatment levels for each alternative based on an unconstrained budget. Not every treatment listed in Table 1-2 would be applied to every acre. A number of treatment combinations are possible and could be employed. Three or four different kinds of treatment would normally be applied from site preparation through precommercial thinning. Repeated applications of the same treatment would occasionally be required. Where competition is minimal or where it can be minimized by protective action, only one or two kinds of treatment might be required, with no reapplications.

The vegetation management process begins with a field survey (site analysis) to identify the existing vegetation interactions (i.e., what vegetation is present and what are the likely growth trajectories of both the conifers and shrubs). An assessment of treatment needs is made (design). Some treatment needs for site preparation and stand maintenance would be identified during timber sale planning.

Other vegetation management treatment needs would be identified after harvest operations are completed and during initial and subsequent surveys. These pre-treatment field surveys would be done in accordance with the Field Guide to Policies and Procedures Required for Vegetation Management Using Integrated Pest Management Practices (USDI, BLM 1981a) (see Appendix D) and would include design criteria such as consideration of all feasible treatments (preventive, corrective), potential impacts, effectiveness and cost. Information from these surveys would be used as a basis for prescribing silvicultural treatments and for writing site-specific environmental assessments (see Glossary).

Information on herbicides and carriers proposed for use is presented in Table 1-3. Application rates will vary depending on the species that need to be controlled or, in the case of soil active herbicides, on soil type. If the dominant competing species is hard to control, the higher rate of herbicide will be used; if it is not, the lower rate will be used.

The activity of soil-active herbicides such as atrazine and hexazinone is affected by soil type and may be more persistent in arid area soils. Picloram may have a slight potential for accumulation under these conditions. In heavy clay soils, such as those found in the Willamette Valley, hexazinone adheres to the soil tightly requiring higher rates of application for the control grasses and forbs. In loamy soils, hexazinone is not held as tightly to the soil, so lower application rates are used for weed control. Table 1-1a shows the different vegetation zones and target species on which these herbicides are used.

Herbicides will only be applied when it is apparent that they are the most feasible method of ensuring the survival or growth of conifers. Information on the current state of a plantation will be collected before treatment is prescribed and will include data to quantify competition, such as overtopping and percent cover and height of competing species.

Aerial application of herbicides will be restricted by specific weather conditions so that chemicals do not enter water or move to nontarget areas. They will not be applied when wind velocity exceeds 5 miles per hour, temperature exceeds 70°F, snow or ice covers vegetation, foggy weather exists that could limit pilot visibility, relative humidity is less than 50 percent, raining (or expected rain) would reduce the effectiveness of the chemical being applied, air turbulence is so great as to seriously affect the normal spray pattern, and temperature inversions are present which could lead to off-site movement of the spray.

Buffer strip size adjacent to live streams, lakes or ponds depends on the method of application. According to BLM standards in Appendix D, aerial spraying requires a 100-foot buffer, vehicle spraying a 25-foot buffer and hand application a 10-foot buffer.

All BLM personnel active in a herbicide spray program will attend a pesticide training course. At least one person from each resource area will be BLM or Oregon State-certified. Training will consist of at least 32 hours of instruction in all aspects of a herbicide application program, including accident prevention and safety.

More detailed information can be found in Chapter 3 and Appendix L or in Environmental Fates and Impacts of Forest Use Pesticides (Ghassemi et al. 1981), Pesticide Background Statements (USDA, FS 1984), Transmission Facilities Vegetation Management Program Final EIS (USDE, BPA 1983) and Environmental Effects of Vegetation Management Practices on DNR Lands (Newton and Dost 1981). Herbicides would be applied and monitored in accordance with the Field Guide to Policies and Procedures Required for Vegetation Management Using Integrated Pest Management Practices in Western Oregon (USDI, BLM 1981a, or subsequent revisions) (see Appendix D), except that requirements for streamside buffers would be less restrictive under Alternative 2.

Most treatments would be accomplished through service contracts awarded on a competitive basis. To comply with applicable laws, regulations and policies, contractors would be governed by performance standards set forth in the standard and special provisions of contracts. Special provisions for a contract would be selected in accordance with the scope of the action, accepted mitigation measures and the physical characteristics of the specific site. BLM manuals, manual supplements and field guides provide a variety of approved standard and special provisions for use in individual contracts. These provisions would be modified if analyses in this EIS or future environmental documents indicate a need for change.

In addition to the previously noted standards for aerial application, the following requirements will be present in contracts. Water intake systems will be arranged so an air gap or reservoir is between the

Table 1-3 Herbicide Use by Alternative - Estimated Annual Acreages

Chemical[1]	Carrier	Season[3]	Application Rate[2] (lbs./acre)	Alt. 1 (PA)	Alt. 2 (Emph. Herb.)	Alt. 3 (No Burn)	Alt. 4 (Lab.-Int.)	Alt. 5 (Res. Aerial)	Alt. 6 (No Aerial)
Site Preparation - Aerial									
Atrazine	Water	FWS	3-4	250	275	250	200	150	0
Atrazine + 2,4-D	Water	WS	3-4, 2-3	3,690	4,635	4,460	2,545	3,225	0
Asulam	Water	S,SM	1.6	65	65	30	65	65	0
2,4-D	Water	S, SM, F	2-4	260	510	310	125	210	0
2,4-D	Oil & Water	S, SM	2-4	400	500	1,180	400	400	0
2,4-D	Oil	WS	2-4	40	40	260	60	40	0
2,4-D + Triclopyr ester	Oil & Water	S, SM	4-8, 3-4	50	50	150	50	50	0
Triclopyr ester	Water	S, SM, F	1-8	983	2,168	4,455	925	935	0
Triclopyr ester	Oil & Water	S	4-8	405	625	705	195	395	0
Triclopyr ester	Oil	W, S	2-5	423	423	1,189	50	253	0
Glyphosate	Water	SM, F	1.5-5	674	874	1,129	355	691	0
Triclopyr ester + Glyphosate	Oil	S, W	2,1	45	45	264	45	45	0
Triclopyr ester + Glyphosate	Water	S, SM, F	2.1	45	45	264	45	45	0
Hexazinone	Water	S, SM, F	1-2	580	630	605	505	415	0
Picloram	Water	S, SM, F	1-2	100	175	210	35	99	0
Picloram + Triclopyr ester	Water	S, SM, F	1-2, 3-4	50	90	50	25	50	0
Glyphosate + Atrazine	Water	S, SM, F	4,4	600	600	600	0	600	0
Fosamine Ammonium	Water	S, SM, F	5-12	0	20	0	0	0	0
Site Preparation - Ground									
Atrazine	Water	FWS	3-4	25	25	20	75	65	75
Atrazine + 2,4-D	Water	W, S	3-4, 2-3	280	365	345	2,810	555	5,237
Asulam	Water	S, SM	1.6	0	0	40	5	0	65
2,4-D	Water	S, SM, F	2-4	10	10	40	220	60	60
2,4-D	Oil	W, S	2-4	0	0	0	10	0	20
2,4-D	Oil & Water	S, SM	2-4	30	0	30	60	65	50
2,4-D + Triclopyr ester	Oil & Water	S, SM	2-4, 1-3	0	0	0	0	0	20
Triclopyr ester	Oil	W, S	2-5	40	80	70	180	60	160
Triclopyr ester	Water	S, SM, F	2-8	0	0	0	357	10	0
Triclopyr amine	Water	S, SM, F, W	1-5	2,410	2,435	757	125	100	225
Triclopyr amine	Undiluted	S, SM, F, W	1-2	310	300	160	230	140	170
Glyphosate	Water	SM, F	0.5-5	185	180	190	805	340	2,424
Hexazinone	Water	W, S	1-2	40	50	50	310	155	300
Picloram	Water	S, SM, F	0.1-3.8	90	120	120	80	120	145
Picloram + Triclopyr ester	Water	S, SM, F	1-2, 1-3	25	10	50	10	50	50
Maintenance & Release - Aerial									
Atrazine	Water	F, W, S	3-4	130	130	237	130	210	0
Atrazine + 2,4-D	Water	W, S	3-4, 2-3	3,195	3,322	3,590	1,750	2,845	0
Asulam	Water	S, SM	1.5	0	0	0	0	0	0
2,4-D	Water	S, F	1.5-3	3,650	4,270	3,934	2,600	2,895	0
2,4-D	Oil & Water	S	1.5-3	2,450	2,507	3,324	1,492	2,540	0
2,4-D	Oil	W, S	1.5-3	1,555	965	857	596	690	0
2,4-D + Triclopyr ester	Oil & Water	S	1-3, 1-3	1,610	1,850	1,074	777	1,184	0
Triclopyr ester	Water	S, F	1-4	1,690	2,895	5,820	1,513	1,970	0
Triclopyr ester	Oil & Water	S	1-2	1,000	1,250	1,920	510	1,100	0
Triclopyr ester	Oil	F, W	1-2	1,830	1,907	4,817	1,353	1,760	0

Table 1-3 Herbicide Use by Alternative - Estimated Annual Acreages (continued)

Chemical[1]	Carrier	Season[3]	Application Rate[2] (lbs./acre)	Alt. 1 (PA)	Alt. 2 (Emph. Herb.)	Alt. 3 (No Burn)	Alt. 4 (Lab.-Int.)	Alt. 5 (Res. Aerial)	Alt. 6 (No Aerial)
Glyphosate	Water	F	1-3	5,465	6,198	7,751	3,380	5,015	0
Triclopyr ester + Glyphosate	Water	S, F	1,1	300	300	820	200	300	0
Hexazinone	Water	W, S	1-2	590	798	818	650	528	0
Glyphosate + Atrazine	Water	W, S	4,4	600	600	600	0	600	0
Triclopyr ester + Glyphosate	Oil	W	1,1	180	250	300	100	150	0
Fosamine Ammonium	Water	S, F	3-4	55	100	100	0	40	0
Maintenance & Release - Ground									
Atrazine	Water	F, W, S	3-4	0	15	0	0	0	55
Atrazine + 2,4-D	Water	W, S	3-4, 2-3	620	350	705	2,461	780	3,250
Asulam	Water	S, SM	1.6	30	30	0	30	30	30
2,4-D	Water	S, F	1.5-4	90	90	170	390	465	1,960
2,4-D	Oil & Water	S	1.5-3	50	50	50	140	235	875
2,4-D	Oil	W, S	1.5-4	0	20	20	114	44	354
2,4-D + Triclopyr ester	Oil & Water	S	1-3, 1-3	0	30	0	0	0	55
Triclopyr ester	Water	S, F	1-4	70	50	120	220	350	476
Triclopyr ester	Oil & Water	S	1-2	50	0	50	250	100	350
Triclopyr ester	Oil	F, W	1-4	1,570	1,590	1,749	1,730	1,500	2,200
Triclopyr amine	Water	SM, F, W	1-2	140	3,335	120	140	140	1,280
Triclopyr amine	Undiluted	SM, F, W	1-5	365	450	410	250	370	600
Triclopyr amine	Oil & Water	S, F	1-2	0	0	0	0	0	0
Glyphosate	Water	F	1-5	515	555	405	1,869	688	3,438
Triclopyr ester + Glyphosate	Water	SF	2,2	0	0	0	0	0	60
Hexazinone	Water	W, S	1-2	280	270	250	210	330	505
Picloram	Water	SM, F, W	1-4	130	110	110	210	210	210
Picloram + Triclopyr ester	Water	S, F	.5, .5	0	750	0	750	0	0
Dicamba	Oil	S	1.5	0	0	0	0	0	0
Fosamine Ammonium	Water	F	4	0	10	10	10	0	10
Roadside Spray & Weed Control									
2,4-D	Water	S, SM	1.5-3	50	50	50	30	50	50
2,4-D + Triclopyr ester	Oil & Water	S, SM	1-3, 1-3	363	537	363	442	363	363
Triclopyr ester	Water	S, SM	1-5	1,245	1,828	1,245	155	1,245	1,245
Dicamba	Water	S, SM	2-3	200	238	200	300	200	200
Diuron	Water	S, M	8-16	171	171	171	50	171	171
Undecided				0	385	0	0	0	0

[1]Does not include all types, brands or formulations of herbicides currently registered by EPA for forestry use.

[2]Active ingredients (in total pounds) applied may be figured by multiplying the application rate by the estimated acres under each alternative. Application rates shown reflect the range of different application rates used in western Oregon. All applications are limited to label specifications.

[3]Season of application, S = spring, F = fall, W = winter, SM = summer

live water intake and the mixing tank to prevent backflow of chemical into the water source. Contractors will not wash out any spray tanks in or near any streams or dispose of any chemical containers on the contract area.

During aerial spraying, spray will be turned off at the end of spray runs during the time when a turn is being made. Initial spray swaths along buffer strips or areas to be protected will be made parallel to these areas and before spraying commences on

the rest of the unit. Mixing and loading will take place in an area where an accidental spill will not flow into a stream or body of water. Aerial application equipment will be equipped with no-drip nozzles that use a vacuum or syphon automatic shut off system that will draw the chemical back from the boom when not spraying. Helicopters will normally be required to fly at an air speed of 40 to 50 mph at a safe distance above the vegetation. Spray pressure in the boom will normally be 20 to 35 pounds per square inch. In addition, during air operations a radio network will be maintained which links all parts of the project.

Prior to any vegetative treatment or ground disturbance, BLM requires a survey of the project site for plants and animals listed or proposed for listing as threatened and endangered species (see Glossary). If a project might affect any listed or proposed Federal threatened or endangered species or its critical habitat, every effort would be made to modify, relocate or abandon the project in order to obtain a no-effect determination. If BLM determines that a project cannot be altered or abandoned, consultation with the U.S. Fish and Wildlife Service would be initiated (50 CFR 402; Endangered Species Act of 1973, as amended).

Whenever evidence of historic or prehistoric (see Glossary) occupation is identified during BLM activities, special surveys are undertaken to determine possible conflicts in management objectives. In addition, a Class III (complete) cultural resources inventory is required on all areas to be subjected to ground disturbing activities. This is accomplished in the pre-planning stage of a treatment, and the results are analyzed in the environmental assessment addressing the action (BLM Manual 8100, Cultural Resource Management). When a cultural resource is discovered during vegetation management activities which might adversely impact that resource, operations in the proximity are immediately suspended and may only resume upon receipt of written instructions from the BLM authorized officer. Procedures under 36 CFR 800 would be followed, including consultation with the State Historic Preservation Officer in the determinations of eligibility, effect, and adverse effects.

Site Preparation

Site preparation treatments are used to prepare newly harvested or inadequately stocked areas for planting a new crop of trees. The primary treatment objectives are to provide planting spots and planting crew access by reducing slash and to improve plantation success by reducing vegetation that competes with conifers (Cleary et al. 1978). Four methods of site preparation (burning, chemical, mechanical, and manual) are planned for use on BLM-administered lands in western Oregon.

The most common site preparation treatment would be prescribed burning, included in all alternatives except Alternative 3 (Table 1-2). Prescribed burning clears areas for planting and reduces both the fire hazard and competing vegetation. Slash piles are often burned, usually to reduce habitat of animals that damage conifers. Broadcast burning would be done when weather and fuel conditions are favorable, usually between March and November. Prescribed burning would occur only at times approved by the Oregon State Department of Forestry, which administers the Smoke Management Plan portion of the State Implementation Plan. The criteria used for burn approval under the Smoke Management Plan includes such things as: elevation of burn unit (is it above known inversion layers?); upper and lower level wind directions (will smoke drift toward designated areas?); temperature inversions (will the smoke get trapped or rise to high levels?); tonnage to burn (how much smoke will occur?); burn location related to designated areas (what is the probability of intrusion?); and forecasts (will changes cause smoke problems?). When all conditions indicate that the probability of good dispersal is high, approval is generally given. BLM districts may use additional criteria during certain times of the year.

All burning would be conducted in accordance with Fire Management Policy (BLM Manual 9211) which requires the preparation of a prescribed burning plan in advance of every burn. The fire plan tailors each burn to specific requirements of the site. It addresses physical characteristics of the burn area, objectives of the burn, fuels on site (loading and characteristics), weather conditions under which the plan will be implemented, expected fire behavior, air and water quality restrictions, lighting sequence, emergency fire suppression plan, equipment and personnel needs, public contacts, and safety.

Two methods of igniting prescribed burns are normally used by the BLM in western Oregon. Drip torches are used to apply a burning mixture of diesel fuel and gasoline by hand. Gelled gasoline (see Glossary) is applied to broadcast burn areas by helicopter-carried drip torch (see Glossary), and is applied to piles by hand. When using hand-

Applying herbicides with backpack sprayer

carried drip torches, individuals traverse the burn area in a specified pattern developed in advance of the prescribed burning plan. By tailoring traverse patterns to each burn area, effectiveness, maximum safety, and control can be maintained. When using helicopter-carried drip torches, individuals are generally not used to manually light any of the burn area except possibly along firelines where the helicopter cannot reach. Helicopters are commonly used on steep or slash-covered units where manual lighting would be hazardous for individuals, or on units that are very large and require the speed of helicopter lighting to accomplish the goal, or where mass ignition can be effectively used to reduce emissions.

Site preparation treatments using herbicides (Table 1-3) are included in all alternatives except Alternatives 7 and 8. Herbicides are used to increase plantation survival rates by controlling grasses, forbs, brush, and noncommercial tree species prior to planting. These treatments improve the potential for success by reducing competition for light, moisture, and soil nutrients. In some cases, herbicides would be applied prior to burning to desiccate vegetation, creating drier fuels for improved consumption.

Stage of plant growth, season of application, and chemical rates of application are especially important in prescribing herbicide treatments. All plants exhibit seasonal changes in susceptibility to herbicides, and these changes vary widely in western Oregon. Information on the most effective timing of applications is found in published research (Conard and Emmingham, 1983, 1984a, 1984b, 1984c, 1984d).

Herbicides are applied in a number of ways depending upon the treatment objective, topography of the treatment area, target species, crop species, anticipated costs, equipment limitations, and potential environmental impacts. Aerial application is done by helicopters. It is the safest and most cost effective method of application and is especially useful in areas of steep terrain where units are large. It can be used for site preparation, maintenance, or release. Aerial application may not be useful in areas that are dissected by many streams because of the required buffers, or in areas adjacent to dwellings. Ground application is accomplished through injection, backpack spraying, vehicle-mounted spray systems, and stump treatments. Injection involves cutting slits in the stems of target plants and applying herbicide into the slits using hand-held containers or injectors. This method is useful on small to medium-sized units, where a specific tree-form species, such as bigleaf maple is being targeted. It causes little impact to the environment because the chemical is injected into the tree.

Backpack systems use a pressurized sprayer to apply herbicides as either a broadcast spray or directly onto individual or small concentrations of plants. It is difficult to use in steep terrain because of the weight of the spray mix plus the need to refill spray tanks after every 3 to 5 gallons of application. It is the least safe method of application because the applicator is in close contact with the spray solution. It is less cost effective than aerial spraying, but also has less environmental impact because of the reduced potential for drift. The latter advantage often leads to its use in more populated areas. It may be used for site preparation, maintenance or release. Vehicle-mounted spray systems incorporate hand-held spray nozzles or fixed nozzles and are used along roadsides and in some flat areas. These systems are intermediate between aerial and ground applications as far as safety and environmental impact. They are obviously limited by the steepness of the terrain. Stump treatment normally involves the direct application of liquid herbicides to stumps and is accomplished using a backpack system or by direct application of the herbicide to the cut surface of the stump. The use

Hand cutting competing vegetation

of a mist blower is restricted to seed orchards. This is mounted on a vehicle and sprays fine droplets into the air.

In mechanical site preparation, machines are used to clear sufficient numbers of planting spots and reduce competing vegetation. Mechanical methods would be used under all alternatives, except that scarification would not be used under Alternative 8. The acreages identified for treatment are listed in Table 1-2 for each alternative. In western Oregon, the most common mechanical methods consist of scarification and piling or windrowing of slash, brush and unmerchantable trees. This is accomplished by using a tractor equipped with a brush blade and is restricted to slopes less than 35 percent, to time periods when soil moisture is low and to suitable soil types.

While not normally defined as a site preparation method, gross yarding (see Glossary) of unmerchantable material during or following logging operations is sometimes used to reduce fire hazard, improve access to planting spots, or reduce the smoke hazard if the site is to be burned.

Manual methods of site preparation utilize hand labor to remove competing vegetation and prepare planting spots. Manual methods are normally used where they are effective and where environmental reasons preclude the use of prescribed burning, herbicides or mechanical methods. Acres identified for manual site preparation are shown in Table 1-2. Manual methods used in western Oregon include hand cutting and clearing.

Hand cutting and clearing is done with hand tools, including power saws. It involves activities such as scalping (see Glossary), cutting stems of competing vegetation and cutting holes in slash concentrations to clear spots for planting. Hand cutting of green brush is occasionally done prior to burning to increase amounts of dry fuels and improve results of burning.

Plantation Maintenance and/or Release

Vegetation management practices which are applied after planting are categorized as either maintenance or release treatments. Maintenance treatments are used to promote the survival and establishment of conifer seedlings. Release treatments reduce competition between shrubs or grass and existing commercial conifer seedlings and are intended to promote dominance and growth of established conifers.

Fast-growing brush and hardwoods such as vine maple, ceanothus, red alder and tan oak overtop and suppress slow-starting conifer seedlings. Brush and hardwoods grow rapidly, shutting out essential light and competing for water during dry periods. On most sites, grass and forbs also compete effectively for water. The degree and type of competition vary by site. With reduced competition, conifers grow beyond the point where they can be overtopped or further suppressed by surrounding vegetation. When this point is achieved (approximately 3 to 10 years from planting), further control of competing vegetation may not be necessary except for precommercial thinning (Cleary et al. 1978).

The primary methods of maintenance and release are herbicide application, mulching, hand pulling and cutting. Occasionally, grazing and grass/forb seeding (biological methods) are also used on an experimental basis (Table 1-2).

Mulching involves covering the ground with paper, plastic, or other material to prevent growth of competitors around seedlings. It is used primarily in areas of southwestern Oregon where grass/forbs is the primary competitor.

Hand pulling is possible only for plants arising from seed and is not effective on sprouted brush with well developed root systems. It is primarily used on young ceanothus, Scotch broom, and manzanita plants. Ceanothus can be readily pulled out where it is 1 to 3 feet high and can be cut off at the root crown where it is 3 to 5 feet high (Horowitz 1982). Plants less than 1 foot high are easily pulled, but because they often occur in great density, it is suggested that treatment be postponed until after natural mortality reduces their numbers, usually by the third year. Pulling operations can be conducted at any time from spring until the ground is covered by snow, and are most effective in loose volcanic soil.

Hand cutting for maintenance and release is the same as that for site preparation, except it is limited to cutting of competitive brush and hardwood species, usually in proximity to conifers. Cost and biological effectiveness are highly dependent on terrain, soils, season of treatment, age, and size of conifers to be released and the species, age, quantity, and size of target vegetation. Recent studies on cutting red alder have produced good results. After two growing seasons, stems cut during June and July experienced a 95-96% mortality rate (Turpin and DeBell, 1986). Additionally, stems cut so that the resulting stumps were less than 20 cm high had the highest mortality and the fewest and shortest sprouts. Control is poor, however, on all other sprouting species and often requires two or more cuttings to attain conifer release (Roberts C.A., 1982).

Herbicides have been used effectively to inhibit the growth of vegetation competing with conifers. The use of herbicides for maintenance and release is included in all alternatives except Alternatives 7 and 8. Table 1-3 shows chemicals to be used and estimated acreage to be treated. In addition to the application methods identified under Site Preparation, the following information (from Gratkowski 1975, Conard and Emmingham 1983, 1984a, 1984b, 1984c, 1984d) concerning the timing of applications is specific to herbicide maintenance and release spray programs.

Correct timing in applying herbicide sprays is essential in releasing young conifers from brush and grass competition. As a result of physiological differences between hardwoods and conifers, many brush species and unwanted hardwood trees are susceptible to herbicide sprays during periods when conifers are resistant. Maintenance and release sprays are applied during five periods of the year when they will control competing vegetation with minimum adverse effect to conifers. These periods are bud break, early foliar, late foliar, late summer and fall. Conifers are closely observed before and during all herbicide operations to determine correct timing of application and hold damage to negligible levels. Stump treatments or individual tree injection methods may take place at any time of the year but effectiveness appears to be greatest between November and February.

Dormant or bud-break sprays are usually applied in late winter or early spring before bud break of the conifers. Oil carriers are used to facilitate adsorption of herbicides through the bark of stems and branches. Early foliar sprays are applied in spring after approximately three-fourths of the new leaves on brush species and hardwoods are developed and before conifer bud burst. For conifer maintenance and release during this period, sprays are applied primarily in water carriers. Late foliar sprays are applied primarily in early summer. Late summer sprays are applied in late July through September, after conifers have ceased growth. Fall sprays are applied from September through November as a plantation maintenance treatment to control grasses and forbs in southwestern Oregon.

Sheep grazing, scalping, and grass/forb seeding are occasionally used to manage vegetation competing with conifer seedlings. Sheep, when properly managed, can be effective in reducing low brush with limited damage to conifers under the proper conditions (Newton and Dost 1984, Rhodes and Sharrow 1983, Sharrow and Leininger 1983). In scalping, all vegetation is removed with a hand tool, exposing mineral soil. Repeated scalping is necessary due to recolonization of the area. Selected grasses and forbs can be seeded on units immediately after burning or scarification, quickly covering exposed mineral soil. This retards or prevents the invasion of light-seeded brush and hardwood species. This method is only effective in vegetation zones where there is little or no competition for moisture. Tree survival and growth have been reduced in most cases but not to the detriment of stand establishment (Klinger, 1982).

Precommercial Thinning

Precommercial thinning is normally applied to conifer stands between 10 and 20 years of age which contain excessive numbers of trees per acre. Precommercial thinning reduces competition and promotes vigorous growth of desirable trees by

removing excess trees, trees of inferior form or quality, and trees of less desirable species.

The number of trees cut per acre during precommercial thinning is dependent on the density of the stand before thinning. While average spacing is approximately 12 feet, the number of crop trees left may vary between 200 and 320 per acre. Contract specifications, emphasized by field instructions to crews, cover desired spacing of crop trees and criteria for crop tree selection.

The primary method of precommercial thinning is cutting trees with a power saw. The injection of herbicides using specially designed tools is another method available. Acres estimated for treatment under each alternative are shown in Table 1-2.

Roadside Maintenance and Weed Control

Vegetation control along roadsides is done primarily by BLM crews. Its purpose is to remove vegetation from ditches and shoulders of roads to prevent brush encroachment into driving lanes, maintain visibility on curves for the safety of vehicle operators, permit drainage structures to function as intended, and facilitate maintenance operations. It is usually accomplished using mechanical methods and herbicides, although some clearing is done manually.

Mechanical cutting is usually done with a mowing device mounted on a truck, tractor, or grader. Manual methods of brush cutting are the same as described under Site Preparation. Herbicides are normally applied with vehicle-mounted sprayers incorporating hand-held or fixed nozzles.

Weed control encompasses a variety of activities including maintenance of recreation sites and hiking trails, and other improvements and structures to control plants harmful to humans of wildlife.

Plants most often treated are poison oak, thistle, and blackberry. Methods of control are similar to those described under Site Preparation and Plantation Maintenance and Release. Herbicides are not used for recreation site maintenance on peak visitation days.

Comparison of Impacts

This section compares in tabular form (Table 1-4) the impacts of each alternative. While impacts are described in detail in Chapter 3, Table 1-4 is presented to assist decisionmakers and reviewers by summarizing the impacts of each alternative.

Implementation

Final Decisions

Due to the length of time that has elapsed between the draft and FEIS, a 60-day public review period for the FEIS is in effect. In addition, the Record of Decision (ROD) will be issued in a draft form for public review. Sixty (60) days after issuance of the FEIS, an evaluation will be conducted of the public comment on the draft, supplement to the draft, and the FEIS; subsequently the Draft Record of Decision will be prepared. The draft decision may be to select one of the alternatives intact or to combine features from several alternatives that fall within the range of actions analyzed in the EIS. Significant impacts, additional or modified standard operating design features, alternatives, environmental preferences, economic policy, and technical considerations will be addressed. The Draft Record of Decision will be available for public comment for a period of time sufficient to allow for public comment. The final Record of Decision will consider pertinent new information.

Monitoring and Studies

Currently, most vegetation management treatments are monitored through administration of contracts under which the practices are authorized. Continuous administration of active slash burning and herbicide spraying contracts is required. Before and after spraying, water samples are taken from selected adjacent streams (see Appendix D). Precommercial thinnings, manual vegetation control, or scarification projects are monitored at regular intervals to determine the quality and quantity of completed work. Prescribed burns are monitored in progress, and the effectiveness of burns is assessed in post-burn evaluation reports. Vegetation management at most recreation sites and along roads and hiking trails is routine maintenance work conducted and monitored by BLM employees.

Silvicultural effectiveness of vegetation management treatments would be monitored primarily through a series of inventories and surveys (USDI, BLM 1981a). Information collected would be used to determine the need for and success of particular treatments. For example,

vegetation survey data collected over a period of years could be used to quantify the effects of treatments on competing vegetation and desired tree species.

Two important programs in western Oregon involve the cooperation of government (including BLM) and private agencies in studying vegetation management practices. The FIR Program (Forestry Intensified Research) is concentrating on practices in southwestern Oregon, while the CRAFTS Program (Coordinated Research on Alternative Forestry Treatments and Systems) coordinates most vegetation management research in the Pacific Northwest.

Impacts that vegetation management treatments have on other resources would also be monitored. Currently, the Oregon Department of Environmental Quality monitors air quality by measuring particulate levels in the atmosphere. Water quality monitoring would be carried out in accordance with Executive Orders 11514 (partially amended by 11991) and 12088, Sections 208 and 313 of the Clean Water Act, BLM Manual 7240 and Oregon Department of Environmental Quality Memorandum of Understanding (MOU-OR 158). Additional monitoring systems for other resources (watershed, wildlife, etc.) as identified and outlined in the final decision will be developed and implemented. These monitoring systems will be applied on a continuous basis, allowing for up-to-date evaluations and responsiveness to changing situations. Specific management actions will be evaluated to ensure consistency with the objectives of the Vegetation Management Program. All monitoring will assess the following:

1. If management actions are resulting in satisfactory progress toward achieving objectives;

2. If actions are consistent with current policy;

3. If original assumptions were correctly applied and impacts correctly predicted;

4. If mitigation measures are satisfactory;

5. If it is still consistent with the plans and policies of State and local government, other Federal agencies, and Indian tribes;

6. If new data are available that would require alteration of the program.

In the event that monitoring results indicate that modifying the program is appropriate, the District Manager or the State Director, as appropriate, will determine what, if any, changes should be made to are consistent with the objectives of the program.

Effectiveness of mitigating measures identified in environmental assessments will be monitored through periodic inspections of selected projects.

Requirements for Further Environmental Assessment

This EIS is a regional programmatic statement for managing competing vegetation on BLM-administered lands in western Oregon and is intended to be applicable for approximately 5 to 10 years. Site-specific environmental assessment and documentation (including application of categorical exclusions where appropriate) will be accomplished annually by each district on proposed vegetation management plans prior to project implementation. Interdisciplinary impact analyses will be based upon this and other applicable EIS's. Additional herbicides proposed for use after publication of this EIS will not be used unless further analysis and documentation is conducted prior to use on BLM-administered lands.

If analysis indicates potential for significant impacts not already described in an existing EIS, another EIS or a supplement to an existing EIS may be required.

Interrelationships

Due to the scattered nature of BLM-administered land in western Oregon, coordination of vegetation management activities with adjacent landowners and managers is essential. BLM also works closely with other government agencies responsible for special resource management programs. The following subsections provide a brief description of major interrelationships involving vegetation management.

Federal Government

The western Oregon BLM districts share in part common boundaries with several national forests. Coordination between district managers, forest supervisors and staffs is routine. Specific project and program coordination takes place as needed between all management levels of each agency.

Table 1-4 Summary of Impacts

Environmental Component Impacted	Existing Situation	Alt. 1 (PA)	Alt. 2 (Emph. Herb.)	Alt. 3 (No Burn)
Allowable Annual Harvest (MMBF)		1,183	1,181	1,139
Air Quality	Occasional smoke intrusions occur, but none have exceeded EPA particulate standards. improved methods. EPA standards would not be exceeded.	Based on acreages only, a 30% reduction in emissions would result with an additional 20% due to	Approximately the same impacts as Alt. 1.	No smoke intrusions would occur. Overall air quality would improve.
Soils				
Scarification/Piling	An estimated 15% productivity loss occurs on about 4,800 acres treated each year.	Productivity losses would occur on 39% fewer acres treated each year.	Productivity losses would occur on 50% fewer acres treated each year.	Productivity losses would occur on 16% fewer acres treated each year.
Burning	Productivity losses cannot be quantified. Impacts are proportional to the number of acres burned (about 14,000 acres annually).	Productivity would be affected on 29% more acres burned each year.	Productivity would be affected on 23% more acres burned each year.	Productivity losses would be eliminated.
Water Quality				
Suspended sediments	Less than 100 mg/l from all sources.	Slight increases are likely.	Slight increases are likely.	Levels are likely to decline.
Dissolved Solids	Less than 100 mg/1 from all sources.	Slight increases are likely.	Slight increases are likely.	Levels are likely to decline.
Herbicide residues	About 80% of past samples contained no residues. Residues in remainding 20% of samples were below significant levels.	Based on acreages only, numbers of samples containing residues would increase, but residues would be below significant levels.	Based on acreages only, numbers of samples containing residues would increase, but residues would be below significant levels.	Based on acreages only, numbers of samples containing residues would increase, but residues would be below significant levels.
Temperature	----------	Slight increases are likely.	Slight increases are likely.	Slight decreases are likely.
Vegetation Habitat Altered by:				
Mechanical treatment (ac/yr)	12,043	11,800	9,864	22,382
Manual treatment (ac/yr)	8,280	17,170	12,235	23,976
Chemical treatment (ac/yr)	18,461	42,339	57,050	60,153
Burning (ac/yr)	13,963	18,026	17,271	0
Animals				
Big Game	Populations are at moderate levels.	Moderate reductions in existing big game population levels would occur.	Impacts would be approximately the same as under Alt. 1.	Populations would be slightly reduced from existing levels.
Cavity Nesters Song Birds and Small Mammals	Populations are at moderate levels and are declining.	Reductions in habitat diversity, snags and downed material would moderately reduce small mammal, woodpecker and song bird populations from existing levels.	Impacts would be approximately the same as under Alt. 1.	Impacts would be approximately the same as under Alt. 1. except populations of cavity nesters and small mammals would be only slightly reduced.
Fish	Most habitat is in fair to good condition. Around 40% of coho salmon habitat is in poor condition. Streams producing at 50% of optimum.	Habitat conditions and population levels would remain unchanged.	Habitat conditions and population levels would decline slightly.	Approximately the same impacts as under Alt. 1.
Cultural Resources (unidentified sites)	----------	Low probability of site damage.	Low probability of site damage.	Low probability of site damage.
Scenic Quality	Low probability of degradation.	Low probability of degradation.	Low probability of degradation.	Low probability of degradation.
Special Areas (sites)	----------	Low probability of degradation.	Low probability of degradation.	Low probability of degradation.
Human Health	Human health not significantly impacted.	Negligible probability of impact.	Negligible probability of impact.	Negligible probability of impact.
Social Environment	----------	Likely to generate more constructive social impacts.	Likely to generate strongly polarized reactions.	Approximately the same impacts as under Alt. 2.
Economic Conditions[1]				
Impacts Compared to Current[2] Program Direction (Alt. 1)				
Total Employment (FTE)[3]	22,604	+0.0	−68	−839
Public Revenue ($ millions)[4]	65.07	+0.0	+0.11	-2.20

Table 1-4 Summary of Impacts (continued)

Alt. 4 (Lab.-Int.)	Alt. 5 (Res.-Aerial)	Alt. 6 (No Aerial)	Alt. 7 (No Herb.)	Alt. 8 (No Action)
1,180	1,177	1,176	1,056	816
Approximately the same impacts as Alt. 1.	Approximately the same impacts as Alt. 1.	Approximately the same impacts as Alt. 1.	Approximately the same impacts as Alt. 1.	Based on acreages only, a 40% reduction in emissions would result with an additional 20% due to improved methods. EPA standards would not be exceeded.
Productivity losses would occur on 53% fewer acres treated each year.	Productivity losses would occur on 41% fewer acres treated each year.	Productivity losses would occur on 37% fewer acres treated each year.	Productivity losses would occur on 31% fewer acres treated each year.	Productivity losses would be virtually eliminated.
Approximately the same impact as Alt. 1.	Approximately the same impact as Alt. 1.	Productivity would be affected on 34% more acres burned each year.	Productivity would be affected on 42% more acres burned each year.	Productivity would be affected on 1% fewer acres burned each year.
Slight increases are likely.	Slight increases are likely.	Slight increases are likely.	Slight increases are likely.	Slight increases are likely.
Slight increases are likely.	Slight increases are likely.	Slight increases are likely.	Slight increases are likely.	Slight increases are likely.
Based on acreages only, numbers of samples containing residues would slightly increase, but residues would be below significant levels.	Based on acreages only, numbers of samples containing residues would slightly increase, but residues would be below significant levels.	Based on acreages only, numbers of samples containing residues would decrease. Residues would be below significant levels.	Residues would be virtually eliminated.	Residues would be virtually eliminated.
Increases are less likely than under Alts. 1 and 2.	Slight increases are likely.	Changes would be negligible.	Changes would be negligible.	Slight decreases are likely.
9,534 27,431 35,704 18,171	11,680 17,731 38,486 18,021	11,860 30,464 26,738 18,666	12,631 48,404 0 19,813	8,555 925 0 13,911
Populations would be slightly reduced from existing levels.	Impacts would be approximately the same as under Alt. 1.	Populations would remain approximately the same as present levels.	Impacts would be approximately the same as under Alt. 6.	Populations should remain at existing levels or increase slightly.
Populations of small mammals, woodpeckers and song birds would decline slightly but not as much as under Alt. 1.	Impacts would be approximately the same as under Alt. 1.	Populations of small mammals, woodpeckers and song birds would remain approximately the same as present levels.	Impacts would be approximately the same as under Alt. 6.	Increases in habitat diversity, snags and downed material would maintain or slightly increase small mammal, woodpecker and song bird populations.
Approximately the same impacts as under Alt. 1.	Approximately the same impacts as under Alt. 1.	Approximately the same impacts as under Alt. 1.	Approximately the same impacts as under Alt. 1.	Approximately the same impacts as Alt. 1.
Low probability of site damage.	Low probability of site damage.	Low probability of site damage.	Low probability of site damage.	Negligible probability of site damage.
Low probability of degradation.	Low probability of degradation.	Low probability of degradation.	Low probability of degradation.	Low probability of degradation.
Low probability of degradation.	Low probability of degradation.	Low probability of degradation.	Low probability of degradation.	Negligible probability of degradation.
Negligible probability of impact. Approximately the same impacts as under Alt. 1.	Negligible probability of impact. Approximately the same impacts as under Alt. 1.	Negligible probability of impact. Approximately the same impacts as under Alt. 2.	Negligible probability of impact. Approximately the same impacts as under Alt. 2.	Negligible probability of impact. Approximately the same impacts as under Alt. 2.
+180	−116	+291	−2,236	−8,432
-0.05	-0.27	-3.52	-12.60	-20.24

[1]See Chapter 3, Economic Conditions for discussion of existing condition and current program direction.
[2]Impacts under Alternatives 1 through 8 are changes from the employment and revenues displayed in Column 2.
[3]One full-time equivalent (FTE) work year equals 220 work days.
[4]Based on $110 per MBF.

The Risk Assessment prepared for this EIS was a cooperative effort between BLM and the USDA Forest Service.

The U.S. Environmental Protection Agency (EPA) has responsibility for herbicide registration (40 CFR 162). This includes responsibility for determining that a herbicide will not generally cause unreasonable adverse effects on the environment. EPA's determinations are based upon research data supplied by the applicant for registration.

The U.S. Fish and Wildlife Service administers the Endangered Species Act of 1973 as amended. Accordingly, BLM consults with that agency when it is determined that a Federally listed or proposed threatened or endangered species or its critical habitat may be affected. The purpose of consultation is to avoid adverse impacts to the species in question. Such consultation may result in modification or abandonment of an action.

The National Park Service (NPS) administers the Nationwide Rivers Inventory, as provided under the National Wild and Scenic Rivers Act of 1968. Present efforts are directed toward inventory and evaluation to determine which free-flowing rivers and river segments are suitable for possible designation as components of the National Wild and Scenic Rivers System. BLM consultation with NPS is required if proposed management actions could alter a river's ability to meet established Wild and Scenic Rivers Act eligibility and/or classification criteria.

State and Local Governments

Section 202(c)(9) of FLPMA requires BLM to develop resource management programs consistent with those of State and local governments to the extent that such BLM programs are also consistent with Federal law and regulations. BLM coordination efforts involve a number of State and local administrative and planning agencies as highlighted below.

The Intergovernmental Relations Division for the State of Oregon is the Clearinghouse for State agencies. Notices of all major BLM proposed actions are provided for coordinated State level review by the State Clearinghouse. Areawide clearinghouses (see Appendix G) coordinate the review of proposed BLM activities by county and local governments in their respective areas of interest.

In accordance with a Memorandum of Understanding (MOU-OR 56), the Oregon State Department of Agriculture Pesticide Use Clearinghouse has been established to assist in the review of herbicide use proposals by Federal, State and industry organizations. The signatory members to the Memorandum of Understanding will review all proposals made by the BLM in Oregon.

Close relations have been established with the Oregon Department of Land Conservation and Development to ensure cooperation and coordination of BLM programs and planning efforts with those conducted by county and local governments under Oregon Revised Statute 197 (Comprehensive Planning Coordination). The relationships of the alternatives to Land Conservation and Development Commission (LCDC) Statewide Goals are shown in Table 1-5.

LCDC is the primary State agency responsible for implementing the Oregon Coastal Management Program established under P.L. 94-370, the Coastal Zone Management Act (CZMA) of 1972, as amended (16 U.S.C. 1451 et seq.). This program relies initially on county and local comprehensive planning under ORS 197 with special emphasis on unique characteristics of coastal resources. In addition to the 15 statewide goals for planning consideration, coastal planning is guided by four special State Coastal Goals and Guides: Estuarine Resources, Coastal Shoreland, Beaches, and Dunes and Ocean Resources.

CZMA requires Federal activities to be consistent to the maximum extent practicable with the Oregon Coastal program. Although Federal lands are specifically excluded from the coastal zone, such BLM activities as would directly affect coastal resources outside the BLM lands require BLM consistency statements. These statements are made through the Clearinghouse notification and review process. All alternatives are expected to be consistent with the CZMA. A detailed consistency determination for the preferred alternative is being sent to the Oregon Department of Land Conservation and Development.

The Oregon State Forester, by means of the Fores Practices Act of 1972, regulates timber harvest methods and supportive practices on all non-Federal lands within western Oregon. Minimum standards are prescribed for reforestation of economically suitable lands, road construction anc maintenance on forest land, chemical applications and slash disposal. Although Federal agencies ar

Table 1-5 Relationship of EIS Alternatives to LCDC Statewide Goals[1]

LCDC Statewide Goals	Discussion
Goal 4: To conserve forest land for forest use.	Under Alternatives 3, 5, 6, 7 and 8, some suitable forest lands could not be reforested due to restrictions on some practices.
Goal 5: To conserve open space and protect natural and scenic resources.	
Land needed or desirable for open space;	None of the alternatives would reduce open space.
Fish and wildlife areas and habitats;	Wildlife populations would increase under Alternative 8. Short-term benefits to some terrestrial animals would occur under all alternatives. Actions under Alternatives 1-7 would reduce wildlife populations and diversity. Fish populations would be slightly reduced under Alternative 2 but would not be significantly impacted under the remaining alternatives.
Ecologically and scientifically significant natural areas;	Vegetation management practices would incorporate features designed to avoid or mitigate impacts on scientifically significant natural areas.
Outstanding scenic views and sites;	Some localized, adverse impacts would affect scenic quality for short periods of time, but overall impacts would be insignificant.
Water areas, wetlands, watersheds and ground water resources;	Water quantity would not be significantly impacted by any alternative. (See Goal 6 for water quality).
Wilderness areas;	Vegetation management practices would be excluded in wilderness study areas pending final designation.
Historic areas, sites, structures and objects;	Historic sites would either be protected or salvaged, if appropriate, under all alternatives.
Cultural areas;	Known archeological sites would either be protected or salvaged, if appropriate, under all alternatives.
Potential and approved recreation trails;	Approved trails would not be directly impacted by any alternative. Some vegetation management practices could be visible from approved trails and could directly impact potential trails.

Table 1-5 Relationship of EIS Alternatives to LCDC Statewide Goals[1] (continued)

LCDC Statewide Goals	Discussion
Potential and approved Federal wild and scenic waterways and State scenic waterways.	Approved waterways would not be directly impacted by any alternative. Some vegetative management practices could be visible from approved waterways and could indirectly impact potential waterways.
Goal 6: To maintain and improve the quality of the air, water and land resources of the State.	The major pollutants and contaminants affecting air quality would be smoke from prescribed burns. Prescribed burning smoke entering Designated
Air Quality	Areas would not exceed State or Federal standards under any alternative. Burning would be conducted in accordance with the Oregon Smoke Management Plan, which is the primary State rule for reducing indirect pollution in air quality maintenance areas.
Water Quality	Best Management Practices for Section 208 of the Water Quality Act would be met or exceeded. Water quality would or could be affected by sediments and herbicide drift. Neither of these would be expected to cause violation of State or Federal water quality standards.
Land (soils)	Actions undertaken under Alternatives 1-7 would result in some loss of soil productivity. The anticipated losses are considered low.
Goal 7: To protect life and property from natural disasters and hazards.	Design features applicable to all alternatives would protect life and property from hazards. Alternatives 5 through 8 have limitations which would further protect against hazards.
Goal 8: To satisfy the recreation needs of the citizens of the State and visitors.	Developed recreation sites would be protected under all alternatives. Under all alternatives, the short-term adverse visual impacts of vegetation management practices could be visible from some developed sites. Adverse impacts on dispersed recreation users would be localized and short-term.
Goal 9: To diversify and improve the economy of the State.	Total employment would increase under Alternatives 4 & 6 but would decrease under Alternatives 2, 3, 5, 7 and 8 Economic diversity would not be affected by any alternative.
Goal 16: To recognize and protect the unique values of estuaries and associated wetlands.	All alternatives could result in some stream sedimentation. Some of these sediments would reach estuaries, but impacts are expected to be minimal.

[1] Public involvement, plan documentation and agency coordination are important aspects of preparing this EIS. Therefore, the EIS alternatives are consistent with LCDC Goals 1 and 2. Other LCDC Goals not generally applicable to the alternatives are: 3. Agricultural Lands; 10. Housing; 11. Public Facilities and Services; 12. Transportation; 14. Urbanization; 15. Willamette Greenway; 17. Coastal Shorelands; 18. Beaches and Dunes; and 19. Ocean Resources. Goal 13, Energy Conservation, was addressed in the western Oregon BLM timber management EIS's.

not bound by State forest practice rules, BLM minimum standards meet or exceed State rules. The BLM and USFS, acting jointly, have entered into a Memorandum of Understanding with the State Forester in this regard.

The Forestry Program for Oregon outlines basic objectives of the Oregon State Board of Forestry for timberland management within the State. The relationships of the EIS alternatives to these basic objectives are shown in Table 1-6.

Management of wildlife, including fish, is the responsibility of the Oregon Department of Fish and Wildlife (ODFW). BLM, in managing lands under its jurisdiction, considers wildlife habitat as a resource category. The Sikes Act (P.L. 93-452), as amended, is the primary tool guiding coordination between BLM and the ODFW. Cooperative agreements and memorandums of understanding describe the responsibilities of the two agencies.

Section 202(c)(8) of FLPMA requires BLM to provide for compliance with applicable pollution control laws, including State and Federal air and water pollution standards or implementation plans.

Table 1-6 Consistency[1] of EIS Alternatives with Basic Objectives of the Forestry Program for Oregon

	Alternatives			
Basic Objective	**Consistent**	**Minimally Consistent**	**Inconsistent**	**Discussion**
To maintain the maximum potential commercial forest land base consistent with other resource uses while assuring environmental quality.	1,2,4	5	3,6,7,8	The benchmark (1,892,832 acres) for consistency is the commercial forest land base minus withdrawn TPCC lands. This acreage would be reduced when the available vegetation management treatments could not maintain minimum stocking levels. Environmental quality would be protected to the degree specified in the Oregon Forest Practices Act.
To maintain or increase the allowable annual harvest levels to offset potential socioeconomic impacts.	1,2,4,5	3,6	7,8	The benchmark for consistency is the current allowable cut volume of 1,183 MM bd. ft. per year. The level of cutting the land base can sustain is dependent on number of acres allocated to timber production, level of management the land base receives and productivity of the land.
To identify and implement the levels of intensive forest management and retain the techniques needed to achieve maximum growth and harvest.	1,2,4,5	6	3,7,8	BLM currently implements a full range of vegetation management practices (refer to Vegetation Management Treatments and Design Features, this chapter) for optimizing timber production. New and improved practices would be implemented consistent with technological advances.

[1]Arrived at through consultation with Oregon State Department of Forestry.

In order to comply with the Clean Air Act of 1963 as amended, BLM cooperates in the Smoke Management Plan administered by the Oregon State Forester. The Smoke Management Plan is an amendment to the State Implementation Plan administered by the ODEQ. The primary objective of the Smoke Management Plan is to keep smoke from prescribed burning away from population centers and other smoke-sensitive areas. Slash burning is allowed only when smoke dispersion conditions are determined by Oregon State Department of Forestry (OSDF) to be favorable.

OSDF, by agreement with BLM, has the primary responsibility for fire protection of public lands administered by BLM in western Oregon. The department undertakes presuppression and suppression actions for all BLM-administered lands in the area and cooperates with BLM's prescribed burning program.

The Oregon Department of Environmental Quality (ODEQ) has lead responsibility for statewide water quality management planning in accordance with the Federal Water Pollution Control Act (Section 208 of P.L. 92-500) as amended by the Clean Water Act (P.L. 95-217). BLM and ODEQ have entered into a Memorandum of Understanding (MOU-OR 158) which outlines their respective roles in meeting State water quality objectives. The Memorandum assures close interagency cooperation and implementation and monitoring of appropriate practices and control measures to comply with the Clean Water Act and State requirements. BLM vegetation management practices meet or exceed objectives of the statewide water quality management plan and best management practices under Oregon Forest Practices Act rules.

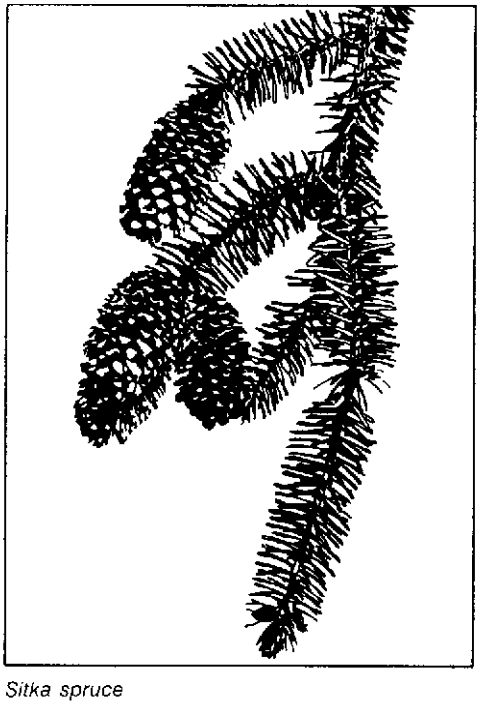
Permittees and grantees operating within rights-of-way on BLM-administered lands are required to comply with Department of Interior regulations applicable to use of herbicides.

Private Landowners

Adjacent private landowners, both timber companies and private residents, are interested in BLM operations near their land. BLM strives to keep these landowners informed about vegetation management operations. Environmental assessments are prepared, and interested landowners are invited to comment on proposed programs. Prior to aerial herbicide operations, residents and contiguous landowners within one-half mile of spray sites are notified.

Scarification and piling

Chapter 2 Affected Environment



Sitka spruce

This chapter provides a basis for assessing the impacts of the alternatives. Information is provided commensurate with the importance of impacts, with less important material summarized or simply referenced. More detailed descriptions of the affected environment are presented in the western Oregon BLM timber management EIS's (USDI, BLM 1978b, 1979a, 1980a, 1981b, 1983a, 1983b, 1983c).

The primary sources of information used in preparing this chapter were BLM planning system documents developed by the Salem, Eugene, Roseburg, Coos Bay and Medford Districts. The Unit Resource Analysis, Planning Area Analysis and Management Framework Plan (see Glossary) for each district are available for review at the respective district offices. Other references are cited within the text by author and date of publication, and a listing of these references appears in the References Cited section in the Appendix.

Climate and Air Quality

The air mass which usually controls weather patterns in the EIS area is predominantly of marine origin. This results in moist, mild winters and dry, moderately warm summers. Average annual

precipitation varies from a range of 20 to 50 inches in the interior valleys of southern Oregon to a range of 60 to 200 inches in the Cascade and Coastal mountains of northwestern Oregon.

Because of complex topographic features, considerable microclimatic variability exists within the area. Site-specific climatic information is available in the western Oregon BLM timber management EIS's. The Clean Air Act Amendments of 1970 established three Federal Air Quality Control Regions (AQCR's) in western Oregon. The EIS area is included within the Northwest, Willamette Valley and Southwest Oregon AQCR's. Air quality throughout most of the area within these AQCR's meets Federal standards. However, air quality problems exist in the urban areas of Portland-Vancouver, Salem, Eugene-Springfield and Medford-Ashland, which have been designated as nonattainment areas. Nonattainment for all these areas except Salem is based in part on levels of total suspended particulates. The Portland-Vancouver area is not in attainment with the 8-hour carbon monoxide standard of 10 milligrams per cubic meter and the ozone standard of 235 micrograms per cubic meter (ug/m3), and contains subareas that are not in attainment with the secondary total suspended particulate standard of 150 ug/m3. The Eugene-Springfield area is not in attainment with the secondary total suspended particulate standard and the 8-hour carbon monoxide standard. The Medford-Ashland area is not in attainment with the primary (260 ug/m3) and secondary total suspended particulate standards and the ozone standard and contains subareas that are not in attainment with the 8-hour carbon monoxide standard. The City of Salem is a designated nonattainment area for carbon monoxide and ozone (ODEQ 1981).

In 1972, the Oregon State Department of Forestry (OSDF), Federal land management agencies, and the Oregon Department of Environmental Quality (ODEQ) developed the Oregon Smoke Management Plan as one means of complying with the Clean Air Act. The Plan is designed to significantly reduce the amount of smoke from prescribed burning from being carried into or accumulating in certain Designated Areas or other areas sensitive to smoke. These Designated Areas, shown in Figure 2-1, include the Willamette Valley and the cities of Tillamook, Coos Bay, Roseburg, Grants Pass, Medford, and Ashland. The Department of Environmental Quality has also identified Newport, Astoria, Bend, and Lincoln City as Designated Areas.

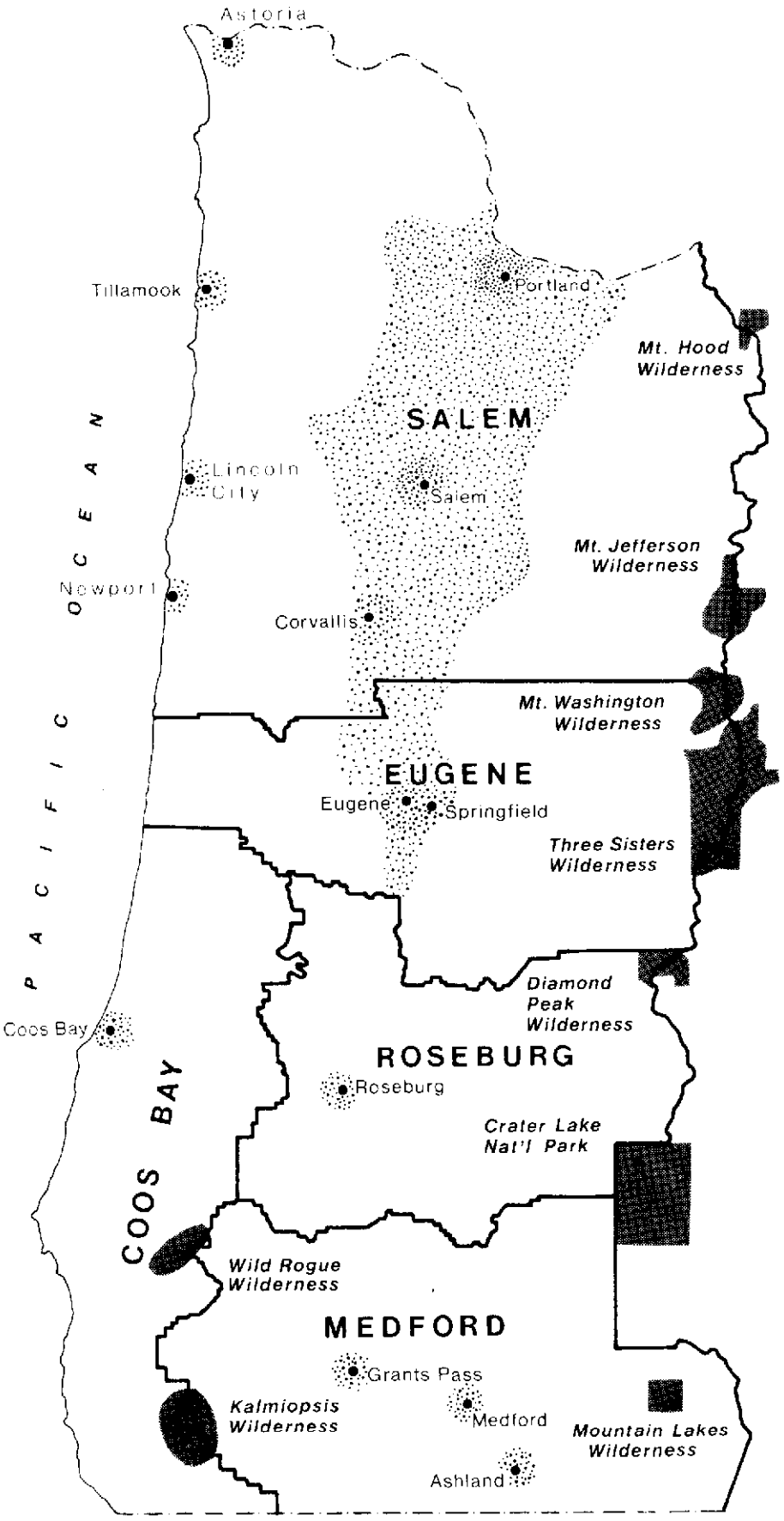
The Clean Air Act Amendments of 1977 contain provisions to ensure that air quality does not deteriorate in areas with clean air. Class I areas, allowed virtually no deterioration, are Crater Lake National Park and six wilderness areas in western Oregon (See Figure 2-1). The remainder of western Oregon including sixteen wilderness areas designated by the Oregon Wilderness Act of 1984 (Public Law 98-328) is Class II, which allows moderate deterioration of air quality.

Joint Federal and State studies have been conducted to determine whether prescribed burning in western Oregon impairs visibility within Class I areas. Four Class I areas (Mt. Hood, Mt. Washington, Mt. Jefferson, and Three Sisters Wilderness Areas) were found to have experienced visibility impairment due to prescribed burning (ODEQ 1986). The Oregon State Implementation Plan and Smoke Management Plan were revised in 1986 to minimize impairment. Oregon experienced a significant reduction in visibility impairment following implementation of the revised plans (ODEQ 1988).

Between 1978 and 1984, BLM in western Oregon burned approximately 450 timber harvest units per year, involving about 13,500 acres annually. This represents about 12 percent of the average number of forested acres burned annually in the EIS area.

Visible smoke problems have been monitored by the OSDF since 1975. OSDF records for 1981 and 1982 and showed that approximately 16 percent of the problem burns reported annually resulted from BLM prescribed burning in western Oregon. These caused or contributed to an estimated five to ten smoke intrusions into Designated Areas each year. Records for 1987 are similar.

The ODEQ has monitored air quality in western Oregon since 1971 by measuring particulate levels in the atmosphere. Acceptable levels of particulates, established by the U.S. Environmental Protection Agency (EPA), are represented by the National Ambient Air Quality Standards. Primary standards have been established to protect public health and are based on scientific data. Secondary standards have been established to protect the public welfare. The primary and secondary standards for particulate material less than or equal to 10 microns in diameter (PM 10) are 150 and 50 micrograms per cubic meter (ug/m3), respectively (U.S. EPA 1987).



Designated Areas

Class I Areas

District Boundaries

Figure 2-1

Designated and Class I Areas in Western Oregon

A three-year (1974-1976) study conducted in the Eugene-Springfield area by the EPA concluded that fall prescribed burning contributed from 3 to 15 ug/m3 to average 24-hour total particulate concentrations, with a maximum contribution of 84 ug/m3 (U.S. EPA 1978). The study also suggested that fall prescribed burning may have contributed to levels of fine particulates (smaller than 0.5 microns in diameter). PM 10 concentrations are proportional to total particulate concentrations, but the proportion apparently is not consistent.

Geology and Topography

The EIS area includes four physiographic divisions: the Coast Range, Cascade Range, Willamette Valley, and Klamath Mountains. These divisions are based upon differing rock types and formations.

Generally, the areas are complexes of volcanics in the Cascades and sediments in the Coast Range. The Klamath Mountains include a complex of volcanic, sedimentary and metamorphic rocks and are the most geologically diverse of the four divisions. More detailed geologic and topographic information is presented in the western Oregon BLM timber management EIS's and in Baldwin (1976).

Soils

More than 450 soil series have been described for western Oregon. Figure 2-2 shows the distribution of major soil orders within the EIS area. More detailed soil information is available in the western Oregon BLM timber management EIS's and BLM and Soil Conservation Service soil surveys.

Soils within the EIS area are generally capable of producing abundant plant growth. Most soils have a high content of organic matter, moderate to high nutrient levels, and medium bulk densities. Soils at higher elevations, however, are often low in nitrogen.

Dry ravelling (see Glossary) of soil materials is a natural form of erosion. It occurs mainly on steep slopes (greater than 70 percent) with high gravel content and is accelerated by some vegetation management practices. About one-fourth of the BLM-administered land in the EIS area is susceptible to dry ravelling after vegetation cover is removed.

Soils with less than 30 parts per million (ppm) mineralizable nitrogen (see Glossary) are considered highly nitrogen-deficient. Most of these soils are found at high elevations in frigid and cryic soil temperature zones (see Glossary). About 10 percent of the BLM-administered land in the EIS area is in these zones, and a high percentage of this land is nitrogen-deficient. Other nutrient-deficient soils are found in areas where topsoil has been removed through past management activities, in serpentine areas of southwestern Oregon, and in areas where soil organic matter has been depleted by intense fires and has not been replenished by natural processes.

Microorganisms are important components of western Oregon soils. They contribute to decomposition of parent materials, formation and maintenance of soil structure, nutrient cycling and decomposition of organic compounds, including herbicides (Moore and Norris 1974).

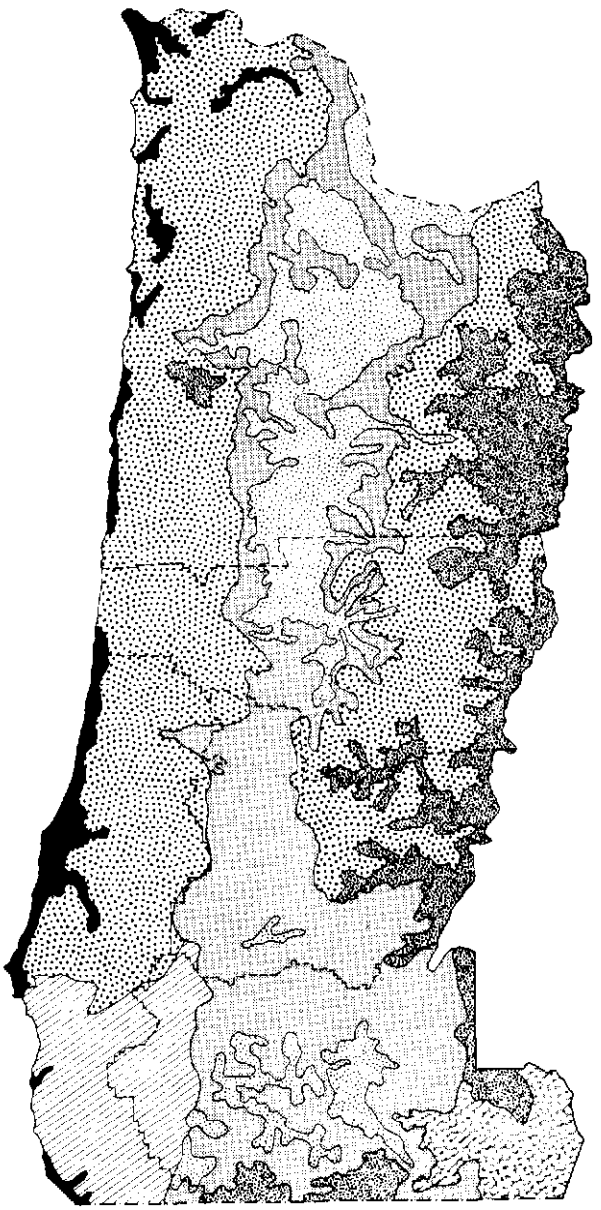
Organic matter is the primary food source for soil microorganisms and is a major source of some plant nutrients. It also has a high water holding capacity, promotes good soil structure, and reduces erosion. Many organic chemicals, including most herbicides, are quickly adsorbed onto organic matter, reducing their movement through the soil.

Water Resources

Surface water in western Oregon drains to the Pacific Ocean either directly through coastal streams or indirectly through the Willamette, Columbia, and Klamath Rivers. Major coastal streams include the Nehalem, Trask, Wilson, Tillamook, Nestucca, Siletz, Yaquina, Alsea, Siuslaw, Umpqua, Coos, Coquille, Rogue, and Chetco Rivers. Major tributaries to the Willamette River include the Clackamas, Molalla, Santiam, Calapooya, McKenzie, Middle Fork, Coast Fork, Long Tom, Marys, Luckiamute, Yamhill, and Tualatin Rivers. The major tributaries to the Columbia River within the EIS area are the Willamette and Sandy Rivers. Smaller perennial streams are abundant because of high annual precipitation.

The dominant factor affecting the water resources of western Oregon is the mild, moist climate. Most precipitation falls as rain from November to March. Higher elevations usually develop a large snowpack. Winter rainfall is the major source of runoff, with peak flows occurring from December to January and low flows occurring in August.

Figure 2 – 2 Major Soil Orders of Western Oregon



Xeric Soils of Moderate Rainfall Western Oregon Regions

- Mollisols, Alfisols, Vertisols and Ultisols of Valleys
- Alfisols, Ultisols, Inceptisols, Mollisols and Vertisols of Foothills and Mountains

Udic Soils of High Rainfall Western Oregon Regions

- Spodosols, Inceptisols and Entisols of Valleys and Coastal Lowlands
- Inceptisols and Ultisols of the Coast Range and Western Cascade Mountains
- Inceptisols, Alfisols and Ultisols of the Western Klamath Mountains
- Inceptisols, Spodosols and Entisols of High Mountains

Xeric Soils of Moderate Rainfall Eastern Oregon Forested Regions

- Mollisols and Inceptisols of the Mountains

--- District Boundary

Streams with runoff supplemented by snowmelt may have a secondary peak in May or June.

Surface water is an important resource in western Oregon. Major consumptive uses include municipal, domestic, agricultural and industrial supply. Major nonconsumptive uses include fisheries, recreation, aesthetics, hydropower generation, transportation, and water quality maintenance. Seventy-four municipal watersheds in western Oregon contain BLM-administered lands. The municipalities, streams and BLM acreages in each of these watersheds are shown in Appendix I.

The quality of surface waters in western Oregon is generally very good, with a dissolved solids content of usually less than 100 milligrams per liter (mg/l). Nutrient concentrations are low, with levels of inorganic nitrogen and phosphorus usually less than one mg/l. Suspended sediment concentrations are usually less than 100 mg/l except during winter storms, when sediments range from 100 to 500 mg/l, and during major floods, when concentrations may exceed 2,000 mg/l. Data on background levels of herbicides in streams are sparse, but available data indicate that herbicides are generally not detectable in streamflow in western Oregon (see Appendix J). According to the limited data available, many large streams in western Oregon have had temperatures above 64 °F, and the ODEQ recommends that temperatures of these streams not be increased (Oregon Department of Environmental Quality 1980; USDI, GS 1981).

Groundwater is widely used in western Oregon, primarily for municipal, domestic, and irrigation purposes. Most of the EIS area is underlain by geologic material which yields 1 to 20 gallons of water per minute to wells. The best aquifers are found in alluvial deposits along major streams. This material may yield 20 to 500 gallons per minute. Groundwater quality is generally good in western Oregon, with dissolved solids concentrations less than 500 mg/l.

Vegetation

Terrestrial Vegetation

Widely diverse vegetation communities occur in western Oregon, varying according to climate, moisture, elevation, soils and other environmental factors. These communities present a variety of problems for managing competing vegetation. This section will briefly describe the 10 vegetation zones occurring in western Oregon and their associated vegetation types. More detailed descriptions of these zones can be found in Franklin and Dyrness (1973). General distribution of vegetation zones is shown in Figures 2-3 through 2-5. Proportions of vegetation zones within each western Oregon BLM district are shown in Table 2-1. Over 99 percent of BLM-administered lands in western Oregon fall within the Western Hemlock, Mixed Conifer, Mixed Evergreen and Interior Valley Zones. Acreages in the other six zones are negligible, but vegetation management problems within all zones can be severe.

The Western Hemlock zone is largely dominated by Douglas-fir forests. Within this zone, moist sites favor understory species such as sword-fern, salmonberry and vine maple, while dryer sites favor salal and Oregon grape. Typically, succession of vegetation stages following logging and burning includes an initial herb-dominated stage (e.g., fireweed) followed by a tall shrub stage (e.g., vine maple, blackberry, ceanothus). This may be followed by a broad-leaved tree stage (e.g., red alder, big leaf maple). Many competition problems occur when understory vegetation remaining after logging is already in the tall shrub stage.

The Interior Valley Zone is typified by farmlands, oak woodlands, conifer forests, grasslands, evergreen shrubs, and riparian communities. Grasslands and forests with mixtures of ponderosa pine, incense cedar, Oregon white oak, California black oak, and Pacific madrone are conspicuous. In the Umpqua and Rogue Valleys, evergreen shrubs such as ceanothus and manzanita are common. Regeneration problems can often be severe following timber harvest in this zone, primarily due to moisture limitations caused by grass and brush encroachment.

The Mixed Conifer Zone is located in the eastern Siskiyou Mountains and southwestern Cascades. It ranges from very hot and dry sites bordered by grass or oak woodlands to wetter sites dominated by Douglas-fir and incense-cedar. Regeneration of trees is generally slower than in other zones because of the more severe environment. Brushfields dominated by chaparral-like evergreen shrubs such as manzanita and ceanothus frequently develop, further slowing the rate of forest regeneration.

Mixed Evergreen Zone forests, found mostly in the western Siskiyou Mountains, consist mainly of Douglas-fir and sclerophyllous species (see

Table 2-1 Distribution Of Vegetation Zones Within BLM Districts

Vegetation Zones	Salem (percent)	Eugene (percent)	Coos Bay (percent)	Roseburg (percent)	Medford (percent)	Western Oregon BLM (percent)
Western Hemlock	98	98	93	47	-	51
Interior Valley	*1	1	-	3	7	4
Mixed Conifer	-	-	-	50	54	30
Mixed Evergreen	-	-	5	-	38	15
Sitka Spruce	1	-	2	-	-	*1
Pacific Silver Fir	*1	*1	-	-	-	*1
Mountain Hemlock	*1	-	-	-	-	*1
White Fir	-	-	-	-	*1	*1
Shasta Red Fir	-	-	-	-	*1	*1
Ponderosa Pine	-	-	-	-	*1	*1

*less than 1 percent

Glossary), especially tanoak. Understory communities (low shrub and herb layers) are typically not well developed. Extensive serpentine areas in this zone support a large array of unusual plant species. Succession is often slow, and sites can easily be occupied by evergreen hardwood stands or dense evergreen chaparral. Large areas covered with these brushfields are capable of developing forest cover.

Sitka Spruce Zone forests, found within the fog belt along the Oregon coast, are typically dense, tall and very productive, with lush understories of shrubs, herbs and ferns. Salal and evergreen huckleberry are common. Following logging, dense shrub communities develop quickly in this zone.

The Pacific Silver Fir and Mountain Hemlock Zones occupy higher elevations in the Cascade Range in northern Oregon. Most stands have well developed shrub, herb and moss layers. Understory species becoming dominant after disturbance are generally species that were present in the stands before disturbance, such as huckleberry and beargrass. There is usually less vegetation competition with conifers in this zone.

The White Fir and Shasta Red Fir Zones in southwestern Oregon are characterized by intermingled nonforested brush communities of ceanothus, manzanita and other brush species. These communities are often fire-maintained seral stages occupying sites capable of supporting conifers. Grass dominance is a major problem, particularly when it sustains gopher populations.

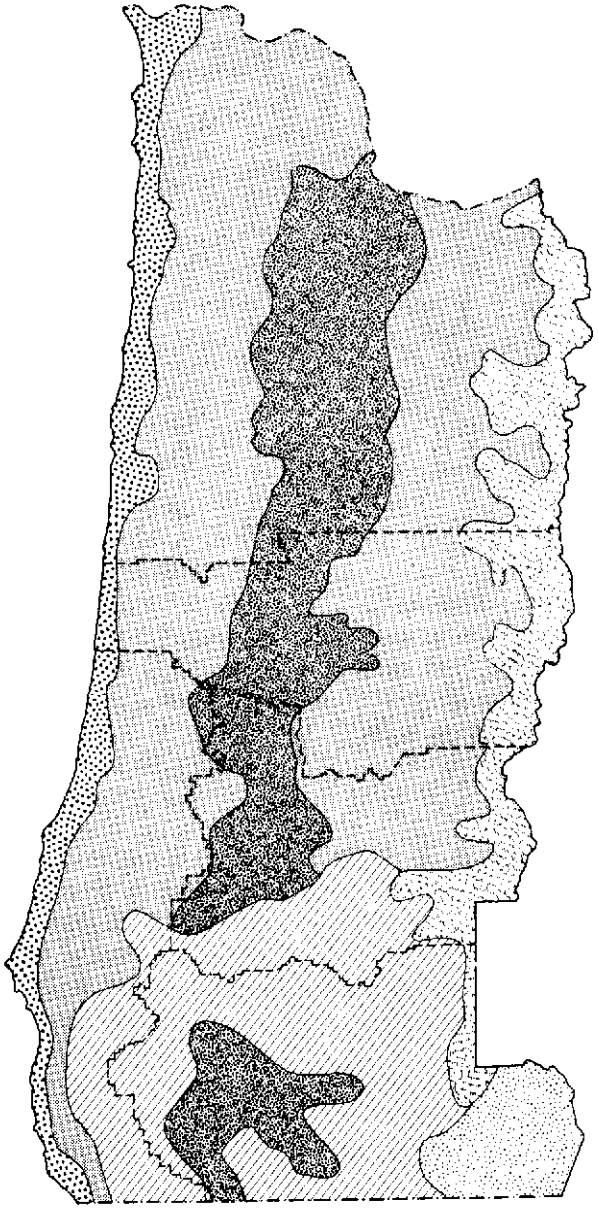
The Ponderosa Pine Zone is located in the southeastern portion of the EIS area intermingled with the Mixed Conifer Zone. It is characterized by understories of rabbitbrush and grasses at lower elevations and golden chinkapin, ceanothus and manzanita at middle and upper elevations.

Vegetation competition in the 10 zones within the EIS area varies significantly. For example, on moist sites in northern Oregon, grass may prevent brush encroachment while in southern Oregon, grass deprives conifers of the moisture they need to survive. Succession of brush species into clearcut areas also varies considerably throughout these zones. Such variations require the use of different vegetation management treatments. Plants which moderately or severely compete with conifers throughout western Oregon are listed in Table 1-1a.

Two seral stages are affected by vegetation management practices; the 0- to 7-year-old grass-forb stage and the 8- to 15-year-old brush-seedling stage. These two stages presently occur on about 20 percent of the BLM-administered acres in western Oregon. Table 2-2 shows acreages of each stage within the BLM districts.

Riparian habitats are located along lakes, ponds, marshes, rivers and streams. These habitats are transitional between bottomland wetlands and upland terrestrial habitats. They may vary from a few feet wide in steep, first order streams to over 500-feet wide along major rivers. Vegetation is affected by the width of the zone and the amount of water available. In narrow, steep draws, vegetation might be restricted to brush species,

Figure 2-3 Vegetation Zones of Western Oregon



Sitka Spruce Zone
Western Hemlock Zone
Interior Valley Zone
Mixed Conifer and Mixed Evergreen Zone
Subalpine Zone
Ponderosa Pine Zone interspersed with Mixed Conifer Zone

District Boundary

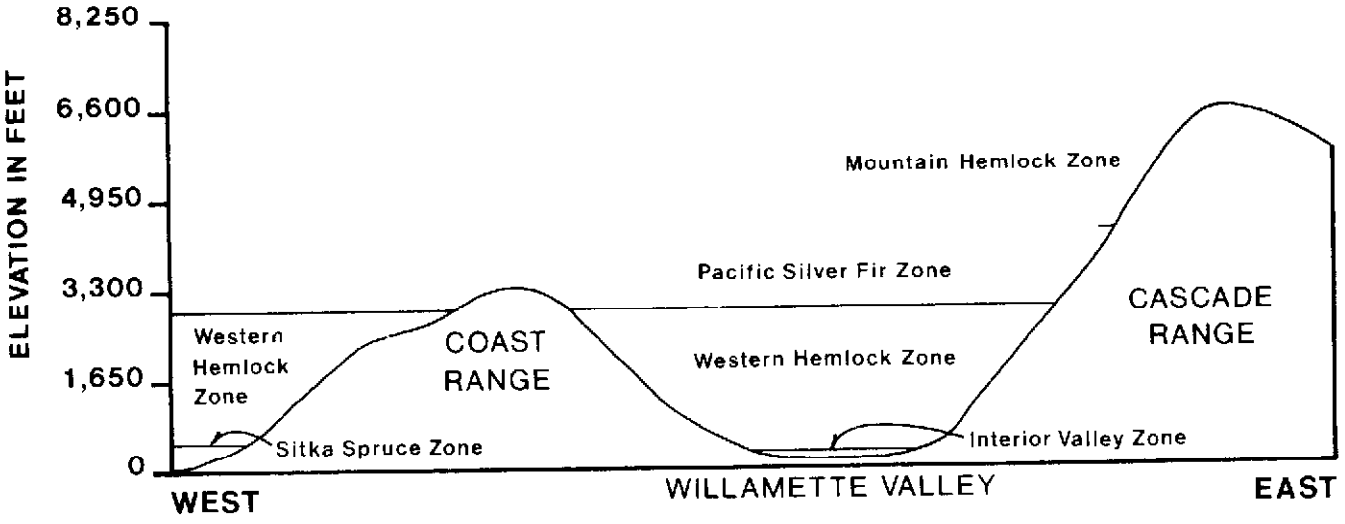


Figure 2-4

Vegetation Zones by Elevation - NW Oregon

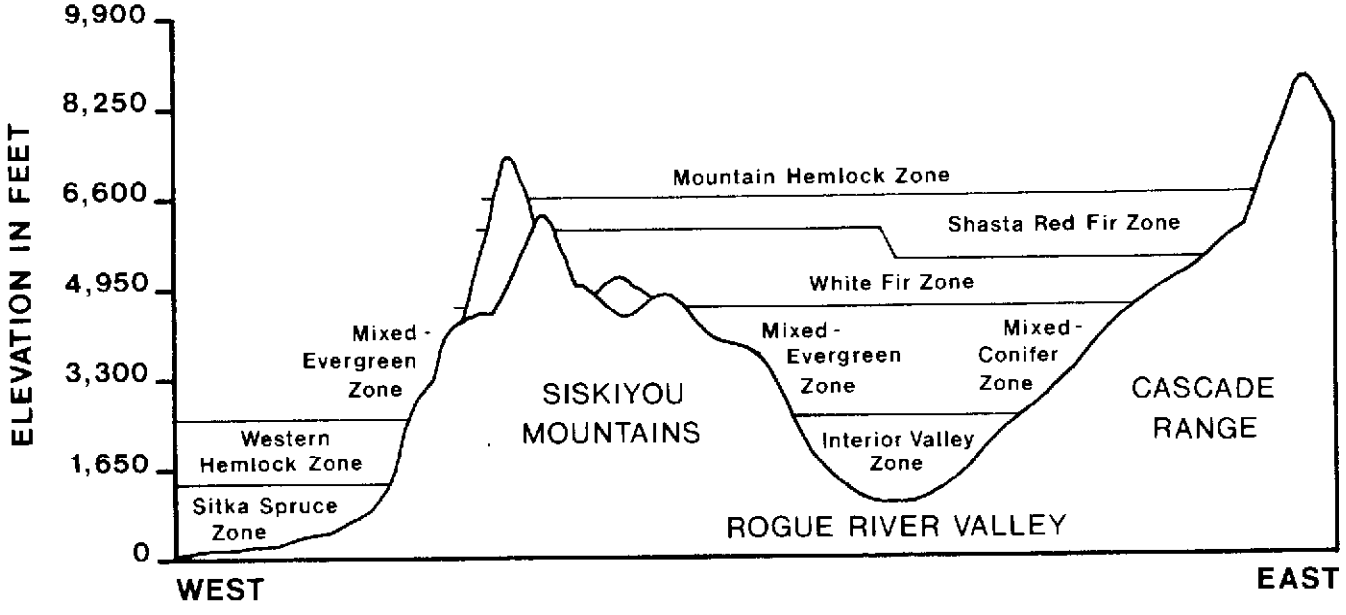


Figure 2-5

Vegetation Zones by Elevation - SW Oregon

Table 2-2 Acreages of Two Early Seral Stages in BLM Districts (1983)

	Grass-Forb (0-7 Years)		Brush-Seedling (8-15 Years)		Combined Stages (0-15 Years)	
	Acres[1]	Percent of District	Acres	Percent of District	Acres	Percent of District
Salem	41,400	10	34,700	9	76,100	19
Eugene	34,300	11	30,100	10	64,400	21
Coos Bay	62,010	19	45,692	14	107,702	33
Roseburg	34,100	8	40,900	10	75,000	18
Medford	23,215	3	13,825	2	37,040	5
Total	195,025	8	165,217	7	360,242	15

[1]Includes some acres in regeneration phase with overstory still standing.

herbs and sedges, while wider zones may support conifers and large amounts of red alder, western redcedar, bigleaf maple, black cottonwood, Oregon ash, or Port-Orford-cedar.

Wetland and Aquatic Vegetation

Wetlands are those areas inundated by surface or groundwater at a frequency sufficient to produce a saturated or seasonally saturated soil condition. Examples of wetlands include marshes, swamps, bogs, wet meadows, and natural ponds. Sedges, grasses, rushes, skunk cabbage, cattails, and algae are typical wetland and aquatic plants.

Threatened, Endangered or Sensitive Plants

Endangered plants are those species that are in danger of extinction throughout all or a significant portion of their range. Threatened plant species are those that presently are not endangered but are likely to become so within the foreseeable future throughout all or a significant portion of their range. Sensitive plants (see Glossary, Sensitive Species) are those species not yet officially listed, but are undergoing a status review.

At present, one federally listed endangered plant species, *Arabis modonaldiana*, has been identified in the EIS area. The only recorded sightings of this plant in the EIS area have been within the Siskiyou National Forest. One federally listed threatened plant species, *Lomatium bradshawii*, is known to occur in the EIS area. This plant has been found in the Eugene District.

Numerous sensitive species observed in the EIS area are currently under review for listing by the U.S. Fish and Wildlife Service as threatened or endangered. The final status of these species will be determined as sufficient data are collected. In the interim, they will be protected from management activities likely to jeopardize their survival on BLM-administered lands. A list of these sensitive species is available upon request.

Animals

Terrestrial Animals

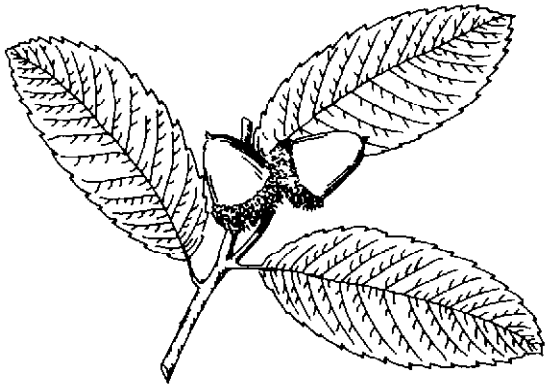
Over 600 species of wildlife, excluding invertebrates, are found within western Oregon BLM districts. The most current list of species can be found in Guenther and Kucera (1978). Site-specific lists are also provided in each BLM district's Unit Resource Analysis (USDI, BLM 1977a, 1977b, 1978c, 1979b, 1980b, 1980c, 1980d).

Approximately 40 species of reptiles and amphibians, 88 species of mammals and 216 species of birds are found in the forest environment (Guenther and Kucera 1978). As many as 200 to 300 of these wildlife species might use a single vegetation treatment area.

Habitat needs for all wildlife species include food, water, cover and living space. Various combinations of these components provide a wide range of habitats for different species. Diversity of habitat and associated wildlife species is believed to increase the stability of communities (Thomas 1979).

The occurrence and abundance of wildlife species correspond to broad vegetation zones and to successional (seral) stages (see Glossary; see Chapter 2, Vegetation) and unique habitats within these zones.

The Western Hemlock Zone provides diverse habitat for numerous wildlife species. Its conifer forests are dissected by many streams and/or wet areas which provide riparian corridors and edge (see Glossary) in an otherwise continuous conifer forest. Old-growth (200+ year) forests of this zone are very stable communities supporting a wide variety of wildlife. In the Coast Range, deer and elk



Tanoak

are particularly abundant, occupying small home ranges with summer and winter ranges in proximity. These animals use dense stands of older forest in this zone for cover and survival forage during harsh weather. At other times, they forage in openings near forest cover. In the Cascades, deer and elk migrate into this zone during the winter to escape deep snow at higher elevations. South-facing slopes below 2,500 feet provide important winter range in the foothills of the Cascades. Cougar and black bear find seclusion and escape cover in the dense forest stands of this zone or in portions of it which are generally inaccessible to people.

The Interior Valley Zone includes wide riparian habitats along the Rogue, Umpqua, and Willamette Rivers. Bald eagles and ospreys nest along these rivers. Columbia white-tailed deer occur in oak-woodland areas along the lower reaches of the North Umpqua River. Wild turkeys, a recently introduced species, inhabit portions of this zone.

Portions of the Mixed Conifer Zone support large numbers of mule deer and black-tailed deer. Hot, dry conditions of this zone support species similar to those of eastern Oregon, such as the Pacific rattlesnake. The zone's southern edge is used as winter range for the largest migrating black-tailed deer herd in Oregon. Brush typically invades burned or logged areas within this zone, providing forage for wildlife. After an initial growth period, brushfields become dense and decadent, causing forage quality to decline. However, brushfields provide excellent cover for large animals and nesting sites for many birds.

The Mixed Evergreen Zone contains a few wildlife species more closely related to California forms than Rocky Mountain forms, e.g., the ringtailed cat and Siskiyou salamander. Acorns provide food for tree and ground squirrels, wood ducks, and some woodpeckers. Shrub species of this zone, such as ceanothus, manzanita, scrub oak, and mountain mahogany are preferred browse species for wintering deer.

The Sitka Spruce Zone provides habitat for the greatest number of bald eagles within the EIS area. Large old trees adjacent to estuaries make excellent eagle nest sites. Abundant shrubs and forbs support numerous rodents, particularly mountain beaver. The cool marine climate of this zone makes winter survival difficult for big game, so thermal cover is especially critical.

The Pacific Silver Fir Zone is important summer range for deer and a few elk, but deep snow and cold preclude year-round residency for either species. The zone contains some of the most remote forests in western Oregon and provides habitat for wolverine, fisher, marten, and cougar, species that require isolation from people. A few unique species of birds, such as the red crossbill, occur at higher elevations in this zone.

The 0- to 7-year-old grass-forb and 8- to 15-year-old brush-seedling seral stages are of major importance to many species. According to Meslow and Wright (1975), 86 percent of the bird species found in Douglas-fir forests use the brush-seedling stage, and 39 percent nest in that stage. The feeding and reproduction functions of many small mammals occur primarily in the grass-forb and brush-seedling stages (Thomas et al. 1977). Deer, elk, and black bear depend upon early seral stages for food. Riparian habitat is the most productive of all habitat types for wildlife (Thomas 1979). It provides important edge habitat as it intersects other

habitats. Riparian areas also provide travel lanes, migration routes and connector corridors between habitat types. Riparian areas are used by an estimated 260 wildlife species in western Oregon and offer optimum habitat for 50 of these species.

Snags provide nesting sites for numerous species. Ospreys nest in the tops of tall snags adjacent to large bodies of water. Black-capped chickadees excavate small cavities in very soft snags for nest sites. Pileated woodpeckers excavate cavities in large snags for nesting sites which are later used by some 30 other wildlife species. Flycatchers, bald eagles, and other raptors perch on branches of snags while watching for prey. Hairy and downy woodpeckers forage on medium-sized snags for termites and woodborers.

Down material provides an array of habitats for wildlife. Logs provide escape cover for a variety of animals ranging from small rodents, reptiles and amphibians to deer. Black bears, fishers, and skunks make dens in hollow logs. Branches and root wads provide perches for flycatchers and chipmunks. Insects that bore in bark or dead wood are sought out by woodpeckers, reptiles, and amphibians. For example, seventy-five percent of the diet of pileated woodpeckers is obtained from insects in down material. The importance of down material to wildlife is described by Thomas (1979).

Threatened or Endangered Animals

Six wildlife species that occur in the EIS area are officially listed by the U.S. Fish and Wildlife Service and/or the State of Oregon as threatened, endangered, or sensitive.

Table 2-3 lists these species, their status and population trends.

The peregrine falcon is occasionally seen in western Oregon (Gabrielson and Jewett 1970). One natural active falcon nest has recently been located in the EIS area (Henry and Nelson 1981). The Columbia white-tailed deer occurs in the oak-ash bottomland and oak-madrone foothills near Roseburg. Bald eagle nesting sites and communal roosting areas are found in large old trees, usually along larger rivers and lakes or adjacent to coastal estuaries. Seven active bald eagle nests are known to occur on BLM-administered lands in western Oregon.
The northern spotted owl inhabits some of the remaining old growth in the Cascade and Coast Ranges. The wolverine is an extremely wide-ranging species found only in the remote alpine habitat of the upper Cascades. The western spotted frog, once thought to occur throughout western Oregon, has not been observed west of the Cascades for several years.

Fish

Salmon and trout are the principal game fish species inhabiting the streams, ponds, and lakes of western Oregon. While habitat conditions have been degraded by past logging activities, road construction, mining, dams, and improperly installed culverts, they are now improving as a result of better management practices and regrowth of streamside vegetation. Table 2-4 shows habitat conditions and population trends of salmon and trout inhabiting BLM-administered streams in the EIS area. Numerous ponds, lakes, and fish hatcheries which support salmonids are also located on or near BLM-administered lands.

Good quality water of proper temperature, free from excessive amounts of chemical contaminants and sediment, is needed to support and maintain spawning and rearing salmon and trout populations. Silt-free, well-oxygenated gravel is important for salmon and trout spawning and for production of aquatic insects. Well-established riparian zones are needed to maintain high terrestrial insect populations. Since young salmon and trout feed primarily on aquatic and terrestrial insects, abundance of salmonid populations is dependent upon healthy insect populations. Shade provided by riparian zone vegetation maintains water temperatures which are critical for optimum fish production.

Many other species of fish are present in western Oregon. These include introduced game fish such as bass, perch and catfish and nongame species such as sculpins, suckers, dace, squawfish and shiners. Population data for these species are scarce. None are of direct commercial value. Some species may be eaten by trout and salmon and/or compete with them for food and space.

Cultural Resources

Federal agencies have been charged with responsibility for cultural resources (see Glossary) on lands under their jurisdiction. Through a group of laws beginning with the Antiquities Act (1906), BLM has been mandated to identify, protect, and

Table 2-3 Threatened or Endangered Species in EIS Area

Species	Federal Status	Oregon Status	Population Trend
Peregrine falcon *Falco peregrinus*	E	E	Declining
Columbia white-tailed deer *Odocoileus virginianus leucurus*	E	E	Stable
Northern bald eagle *Haliaeetus leucocephalus alascanus*	T	T	Stable
Northern spotted owl *Strix occidentalis caurina*	S	T	Declining
Wolverine *Gulo gulo*		T	Declining
Western spotted frog *Rana pretiosa*		T	Declining

T = Threatened E = Endangered S = Sensitive

Table 2-4 Cold Water Fish Habitat and Populations[1]

Species	Stream Miles	Condition of Habitat[2] Exc. (%)	Good (%)	Fair (%)	Poor (%)	Habitat Trend	Current Population	Population Trent
Cutthroat	1,635	10	25	55	10	Stable	Moderate	Stable
Steelhead	766	6	26	58	10	Stable	Moderate	Stable
Chinook	240	3	35	50	12	Stable	Moderate	Increasing[3]
Coho	706	3	21	36	40	Stable	Low	Declining

[1] Habitat miles, condition and trend are for BLM-administered lands in the EIS area.

[2] Streams in excellent condition have riparian vegetation (see Glossary), abundant and diverse instream structure (see Glossary), numerous high quality pools, sediment-free bottom substrate, adequate spawning gravels and stable banks and channels. Streams in good to poor condition lack one or more of these characteristics.

[3] Due primarily to hatchery releases.

Source: USDI, BLM 1977a, 1977b, 1978c, 1979b, 1980b, 1980c, 1980d.

enhance such resources on public lands. A number of procedures, including those specified in 36 CFR 800.4(a), were used to identify cultural resources within the BLM districts.

Surveys of existing cultural resource information (Class I inventories) have been completed for each BLM district and are available in the district offices (see Beckham and Minor 1980; Beckham et al. 1981; Honey and Hogg 1980; Minor et al. 1980; Follansbee and Pollock 1978). All recorded sites were identified through a compilation of each district's existing site record data.

The criteria used to assess the eligibility of identified cultural resources for inclusion in the National Register of Historic Places are described in 36 CFR 60.4.

Archeological Sites

Over 400 archeological sites have been identified on or near BLM-administered land in the EIS area. Some information has been lost from all of these sites as a result of natural or human disturbances prior to discovery. Future intensive surveys are certain to locate many additional sites.

Most identified archeological sites appear to have been small, seasonally used campsites. A few larger sites have been found which may have been used as semipermanent villages. Several archeological sites are listed on the National Register of Historic Places (see Glossary), and numerous others have been determined eligible for inclusion.

Historic Sites

Over 250 historic sites have been located on or near BLM-administered land within the EIS area. Most sites relate to early settlement, transportation, mining, and logging. All of these have deteriorated to some extent from weathering and/or human disturbance.

Numerous historic sites within the EIS area are listed on the National Register of Historic Places or have been determined eligible for inclusion.

Paleontological Sites

Numerous vertebrate, invertebrate, and plant fossils are known to occur within the EIS area. These include tree, leaf, mollusc, crustacean, mammoth, bison, and horse fossils. Lists and brief descriptions of paleontological sites located on or near BLM-administered lands can be found in USDI, BLM (1981c).

None of the known fossils on BLM-administered land are of remarkable scientific interest. However, all reports of fossil-bearing deposits are examined by qualified personnel to avoid destruction of those which may be important.

Recreation and Visual Resources

Visual resources are the land, water, vegetation, animals and other natural or man-made features visible on public lands. Western Oregon's highways, rivers and trails pass through a variety of characteristic landscapes where natural attractions such as waterfalls and cultural modifications such as clearcuts can be seen. So that visual resource values can be considered when planning vegetation management activities, public lands have been assigned visual resource management (VRM) classes according to scenic quality, sensitivity level and distance zone criteria (see Glossary). VRM classes provide objectives designed to mitigate adverse impacts of land management practices on scenic values (BLM Manual 8400). VRM maps and narratives derived from inventories and evaluations of visual resources on public lands are available for review in each district office.

Outdoor recreation activities occur throughout the forested environments of western Oregon. Sightseeing, picnicking, camping, fishing, and hunting accounted for an estimated 1.8 million visits to public lands during 1982. Other popular activities are driving off-road vehicles, horseback riding, floating rivers, and studying natural features. Within the forested environment, each recreational pursuit usually occurs in a particular setting. Forty-two developed BLM recreation sites provide opportunities for camping, picnicking and swimming. Hunting usually occurs in and around natural or man-made openings such as meadows, clearcuts, logging roads or utility rights-of-way. Dense vegetation and steep terrain generally limit off-road vehicle use on public lands to existing roads and trails. Detailed information on recreational use of public lands is contained in the western Oregon BLM timber management EIS's and related background information.

Chinkapin

Special Areas

Within the EIS area, BLM administers all or portions of 17 proposed or designated Research Natural Areas, 8 Outstanding Natural Areas, 1 National Wild, Scenic and Recreation River (14 inventoried as potential), 1 National Scenic Trail, 1 National Recreation Trail, 4 State Scenic Waterways, and 39 designated Areas of Critical Environmental Concern (see Glossary). Half of these areas overlap with the Natural Areas. Most of these areas are discussed in the western Oregon BLM timber management EIS's.

Wilderness Values

Under the terms of FLPMA, roadless areas of 5,000 acres or more with wilderness characteristics are to be reviewed within 15 years for possible wilderness designation. FLPMA also states that in the event of conflict with or inconsistency between its provisions and those of the O&C Act as they relate to management of timber resources, the O&C Act shall prevail. Accordingly, the wilderness review provisions of FLPMA do not apply to revested Oregon and California Railroad Grant lands and reconveyed Coos Bay Wagon Road Grant lands suitable for sustained yield management as commercial timberlands.

The wilderness inventory, the initial phase in the wilderness review, has been completed in the EIS area. Four wilderness study areas have been designated in western Oregon. These are Sisters Rock and Zwagg Island in Coos Bay District and Soda Mountain and Mountain Lakes in Medford District.

BLM also manages two wilderness areas in western Oregon: Table Rock in the Salem District and Two Islands in the Oregon Islands Wilderness off the Oregon Coast. Most of the islands in the Oregon Islands Wilderness are managed by the U.S. Fish and Wildlife Service.

Economic Conditions

Vegetation management activities generate employment and personal earnings in the local economy. The level and effectiveness of vegetation management conducted on forest land in western Oregon administered by the BLM affects the volume of timber which may be offered for sale under the Bureau's policy of nondeclining even flow (see Glossary). Timber harvest yields jobs, personal earnings and public revenue in the local economy. The eighteen counties listed in Table 2-5 are presented here as the regional economy affected by the action. The BLM administers roughly 2.4 million of the region's 22.1 million acres. This is approximately 10.8 percent of the land base (see Table 1-1).

Description of the Regional Economy

The population of the region increased more than 25 percent between 1970 and 1980 and exceeds 2.3 million (Table 2-5). As part of a nationwide shift of population westward, the rate of growth in the region (2.3 percent compound annual) was more than twice the population growth rate in the United States (1.1 percent). Net migration into the region accounted for 71 percent of the population increase. Recent data suggest a turnaround in migration patterns; the region experienced net outmigration from April 1980 to July 1985 (Center for Population Research and Census 1985).

Employment and income growth in the region's trade and service sectors was strong from 1972-1980. This growth was sufficient to absorb a labor force growing because of immigration and an increase in the proportion of women employed or seeking employment. Since 1980, a decline in employment, particularly in lumber and wood products, has occurred (Table 2-6). Overall, employment remains below the 1979-81 average with services being the primary growth sector. The lumber and wood products industry was lowest in

Table 2-5 Population Changes, 1960-1985

County	County Population 1960	1970	1980	1985
Benton	39,165	53,776	68,211	69,100
Clackamas	113,038	166,088	241,919	248,200
Columbia	22,379	28,790	35,646	36,100
Coos	54,955	56,515	64,047	60,150
Curry	13,983	13,006	16,992	16,900
Douglas	68,458	71,743	93,748	92,150
Jackson	73,962	94,533	132,456	137,900
Josephine	29,917	35,746	58,855	61,500
Klamath	47,475	50,021	59,117	57,550
Lane	162,890	215,401	275,226	269,500
Lincoln	24,635	25,755	35,264	37,230
Linn	58,867	71,914	89,495	89,000
Marion	120,888	151,309	204,692	213,750
Multnomah	522,813	554,668	562,640	561,800
Polk	26,523	35,349	45,203	44,300
Tillamook	18,955	18,034	21,164	21,500
Washington	92,237	157,920	245,808	268,000
Yamhill	32,478	40,213	55,332	57,600
Region	1,523,618	1,840,781	2,305,815	2,342,230
Oregon	1,768,687	2,091,533	2,633,105	2,675,800

Sources: U. S. Dept. of Commerce, Census of Population, 1960, 1970, 1980. Portland State University, Center for Population Research, "Population Estimates of Oregon Counties and Incorporated Cities"; Jan. 1, 1986.

Table 2-6 Average Size of the Labor Force and Employment in the Region

SECTOR	Regional Average Employment 1970-81	1985
Civilian Labor Force	1,237,600	1,161,620
Total Employment	1,123,100	1,063,380
Nonagricultural Wage and Salary	945,800	914,040
Manufacturing		
Lumber and Wood Products	61,800	52,050
Paper and Allied	9,300	6,070
Nonmanufacturing	744,500	738,950
Trade	234,600	230,260
Services & Misc.	173,700	195,120
Government	180,400	171,480

Source: State of Oregon, Employment Division, Resident Labor Force, Unemployment & Employment, 1979-1985.

1982. Subsequent recovery has not brought employment in that sector to 1979-81 levels.

Projections show long-term declines in Oregon lumber and wood products employment. Whether these declines can be offset by continued growth in the nonmanufacturing sector and local programs promoting diversification in non-wood manufacturing is still unknown.

Because lumber and wood products employment averages 30 percent of manufacturing employment in the region, and the sector's output is largely exported to national and international markets, local employment rises and falls markedly with shifts in the national business cycle.

Effects of Vegetation Management Activities on Employment

Site preparation, tree planting and treatments designed to insure survival or promote growth of commercial species are activities which generate jobs and personal income in the local economy. In

the region, there are roughly 2,000 full-time-equivalent jobs in the private sector directly related to reforestation, vegetation management and other forestry services (Table 2-7). In the 1979-85 period, this represented 0.2 percent of the region's total employment.

Table 2-8 reports that approximately 69,000 acres of BLM-administered land were treated in the EIS area in FY 85, and approximately 52,000 days of work in the private sector were directly dependent on this level of annual treatment.

Effects of Timber Harvest on Employment

The sale of timber from lands administered by the BLM in western Oregon is governed by the principle of sustained yield. The BLM is responsible for implementing timber growing practices that assure a continuous supply of wood for harvest by communities that are dependent on forest products for employment and income. The degree of vegetation management accomplished by the BLM affects the volume of timber offered for sale by influencing the speed of reforestation, rate of growth, and yield per acre.

Timber-related industries play a major role in the region's economy. Approximately 1 of every 18 workers in the region harvests, processes or transports some type of wood product (ratio of lumber, wood, paper, and allied employment to total employment). In contrast, 1 of every 52 workers in the United States was involved in forest management, harvesting, primary processing or transportation and marketing of wood products (1972 estimate derived from Table A-43, Phelps 1980).

Table 2-7 Estimated Private Sector Employment in Forestry Services in the Region

	Annual Average Covered Employment	Annual Average Covered Payrolls	Annual Average No. of Firms
1979	1,978	$18,159,000	172
1981	1,653	18,121,000	186
1985	1,878	22,119,000	201

Source: Date on covered employment and payrolls (see Glossary) are from Employment Division, Dept. of Human Resources, State of Oregon.

Table 2-8 BLM Acres Treated within EIS Area and Resulting Private Sector Employment, FY 1985

Activity	Acres FY 85	Direct Employment (Days of employment per year) FY 85
Site Preparation		
Mechanical		
Scarification	1,637	819
Piling	564	1,128
Gross Yarding	7,000	2,800
Manual		
Cutting	286	143
Spot Clearing/ Scalping	1,076	1,437
Slash/burn	1,764	648
Chemical		
Aerial	0	0
Ground	0	0
Burning	14,115	2,823
Tree Planting	17,568	16,731
Maintenance and Release		
Manual		
Cutting	3,602	7,204
Mulching	1,314	1,752
Pulling	45	23
Chemical		
Aerial	0	0
Ground	0	0
Biological		
Seeding	1,427	0
Animals	547	0
Precommercial Thinning		
Manual	16,166	16,166
Chemical	0	0
Roadside Maintenance		
Mechanical	1,734	NA
Manual	215	215
Chemical	0	NA
Summary of Major Groupings		
Tree Planting (Reforestation) Employment		16,731 (76 FTE[1])
Control of Competing Veg. Employment		35,156 (160 FTE)
Total		51,887 (236 FTE)

[1] Each full-time-equivalent (FTE) work year equals 220 work days.

Source: Acres are from annual "Program and Cost Report," USDI, BLM. Contract employment is based on production rates and overhead factors estimated by BLM silviculturists.

Timberlands administered by the BLM in western Oregon play a significant role in providing raw material to the region's lumber and wood products sector. In fiscal year 1985, 1,008 million board feet (MMBF) was harvested from land administered by the BLM's five western Oregon districts (Table 2-9). This represented about 14 percent of the region's average annual harvest from all ownerships (Table 2-10). From 1979-81, harvest and conversion of BLM timber into lumber, plywood, paper and allied products supported an average of 5,900 direct jobs in the region (Table 2-11). In 1985 this increased to about 6,500 jobs.

Since counties and some local jurisdictions in the region share receipts from the harvest of BLM timber with the Federal government, fluctuations in timber harvest on lands administered by the BLM in western Oregon also affect employment in county government. Disbursements to county governments during 1979-1981 are estimated to have directly funded just less than 1,900 jobs. Fiscal year 1985 payments to O&C counties funded an estimated 2,284 jobs. This unusually high level of payments was due to an acceleration of payments which would ordinarily have been made to the counties early in FY 86.

The effects of the BLM's vegetation management, timber management, and public revenue sharing on employment and earnings are summed in Table 2-11.

Effects of Timber Harvest on Public Revenue

Receipts from the sale or use of resources found on O&C, CBWR, and public domain lands are distributed to State and local governments through formulas established by Congress and the Oregon legislature. Receipts from the sale of timber on all O&C lands are pooled. Fifty percent of this revenue is distributed among the counties with O&C land in proportion to the 1915 assessed value of the O&C lands in each county. Payments made to local governments from CBWR land revenues are calculated in the form of timber severance and in-lieu property taxes. Four percent of revenues from public domain lands is remitted to State governments. In Oregon, these revenues are distributed to counties on the basis of total land area for the benefit of county roads and bridges.

Table 2-12 reports recent disbursements to the counties within the region generated by timber harvest on BLM land and distributed according to the formulas cited above. Since O&C revenue distributions represent 99 percent of the total BLM timber-related disbursements, O&C disbursements are the only forms of public revenue discussed in the balance of this EIS. Table 2-13 indicates that in fiscal year 1981-82, O&C disbursements were 17 percent of total county revenues in the eighteen-county region. This includes revenues from O&C land administered by the USFS and nontimber sales and leases on land administered by the BLM. Per resident, county receipts of O&C revenue distributions ranged from $317 in Douglas County to $2 in Multnomah County.

Social Environment

The social environment affected by BLM's vegetation management program includes individuals and the communities, organizations, and groups they have formed, their agencies and institutions of government, and the companies and businesses they work for. It also includes people's attitudes, opinions, and perceptions about vegetation management policies and practices. A detailed social analysis of the EIS area including a population profile and demographic analysis, an institutional analysis and a formal public opinion survey was not undertaken for this EIS. However, during the past 5 years BLM has conducted studies in the area with extensive public involvement for seven timber management EIS's, a vegetation management EIS, and numerous environmental assessments. The following description of the social environment that could be affected by BLM's vegetation management program is based on that information and on concerns expressed during the scoping meetings for this EIS.

Social Dimensions of Employment

In addition to direct impacts on people's jobs and personal income, there are social aspects of employment that may be affected by BLM's programs. These social aspects include the importance of certain types of jobs to specific communities, people's degree of dependence on particular jobs, the availability of alternative jobs, people's access to jobs, and a community's level of acceptance of certain types of work. For example, some people are very dependent on a certain type of work; for some people alternative jobs are not available, access to alternative jobs is limited, or alternative jobs are perceived as inappropriate work. The social effects of job losses are more

Table 2-9 Harvests, Sales and Receipts from BLM Timber in the Region (1979-1985)

Fiscal Year	Sales (MMBF)	Harvests (MMBF)	Values of Sales $ (MILL.)	Value of Receipts $ (MILL.)	Average Sale Value ($/MBF)	Average Harvest Value ($/MBF)
1985	963	1,008	78.6	108.9	81.64	108.04
1984	1,087	1,039	120.2	118.9	110.58	107.60
1983	1,129	812	136.0	96.8	120.46	119.21
1982	1,113	353	105.0	79.2	94.34	224.36
1981	1,059	779	282.5	198.4	266.76	254.69
1980	1,121	919	365.7	200.6	326.23	218.28
1979	1,097	1,086	302.4	204.4	275.66	188.21
Annual Average 1979-1985	1,081	857	198.6	142.9		

Source: BLM Facts-Oregon and Washington, various years.

Table 2-10 Timber Volume Harvested Annually (1978-1984) in the EIS Region (Millions of Board-feet, Scribner Long Log Scale)[1]

Calendar Year	BLM	All Ownerships
1978	830	6,365
1979	943	6,246
1980	793	5,288
1981	676	4,472
1982	300	4,106
1983	751	5,285
1984	880	5,678

[1] BLM totals differ between Tables 2-9 and 2-10. Data for Table 2-9 are available only for fiscal years (Oct. 1-Sept. 30), and log volume is measured by Scribner short-log rules. Data for Table 2-10 are tabulated by calendar year, and log volume is measured by Scribner long-log rules.

Source: Oregon State Department of Forestry, "Oregon Timber Harvest Report," various years.

significant for these people than for those who are flexible and have access to alternative jobs. The extent to which the social environment may be affected by economic impacts can be estimated in terms of the numbers of jobs in western Oregon that are dependent on the timber harvest from, reforestation of, and vegetation management on BLM lands. Based on information in Chapter 2, Economic Conditions (see Tables 2-6 and 2-10) BLM-administered lands can be roughly estimated to provide the resource base for approximately 8,490 forest products jobs (14 percent of forest products employment in the region), and about 261 reforestation and vegetation management jobs (14 percent of all reforestation and vegetation management jobs in the region). These estimates are based on the fact that approximately 14 percent of the region's timber harvest is from BLM lands. The forest products jobs are about 0.8 percent of the total employment in the region, and the reforestation jobs are about 0.02 percent of the total.

Another significant social dimension of employment is the distinction between timber harvesting and processing jobs and reforestation and vegetation management jobs. Loggers and mill workers are paid more than reforestation and vegetation management workers. In addition, the attitudes and cultural identities of the workers are often different. Therefore, available jobs in one category cannot be easily substituted for lost jobs in the other.

Public Services

The public services potentially affected by BLM's vegetation management program are those provided by the 18 counties in western Oregon which receive revenue from O&C timber sale receipts (Table 2-12). Services provided by the counties include public safety, tax assessments, road maintenance, courts, health and human welfare, maintenance of land records, and others. O&C revenues are paid into each county's general treasury and are not allocated by BLM to specific services. Table 2-13 shows the importance of the O&C receipts to each county budget.

Table 2-11 Estimated Annual Effects on Private Sector Employment of Forest Management Practices on Lands Administered by BLM in Western Oregon (1979-1981 and 1985)[1]

	1979-1981 Program Size	Average Jobs[2]	FY 85 Actual Program Size	FY 85 Actual Program Jobs[2]	FY 85 Planned Program Level Size	FY 85 Planned Program Level Jobs[2]
Reforestation (ac.)	27,100	117	17,568	76	33,825	149
Control of Competing Vegetation (ac. treated)	45,900	44	44,492	160	84,491	147
Timber Harvest and Processing (MMBF)	911[3]	6,377	1,008	7,056	1,183	8,281
Public Revenue Disbursement ($ million)	83	1,900	100	2,299	65	1,489
Economic Effect on Other Business Sectors[4]		13,039		15,729		16,503
Total Economic Effect in the Region		21,477		25,320		26,566

[1] The Planned Program Level assumes that annual harvest equals current allowable cut (1,183 MMBF), and average price received is $110 per MBF. Using this as a baseline for impact assessment removes the effects of price fluctuations and short-term harvest variations due to market factors. In the long run harvests should equal sales. The difference between the Actual Program and the Planned Program is attributable to both market factors and short-term program factors.

[2] All estimates refer to full-time equivalence, e.g., two jobs of 6-month duration are the equivalent of one full-time job.

[3] Long log Scribner divided by 0.89, a factor which converts long log to short log Scribner measure.

[4] Based on employment and personal income multipliers derived using the USFS input-output model, IMPLAN (see Glossary) (analysis prepared by EIS staff).

Source: Computations by EIS staff.

Table 2-12 O&C Disbursements Contributed by BLM Timber Harvests

County	Percent Share of O&C Payment	Annual Payments (millions of dollars)[1] Aug. 79-81	1982	1983	1984	1985
Benton	2.81	2.73	1.10	1.33	1:33	3:28
Clackamas	5.55	5.39	2.18	2.62	2.62	6.50
Columbia	2.06	2.00	0.81	0.97	0.97	2.40
Coos	5.90	5.73	2.32	3.27	3.22	7.32
Curry	3.65	3.54	1.43	1.72	1.72	4.27
Douglas	25.05	24.33	9.84	11.97	11.94	29.40
Jackson	15.67	15.21	6.16	7.40	7.40	18.33
Josephine	12.08	11.73	4.75	5.70	5.70	14.12
Klamath	2.34	2.27	0.92	1.10	1.10	2.74
Lane	15.27	14.83	6.00	7.21	7.21	17.86
Lincoln	0.36	0.35	0.14	0.17	0.17	0.42
Linn	2.64	2.56	1.04	1.25	1.25	3.09
Marion	1.46	1.42	0.57	0.69	0.69	1.71
Multnomah	1.09	1.06	0.43	0.51	0.51	1.27
Polk	2.16	2.10	0.85	1.02	1.02	2.52
Tillamook	0.56	0.54	0.22	0.26	0.26	0.65
Washington	0.63	0.61	0.25	0.30	0.30	0.74
Yamhill	0.72	0.70	0.28	0.34	0.34	0.84
Total O&C Disbursements		97.10	39.29	47.83	47.75	117.46
Est. Amount from BLM managed lands		82.98	33.58	40.88	40.81	100.38

[1] Payments are based on collections from management of O&C lands by both the BLM and the USDA Forest Service. Collections from BLM timber sales are about 86-88 percent of total O&C collections.

Source: BLM Facts-Oregon and Washington, various years.

Table 2-13 Distribution of O&C Receipts to O&C Counties FY 1981-1982[1]

O&C County	County Revenues From All Sources (thousands of dollars)	O&C Disbursement (thousands of dollars)	O&C Disbursement As Percent of Total	O&C Disbursment Per Capita
Benton	$ 13,512	$ 2,724	20.2	$ 38.89
Clackamas	46,280	5,381	11.6	21.95
Columbia	7,349	1,997	27.2	55.25
Coos	15,281	5,720	37.3	90.37
Curry	12,201	3,539	29.0	203.38
Douglas	49,693	24,287	48.9	263.14
Jackson	33,913	15,193	44.8	113.63
Josephine	20,916	11,712	56.0	191.38
Klamath	18,955	2,269	12.0	38.70
Lane	74,671	14,805	19.8	54.70
Lincoln	13,147	349	2.7	9.82
Linn	19,378	2,560	13.2	28.28
Marion	32,919	1,416	4.3	6.75
Multnomah	127,728	1,057	0.8	1.87
Polk	8,436	2,094	24.8	44.89
Tillamook	10,123	543	5.4	25.73
Washington	61,510	611	1.0	2.41
Yamhill	8,387	698	8.3	12.40
All 18 O&C Counties	$574,399	$96,955	16.7	$ 41.22

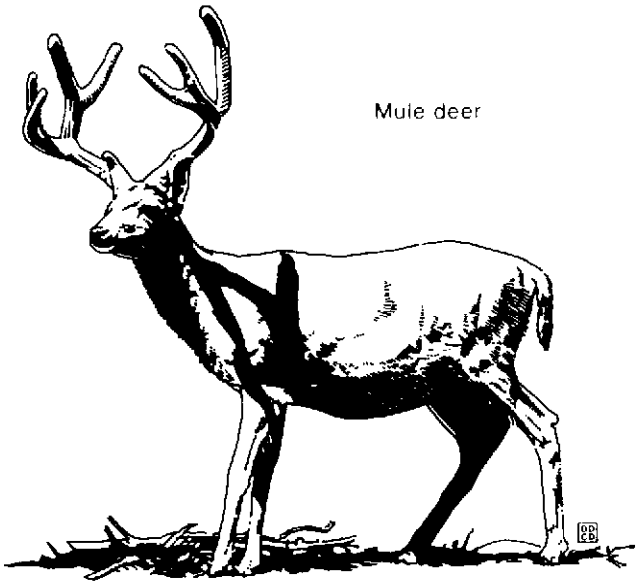
Source: Bureau of Governmental Research & Service, University of Oregon 1983.

[1] The county fiscal year was from July 1, 1981 to June 30, 1982, which differs from the Federal Government fiscal year from October 1 to September 30.

Attitudes and Opinions

A significant social issue related to BLM's vegetation management program is public disagreement about the use of herbicides and the effectiveness of alternative treatments. A clear illustration of this phenomenon can be seen in the letters of comment on BLM's 1978 Draft EIS Vegetation Management with Herbicides: Western Oregon - 1978 through 1987. There, in reviewing the same document, opponents of herbicide use perceived a bias in favor of using herbicides while proponents of herbicide use perceived a bias against using herbicides. The opponents see BLM as an advocate of herbicide use, defending that position rather than seeking public input to the process of decisionmaking. The proponents see BLM abandoning what they believe to be a demonstrably safe and effective means for increasing timber production.

The controversy has opposing factions whose points of view are sometimes unaffected by the other side's perceptions or data. BLM is in the



Mule deer

middle, having to make decisions that best serve a larger public interest encompassing much more than this controversy. The full extent and intensity of the controversy among the people of western Oregon is not known.

The controversy is sustained by the following four factors. First, EPA has approved the chemicals for use and has provided instructions for safe handling and application. For some people this is the whole story. They see no basis for opposition to using the herbicides and, therefore, no reason for BLM to limit herbicide use or to entertain alternative points of view. A related factor is the observation that the same herbicides used in forestry are used more frequently and in larger amounts for agriculture and home use, without generating comparable opposition.

Another factor is that some people are suspicious of the accuracy of EPA's determinations about herbicides. They fear that the approved herbicides may eventually be found to be as dangerous as other substances previously thought to be harmless. By then, they reason, it will already be too late to avert at least some harmful consequences.

A third factor which sustains the controversy is the difficulty in establishing scientifically, in a way that is comprehensible and believable to concerned individuals and interest groups, either the presence or the absence of cause and effect relationships between herbicide use and environmental damage or between exposure to herbicides and human health problems. This complicated scientific situation is important in three ways. In some cases (especially concerning long-term effects) the scientific evidence may simply be inconclusive. Therefore, questions concerning the effects of using a particular chemical, though they appear to be scientific, may have to be answered today in social and political terms. Conclusive scientific analyses may not be available for years. Secondly, some segments of the public may distrust or reject sound scientific conclusions because they cannot understand the analytical process leading to the conclusions and/or because they have come to consider all scientific studies concerning herbicides to be inconclusive or dubious. Finally, some people criticize the fact that many studies of the health effects of herbicides are based on laboratory animal studies, while their direct experiences of perceived impacts on people and wild and domestic animals seem to be ignored. A more extreme manifestation of this problem arises when parties to the controversy do not even agree on the identification of credible sources of information and analysis or on the definition of legitimate scientific research.

A fourth factor that helps sustain the controversy about herbicide use is that some people are increasingly concerned about not having control over their larger environment, including the management of public land resources. There is a growing awareness that the public has a legitimate interest in how the public land resources are managed. A traditional attitude of "leaving resource management to the professionals" is becoming less prevalent, and increasing numbers of people seem to have a desire to have some say in how the professionals (in this case BLM foresters and managers) do their job.

Another controversial vegetation management issue is smoke from prescribed burning. Concern with smoke is greatest in the Eugene and Medford metropolitan areas. Smoke has not been identified as a significant issue in other areas.

Just as there are social factors linked to economic conditions, there are social factors linked to other components of the environment such as air and water quality, wildlife and recreation, and likewise linked to human health and public safety issues. For example, some people are concerned about the safety of forest workers and the health of others who are exposed directly or indirectly to the chemicals, with or without awareness of the exposure. Some people are also concerned about contamination of water sources that are eventually used for such things as irrigation, stock watering, domestic water supply, and fish hatcheries. The persistence of these fears and anxieties appears to be directly related to the perception of scientific uncertainty about the existence of health risks.

Community Stability

Approximately 2,342,000 people (about 88 percent of Oregon's population) live in western Oregon, with nearly 632,000 (about 27 percent of western Oregon's population) in the central cities of Portland, Eugene, Springfield, and Salem, and roughly the same number in smaller cities and suburbs surrounding the large cities. Therefore, about half the population of western Oregon lives in small communities and rural areas. These residents use forest products and are forest recreation users. Some of them are concerned about forest

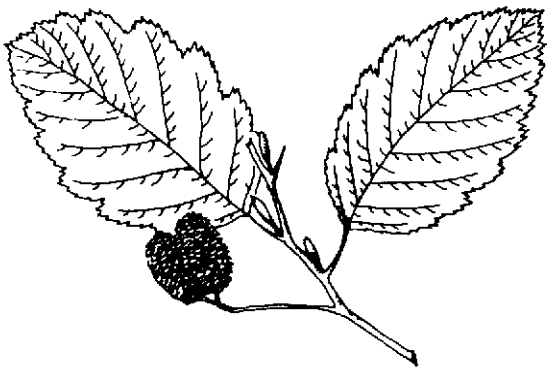
management practices and their impacts on environmental quality.

In rural areas, different communities and different groups within some communities may have incompatible wants, needs, and uses for BLM-managed forest lands in western Oregon. The proximity of small communities and rural residences to forest lands affects people's attitudes about lifestyle, quality of life, and their sense of individual and group identity. Some small communities are largely dependent on forest industry employment, and forest lands are also preferred locations for a variety of recreational and subsistence activities. There are also an increasing number of people living in the forested regions who value forest lands primarily for reasons other than timber production.

The people who are most likely to be affected at some time by the BLM vegetation management program are those who live in close proximity to BLM lands. During the years 1977 to 1979, the BLM district offices in western Oregon inventoried residences within one-half mile of BLM-administered lands. The results of those inventories were:

District	Residences Within One-Half Mile
Salem	2,307
Eugene	2,945
Roseburg	3,400
Medford	5,600
Coos Bay	1,503
Total	15,755

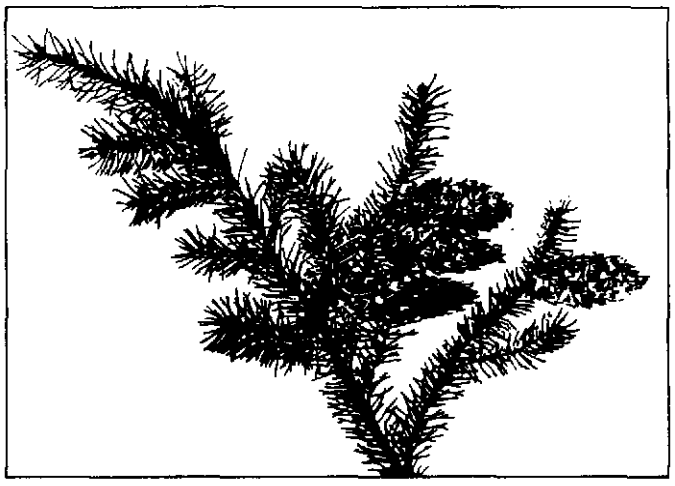
Changes have, of course, occurred during the succeeding years, and the numbers of inhabitants of each residence are not known. However, these figures provide a reasonable estimate of the numbers of residences in areas most likely to be directly affected by BLM's vegetation management activities.



Red alder

Chapter 3 Environmental Consequences

In this chapter, environmental consequences (impacts) are compared to the existing situation as described in Chapter 2. The significant impacts resulting from implementation of each of the alternatives are analyzed in relation to these existing situations. A tabular comparison of composite impacts from each alternative is shown in Table 1-4. Analysis, including the scoping process, indicates that regardless of the alternative selected for managing competing vegetation, no significant impacts upon climate, geology, topography, minerals, grazing, agriculture, utilities, communications sites, paleontological sites, energy, wilderness, wetlands, and aquatic vegetation would result. Therefore, these topics are not discussed. Vegetation management practices would increase coniferous wood fiber production and provide for higher timber harvests in the short and long term. Sufficient research has not been conducted to predict effects on long-term productivity for all plant and animal species.



Douglas fir

The major actions which cause impacts are site preparation, plantation maintenance and release, precommercial thinning, roadside maintenance, and weed control. Most of these impacts would occur on lands within the 0-7- and 8-15-year seral stages as shown in Table 2-2. Approximately 20 percent of BLM-administered lands are expected to be within these seral stages during the next decade.

Basic assumptions of the analysis are that sufficient funding and personnel will be available for implementation of the final decision, all design features described in Chapter 1 and Appendices D and E (whichever is applicable) will be applied, and types and amounts of treatments will be applied as indicated in Table 1-2. The program is intended to be in effect for approximately 5 to 10 years.

Impacts on Air Quality

The majority of the vegetation management methods considered in this FEIS may temporarily affect local air quality, but prescribed burning is the only method that could possibly pose a significant adverse effect. For this reason, the focus of this section is on prescribed burning. Some summary information on herbicide drift and volatility is provided to address the short-term impacts to air quality which may occur immediately following herbicide application.

Impacts on air quality are assessed against baseline periods as required by the Clean Air Act. Each State establishes administrative rules, including definition of an appropriate baseline period for reference. In Oregon, the Department of Environmental Quality has established the baseline for measuring changes in air quality as Calendar year 1977 or 1978. For this EIS, a 1976-79 baseline period was used because it provided a better basis for analysis of impacts. Estimates of fuels (tons/acre) consumed during the baseline period (Sandberg et al. 1985) were used in conjunction with acres burned during that period. Estimates of fuels that would be consumed under the proposed action and alternatives were calculated using projections made by Sandberg (Sandberg et al. 1985) (See Appendix N). Table 3-1 shows that the proposed action would provide an estimated 30% reduction in emissions from the baseline period based on proposed acreages and the limited changes made so far in the burning program. Additional emphasis on rapid ignition, gross yarding, spring burning, and other methods of reducing smoke under the Alternative 1 would provide an estimated additional 20% reduction of emissions.

Appendix N shows the available prescribed burning background information reported in the Oregon Smoke Management Annual reports 1977-1985, and the method of determining the BLM 1976-79 baseline acres. Also shown are the calculated biomass consumption rates for the baseline period and for 1984 for all landowners in western Oregon who burned fuels. Impact assessment was based on the Sandberg projections in Appendix N. Sandberg's mid-range (realistic) estimate of consumption (the level used in this analysis) shows a 28% reduction of emissions since the baseline. The reductions in emissions were attributed to the change in practices mentioned previously. These reductions in western Oregon are for all landowners and therefore can be considered cumulative impacts from prescribed burning. The projected emissions displayed in Table 3-1 show that future BLM emission levels will remain below the baseline period and no deterioration of ambient air quality standards should occur under any alternative. Emissions from BLM prescribed burning would be highest under Alternative 7 and would be eliminated under Alternative 3.

Smoke from prescribed burning could adversely effect air quality and impair visibility. Historically, BLM accomplishes approximately 75 percent of its annually planned burning. This reduction is due to environmental and smoke management restrictions. If all proposed burning were completed, total acres burned (compared to the 1976-79 baseline acreage of 13,963) would increase under all alternatives except 3 and 9 (see Table 1-2 and Appendix N). If the historical average is maintained, total acres burned would be less than the 1976-79 baseline acres.

All prescribed burning would be conducted within the guidelines of the State of Oregon Smoke Management Plan and Visibility Protection Plan. These plans set criteria for use in planning and implementing burn projects. BLM standard operating procedures and State of Oregon Smoke Management Planning reduce the amount of visible smoke and the potential degree to which air quality could be degraded.

Visibility is a function of the amount and size of particulate matter in the atmosphere and on the volume of air into which the particulates are dispersed. The volume of air into which smoke can be dispersed is dependent upon the inversion height. Good visibility is associated with unstable air; poor visibility is associated with stable air. Particles that are between 0.3 and 0.8 microns are the most effective at reducing visibility. However, particles from 0.1 to 10 microns all contribute to visibility impairment. Smoke from prescribed fires has been found to contain a large number of particles less than one micron in diameter. Therefore, visual impacts in the local area would be

noticeable but not significant unless unexpected weather changes occurred.

Smoke would also introduce contaminants in the air, notably particulates. In addition to particulates, combustion of forest residue produces water vapor, carbon dioxide,(CO_2), carbon monoxide (CO), sulfur oxides (SO_X), nitrous oxides (NO_X), and hydrocarbons (HC) (Sandberg et al. 1979). Table 3-1 shows estimated quantities of emission components which would be produced under each alternative. Estimates of emissions are those that would realistically occur under normal operations. The consumption rates used were based on 2-inch duff depths and 74% accomplishment of burning objectives (see Appendix N). Compared to the 1976-79 baseline period, air quality would not deteriorate under any alternative.

The quantity of smoke emissions is not merely a function of the number of acres burned. Several factors have notable effect on the amount of emissions, including fuel loading (amount and size), fuel moistures of the various size classes of fuel at time of burn, weather conditions, type of burn (pile or broadcast), type of ignition, and amount of green vegetation in the burn area (Sandberg et al. 1985). Impacts on air quality, therefore, are a function of all of these factors. Emission levels have been reduced as much as 50 percent by gross yarding and removing fuels from sites, and by burning under spring-like conditions when heavy fuels are moist, but light fuels are dry. Gross yarding and removing fuels has also been reported to reduce particulate emissions by 200 to 2,000 pounds per acre depending on the size of fuels removed and the season of burning (Sandberg and Ward 1982). Quick mop-up of prescribed fires would also reduce emissions, since residual smoke is higher in contaminants than smoke generated during the flaming stage of the burn. The use of mass ignition (i.e., helicopter) can reduce the amount of

Table 3-1 Average Emission Components From Prescribed Burning (Tons/Year)[1]

	1976-79 Baseline	Alt. 1 (PA)	Alt. 2 (Emph. Herb.)	Alt. 3 (No Burn)	Alt. 4 (Lab.-Int.)	Alt. 5 (Res. Aerial)	Alt. 6 (No Aerial)	Alt. 7 (No Herb.)	Alt. 8 (No Action)
Tons of Slash Burned[2]	636,713	445,523	426,885	0	449,130	445,422	461,354	462,590	361,622
Water Vapor and Carbon Dioxide[3]	Greater than 90% of the mass of combustion products								
Contaminants									
Particulates[4]	10,824	7,574	7,257	0	7,635	7,572	7,843	8,325	5,845
Hydrocarbons[5]	7,959	5,569	5,336	0	5,614	5,568	5,767	5,782	4,520
Carbon Monoxide[6]	82,773	57,918	55,495	0	58,387	57,905	59,976	60,137	47,011
Sulfur Oxides[7]	Negligible								
Nitrogen Oxides[8]	1,273	891	854	0	898	891	923	925	723
Total Contaminants	102,829	71,952	68,942	0	72,534	71,936	74,509	79,087	55,528

[1]Estimated at 74% accomplishment level - See Appendix N.
[2]Based upon 45.6 tons per acre for baseline and 33.4 tons per acre for alternatives (Sandberg et al. 1985).
[3]Average emission is 1 to 1½ tons/ton fuel burned (Ryan et al. 1976 cited in Sandberg et al. 1978).
[4]Particulates are near 0.1 micrometer in diameter. Average emission is 26 pounds/ton fuel burned. To put the particulate levels presented here into perspective, wood burning stoves and fireplaces produced 8,500 tons of particulates in Portland; 1,900 tons in Medford; and 2,300 tons in Eugene during 1981.
[5]Hydrocarbons, also known as volatile organic compounds, are a diverse class of compounds containing hydrogen, carbon and oxygen. Average emission is 34 pounds/tons fuel burned during broadcast burning.
[6]Average emission is 20 to 500 pounds/ton fuel burned (260 pounds/ton displayed). Carbon monoxide is unstable and dissipates rapidly in the atmosphere.
[7]Sulfur oxides (SOx), including sulfur dioxide, are produced in small quantities, since most forest residues contain less than 0.2 percent sulfur.
[8]The temperature required to fix atmospheric nitrogen is over 2,800 F, and these temperatures are not easily attained in slash burns. Nitrogen content in wood ranges from 0.2 to 0.7 percent; this source results in the production of several forms of nitrogen oxides. Average emission is 4 pounds/ton fuel burned.

Sources: Hall (1972), Sandberg et al. (1979), Sandberg et al. (1985), Ward et al. (1988) and U.S. EPA (1978).

emissions significantly (Sandberg et al 1985). As a result of partially instituting these practices, there has been a decrease in emissions, and realistic acreage projections are generally stable or slightly decreasing. Based on the projections shown, the National Ambient Air Quality standards are not expected to be exceeded under any alternative.

Protection of visibility within Class I areas during high burn periods is a concern. This concern, under all alternatives except no burn, is addressed because as previously stated burning would be done in accordance with the Oregon Smoke Management Plan and site-specific prescribed burning plans to protect sensitive areas. The Oregon Smoke Management Plan would limit the extent of prescribed burning per day and amount of fuel consumed upwind of Designated Areas to protect population centers from smoke. Normally, smoke would be carried into upper air levels and away from Designated and Class I Areas (see Figure 2-1). Occasionally, however, unforecasted weather changes could cause smoke to reach these locations. Past experience indicates that visible intrusions into Designated Areas would occur. Since smoke particles can scatter visible light for up to 100 miles downwind from a burn, visible intrusions could also occur into Class I Areas (Personal communication, John Deeming, formerly USFS PNW Research Station, Portland). The probability of visible intrusion into Designated and Class I Areas would be highest under Alternative 6, due to more acres burned, and would be eliminated under Alternative 3.

Considering the smoke reduction methods discussed, and the policy of allowing individual districts to further restrict burning when necessary, the use of prescribed burning should not cause significant impacts. Smoke intrusions should not occur into the Medford-Ashland nonattainment area because burning would be substantially completed during the day thus limiting night time intrusion due to downslope air movement. Most night time air movement would be into intervening small valleys rather than into the Medford-Ashland airshed. Residual smoke would be further reduced due to smaller fuel loadings and standard operating design measures to ensure rapid fuel consumption.

Emissions are also produced by burning gasoline and diesel oil used for fuel ignition. Since gasoline and diesel oil have chemical compositions similar to that of forest residue, their combustion produces similar emissions. During prescribed burning, approximately 1 gallon of gasoline-diesel oil mixture is applied per acre by hand-held drip torches, or 2 gallons of gasoline per acre are applied by helicopter-carried drip torches. Data on the quantities of emissions produced by burning gasoline and diesel oil during prescribed burning are currently unavailable. The small amounts used, however, suggest that emissions produced would not significantly impact air quality.

Impacts from the combustion of gelled gasoline would be insignificant. The final combustion products of the gelling additive are aluminum oxide, water and carbon dioxide. It is expected that the small quantities of aluminum oxide produced would be consumed in the fire (Personal communication, John Kowalczyk, ODEQ,).

Whereas air quality effects from prescribed burning may last several days, those from herbicide application last only several hours. Air quality impacts are the result of herbicide volatilization and spray drift.

Herbicides may affect air quality either through volatilization or spray drift. Volatility refers to the tendency of the chemical to vaporize or give off fumes. The amount of fumes or vapors emitted is related to the vapor pressure of the chemical. Spray drift is the movement of airborne spray particles from the target area. The amount of spray drift depends on (1) size of the droplets, (2) amount of wind, and (3) height above the ground at which the spray is released. Drift is increased by small droplet size, increasing wind speed, and greater height from which the spray is released.

The air may serve as a carrier of spray drift from both helicopter and ground vehicle spraying. Liquid spray droplets most prone to drift are usually 100 microns or less in diameter (spray equipment is designed to produce predominantly 200 micron droplets). A small amount of herbicide may move (via spray drift or volatization, see Glossary) from the treated area during or shortly after aerial application. For herbicides applied aerially in a 5-mile-per-hour wind, concentrations of spray that drift 100 feet downwind are about 1 percent of those onsite.

Although herbicide applications result in vapor losses, commercial uses have not shown volatility to lead to phytotoxicity in nontarget plants (NRCC 1974). Loss from volatilization is reported to be negligible with glyphosate (Weed Science Society of America, 1983). Norris (1983) stated that volatilization of glyphosate and picloram is unlikely

because these herbicides have a low vapor pressure. He also reported that 2,4-D esters may volatilize, but only briefly because the ester hydrolizes to non volatile forms within a few hours or days after application. Volatilization will depend on the formulation of 2-4,D, with acids and amines being less volatile than esters, which vary from high to low. The oil soluble amines are considered to be least volatile. Only the low volatile formulations of 2,4-D are used for spraying in forestry. Dicamba may volatilize from soil surfaces but further study is required to determine the extent of such losses.

Impacts on Soils

Manual Methods

Disturbance of soils by manual methods of vegetation management is usually negligible. Only if large areas are cleared of duff and debris on steep slopes is there any potential for accelerated erosion. But the amount of vegetation removed by manual methods in those areas will be insufficient to cause any substantial impact on the soils.

Mechanical Methods

The majority of acres treated by mechanical methods involve tractor piling slash for site preparation or fuels treatment and scarification for site preparation. Newton and Norgren (1977) have concluded that mechanical methods have the highest potential of any method of vegetation management for direct impacts on soils.

Tractor piling of slash or scarification would result in soil compaction and loss of nutrients. Impacts would generally be greater on shallow skeletal soils and those in the frigid and cryic temperature zones. Clutter and Dell (1978) have shown scarification reduced soil productivity by 11 to 22 percent in 30-year-old pine plantations. Power (1981a) has measured a 17 percent reduction in productivity in an 18-year-old Douglas-fir stand that had been scarified. Long-term data on the effects arising from tractor piling or scarification are not available, but studies show that soil compaction reduces soil productivity (Froelich 1973) and inhibits extension into the soil of mycorrhizal mycelia (Perry and Rose 1980).

Mechanical site disturbance may also remove some of the protective duff layer. In combination with compaction, this may increase the potential for surface erosion, especially on steeper slopes. Accelerated erosion removes the productive topsoil and leads to a loss in soil productivity.

It must be noted that Oregon BLM Policy (IM-OR-83-662) limits soil compaction to less than 12 percent of a harvest area. On the basis of this policy, coupled with the assumptions that topsoil displacement is minimized and compacted soil is tilled, productivity losses should not exceed six percent on a total harvest basis.

Impacts would be proportional to the number of acres treated under each alternative (see Table 1-2). Impacts to soil productivity would be greatest under Alternative 3 and least under Alternative 8.

Prescribed Burning Method

Burning can adversely affect the duff layer, leading to surface erosion and reduced site productivity. An extremely severe burn may also alter the soil microbial community. Accelerated soil and rock slides or flows on steep slopes after vegetation is burned also may be an indirect effect.

Loss of organic matter and nutrients arising from burning is a well-documented impact (Wells et al. 1979, Fredricksen 1972). Higher fire intensities and long burning durations would cause greater impacts on duff, soil organic matter, nutrient leaching and soil productivity. Loss of nutrients through leaching could occur for approximately 2 years. Loss of the soil's organic matter, the major source of nitrogen and sulfur for plant life, would be of particular concern. These nutrients are typically in short supply in western Oregon's forests.

More specifically, a fire which heats the soil to temperatures above 100 degrees Centigrade will temporarily alter the microbial community and can also increase surface erosion. The alteration of the microbial community by fire may directly kill organisms in the upper and litter layers of the soils (Wells et al., 1979). It may also indirectly by altering the environment affect soil micro-organisms to favor one over another. Burning also affects the rate of nutrient cycling (Perry et al., 1985). Persistent, deep burning slash fires will cause additional losses of nutrients during the first few years after burning. (Sidle, 1980). Also, burning debris piles after scarification can severely affect as much as 10 percent of the area's soils. (Morris 1970). In addition, some of the nutrient capital held in the logging debris, litter, duff, and soil is volatilized during burning and is leached from the ashes (Kraemer and Hermann, 1979).

The amount of surface erosion is proportional to the burn's severity. The latter is measured by the amount of exposed inorganic soil (consumption of the forest floor). Burn severity is controlled by fuel loading, fuel moisture content and soil moisture content (Bennett, 1982). Relatively unproductive sites, like steep slopes, or areas with shallow organic layers or high erosion potential, are the most vulnerable to excessively hot fires (Perry et al., 1985).

An indirect effect of burning arises when it removes the soil's litter layer resulting in a corresponding decrease in the soil's ability to absorb and store water, with consequent increased runoff and erosion potential. Once organic matter is consumed by the fire, the stability of soil aggregates is lost and dry ravel occurs (Everest and Harr, 1982). Dry ravel is the crumbling and downslope movement of the surface layer of soil. Power (1981) and Klock (1979) have shown that loss of topsoil results in decreased soil productivity. On steep south-facing slopes, ravelling may continue for up to 30 years after disturbance or until vegetation reestablishes. Studies by Forestry Intensified Research (FIR) in southwest Oregon have shown that conifer seedlings can be buried in ravel up to 6 months, then reappear and still continue to grow indicating that ravel is not a major factor in plantation failure (McNabb 1988). Single-grained soils, such as those derived from granite or volcanic ash, are most susceptible to surface erosion following burning (Everest and Harr, 1982).

Chemical Methods

The soil as well as vegetation can be a major receptor for herbicides, whether applied aerially or by truck-mounted or backpack units.

The behavior of a chemical substance in soil is determined by several properties relating both to the chemical and soil environments. Two of the more important properties are persistence and mobility. Persistence refers to the length of time a herbicide remains active in the soils. Persistence is important in one sense because for some herbicides, such as picloram beads, it influences the length of time that weed control can be expected. It is also important because, if an herbicide is present in the soil in high enough quantities, its residual toxicity can have unintended after-effects that may injure succeeding plants for a period of time after application. In forestry, herbicide application may occur only 1 to 3 times during an 80-year rotation so chemicals have ample time to degrade and not affect new plantations. Mobility refers to the ability of a herbicide to move within the soil profile. Mobility is important because if a herbicide is present in the soil in high enough quantities and moves throughout the profile, its residual toxicity can have unintended after effects that may injure plants.

Many factors affect a herbicide's persistence and mobility in soil. Soils contain a number of microorganisms that use all types of organic matter, including herbicides, for energy and growth. If an herbicide reaches the soil, these microorganisms will utilize it after contact. This process is known as microbial decomposition. The rate at which microorganisms decompose an herbicide in the soil depends on the type and quantity of microorganisms which is determined by soil factors such as soil temperature, moisture content, aeration, and the amount of organic matter. In addition to microbial decomposition, there is a related process known as chemical decomposition. Different soils contain different chemicals that may interact with an herbicide to either destroy it or activate it.

Colloid refers to the microscopic inorganic and organic particles in the soils. These particles have adsorptive, glue-like capacities. Observations in research show that soils high in organic matter and clay content have a tendency for herbicides to persist for a longer time than in sandy soils, which are more porous and allow for more mobility. In contrast, leaching refers to the movement of a substance by water through the soil. The movement of an herbicide by leaching may determine its effectiveness or selectivity, or may account for its leaving the soil. The degree to which a herbicide may leach depends upon its adsorptive relationship with the soil, its solubility in water, and the amount of water passing through the soil. Volatility of herbicides may also affect soils. Some herbicides that are highly volatile may move into porous soils as a gas. Finally, some herbicides may decompose if exposed to light, whereas others may not be susceptible. The process is known as photodecomposition.

The behavior in the soil environment of herbicides proposed for use is summarized in Table 3-2 and discussed below.

The soil and its surface make up an extremely dynamic biological system that provides processes by which herbicides can be destroyed, thus preventing accumulation and redistribution. The

Table 3-2 Behavior of herbicides in Soils

2,4-D	Degradability in soil depends on microbial activity but is fast in organic and moist soils. Persistence is short, and mobility is relatively high.
Dicamba	Moderately persistent, does not adsorb readily to soil particles, and is highly mobile. Mainly lost by soil microbial decomposition.
Glyphosate	Strongly adsorbed by soil. Adsorption is higher with organic soils and lowest in sandy soils. Decomposed rapidly and completely by microorganisms.
Picloram	Highly stable in plants, can be leached, relatively nonvolatile. Moderately to highly persistent in soil. Relatively mobile. Degradation results from sunlight and microbial action.
Triclopyr	Low persistence, not strongly adsorbed and is potentially mobile. Rapidly degraded by microorganisms, rapid photodegradation.
Atrazine	Moderately persistent, moderately mobile, adsorbs readily to soil particles, most readily to soils with high organic matter. Lost be chemical and microbial degradation.
Hexazinone	Variably persistent depending on field conditions, may be susceptible to leaching. Degraded by light and microbial activity.
Diuron	Highly persistent, little or no leaching. Decomposed by microorganisms.
Asulam	Variable persistence, more rapid with higher temperatures, highly mobile with probability of leaching. Breakdown primarily by microbial degradation.
Fosamine	Very short persistence, strongly adsorbed to soil particles, is not mobile. Rapidly degraded microorganisms.

(Information compiled from BLM Noxious Weed EIS, U.S. For. Serv. 1984, U.S. Dept. Energy 1983, and Newton and Dost, 1984).

mobility of herbicides in soil depends on solubility, adsorption, and persistence. Degradation is usually biological, but chemical and light degradation also have a role.

The persistence of herbicide formulations containing 2,4-D has been studied in a variety of soil types and under a wide range of environmental and laboratory conditions. 2,4-D persists only briefly in most soils, generally less than 1 month (Ashton 1982). Norris (1983a) found the half-life of 2,4-D in soil to be 1 to 4 weeks with little potential for bioaccumulation. In general, 2-4-D is relatively mobile in soil compared with other herbicides. 2,4-D thus moves more readily through the soil profile, especially if a soil is low in organic matter. This mobility is less in soils higher in organic matter, such as those in western Oregon (Ghassemi and others 1981k). Microbial degradation (see Glossary) is the major mechanism by which 2,4-D is lost from the soil, especially under warm moist conditions with high soil organic matter - conditions that stimulate the growth of microorganisms. Only minor losses of 2,4-D result from photodecomposition and, for most formulations, volatilization.

The fate of formulations containing picloram in soil is determined by several factors, including volatilization, photodecomposition, adsorption and leaching, runoff, and chemical and microbial degradation. Volatilization is not considered a major determinant of environmental fate because of the low vapor pressure of picloram. Picloram is degraded by natural sunlight and ultraviolet light, although the extent of photodecomposition under field conditions has not been measured. It is generally considered to be a mobile herbicide because its adsorption to soil particles is low. Picloram's mobility depends upon net water flow and the amount of organic matter, with mobility being less in soils high in organic matter, such as those in western Oregon.

Preliminary studies with various soil types found that picloram is usually confined to the upper 1 foot of the soil profile when application rates are low (less than 1 pound/acre) but that picloram can readily move to depths greater than 3 feet, even in relatively dry areas, when the application rate is high (3 to 9 pounds/acre) (NRCC 1974). BLM application rates will not exceed 1 pound/acre.

The persistence of picloram in soils is considered to be moderate to high and is related to both treatment rate and climate. The half-life of the compound has been reported to range from more than 4 years in arid regions to 1 month under highly favorable conditions of moisture, temperature, and organic content of the soil (NRCC 1974).

Dicamba has a moderate (3 to 12 months) persistence in soil compared to other herbicides (Ashton 1982). Dicamba does not adsorb readily to soil particles and colloids (see Glossary) and thus has a high degree of mobility in most soils. The major route for loss of dicamba in soil appears to be microbial degradation rather than chemical degradation or photodecomposition.

Glyphosate is rapidly and strongly adsorbed to soil particles and accounts for its observed lack of mobility, its tendency not to leach in soil, and its unavailability for root uptake. Adsorption to soil is believed to be through the phosphonic acid component. The phosphate level in the soil influences the amount of glyphosate adsorbed, and glyphosate adsorption is greater in soils with high concentrations of trivalent metals such as aluminum and iron, rather than high concentrations of sodium and calcium (Dost 1983).

Dissipation of glyphosate in soil is fairly rapid (half-life of about 2 months) and results mainly from microbial degradation. The main soil metabolite of glyphosate is aminomethylphosphonic acid (AMPA), which itself is also highly biodegradable. (USDA, FS 1984).

Since the persistence of 2,4-D and glyphosate in most soils is short (Ashton 1982; USDA, FS 1984), and they break down rapidly and completely in most soils, they will not be present in sufficient amounts or long enough to reduce the productivity potential of those soils. There has been at least one study that suggests glyphosate may effect soil productivity for a period of time after application in soils containing more than 80 percent sand (Eberbach 1983). However, the average sand content of forest soils in the EIS area is far below this figure. Considering the low application rates, number of applications (primarily only once a year), and physical characteristics of the soils in the EIS area, glyphosate application should not substantially affect soil productivity under the proposed program.

Dicamba, because it is mobile and persists longer than glyphosate or 2,4-D in most soils, will have more of a probability for effecting soil productivity. The possibility, though, is lessened by the low application rates, number of applications proposed (primarily only once a year), and physical characteristics of the soils in the EIS area.

No research has been published on the persistence of atrazine in Pacific Northwest forest soils. However, data from other areas show atrazine persistence in soils is considered intermediate with 2 to 18 months being required for degradation (Kearney et al. 1969). When atrazine was surface applied and leached, most of the herbicide remained in the first inch of soil regardless of whether 2, 4 or 8 inches of water were applied (Kozlowski and Kuntz 1963). Atrazine is more readily adsorbed on muck or clay soils than on soils of low clay and organic matter content (WSSA 1983).

No quantitative data exist on the persistence of hexazinone in forest soils, but it is generally regarded in the Northwest to be comparable to atrazine or less persistent (Newton and Dost 1984). Under agricultural field conditions, the half-life of intact (^{14}C) hexazinone in soil treated at 3.7 kg/ha was about 1 month in Delaware, 2 months in Illinois, and 6 months in Mississippi (Rhodes 1980).

In a study conducted in southwest Oregon, triclopyr was applied to a small watershed at a rate of 3.35 Kg/ha. During application, the peak concentration of triclopyr in the water was 0.095 ppm. Within 20 hours the concentration dropped to 0.003 ppm. Soil collections showed triclopyr residues to be largely confined to the top 15 cm of soil with almost 90 percent in the top 5 cm. The herbicide half-life in the soil was about 3 months (Norris, Montgomery, and Savelle, 1976). A similar study in a wooded area of West Virginia showed no significant amount of triclopyr moved from the site of application through soils or stream water (Schubert, McKellar, Stevens, and Byrd, 1980). In a study using British Columbia coastal forest soil, no movement of triclopyr residues within or through the soil could be detected (Hui, 1985). A study on Canadian forest soils, one predominantly sandy and the other one clay, determined that triclopyr was not persistent. After 2 weeks, 50 percent of the initial deposition

had dissipated, and after 4 weeks, 90 percent was gone. A slight amount of leaching occurred, but at 25-30 cm, triclopyr residues were rare. There was no evidence of mass movement of triclopyr at quantifiable levels (0.54 ug/kg) down slope in the soil. The study concluded that environmental problems with regard to persistent or mobility are very unlikely to occur (Stephenson and Solomon, 1987a).

Under most climatic and soil conditions, the rate of diuron disappearance will equal or exceed 80 percent per year, depending on soil type. The principal soil factor is organic content which is inversely correlated with persistence and positively correlated with the rate of microbial degradation (U.S. Forest Service 1981). Surface-applied diuron in the field did not move below 5 cm in a Monoma silty clay loam which received 20 cm of water during the 54-day test period (Majka and Lavy 1976). Bowmer (1972) and Khan et al. (1976) have shown that diuron does not accumulate in orchard soils as a result of annual applications. Herbicide residues were generally confined to the upper 15 cm of soil. Degradation rates at any time were generally proportional to the herbicide concentration in the soil.

Data on fosamine behavior in soil are not available at this time. In view of the similarity of the behavior of fosamine and glyphosate in many other respects, it is anticipated that the behavior and fate of fosamine will be similar to that of glyphosate (Newton and Dost 1984).

Breakdown of asulam occurs over a wide range of temperatures but is faster under warm, moist conditions (Smith and Walker 1977). It is mobile in soils and may be subject to leaching (Babiker and Duncan 1975).

Whether the presence of any of the 10 herbicides in soils impacts the latter's productivity is uncertain. Many micro-organisms in the soils metabolize herbicides and are often reported to be responsible for the herbicides' decomposition (Norris and Moore, 1981). But, in some instances, the presence of herbicides adversely effect organisms in the soils. Conclusive data on the topic, however, is lacking.

Impacts on Water Resources

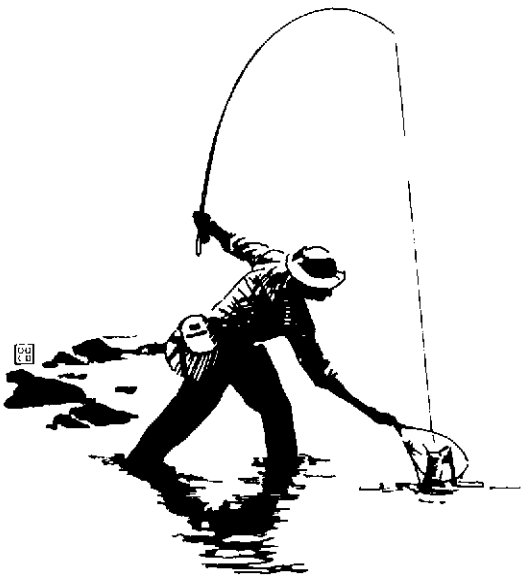
Manual Methods

Manual clearing, chopping and weeding have a low potential for adverse impacts on water resources. An exception to this can be precommercial thinning resulting in thinning debris (needles) entering streams causing a short-term increase in the streams' nutrient base. Proper precautions to prevent oil and fuel from power tools from entering streams will prevent adverse impacts on water resources from these methods.

Mechanical Methods

Increased sedimentation of nearby lakes and streams may result from mechanical methods of vegetation management, depending on operating practices, slope steepness and distance.

First-order stream channels (the upper reaches of a stream where it begins) are most likely to be affected by piling of slash, scarification and the like, since these channels are small and are often located within the treatment area. In order to protect stream channel stability, slash should not be piled within the stream's high water mark. Operation of equipment within stream channels should be prohibited so as to avoid the consequences that follow from that activity.



Operating practices designed to prevent adverse impacts on soils will also have the same mitigative effect on water quality. These practices include timing restrictions, avoiding work in unstable soils, and limiting equipment to slopes of less than 35 percent. Protective buffer strips along water sources can act as a filter mat to minimize sedimentation from off the site due to upslope site disturbance.

Prescribed Burning Method

Potential impacts from burning, if it is severe enough to produce unwettable (hydrophobic) soils, include increased sedimentation, increased nutrients leached from ashes, and increased runoff during storms.

Prescribed burning would be expected to increase concentrations of certain chemicals dissolved in stream water, most notably nitrogen. Tiedemann et al. (1978) found that concentrations of nitrate-nitrogen increased from less than 0.016 milligrams per liter (mg/l) to 0.56 mg/l following severe, summer wildfire in a central Washington Cascades watershed. Fredriksen (1971) reported nitrate-nitrogen concentrations of 0.2 mg/l following prescribed burning in the Oregon Cascades, a value 200 times the nitrate concentrations in an unburned control watershed. Fredriksen (1971) also reported elevated levels of ammonia-nitrogen and manganese following prescribed burning in the Oregon Cascades. Ammonia-nitrogen and manganese reached peak concentrations of 7.6 and 0.44 mg/l, respectively, in surface runoff that extinguished the prescribed burn. Average concentrations of ammonia-nitrogen (1.19 mg/l) and manganese (0.11 mg/l) continued to exceed EPA recommended water quality criteria (0.02 mg/l for free ammonia, 0.05 mg/l for manganese) for 12 days.

Based on Fredriksen's study, prescribed burning would be expected to increase in-stream concentrations of nitrate-nitrogen as much as 200 times that of background levels of undisturbed forest watersheds. Increases would be expected to occur for 1 to 2 years after burning. Maximum concentrations of nitrate-nitrogen should remain less than 1 mg/l, well below the level of 10 mg/l established for drinking water supplies. Prescribed burning may cause ammonia-nitrogen and manganese to exceed EPA recommended water quality criteria for short periods in headwater streams that directly drain burned areas; however, public water intakes are not often located in these headwater streams. Dilution by larger streams from unburned areas would quickly lower concentrations to within recommended levels. Based on acreages proposed for burning, Alternative 7 would have the greatest potential for impacting water quality. No impacts from burning would occur under Alternative 3.

Suspended sediment concentrations may be affected by vegetation management activities, particularly those activities which impact the soil surface. Rice et al. (1972) found that the amount of soil erosion reaching streams is generally proportional to the amount of bare soil in a watershed. Increased sediment concentrations following broadcast burning have been recorded in both the Oregon Cascades and the Coast Range (Fredriksen 1970; Beschta 1978). These studies indicate that scarification and/or prescribed burning would be expected to increase suspended sediment concentrations in EIS area streams. The magnitude of impact from a treatment would depend on the amount of soil exposed, the intensity of the disturbance (i.e., the severity of the burn or the disturbance due to scarification), and distance to the nearest stream. Previous studies indicate that concentrations of suspended sediment return to natural levels, usually about 5 years following disturbance, as vegetation becomes reestablished on disturbed areas (Beschta 1978). Alternative 7 would have the greatest potential for increasing sediment concentrations, because this alternative calls for the highest combined level of scarification and burning.

Chemical Methods

Once in the environment, an herbicide is subject to degradation by soil microorganisms, chemical and photodegradation, adsorption onto soil particles and organic matter, volatilization from soil, plant or water surfaces, or uptake by plants (EPA, 1980). For an herbicide to reach surface or groundwater, it must be relatively soluble in water, resistant to adsorption by soil and organic matter, and sufficiently persistent to endure until it enters the water (Newton and Norgren, 1977).

Impacts on Surface Water

Of the various techniques for herbicide application, aerial applications present the highest hazard for surface water contamination. Direct application and drift are the principal ways herbicides reach surface waters (Norris and others, 1983). Herbicides could reach relatively high concentrations for a short duration through direct application or drift.

Wet, marshy areas generally retain higher levels of herbicides for longer periods of time than upland areas, as a slight rise in the water table can flush large quantities into stream systems (Norris 1980). Also, there is less opportunity for mixing and dilution in lakes and wetlands compared to flowing streams.

The actual concentration in surface water from direct application depends on the rate of application, depth of water, and interception by overhanging vegetation. For example, if four pounds of active ingredient per acre were applied to a 2-foot deep stream with no overhanging vegetation, the instantaneous peak concentration in the stream upon direct application would be 736 ppb (parts per billion). However, this direct application should not occur if "no-spray" buffers are marked and other mitigation measures are followed.

Drift of chemical is the more likely means of entry into surface waters. Application factors such as nozzle type, emulsion, wind speed, temperature, and relative humidity affect the occurrence of drift. A 100-foot buffer is the minimum required for aerial application adjacent to Class I streams.

A 100-foot buffer would result in less than 2 percent of the direct overflight concentration from a helicopter (applying herbicides at a high volume in a 1-10 mph cross wind) reaching the stream (Newton and Norgren, 1977). This would amount to 15 ppb in a 2-foot deep stream when the chemical is applied at four pounds per acre.

As the peak concentration travels downstream, it would diminish due to dispersion, chemical degradation, and adsorption of chemicals to sediments and organic matter (Lorz and others, 1979). Dilution by tributaries will also reduce the concentration. For example, if streamflow within the 100-foot buffer is 2 cubic feet per second, and downstream at a water intake the flow is 10 cubic feet per second, then the peak concentration would be reduced from 15 ppb to 3 ppb at the intake.

For truck-mounted sprayer systems used for roadside spraying, chemical application is prohibited within 25 feet of surface water, and the buffer for hand application methods is 10 feet. Drift from truck-mounted and backpack sprayers can be controlled more closely than aerial application.

Mobilization of herbicides in ephemeral stream channels can be an important mechanism for chemicals to enter surface waters if precipitation prior to chemical degradation is sufficient to cause streamflow. This can result in relatively low concentrations for longer durations (Norris and others, 1983).

Herbicides also may reach surface water by overland flow. Overland flow is rare in the forest environment (Harr, 1976). The bare, compacted soils where it does occur are unlikely to be treated with chemicals (Norris and others, 1983).

Where runoff does occur, the concentration of herbicide may decrease as it flows over the unsprayed areas adjacent to stream channels (Norris, 1981a). Nearly all chemicals are applied from March through October, so the highest hazard for mobilization of residues from overland flow (or mobilization in ephemeral channels) would be during spring (March to May) runoff events or early fall rain-on-snow events.

Leaching of herbicide residues depends on soil type, organic matter content, herbicide solubility in water, rainfall, and chemical persistence. Most herbicides are relatively immobile in soils and do not persist long enough to travel more than a short distance through the soil (Norris and others, 1983). In a survey of agricultural uses in Oregon, pesticides and herbicides have never leached into aquifers resulting in contamination (Parsons and Witt 1988). Due to the low frequency of application and wide dispersion of treatment units, the risk is very low.

A study with 2,4-D applied for brush control on hill pastures in southern Oregon (Norris and others 1982) found that during 7 months following application, 4.5 grams of 2,4-D were discharged into streams, representing 0.014 percent of the total amount applied. They concluded that most of the herbicide discharged into streams in this study was deposited in dry stream channels or streambanks.

Ghassemi and others (1981) have determined that 2,4-D may remain stable for many months in cool, nutrient-poor, natural surface waters. This time would decrease as more microorganisms become present to biodegrade the 2,4-D. Although 2,4-D photodecomposes, photodecomposition is not considered a major mechanism for removal of 2,4-D from water. Studies have shown that 2,4-D does not adsorb readily to particles and sediment in water (USDA, FS 1984) and that the maximum residues of 2,4-D in aquatic environments, when found, are in the ppb rather than ppm range (Ghassemi and others 1981).

From 1977 to 1982, BLM collected water samples from aerial application of 2,4-D in western Oregon, analyzing 337 samples but finding only 69 testing positive for 2,4-D residue. All of the positive samples contained less than 30 ppb (USDI, BLM 1983), less than the 1976 EPA water quality criteria recommended limit of 100 ppb for drinking water. These sites were sprayed aerially on relatively steep forest land.

On the basis of the previously cited studies on the environmental fate of 2,4-D in the environment and with the use of such design features as buffer strips, wind restrictions, temperature restrictions, and pretreatment surveys to highlight potential problems and derive solutions, the use of 2,4-D is not expected to have any significant adverse impact to surface water.

Ghassemi and others (1981) reviewed the persistence and fate of dicamba in aquatic systems. Because dicamba salts are highly water soluble and rapidly enter the soil, sufficient residues are unlikely to remain for transport via precipitation runoff into nearby water bodies. Frank and Sirons (1980) found dicamba residues (0.7 ppb) in only 1 of 949 stream samples after dicamba was applied to watershed soils.

Norris and Montgomery (1975) sampled a stream following treatment of 165.5 acres of a total 602.7-acre forest watershed in the Pacific Northwest sprayed aerially with dicamba at a rate of 1 pound/acre. Samples taken where the stream flowed out of the watershed contained dicamba residues within 2 hours after the start of spraying. These residues rose to a high of 37 ppb at 5.2 hours and then dropped to background levels (less than 1 ppb) 37.5 hours after the start of spraying. The authors attributed these residues to drift and to direct application of dicamba to water surfaces.

These studies show that dicamba generally enters the soil rapidly and is not available for transport into surface waters. The studies also show that when dicamba enters surface waters through drift or direct application, it dilutes or disperses to an undetectable concentration in a relatively short time. With the use of buffer strips and controls on allowable wind speed for aerial application of herbicides, dicamba has little chance of reaching surface water in measurable amounts.

Because of its mobility, picloram may be carried by surface runoff to nontarget areas, including streams and ponds. Runoff, however, removes less than 3 percent of the total picloram applied to soil, and the concentration of picloram in runoff generally decreases with time as well as with the time between application and the first rainfall (Trichell and others 1968 in National Research Council of Canada 1974). Other factors that decrease the concentration of picloram in runoff include decreases in the slope of the terrain, the use of slow-release granular formulations rather than liquids, and the distance over which the runoff flows.

BLM's water sampling conducted with the aerial application of picloram on forest land in western Oregon from 1977 to 1982 found residues in 2 out of 21 samples collected. Concentrations were less than 10 ppb in both positive samples (USDI, BLM 1983).

The maximum proposed picloram application rate and use of the required design features would prevent formulations containing picloram from entering the surface water in significant amounts. All of the determined toxic levels of picloram to plants and animals are shown in ppm, but the studies showing picloram in surface water have detected it at ppb levels. The use of picloram is not expected to have significant adverse effects on surface water quality.

Glyphosate has a low tendency to run off because it strongly adsorbs to both organic and mineral matter and is subject to biodegradation in natural waters, mainly by microorganisms. Glyphosate has been found to have a half-life of from 7 to 10 weeks in natural surface water (USDA, FS 1984).

The strong adsorption of glyphosate to soil particles greatly reduces its mobility through leaching and surface washout. Rueppel and others (1977) tested the mobility of glyphosate in three different soils by means of soil thin-layer plates spotted with radio-labelled glyphosate. These plates were washed twice with water, and the final distribution of radio-labelled glyphosate was determined by beta camera analysis after each washing. On all three soils tested, even after the second washing, glyphosate moved only a short distance, indicating that it is an immobile herbicide.

In an experiment in the Oregon Coast Range conducted with direct application over a creek of 3-lb/acre active glyphosate, maximum concentrations of 0.27 ppm were observed in ponded slow moving waters. Concentrations diminished to .08 ppm in 6 hours and to .005 ppm

on day 3; subsequent monitoring did not detect glyphosate. Glyphosate disappears rapidly from the forest community being adsorbed to soil and sediments to be broken down by microbial action (Newton et al. 1984).

If glyphosate is to be applied by hand or with a vehicle-mounted hand gun, little potential exists for drift, and therefore the herbicide will be almost entirely bound up immediately in the treated vegetation or by soil particles. The insignificant amount of glyphosate that might enter the water would quickly come into contact with water-borne sediment or organic matter and bind to the medium. The use of glyphosate is not expected to significantly affect surface water quality.

Asulam is used specifically for the control of a single species, bracken fern, an upland species which is seldom associated with riparian areas. Opinions differ on asulam's movement through soil. One opinion is that asulam is rapidly mobile in soil and could leach down the soil profile into the drainage water. Babiker and Duncan (1975) postulate that the well drained nature of bracken sites, coupled with asulam mobility, pose some risk of drainage into stream water.

The other opinion is that it is improbable that asulam would move laterally through the soil and through buffer zones in aquatic systems; therefore, aquatic systems are not subject to appreciable contamination (Newton and Dost, 1984). The ecological effects of asulam herbicide on aquatic ecosystems are not known.

Atrazine is only slightly soluble in water and its low solubility, coupled with a tendency to adsorb to soil particles, results in only relatively small amounts of atrazine in runoff water. Atrazine degrades slowly in water, thus dilution, transport, and metabolism by aquatic plants, etc., are the prime means by which atrazine concentrations are reduced in aquatic environments (USDA For. Serv. 1984).

This potential is present in agricultural areas, and atrazine is, in fact, found in midwestern rivers. Treated areas in forestry are usually non-erodable uplands that do not have overland runoff with immediate drainage into courses (Newton and Dost 1984).

Diuron has been used as an aquatic herbicide. It is generally transported in solution rather than adsorbed to soil particles (U.S. Dept. Energy 1983). Maximum diuron concentrations in runoff were measured following rainstorms that occurred soon after application (Willis et al. 1975). In a three-year period, maximum seasonal losses were 0.12 percent. Leaching is unlikely in most soils (WSSA 1983).

Under field conditions, fosamine ammonium is decomposed rapidly by microorganisms (U.S. For. Serv. 1984). Despite its water solubility, fosamine ammonium is a low mobility herbicide being adsorbed tightly to soil particles. Leaching and desorption from soil are lowest in soils with high clay content. Some fosamine ammonium hydrolysis occurs in water.

Hexazinone degrades readily in sunlight under many aqueous conditions. Degradation in natural waters is only slightly inhibited by presence of sediments (U.S. For. Serv. 1984).

Canadian study concluded that under actual conditions of use in forestry, triclopyr is relatively nonpersistent in water and is not bound to sediments to any great extent. There is little practical difference between triclopyr and the butoxyethanol ester of 2,4-D with respect to either persistence or distribution in the aquatic system, although triclopyr appears to dissipate somewhat more rapidly than 2,4-D (Stephenson and Solomon, 1987b).

The proposed application of herbicides would involve relatively small, widely dispersed areas whose sizes would rarely exceed 100 acres and most would be smaller than 10 acres. Aerial spraying at the upper reaches of a watershed often does not attempt to exclude ephemeral stream channels, which range from a couple of feet to several yards wide. In these channels, one of two situations usually apply to preclude the flushing of herbicides downstream in amounts likely to cause impacts: (1) enough rain falls to induce runoff but not enough for the streamflow to reach the next order stream, or (2) if the streamflow is great enough to reach the next order stream, enough water flows to dilute the herbicide. Larger ephemeral stream channels, typically near or in valley bottoms, would be protected by restrictions similar to those that apply to other areas such as riparian zones or wetlands.

With the use of buffer strips and restrictions on equipment, windspeed, and application rates, significant impacts to surface water quality are unlikely to occur from the normal use of herbicides. In herbicide spraying operations that have not ap-

plied these restrictions, the amount of herbicide entering the water has been in the parts-per-billion range and not in the parts-per-million range that appears to be the level for the most adverse effects. Since most treatments would be applied not more than one time per year, little potential exists for herbicides to accumulate in harmful amounts.

The proposed action is expected to have slight or nonexistent cumulative effects on water quality. With the design features proposed, such as buffer strips, restrictions on allowable wind speed for spraying, restrictions on air temperatures, and others, little or no herbicide is expected to enter the water, and any herbicides entering the water would be dispersed and degraded before the next application with little or no chance of accumulation.

In most instances, treatment areas on BLM-administered lands are small and dispersed and do not undergo intense herbicide use. As a result, treatments are not expected to contribute to long-term measurable levels of herbicides in water.

The BLM routinely monitors water quality in conjunction with spray operations. Baseline water samples are taken prior to application of herbicides and are collected at times when detection of herbicides is most likely, i.e, in the first 24 hours following herbicide application to measure concentrations from accidental drift. The first major post-spray rainfall event is also monitored to measure concentrations carried by surface runoff or soil erosion. The results of BLM's water quality monitoring, which identify the relative quantities of specific herbicides utilized 1977-1982, are summarized in Table 3-3, along with EPA recommended water quality criteria for selected herbicides. The table indicates that 822 percent of the analyzed water samples showed no detectable levels of herbicides. Less than 0.5 percent of the analyzed samples exceeded the recommended level for a 24-hour mean concentration. Three samples from one atrazine spray unit exceeded the recommended level of 50 parts per billion (ppb) for the 24-hour mean. Samples taken 24 hours later on this stream showed herbicide concentrations less than 10 ppb.

Based on the data in Table 3-3, BLM spray operations would be expected to rarely cause stream contamination that would exceed EPA recommended criteria. Potential for impacting water quality from spray operations would depend upon the number of acres to be sprayed and the restrictions imposed under each alternative. Potential water quality impacts would be greatest under Alternatives 2 and 3, decreasing to least under Alternatives 7 and 8.

Impacts on Groundwater

Groundwater contamination is dependent on having a high water table and frequent high levels of herbicide applications. Infrequent herbicide applications in forestry (1-3 times in 80 years) and absence of static groundwater under most forest areas makes the hazard of groundwater contamination low. A survey of Oregon Department of Environmental Quality records shows that out of 57 wells tested for 2,4-D, 28 tested for atrazine, 24 tested for diuron, 22 tested for hexazinone and 49 tested for dicamba, in agricultural situations, only 1 positive test was found. One well showed dicamba present at 0-1 ppb. (Parsons and Witt, 1988).

Due to the checkerboard ownership pattern of western Oregon BLM lands, it is possible that those impacts identified in this analysis could combine with impacts caused by vegetation management actions on adjacent lands for greater cumulative impacts than for BLM operations alone. These potential impacts would include changes in dissolved solids concentrations, suspended sediment levels, herbicide levels and stream temperatures. Cumulative impacts are not expected to be much more significant than those discussed above. Specific analysis on a drainage basis would be done at the time of annual program or project planning.

Impacts on Vegetation

Terrestrial Vegetation

Management of competing vegetation would have both beneficial and adverse impacts on terrestrial vegetation within the western Oregon BLM districts. Both target and nontarget vegetation in areas scheduled for treatment would be directly affected. The degree to which vegetation would be affected would depend on the types of treatment used and the number of acres treated under each alternative (see Table 1-2). The overall effect of managing competing vegetation would be to accelerate succession through the grass-forb and brush-seedling seral stages (see Table 2-2), reducing the total amount of BLM-administered land occupied by vegetation of these seral stages.

Table 3-3 Water Quality Monitoring of BLM Spray Projects, 1977 to 1982.

Herbicide	Total Analyzed	With No Residue	Number of Samples 0-10 ppb[1]	11-30 ppb	31-50 ppb	51-100 ppb	101-500 ppb	Maximum Observed Concentration (ppb)	Recommended 24-hour Mean Concentration[2] Irrigation (ppb)	Drinking (ppb)
Asulam	1	1	-	-	-	-	-	-	-	-
Atrazine	221	166	48	6	-	-	2	503.0	50	50
Triclopyr	30	20	10	-	-	-	-	3.8	-	-
Fosamine ammonium	2	2	-	-	-	-	-	-	5,000	5,000
Picloram	21	19	2	-	-	-	-	1.1	1	500
Glyphosate	97	86	10	-	1	-	-	35.0	-	-
Hexazinone	7	7	-	-	-	-	-	-	-	-
2,4-D	337	268	67	2	-	-	-	16.8	50	50

[1]ppb = parts per billion
[2]Newton and Norgren (1977, Table 2, p. 77). These criteria are for 24-hour mean concentrations for streams flowing less than 10 cubic feet per second and are not directly comparable to the individual sample concentrations from BLM spray monitoring. Sample concentration from BLM monitoring would tend to be higher than 24-hour mean (average) concentrations because spray monitoring is concentrated in the period immediately following herbicide application, when concentrations are likely to be highest. Twenty-four-hour mean concentrations downstream from BLM spray operations would be lower than the concentrations of individual samples.

Manual Methods

Manually cutting brush and hardwoods for both site preparation and release would temporarily reduce competition. However, studies and field observations indicate that within 6 months to 2 years after treatment, sprouts of vine maple, red alder and salmonberry would regenerate to their original height, and brush density would increase fivefold (Roberts 1980). Another study revealed a 1,327 percent increase in stem density of selected southwestern Oregon broadleaf evergreen species 2 years after treatment (Personal communication, Stephen Hobbs, Adaptive FIR). These impacts would be most pronounced in Mixed Conifer and Mixed Evergreen Zone forests due to the abundance of prolific sprouting species in these zones. In addition, manual cutting could result in injury to more than 20 percent of released conifers from saws, falling debris and shock from exposure (Roberts 1980). Recent studies on cutting red alder have produced good results. After two growing seasons, stems cut during June and July experienced a 95-96% mortality rate (Turpin and DeBell, 1986). Additionally, stems cut so that the resulting stumps were less than 20 cm high had the highest mortality and the fewest and shortest sprouts.

Mulching on dry sites would prevent the growth of grass and increase available moisture to conifers. A 1982 study in the Roseburg District revealed a 93 percent survival rate on mulched plots containing Douglas-fir seedlings after three growing seasons. On slopes greater than 65 percent, mulch could slip downhill and damage conifer seedlings.

Scalping would temporarily remove competing vegetation from individual planting spots. Vegetation with extensive root systems, particularly some grasses, would quickly regenerate in most areas. Occasional damage to seedlings could occur if scalping were done after planting. Overall, scalping would not significantly impact vegetation.

Hand pulling would completely remove competing plants from individual planting spots. Conifers would remain free from competition until other species invaded from surrounding areas. Since this practice would be limited primarily to young ceanothus, Scotch broom, and manzanita plants, overall impacts would be insignificant.

Often hand cutting of brush is combined with precommercial thinning. The impacts of precommercial thinning on vegetation (whether in conjunction with brush removal or not) would be similar to those of release treatments. Although some damage would occur to released conifers by accidental cutting or by falling trees, precommercial thinning would increase merchantable volume (see Glossary) by 20 to 25 percent (Curtis et al. 1982). As with manual release cutting, manual precommercial thinning would leave a dense slash layer on the ground that could not be burned, creating a fire hazard for 3 to 5 years.

Based on acreage treated, impacts on vegetation from manual treatments would be greatest under Alternative 7, and progressively less under Alternatives 6, 3, 4, 5, 1, 2 and 8.

Mechanical Methods

Scarification would remove most of the brush in treated areas, killing over 70 percent of the root systems (Newton and Dost 1981). By exposing bare mineral soil, scarification would aid germination of light-seeded species such as grasses and hardwoods. On scarified units with low rainfall where grass establishes itself as the dominant vegetation, conifer seedlings would suffer increased moisture stress and damage from rodents and deer. Damage to conifers from animals could also increase if slash were piled during scarification and left unburned, providing excellent habitat for rodents. In addition, piling would impact conifer stocking, and thus productivity, by decreasing plantable acres.

Scarification, piling, and cutting would be most effective in controlling competing vegetation when used in combination with other site preparation methods. Scarification by itself would expose bare mineral soil, aiding germination of light-seeded species such as grasses and alder. Some shrubs would resprout from surviving root systems. The result would be open stands of hardwoods and brush surrounded by a dense cover of grasses and forbs (Newton and Dost 1981).

Impacts of mechanical treatments would be greatest under Alternative 3, and progressively less under Alternatives 6, 7, 1, 5, 4 and 2. Vegetation would not be impacted by mechanical treatments under Alternative 8.

Prescribed Burning Method

Prescribed burning would temporarily reduce total brush cover or suppress some species of competing vegetation (Morris 1970). By exposing mineral soil, however, burning would also promote the subsequent invasion of grasses, forbs and hardwoods. The germination of some competing shrubs such as manzanita and ceanothus would be stimulated by burning, most often in the Mixed Conifer, Mixed Evergreen, and Ponderosa Pine Zone forests of southwestern Oregon.

Severe burns would be more likely than light burns to kill vegetation roots. Past research (Morris 1970 cited in Cramer 1974) indicates about 6 percent or less of a treated area would be severely burned, and 55 to 75 percent would be lightly burned. Lightly burned acres would have a higher percentage of herbaceous and brush cover present within 2 years after burning. Some control over burn intensity would be exercised by specifying fuel moisture contents, ignition patterns, and other variables in the site-specific prescribed burning plans.

Risk of wildfire from escaped prescribed fires would not be significant under any alternative. From 1980 to 1985, 3.7 percent of BLM prescribed fires resulted in wildfires. These wildfires accounted for 2.4 percent of all acres burned by BLM in western Oregon.

Impacts on competing vegetation from prescribed burning would be similar under Alternatives 1, 2, 4, 5, 6 and 7. Impacts would be less under Alternative 8 because fewer acres would be burned. Alternative 3, which would not allow burning, would result in reduced reforestation success and an estimated 4 percent reduction in western Oregon BLM's annual timber sale program.

Chemical Methods

Herbicides impact the species composition, size, density, and vigor of vegetation. Impacts on vegetation would range from complete control to negligible damage depending on species, chemicals used, dosages and timing of applications.

Herbicides used for site preparation, maintenance, and release would usually result in a large percentage of brush and hardwood defoliation, a fair amount of topkill (see Glossary), and minimum resprouting. Treatments would not necessarily eliminate all competing vegetation but would temporarily reduce competitors, increasing the amount of light reaching conifers and decreasing brush and grass competition for soil moisture and nutrients. Impacts of herbicides would be greater on plant sprouts or seedlings than on full-crowned, mature plants. Use of herbicides would also reduce habitat of rabbits and rodents which would otherwise occupy planted areas and feed on young conifers.

Triclopyr and 2,4-D are used for release of Douglas-fir. Triclopyr will cause injury to ponderosa pine whenever applied and can injure Douglas-fir if applied during the growing season. Serious injury to Douglas-fir from 2,4-D seldom occurs, but injury

to ponderosa pine can be significant if applied in the spring. The herbicides atrazine, asulam, fosamine ammonium, glyphosate and hexazinone can be used for release without conifer injury if the rate and time of application are correct. Picloram, dicamba and diuron are injurious to conifers and are not used for release.

Chemical release would increase the growth rate of young conifer seedlings stressed by competing vegetation. In a western Oregon study (Gratkowski and Lauterback 1974), selected herbicides were used to release Douglas-fir from ceanothus. Height growth of young Douglas-fir was reported for a 5-year period after release. Percentage increase in height growth over nonreleased trees varied from 30 percent (for trees 1 foot high when spraying occurred) to 49 percent (for trees 6 feet high) in basal spray plots and from 155 percent (for trees 1 foot high) to 71 percent (for trees 6 feet high) at aerial spray locations. A study conducted by Gratkowski (1979) on the release of Douglas-fir from snowbrush ceanothus compared the results of three treatments: slashing with follow-up stump spray, slashing only and basal spray only. Results of this study show that after 10 years on the slashed-only plots, a tree 6 feet tall at the time of release increased in height 29 percent over the control trees. On the basal spray-only plots the increase was 39 percent over control trees and on the combined treatment plots the increase was 56 percent over control trees. A third study, conducted by Lauterback (1967), showed diameter growth of trees in sprayed areas was 2 to 2.5 times that of trees in unsprayed areas 5 to 6 years after treatment.

In a more recent study (Petersen, et al. 1988), chemically released Douglas-fir showed stem diameter increases of 2 to 6 cm and height increases of 1 to 2 m after six growing seasons. Additional examples are presented in White (1988).

Herbicide injection (sometimes used for precommercial thinning) would leave trees standing and would not generate a dense slash layer. This would reduce fire hazard and accidental injury to conifers. Herbicide injection could adversely affect released conifers if certain chemicals (i.e., picloram) were adsorbed through root contact with injected trees.

Oil carriers would also impact vegetation. In addition to improving spray coverage and herbicide penetration, diesel carriers in themselves could damage or kill plants. Occasional damage would occur to individual conifers which began bud break earlier than the majority of conifers in a spray unit.

Based on acreages proposed for treatment, impacts of herbicides on vegetation would be greatest under Alternative 3, and progressively less under Alternatives 2, 1, 5, 4 and 6. Alternatives 7 and 8, which would not allow herbicide use, would result in reductions of approximately 11 percent and 31 percent, respectively, in BLM's annual timber sale program.

Under Alternatives 1 through 5, nontarget vegetation immediately adjacent to spray units could be adversely affected by herbicides drifting beyond unit boundaries. Such impacts would be reduced, but not eliminated, by buffer strips and application techniques (Gratkowski 1974).

Biological Methods

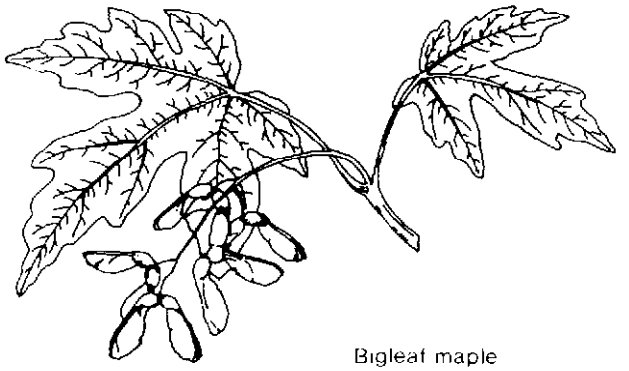
Seeding selected grasses and forbs on units in high rainfall areas immediately following burning or scarification would retard or prevent invasion of light-seeded brush and hardwood species. Seeding would only be effective in portions of vegetation zones where there would be little or no competition for moisture (i.e., north slopes in coast range). In such areas, grasses and forbs would have little effect on conifer survival and growth compared to losses caused by brush and hardwoods (Klingler 1980).

Properly managed, sheep could be effective in reducing competing vegetation on selected sites with limited damage to conifers. Sheep reduce palatable grasses, forbs, sprouts and low top growth of several species of shrubs, leaving taller and less palatable species (Sharrow and Leininger 1983). Sprouting and regrowth of grasses following grazing is vigorous.

No impacts from biological treatments would occur under Alternative 8. Overall impacts under the other alternatives would be negligible because of the limited number of acres that would be affected.

Threatened or Endangered Plants

Unidentified populations of threatened or endangered plant species could be susceptible to any impacts described under terrestrial vegetation. Direct effects of injury or death to plants could cause the immediate elimination of a species in all or a significant portion of its range. The more subtle



Bigleaf maple

effects of vegetative community changes could cause the eventual elimination of a species on a specific site locally through loss of competitive ability relative to other vegetation.

If any species of vascular plant is determined by the U.S. Fish and Wildlife Service to be threatened or endangered, any action that would contribute to its extinction or to its threatened or endangered status would be in violation of the Endangered Species Act of 1973 as amended. Therefore, environmental assessments accomplished prior to any site-specific action would document any threatened or endangered plant species known to be present on the site and identify appropriate measures to be taken to protect the species.

Conclusions

The overall impact of Alternatives 1 through 7 would be to suppress competing vegetation, thereby increasing conifer survival and growth. The greatest levels of vegetation control would be provided under Alternatives 1 and 2 (see Table 1-2), which would include the full range of vegetation management practices and would treat the largest number of acres through burning or herbicide application. Less impact on competing vegetation would occur under Alternatives 3 through 7, which restrict or preclude some treatments. Alternatives 3 and 7 would result in reductions of approximately 4 percent and 11 percent, respectively, in BLM's annual timber sale program. Alternative 8 would least impact competing vegetation, resulting in the lowest level of conifer survival and a 34 percent reduction in BLM's annual timber sale program.

Herbicides would provide greater control of resprouting vegetation than other treatments. Suppression of most competing vegetation through manual cutting would be temporary because sprouts would quickly regenerate, increasing brush density to above pre-treatment levels. Mechanical treatments would temporarily remove competing vegetation from sites but would aid germination of grasses and hardwoods. Thinning of some competing vegetation, such as red alder, if done during effective cutting periods and at the right age, can be as effective as herbicides.

Impacts on Animals

Terrestrial Vertebrates

Impacts on wildlife from vegetation management would be beneficial or adverse, depending on the animal species affected and the treatments used under each alternative. Although some treatments (i.e., grass/forb seeding) would provide short-term benefits to some wildlife species, the overall long-term results of controlling competing vegetation would be reduced habitat diversity with a corresponding reduction in wildlife species abundance and diversity.

Precommercial thinning, although it may open a young forest canopy, generally does not benefit deer and elk because the unremoved slash impedes movement. The obstacle presented by slash accumulations restricts deer and elk from utilizing any forage increases which result from the thinnings. Cover use is also restricted by slash accumulations. Therefore, reduced deer and elk use would occur on those acres precommercially thinned (see Table 1-2). This condition could last as long as two decades before decomposition removed the obstacles.

Conversely, birds and small mammals may increase their use of an area following precommercial thinning. Slash accumulations provide cover for them, and any increases in forage production can be utilized.

Most detrimental to wildlife would be cumulative impacts resulting from successive treatment of sites and/or from treating a number of closely spaced sites within a short time period. Adverse impacts on wildlife populations could be reduced by treating no more than 25 percent of the 0-15-year seral stages within a 1-mile radius of a treatment unit during any 3-year period.

Mechanical Methods

Mechanical piling of slash during scarification would result in soil compaction, damaging subterranean habitat used by some burrowing animals. Piling would remove downed slash that hinders movement of deer and elk but may create large barriers if slash is windrowed. Removal of downed woody material would reduce habitat for many small wildlife species.

Gross yarding for site preparation normally removes logging slash as small as 6 to 8 inches in diameter and 8 feet in length. This would reduce new habitat made available to birds and small mammals by timber harvest. Gross yarding would benefit big game by improving access through treatment areas and increasing availability of forage.

Impacts from mechanical treatments would be greatest under Alternative 3 and considerably less under the remaining alternatives.

Prescribed Burning Method

Broadcast burning would destroy animals unable to flee treated areas or escape into burrows. Spring burns (March through June) would destroy nests with eggs and young hidden in vegetation. Prescribed burning during the nesting season could also cause raptors and herons to abandon nest sites adjacent to treatment areas. Such abandonment would result in the loss of young or failure to produce offspring during the year. Burning fuel piles would destroy few animals since species inhabiting piles could easily escape.

Wildlife habitat would also be impacted by prescribed burning. Effects on ground cover would vary with fire severity. Lower severity fires on wet sites would remove less ground cover than high severity fires on dry sites. Loss of small ground cover and charring of larger branches and logs (more than 3 inches in diameter) would be detrimental to some birds (e.g., woodpeckers, chickadees) and to some small mammals (e.g., weasels, rabbits, deer mice) that use forest residues for food or shelter. Charring of large branches and logs would also be harmful to insects, an important link in the food chain. Burning of downed woody material would cause a long-term reduction of this important habitat in future managed forests.

Leaving an average of two snags per acre would be necessary to maintain viable populations (see Glossary) of cavity nesting animals (USDA, FS 1982); however, most snags in timber harvest units are removed during logging operations. The few remaining snags or trees retained for wildlife are felled if they might increase fire hazards during prescribed burning or are found to be safety hazards during logging operations. Because snags develop slowly, their removal would have a long-term impact on the abundance and diversity of species dependent upon this habitat.

Grasses and forbs normally begin growing vigorously within a few months after slash burning, providing habitat for animals adapted to early seral stages. Burning improves the quality and palatability of forage for big game (Yoakum et al. 1980). Crouch (1974) indicated that prescribed burning increased the food supply of black-tailed deer. Harper (1969) found more Roosevelt elk use on burned logging sites than on unburned sites, a difference he ascribed to the greater abundance of grasses on burned areas. However, Harper believed prescribed burning would not necessarily increase forage on all sites, because each site varies in its response to burning. Burning would also benefit deer and elk by removing obstructions to their use of forage areas (Crouch 1974).

Based on acreage treated, impacts from burning would be similar under Alternatives 1, 2, 4, 5, 6 and 7. Impacts would be less under Alternative 8 and eliminated under Alternative 3.

Chemical Methods

Wildlife can be affected by herbicides directly from toxic affects to animals and indirectly from changes in the habitat.

Habitat Changes

Herbicides significantly modify wildlife habitat by suppressing grasses, forbs, brush and hardwoods in favor of conifer development. This reduces habitat diversity and stratification, adversely impacting those animals that utilize the grass/forb and brush/seedling seral stages. Temporary favorable conditions may occur when brush height is lowered or sprouting is induced by herbicide application, thus making forage more available.

Harper (1971) reported that elk in western Oregon were adversely affected when ground forage was removed with herbicides but were benefited by the opening of dense brushfields. Black (1970) found that deer use increased on treated areas 1 year after treatment. Generally, increases or decreases in forage would be temporary, but in important

habitats within the EIS area such as big game winter range, fawning and calving grounds, or small year-round habitat areas, substantial decreases in forage could reduce local big game populations. Such decreases in forage would be likely to occur in localized areas under all alternatives except 7 and 8.

Snags remaining after logging are occasionally felled to reduce hazards to aircraft during aerial herbicide spraying. In the long term, this practice would reduce populations of animals dependent upon snag habitat.

Known raptor and heron nesting sites would be avoided during the January through August nesting season. However, aerial herbicide applications near unidentified nest sites could cause abandonment of nests, resulting in loss of young or failure to produce offspring.

Although herbicide use would temporarily increase forage for some species (e.g., elk), the anticipated overall impact of shortening early successional stages and reducing vegetation diversity would be to reduce wildlife populations. This adverse impact would be greatest under Alternatives 1, 2 and 3 and would result in little change from existing population levels under Alternatives 4, 5 and 6. Herbicides would not be used under Alternatives 7 and 8.

Toxic Effects

A risk assessment was conducted to determine the potential toxic impacts to wildlife from herbicides proposed for use in BLM's vegetation management program. The assessment evaluated a realistic dose which equates to normal applications and a worst-case estimation where animals received much higher than normal doses of herbicides. The risk assessment determined that, in general, toxic effects from this program were low. Anticipated risks to wildlife are also thought to be low because of the widely separated treatment areas, low application rates, and infrequent treatments. The risks to wildlife from herbicides are a function of the inherent toxicity (hazard) of each of the herbicides to different animals and the amount of each chemical (exposure) animals may take in during a control situation. A more thorough discussion of impacts to wildlife from exposure to the 10 proposed herbicides may be found in the Wildlife Risk Assessment in Appendix P.

A summary of this risk assessment indicates there are three levels of risk (none, low and moderate) for 14 wildlife species examined (Table 3-4). Herbicides evaluated to have no risk to terrestrial wildlife are glyphosate, dicamba, and fosamine.

Glyphosate poses very little risk to any wildlife. The lethal dose required to kill 50 percent of test animals (LD_{50})(see Glossary) for most mammals is greater than 3,800 mg/kg (USDA 1984). The highest worst-case dose estimations for exposure (risk) is 550 mg/kg for mice, which is less than 70% of the 1/5 LD_{50}, indicating no risk by EPA standards[b].

Dicamba is slightly toxic to mammals and almost nontoxic to birds (USDA 1984). The LD_{50} for mice is 1,189 mg/kg and over 10,000 mg/kg for bobwhite. Worst-case doses for some species exceeds their 1/5 LD_{50} but are well below LD_{50}. All realistic doses are all well below the 1/5 LD_{50}, which indicates very little risk.

Although fosamine is slightly toxic to birds and mammals (Dupont 1983), exposure dose levels are

Table 3-4 Toxicity and Risk Levels for Wildlife (Risk to Wildlife from 10 Herbicides Proposed For Use in Western Oregon's Vegetation Management Program)

	Toxicity[a]	Risk
Glyphosate	Low	No
Dicamba	Slight	No
Fosamine	Slight	No
Hexazine	Low	Low
Asulam	Slight	Low
Diuron	Slight	Low
Picloram	Slight	Low
Atrazine	Low	Slight
2,4-D	Moderate	Moderate
Triclopyr	Moderate	Moderate

[a] Toxicity rating (USDA, 1981)

Classes	LD_{50} Levels (mg/kg)
Extremely toxic	<5
Very toxic	5-49
Moderately toxic	50-499
Slightly toxic	500-4,999
Low	>5,000-14,999
Nontoxic	>15,000

[b] EPA Risk Standards (EPA 1986)
<1/5 LD_{50} No risk
<1/5 LD_{50} Some risk but mitigable

well below 1/5 LD_{50} for both realistic and worst-case. Fosamine presents negligible risk to wildlife.

Five of the herbicides examined (hexazinone, asulam, diuron, picloram, and atrazine) have low risks to wildlife. Generally, low risks can be mitigated by using lowest possible application and avoiding key habitat areas.

Hexazinone has low toxicity to most wildlife, particularly birds (EPA 1982e). Worst-case doses are all below LD_{50} levels. Realistic doses are all below 1/5 LD_{50} indicating very low risk.

Asulam, diuron and picloram are slightly toxic to birds and mammals (USDA 1984). The LD_{50} for small birds and mammals range from 2000 mg/kg for mourning doves to 2,600 mg/kg for mice (EPA 1984b, EPA 1986a, Hudson et al. 1984). Worst-case doses are well below the LD_{50} for all species. The realistic dose for several small mammals are above the 1/5 LD_{50} which indicates some risk.

Atrazine also has slight risk to some wildlife but has low toxicity to most wildlife particularly birds and small mammals (EPA 1984b). Although several species of small mammals have worst-case dose levels that exceed the 1/5 LD_{50}, none of the realistic-case dose levels exceed the 1/5 LD_{50}. Using EPA standards, these indicate some risk but can be mitigated (EPA 1986).

Only two of the herbicides examined are moderate risk to wildlife, 2,4-D and triclopyr. Several worst-case doses exceed the LD_{50}. Only three species have realistic doses that exceed 1/5 LD_{50} which indicate some risk that can be mitigated.

2,4-D is moderately toxic to wildlife (Ghassemi et al. 1981). Mammalian LD 50's range from 100 mg/kg for dogs, to 848 mg/kg in guinea pigs. Oral LD_{50} for birds range from 472 mg/kg in young pheasants to over 2,000 mg/kg in mallards, which indicates moderate toxicity (Hudson et al. 1984). Worst-case doses for some small mammals, reptiles and amphibians are above their LD_{50}, which is high risk. Realistic doses for these species are above 1/5 LD_{50} but well below LD_{50}, which indicates moderate risks but mitigable.

Triclopyr is moderately toxic to mammals and slightly toxic to birds (USDA 1984). Exposure to triclopyr is low to moderate. Realistic doses are all well below 1/5 LD_{50}, while one worst-case dose exceeds the LD_{50} (mice). The risk for small mammals and small birds appears to be moderate. Larger mammals and birds are at low risk from the use of triclopyr.

Generally, local populations of small animals which are less mobile may be adversely affected if large areas are treated. However, reproductive capacity of these species are generally high enough that within the next breeding cycle individuals lost will be replaced. Larger mammals and birds are at low risk from use of the 10 herbicides. Areas with sensitive species would be avoided.

Chronic (long-term) effects of these herbicides on wildlife are not anticipated. Because the herbicides examined in this EIS show no tendency to bioaccumulate, long-term persistence in food chains and subsequent toxic effects were not considered a problem and were not examined in the risk analysis.

Diesel oil is often used as a carrier for forest herbicides. Data are insufficient to predict the impacts of diesel oil carriers on animals in the EIS area, but direct loss is likely to be low. Adult ducks are known to be adversely affected at dosages higher than those used in normal forest applications (Hartung 1965, 1966; Tucker and Crabtree 1970). Diesel oil can also coat eggs, reducing hatching success (Kopischke 1972), and coat birds, increasing their vulnerability to other environmental stresses such as predation and hypothermia. Early spring application of herbicides in diesel oil carriers may reduce nesting success of some birds (USDE, BPA 1983).

Fish

Vegetation management activities can impact fish and aquatic habitat by causing changes in food sources, water temperatures, water chemistry, and condition of bottom materials. Chapter 3, Impacts on Water Resources, provides information on potential changes in sediments, organic matter, and water quality. Many analyses and conclusions appearing in this section are based on those data.

To avoid or minimize vegetation management impacts on aquatic habitat, the BLM employs a number of protection measures. Buffer strips (see Glossary), stream cleaning and equipment restrictions are typical of past efforts. Because of these protection measures, impacts from prescribed burning, mechanical treatment and precommercial thinning will be negligible under routine operations. The alternatives provide a range of protection. Alternatives 1 and 3 through 8 would maintain protective buffers on all flowing streams. Under

Alternative 2, requirements for protecting first and second order streams (see Glossary) would be less stringent than under the other alternatives.

Bottom material (boulders and gravel) with a minimum of sediments (see Glossary) is essential to the health of fish populations. In the EIS area, excessive amounts of sediment in fish habitats result primarily from landslides caused by surface-disturbing activities near channels (see Chapter 3, Impacts on Soils and Water Resources). Excessive sediments affect fish by reducing aquatic food sources and by cementing or covering gravel. This reduces dissolved oxygen and eliminates or reduces spawning, incubation, and rearing of young fish. According to Gibbons and Salo (1973), excessive sediments have the greatest impact of all factors affecting aquatic life. Suspended sediments would be reduced from present levels under Alternatives 3 and 8 due to reductions in burning and/or scarification. The remaining alternatives would increase sediments over present levels in some localized stream reaches, but increases would not be expected to significantly affect fish habitat.

Aquatic and terrestrial invertebrates (mainly insects) are the major food sources for young salmon and trout. According to Erman et al. (1977), undisturbed buffer strips at least 30 meters (about 100 feet) wide on each side of a stream are needed to maintain insect populations. Insects falling from multi-storied vegetation are widely dispersed over adjacent water, providing a constant and plentiful source of food. Food sources in small perennial headwater streams would decline under Alternative 2 due to less stringent buffer zone requirements.

Water temperatures are critical for optimum fish production. Reduction of riparian zone vegetation would likely increase summer and decrease winter water temperatures. High summer water temperatures could reduce dissolved oxygen, increase the incidence of fish disease, block upstream fish passage, overcrowd juvenile rearing areas and reduce food production. Low winter water temperatures could slow egg incubation. Impacts on fish due to changes in water temperatures would likely occur under Alternative 2. Temperature changes under the remaining alternatives would not significantly affect fish production.

The possibility exists for herbicides to enter streams through either accidental direct application, drift, or movement of chemical residues from upland areas. The amount of herbicide reaching a body of water depends primarily on the application method and the application rate. Chemicals proposed for use in vegetation control at their levels of application and with specified buffers along existing water bodies are not expected to significantly affect fish or their habitat under any alternative.

Although the toxicity of some chemicals is slight to high, the likelihood of exposure of fish populations and aquatic organisms to toxic concentrations of herbicides under realistic operations is low (Table 3-5).

The chemicals asulam, dicamba, fosamine and hexazinone are slightly toxic to aquatic organisms. The 96-hour LC_{50} (lowest concentrations that kills 50 percent of the fish - See Glossary) was 5,000 ppm for asulam (WSSA 1983); 28 ppm for dicamba (Johnson and Finley, 1980); 100 ppm and 180 ppm for fosamine and hexazinone, respectively (Mayer and Ellersieck, 1986) and under realistic operations would present no significant risks of acute effects to aquatic animals. Under worst-case senarios and accidents, fosamine and hexazinone concentrations in water would be relatively low and would be mitigated. However, in an extreme-case accident (i.e., truck spill in a pond) dicamba concentrations could have significant risks to fish and microcrustacea.

The chemicals 2,4-D, diuron, glyphosate and picloram are all moderately toxic to aquatic organisms. The 96-hour LC 50's ranged from 1.3 ppm (Folmar 1979) to 8.6 ppm (Lynn 1965) for these chemicals and under realistic operations no significant risks of acute effects to coldwater fish are expected to occur. However, under worst-case and accidental senarios, estimated environmental concentrations would have significant risks of acute effects.

The chemicals atrazine and triclopyr are highly toxic to aquatic organisms. Both chemicals present risks during normal (realistic) operations and worst-case and accidental senarios. However, normal operation risks can be mitigated by enlarging buffers and/or reducing application rates. In addition, atrazine is a grass control herbicide which is seldom used in the proximity of streams.

The low 96-hour LC 50's for atrazine (0.87 ppm, Birge et al. 1979) and triclopyr (0.74 ppm, Dow Chemical Company 1983) present a slight risk under environmental concentrations in realistic aerial operations and a significant risk in worst-case or accidental operations.

Table 3-5 Toxicity and Risk for Associated Aquatic Organisms[a]

Chemical	Toxicity to Aquatic Organisms	Risk	
		Realistic[b]	Worst-Case
Asulam	Slight	No	No
Dicamba	Slight	No	Significant
Fosamine	Slight	No	Slight
Hexazinone	Slight	No	Slight
2,4-D	Moderate	No	Significant
Diuron	Moderate	No	Significant
Glyphosate	Moderate	No	Significant
Picloram	Moderate	No	Significant
Atrazine	High	Slight	Significant
Triclopyr	High	Slight	Significant

a - Summarized from Appendix P
b - Normal routine operations

The realistic case analysis shows no significant risk to the health of aquatic organisms from ground (vehicle or backpack) operations, and only atrazine and triclopyr show slight risk under aerial application. In worst-case aerial application and accidents, most herbicides show significant risk to aquatic organisms. Under the accident most likely to occur (direct spraying), only asulam, fosamine, and hexazinone would have no acute risks. Dicamba would present mitigable risks, while all other chemicals would have significant risks of acute effects on trout. A more thorough summary of impacts on aquatic organisms from exposure to the 10 herbicides may be found in the Wildlife Risk Analysis in Appendix P.

Exposure to toxic concentrations would predominately be short-term acute exposures (Norris et al. 1983). Probably not all aquatic organisms would be affected, with some individuals leaving the area or exhibiting a greater tolerance to the herbicide (Norris et al. 1983). Repopulation of the area would probably occur through local survivors, migration or hatching. With increasing distance downstream from the initial exposure, peak concentrations of herbicide residues would decrease, reducing the likelihood of impact on the entire system (Newton and Norgren 1977). Also, available data indicate that herbicides, some more than others, accumulate in fish to a very limited extent but are quickly excreted in clean water (Dost 1983).

Because of the short duration of exposure, proposed application use rates, and protection measures (see Impacts on Water Resources), herbicides are not expected to significantly affect fish or their habitat under any alternative.

The condition and trend of individual habitat components have a direct bearing on fish populations. When all components are adequately protected, fish populations will be maintained and will probably increase over existing levels. When one or more components are severely impacted, fish populations will remain below potential levels (Reiser and Bjornn 1979; Everest and Harr 1982). Under existing conditions, streams in the BLM districts are considered to be producing fish at 50 percent of potential levels. Under Alternative 2, fish production would decline slightly by the fifth decade. The remaining alternatives would not significantly change fish production from present levels.

As discussed under Water Resources, there is a potential for cumulative impacts from vegetation management on BLM managed lands and adjacent lands. These impacts on water resources would have corresponding impacts on fish as discussed above. Increased sedimentation, chemical contamination and water temperature are the primary concerns.

Threatened or Endangered Animals

Threatened or endangered species receive special attention under the provisions of the Endangered Species Act of 1973, as amended, and BLM policies and guidelines. Essential habitat of listed species

are avoided or special precautions taken to ensure their well-being (see Chapter 1, Vegetation Management Treatments and Standard Operating Design Features). No significant impacts are expected to occur to these existing sites.

Conclusions

Short-term benefits to some terrestrial animals would occur under all alternatives, but overall, control of competing vegetation under Alternatives 1 through 5 would unavoidably reduce terrestrial animal populations and diversity from present levels. Alternatives 1, 2 and 5 would have moderately adverse impacts on terrestrial wildlife, particularly big game and song birds, because they would result in the greatest number of acres treated and would include the full range of vegetation management practices. These alternatives would reduce the availability and variety of big game forage, reduce nesting and foraging habitat for many song birds, and reduce snag habitat for woodpeckers and other cavity nesters. Alternatives 3 and 4 would result in slightly adverse impacts to most terrestrial animals. Alternatives 6 and 7 would probably not reduce animal populations below present levels. Alternative 8 would maintain or slightly increase wildlife diversity by maintaining unaltered early seral stages. Most game fish populations would be expected to decline slightly under Alternative 2 due to reduced requirements for streamside buffers, but would not be significantly impacted under the remaining alternatives.

Impacts on Cultural Resources

Although considerable BLM land has been surveyed or inventoried for cultural resources, field surveys have not been completed on all BLM lands. However, surveys would precede specific management actions that could result in damage to cultural resources (BLM Manual 8100, Cultural Resource Management). Under all alternatives, sites identified during these surveys would be protected in accordance with the National Historic Preservation Act of 1966 and Executive Order 11593, as stated in the Code of Federal Regulations (36 CFR 800).

Cultural resources not identified by field survey could be inadvertently impacted under all alternatives except 8. The potential for damage would vary with the amount of ground disturbance and prescribed burning that would occur under each alternative. Scarification could damage artifacts and disrupt relative positions of cultural materials. Mixing organic matter in archeological sites could contaminate Carbon 14 dating samples, making them unreliable for scientific analysis. Uncovering sites could increase the possibility of illegal artifact collecting. Burning for site preparation could destroy combustible cultural materials and damage stone and ceramic artifacts.

The number of undiscovered sites that could be impacted cannot be estimated. Impacts to a site could obliterate structural remains and subtle indications of prehistoric activity. The top 12 to 18 inches of prehistoric sites with subsurface deposits could be severely impacted. The potential for impact would be greatest under Alternative 7 and least under Alternative 8.

Impacts on Recreation and Visual Resources

Vegetation management treatments such as scarification, herbicide application and prescribed burning cause visual impacts primarily by creating color contrasts between treated areas and surrounding vegetation. Scarification disrupts the land surface and exposes bare soils to view. Herbicide application, in addition to causing color contrasts, reduces vegetative variety and can prevent the occurrence of seasonal changes (spring flower, fall color) within treated areas. Prescribed burning creates contrasting blackened areas and releases smoke into the air, which temporarily impairs visibility. However, prescribed burning does lessen the amount of logging debris that is visible and darkens the color of stumps and snags that, if not burned, would become more noticeable as they bleached over time.

Since the boundaries for most vegetation management projects (e.g., scarification and prescribed burning) would conform to the boundaries of units just harvested, visual impacts described above would occur in areas where the more visibly intensive impacts of timber harvesting have already taken place. Nevertheless, the various treatments would make clearcuts more noticeable and would prolong the time required for the areas to "green-up" with naturally invading grasses and forbs and to blend with surrounding vegetation. These short-term "secondary" impacts would be partially offset, in the long term, where treatments enhanced the survival and growth of planted seedlings.

Most vegetation management practices would occur in visual resource management (VRM) Class IV areas (approximately 90 percent of the land base). Because these public lands are generally of low to moderate scenic quality, are low sensitivity areas seldom seen by most people, and are intermingled lands primarily managed for timber production, visual and recreation impacts in VRM IV areas under all alternatives would be low. Use of public land for hunting, berry picking, and other dispersed activities will continue to occur but will shift away from treated areas when resource availability is reduced to the point where recreation experience expectations cannot be realized. Impacts of smoke and herbicide residue on the health of forest visitors are discussed in Chapter 3, Impacts on Human Health.

Visual and recreation impacts would also be low in VRM II and III areas such as developed recreation sites, hiking trails and along State scenic highways and rivers. Under Alternative 8, the appearance of recreation sites and other developed areas would deteriorate as they became overgrown with undesirable vegetation. Under Alternatives 1 through 7, some vegetation management practices would take place within and adjacent to some of these areas, and the effects of these practices would be seen. Such site-specific impacts would be analyzed in district environmental assessments prepared on detailed vegetation management plans. Impacts of the vegetation management program on areas with special designations are discussed in the following section, Impacts on Special Areas.

Impacts on Special Areas

All vegetation management treatments applied near designated or proposed Research Natural Areas, Outstanding Natural Areas, National Wild, Scenic or Recreation Rivers, National Scenic or Recreation Trails, State Scenic Waterways, State Recreation Trails or Areas of Critical Environmental Concern would incorporate features designed to avoid or mitigate impacts on important resource values. However, important plants, animals, habitats, scenic qualities or recreational values could be damaged or destroyed where aerial herbicide spray drifted from adjacent target areas or where nearby prescribed burning done in the proximity escaped.

The probability of adversely impacting special areas would generally correspond to levels of prescribed burning and aerial herbicide spraying under each alternative. Impacts would be most likely under Alternative 2, which would treat the most acres by prescribed burning and aerial spraying, and least likely under Alternative 8. Site-specific impacts to special areas will be further analyzed in environmental assessments prepared at the resource are level which will precede each vegetation management action.

Impacts on Human Health

Manual, mechanical, prescribed burning, and herbicide methods of vegetation management all present some level of risk to human health and safety. This section discusses the human health and safety risks associated with each of those vegetation management methods.

The USDI Bureau of Land Management based its evaluation of human health risks presented by the use of herbicides in the Western Oregon vegetation management program on a quantitative risk assessment of 16 herbicides done by Labat-Anderson, Inc. (LAI), a private consulting firm. The USDA Forest Service used that same quantitative risk assessment to evaluate human health effects in their vegetation management program in Washington and Oregon.

The LAI quantitative risk assessment consisted of three parts: a hazard analysis that defined the toxic properties of each proposed herbicide and set numerical values on which to base risk calculations, an exposure analysis that estimated herbicide doses people might receive in the program, and a risk analysis that combined the toxicity and estimated dose information to derive numerical indicators of risk. The hazard analysis discussed the results of a review of the toxicological literature on each chemical and included information on what was known about the quality of the toxicological studies and what studies were missing or not yet completed. This risk assessment method is the one currently accepted by the scientific community as appropriate to characterize risk.

The Forest Service also evaluated the hazard of the herbicides by employing the University of Washington to evaluate the "quality" of the oxicological data base upon which the hazard values used in the quantitative risk assessment were based. This latter evaluation was described as a qualitative risk assessment in the Draft Forest Service EIS although it did not estimate exposures nor did it explicitly evaluate human health risks in the vegetation management program. The BLM

opted not to conduct an evaluation of the quality of the toxicological data along the lines of the University of Wasjington's review. This decision was based upon the judgement that such an additional review of the toxicological data base was unnecessary for purposes of quantifying the risks posed by the proposed use of herbicides.

The BLM and Forest Service EIS discussions of health risk are substantively the same because of their basis in the LAI quantitative risk assessment. However, they do differ in conclusions about two chemicals, diuron and fosamine. The BLM quantifies the risks of these two chemicals and presents those results along with results for the other chemicals in Chapter 3 of their EIS. The Forest Service concludes in Chapter 4 of their EIS that the data base on the two chemicals is not adequate to assess risk. This conclusion is based on reviews of diuron and fosamine by the University of Washington in their qualitative risk assessment that relied heavily on the California Department of Food and Agriculture (CDFA) evaluations of toxicological studies.

The BLM concluded that the data were sufficient to characterize the risks of the use of diuron and fosamine based on the LAI risk assessment. BLM understands that the reason the Forest Service did not present risks calculated for those two chemicals was that the experts on the University of Washington staff and the LAI staff disagreed about the quality of the data and the Forest Service took the more conservative stance in deciding to eliminate the two chemicals from the proposed herbicides in their EIS. LAI advised the BLM that enough information was available for those two chemicals to characterize their risks. In particular, where studies were missing for specific endpoints, surrogate studies were used. For example, chronic toxicity tests for fosamine were not available so information from a subchronic study was used. Therefore, none of the proposed herbicides have been eliminated from the discussion of risks in BLM's EIS. The BLM, on the other hand, has reserved decisions about the use or elimination of particular herbicides until it writes its Record of Decision.

First the potential impacts of the vegetation management methods are described. Then the herbicide risk assessment (described in detail in Appendix L) is summarized. Reasons for the worst case analysis are explained and data gaps are identified. Then the risk assessment methods, results, and conclusions are described. Risks of cancer and heritable mutations which may be caused by exposures to the herbicides, in workers and among the general public, are also summarized. Synergistic effects and effects on sensitive individuals are addressed. Risks associated with inert ingredients and petroleum distillates in the herbicides or herbicide carriers are discussed. The potential for cumulative effects is also discussed.

Summary of Potential Impacts by Methods

Manual Methods

Manual methods include the use of hand tools such as axes, brush hooks, shears, and chain saws to cut brush physically. Grub hoes can be used to remove some forbs, grasses, and brush seedlings. Manual methods often involve walking or climbing through steep, brush-covered terrain.

There are clear hazards associated with the use of hand tools or working on steep slopes under unfavorable site conditions. Site conditions can be extreme, ranging from gentle slopes with low to moderate brush to steep slopes with dense brush 10 to 12 feet tall. This working environment increases the hazards of working with cutting tools such as axes, brush hooks, machetes, and chain saws. Workers could be cut by their tools, hit by falling brush, or they may fall into the brush onto sharp stumps or the ends of the cut brush. Workers using chainsaws would be exposed to exhaust fumes that contain toxic chemicals such as carbon monoxide. Exposure to poison oak, ticks and poisonous snakes also presents the risk of injury. The risk of injuries increases as the size of the work crew increases and as the crew's work is required to be done in a relatively concentrated area. Worker fatigue, the result of such physically strenuous tasks, also can increase the risk of injury. Injuries can range from minor cuts, sprains, bruises, and abrasions to severe injuries causing major arterial bleeding, compound bone fractures, or serious brain concussions. When injuries are severe, fatalities may occur.

Other types of health effects associated with outdoor work in rugged terrain are also possible. When temperatures are high, workers may experience increased fatigue, heat exhaustion, or heat stroke. Falls or other accidents may adversely affect pregnant female workers or may affect the reproductive capacity of either female or male workers. In addition, continued work in rugged

terrain may initiate or exacerbate chronic health effects, such as tendon or ligament damage or arthritis. In extreme cases, exertion from manual methods in rugged terrain may bring on a heart attack or stroke in workers who are prone to such health effects.

Injury frequency rates indicate the hazards of various vegetation control methods. Brush cutting injuries reported by the Bonneville Power Administration for the period 1976 through 1980 ranged from 2.5 to 10.3 injuries per 200,000 man-hours worked. During the same period, no chemical toxicity injuries or helicopter-related injuries were reported (DOE, 1983). Dost surveyed the Oregon State Accident Fund records for 1978-1979 to assess injury rates associated with forestry practices. Among the major items reported were strains and bruises (46.6 percent of reported accidents), eye injuries (8.6 percent), chain saw cuts (7.0 percent), poison oak reactions (5.7 percent), fractures (4.8 percent), and vehicle and equipment accidents (4.8 percent) (Dost, 1981). Based on the number of acres treated with manual and/or mechanical methods, injuries would be most likely under Alternatives 3 and 7 and least likely under Alternative 8.

The likelihood of incurring injury is directly dependent on the amount of personnel time spent completing the work, combined with the incidence of accidents per man-day. Labor requirements vary with the type of work being done. Stavins et al. (1981) reported that labor requirements for Federal agencies in the Pacific Coast States were 2.5 to 5.0 man-days per acre for clearing, and 0.75 to 3.125 8-hour-days per acre for spot release treatment ranging from 25 to 100 percent of the brush being cut. The average was 3.75 days per acre for 100 percent clearing and 2.65 days per acre for all release treatments. These quantities are the determinants of exposure to injury.

The likelihood of injury per man-hour has not been formally calculated on a large scale in connection with manual removal of brush. Several approaches may be used to arrive at estimates. Bernstein (1979) identified. Then the frequency of 1 minor injury per 13 man-days with no major injuries, based on 265 man-days of brush removal. The same crew sustained a rate of 1 injury per 25 man-days during precommercial thinning, and there was a general feeling that brush removal was a more hazardous undertaking than thinning with associated hardwood control. Roberts (1980) reported only minor accidents in 30 man-days of brushing, with one near-miss of a serious eye injury. Again, workers regarded brushing as above average in hazard. Richard Koven (Koven, 1981) testified during the 2,4,5-T Rebuttable Presumption Against Registration (RPAR) hearings, based on a listing of injuries reported by the Northwest Forest Workers Association, that the Association experienced 29.35 hours of lost time injuries per 100,000 hours worked and 46.96 reported injuries per 100,000 hours worked. He stated that "It is the belief of the Association that these rates reflect a relatively safe work situation."

The risk of worker injury can be reduced by proper supervision and clear instructions on the safe use of manual equipment. Wearing boots with nonskid soles and snag-resistant long sleeve shirts and trousers also reduces the risks.

In general, members of the public are not at risk from manual methods. The tools are used by the workers and no member of the public is likely to come near enough when such tools are in use to be injured.

Mechanical Methods

Mechanized equipment, such as bulldozers, disks, flails, brush cutters, chippers, and crushers, are used to control vegetation mechanically. The equipment operator and other workers in the vicinity of the equipment are at risk of injury. The equipment operator could be injured in several ways. First, the equipment operator could lose control of the machine on steep terrain, which could cause serious injury. Such accidents are uncommon among experienced operators, but they are difficult to avoid entirely. Accidents may occur when pushing brush under conditions of poor visibility, and when encountering a short headwall or road cut or when the operator misjudges the slope. When the machine drops, it could roll over the operator, as well as create flying debris that could pose a hazard.

A second cause of injury, usually less serious, is the result of being struck by falling trees or pieces of wood or rocks thrown by the equipment while it is operating. In such cases, the operator's assistant on the ground is more at risk than the operator, especially when brush cutters or mowers are being used.

Minor injuries also can result from working around large machines that tend to be slippery, oily, or

otherwise capable of contributing to operator risk during service or repair.

The high noise levels associated with the operation of heavy equipment also pose the potential for causing hearing impairment. Hearing loss is a probable consequence of chronic exposure to noise at high levels and at consistent frequencies, when no ear protection is used.

The risks to the general public from mechanical methods are negligible. The only injuries to the public that are remotely possible from these methods would be from accidents while the equipment is in transit from storage to the treatment site or in the extremely rare instance when a member of the public ignored safety precautions and entered a treatment site while the equipment was in use.

Prescribed Burning Method

Broadcast and pile burning methods present the combined hazards of smoke and fire to ground crews at the site. Effects on workers may range from eye irritation, coughing, and shortness of breath in moderate to heavy smoke to severe burns that may leave permanent scars. There is some marginal risk that chronic exposure of workers to smoke may lead to long-term health effects such as emphysema or lung cancer. In the extreme, where a burn escapes (gets out of control), fatalities to workers may result.

Burning methods also present the possibility that escaped fire may endanger members of the public in adjacent areas. In the extreme case, escaped fire may trap and kill members of the public.

Smoke from prescribed burns or the burning of piled slash may have a local, transitory effect on air quality. Sensitive members of the public may experience eye, throat, or lung irritation from these low-level exposures. For several reasons, smoke presents a negligible risk of long-term health effects to members of the public in an area where burning occurs. The public is not likely to be exposed as long or to as high a smoke density as a worker in a single prescribed burn or as often over a lifetime as workers who burn a number of areas on a forest in a given year.

These principal health and safety risks associated with prescribed burning are discussed below in the following three categories: (1) risk of the fire escaping control, (2) risk of direct physical injury to workers, and (3) risk of chemical or particulate injury from the smoke.

Risk of Escape

All controlled burns require a burning prescription. The prescription includes a description and discussion of fuels, weather, and timing; how to burn; and safeguards (BLM Manual 9214). The safeguards section addresses all precautions needed to confine the burning to the prescribed area, including "holding and patrolling," paying extra attention to potential "danger spots," up-to-date current and long-term weather forecasts, and new advances in fire technology. Personnel qualification standards and training requirements have been established for personnel involved in control burning (BLM Manual 9215). All of these requirements are directed toward reducing the risk of escape.

Between 1979 and 1981, approximately 234,300 acres were burned under controlled conditions in the Pacific Southwest Region. The Klamath, Shasta-Trinity, and Six Rivers National Forests used these methods as a major part of their vegetation management program. From 1979 through 1981, there was a combined total of 1,348 controlled burns on these forests, with only six escapes (table 3-6). All of the escapes were less than 10 acres in size. Based on these data, the risk factor is 0.004 to 1 that a controlled burn would escape.

Risk of Direct Physical Injury

Workers on burn areas would be exposed to potential injury due to the manual treatments they would perform and the conditions under which they would work (see preceding discussion on Manual and Mechanical Treatments below). Workers who manually light burn areas would be exposed to burning materials, which could cause physical injuries.

Assuming that normal safety precautions are taken for working around gasoline, there would be no significant hazard associated with the mixing of gelled gasoline. The probability of workers on burn areas being physically injured would be approximately the same under all alternatives except 3. Injuries associated with burning would not occur under Alternative 3.

Data on typical casualty costs of controlled burning in Pacific Northwest forests, including 1 to 3 years of data from the Wenatchee National Forest and from two forest industries operating in northwest Oregon, suggest that one minor injury will occur for

every 500 acres burned and one disabling injury will occur for every 7,500 acres burned. On three National Forests surveyed in the Pacific Southwest Region, there were 1,348 areas burned and only 15 personnel injuries, which is one for every 90 controlled burns.

These data, if representative, suggest that one minor injury will occur for every 500 acres burned and one disabling injury will occur for every 7,500 acres burned (more or less).

On the three Forests surveyed in the Pacific Southwest Region, there were 1,348 areas burned and only six personnel injuries, which is one for every 225 controlled burns (table 3-6).

Public safety would not be affected by any method of igniting burn areas. Most burning would occur in locations where the public either would not be present or would be highly visible to those doing the burning. Further, those on or near a burning area would be well aware of impending activities because several hours of active preparation are required before ignition begins. Safety measures normally taken to protect fire fighters participating in the prescribed burning would also protect the public.

Risk of Chemical or Particulate Injury from the Smoke

The effects on health caused by smoke constituents must be considered in addition to injuries encountered in fuel preparation, either by hand slashing or herbicide application, or in travel to the burn site.

Smoke from burning is not expected to significantly affect human health under any alternative. Levels of suspended particulates (a suspected factor in some health problems) are expected to be well below the 150 micrograms per cubic meter (ug/m^3) public welfare standard and the 260 ug/m^3 public health standard published by the Environmental Protection Agency (EPA). Effects of smoke would be minimized by complying with the required burn permits, which include coordination with weather forecasts to determine burn or no burning days.

Burning of vegetation previously sprayed with herbicides would not be done for several months to 1 year after the spraying. This would allow the chemicals adequate time to be degraded to nonhazardous metabolites, thus resulting in no expected impacts to humans from combustion.

When wood is burned, a wide variety of combustion products are formed. The types and relative abundance of these compounds vary with the temperature of the fire, the moisture content of the

Table 3-6—Escapes and resulting injuries from burns on three National Forests from 1979-81

	Year			
Forest	**1979**	**1980**	**1981**	**Total**
Klamath				
Number of burns	127	145	147	419
Escapes	0	0	0	0
Injuries	3	3	3	9
Shasta-Trinity				
Number of burns	68	224	200	492
Escapes	3	3	0	6
Injuries	4	1	1	6
Six Rivers				
Number of burns	110	190	137	437
Escapes	0	0	0	0
Injuries	0	0	0	0

wood, and the species of wood. Water vapor and carbon dioxide account for more than 90 percent of the mass of combustion products emitted from burning woody vegetation (Ryan et al., 1976, as cited in Sandberg et al., 1978). The levels of particulates emitted from slash burning are much less than the primary and secondary national ambient air quality standards for total suspended particulates (see Appendix L).

Combustion of vegetation also releases carbon monoxide (CO), sulfur oxides (SO_X), nitrous oxides (NO_X), and hydrocarbons (Sandberg et al., 1978). Release of sulfur oxides is considered negligible. Nitrous oxides are released only in some very hot fires at very low levels. Exposure to hydrocarbons is discussed in the section on cancer risk. Carbon monoxide is unstable and dissipates rapidly in the atmosphere. The estimated concentration of carbon monoxide of 67 parts per million (ppm) (Appendix F) slightly exceeds the 8-hour time-weighted average threshold-limit value (TLV) of 50 ppm, but it is three times less than the ceiling of 200 ppm set by the Occupational Safety and Health Administration (Chemtox, 1987). Persons working in prescribed operations are likely to be exposed to smoke for only 1 to 2 hours in a day; therefore, 67 ppm is a reasonably safe level.

Cancer Risk from Burning Vegetation

In some cases, irritants unique to a certain plant may be released upon burning. These include the specific emissions from vegetation combustion that are known to cause debilitating symptoms in fire crew members after inhalation and the specific toxic agent in poison oak that has been responsible for a large number of workmen being out of work for long periods because of slow recovery.

A report to BLM on impacts of smoke from burning is found as Appendix O. This report basically studies the polyaromatic hydrocarbons (PAH) found in smoke and is the first step in assessing the potential environmental health risks associated with smoke derived from burning forest and range residues. Products of combustion include several discrete groups. Smoke has a large number of low-molecular hydrocarbons that are relatively innocuous (for example, nitrogen oxides that may have some environmental effects but do not represent a primary health hazard), and the PAH's, which are large compounds of multiple benzene rings. The analysis in Appendix O concentrates on these 3-25 compounds as the most likely candidates for human health risk, primarily cancer. Based on assumptions concerning exposure over 70 continuous years to one PAH, benzo(a)pyrene (BaP), a conservative probability of 3×10^{-3} for contracting cancer is predicted. A more realistic risk of cancer based on research measurements of all PAH in smoke is 3×10^{-8}. It is questionable if the rather severe exposure sequence assumed for prescribed fire would ever occur. However, this exposure will be used for analysis until additional specific data require it to be changed.

Biological Methods

Biological methods that have been tried, either experimentally or on an operational basis, for controlling vegetation on forest lands in California are the grazing of cattle, goats, and sheep.

During the scoping process, concern was expressed that water-borne diseases could be spread if animals were used to manage competing vegetation. It would require a range of 0.5 to 20 acres of productive forest land to sustain one 1,000 pound cow, or 5 sheep, or 5 goats for one animal unit month (AUM). This is a low concentration of animals and there would be a relatively small amount of fecal matter deposited on the site. Under these conditions, because of soil filtration and dilution, the risk of transmitting human diseases would be minimal.

Herbicides

In this FEIS the BLM proposes the use of 10 herbicides; asulam, atrazine, 2,4-D, dicamba, diuron, fosamine, glyphosate, hexazinone, picloram, and triclopyr. The DEIS proposed the use of 14 herbicides. The FEIS proposal deleted ammonium sulfamate (Ammate), diquat, and MSMA. These three deleted herbicides are not covered by the risk assessment, so a similar risk analysis would be conducted for them prior to using them on BLM-administered lands. Dalapon was dropped because it is no longer registered for forestry. Amitrole, bromacil, 2,4-DP, and tebuthiuron are included in the Risk Assessment (Appendix L) for USDA Forest Service applications only and are not proposed for use by BLM in this FEIS.

The risk of adverse health effects from the use of any of the 10 herbicides addressed in this EIS depends on the level of exposure at any given time, on the duration and frequency of exposure over time, and on the inherent toxicity of the herbicide. The principal factors determining the herbicide exposures of workers and the public are the application method, the application rate, and distance from the spray site.

The manual application of herbicides has the potential for a relatively high exposure to ground crews but little likelihood of direct exposures to the public. While the aerial application of herbicides involves lower exposures to fewer workers at the site, it presents the possibility of drift offsite and some low-level exposures to members of the public directly or through their food or drinking water sources.

Workers or members of the public who receive a relatively high acute herbicide dose from accidental exposures may experience immediate ill effects, including dizziness, nausea, vomiting, headache, muscle cramps, and fatigue. Higher acute doses, for example, in cases where a worker spills herbicide concentrate on his skin and does not wash it off, may affect the function of major organs, such as the lungs or kidneys, and in the extreme case may cause death. In general, doses high enough to produce such severe effects have been seen only in cases of suicide attempts or in accidental ingestion of herbicide concentrate. Such high dose levels could occur in BLM's vegetation management program only in the case of severe accidental exposures.

Like other pesticides, and synthetic organic chemicals in general, herbicides also have the potential to produce more subtle, long-term types of health effects, such as producing adverse reproductive effects, causing cancer, or causing heritable mutations.

In response to the comments received during the scoping process expressing concern about the chronic toxicity of herbicides, a comprehensive analysis of human health risks was conducted to develop the most accurate description of the real risks to workers and the public of adverse health effects (both acute and long term) from the use of herbicides. The risk assessment methods and results are explained in the following section. More details about the risk assessment can be found in appendix F.

Overview of the Herbicide Risk Assessment

The analysis of human health risks from the use of the 10 herbicides in BLM's Western Oregon vegetation management program was accomplished using the methodology of *risk assessment* widely accepted by the scientific community (EPA, 1986a; NRC, 1983). In essence, the risk assessment compares herbicide doses that people *may* get from applying the herbicides or from being near an application site with doses shown to be *safe* to laboratory test animals in long-term studies. Shorter term (subchronic) study results were used if they indicated greater toxicity. For the herbicides that could possibly cause cancer, the risk of cancer over a person's lifetime was based on animal studies that related the chances of developing tumors to increasing herbicide doses.

The details of the risk assessment are presented in Appendix L. The risk assessment covered four additional herbicides—amitrole, bromacil, 2,4-DP, and tebuthiuron-that are proposed for use by the USDA Forest Service but that are not applicable to BLM's program at this time. The discussion of the risk assessment presented here does not include those four chemicals.

The risk assessment evaluated the chances of herbicide exposures causing general systemic effects that could range from nausea and headaches at low doses to organ damage at much higher doses, effects on reproduction, and the possibility of birth defects from those doses. The risk assessment also examined the possibility of acute toxic effects from the higher exposures likely to occur in abnormal situations, such as when the wrong herbicide is used, or in accidents, such as a helicopter jettisoning its load of herbicide mixture into a pond. A margin of safety (MOS) was computed for each type of dose estimated for workers or members of the public by dividing the lowest systemic effect or reproductive effect no-observed-effect level (NOEL) found in laboratory studies on each herbicide by the estimated dose. In general, where the MOS was 100 or greater, that is, where the estimated dose was 100 times lower than the laboratory NOEL, the risk of systemic or reproductive effects was considered negligible for a particular exposure.

For the herbicides that laboratory studies have indicated could possibly cause cancer (asulam, atrazine, glyphosate, picloram, and 2,4-D), the risk of cancer over a person's lifetime was based on a cancer potency value, derived from laboratory animal studies, that related the chances of developing tumors to increasing herbicide doses. The cancer potency value, adjusted for human doses, was multiplied by an estimated lifetime human dose for each of the different categories of workers or members of the public to arrive at an individual's lifetime cancer risk. Individual risk multiplied by the number of persons in each worker or public category gave an estimate of cancer

incidence—the numbers of cancers liable to appear in that population segment.

Also examined was the potential for the herbicides to cause heritable mutations, synergistic effects, cumulative effects, and effects on sensitive individuals.

The conservative approach used in this risk assessment tended to exaggerate the estimated risks to human health from herbicide use. A number of assumptions about the proposed herbicide spraying operations tended to overestimate the doses workers and the public would likely receive. The way herbicide toxicity information was used to judge risks based on effects seen in the most sensitive laboratory test animals tended to make that part of the risk assessment conservative. This conservatism, both in estimating exposures and in setting toxicity levels, when combined to judge risks, led to an exaggeration of the real risks of the vegetation management program to err on the side of protecting human health.

A detailed discussion of the approach used for dealing with missing or unavailable information, of how those risk assessment data gaps relate to EPA pesticide registration data gaps, and the use of worst case assumptions is presented below. Brief toxicity evaluations of the 10 herbicides are also provided below. Where information was missing or unavailable on exposures or on a certain toxicity endpoint for a particular herbicide, the data gap was evaluated in terms of its importance in determining human health risks in the EIS and in terms of the cost and delay required to supply the information. Exposure studies on similar chemicals and laboratory studies on related toxicity endpoints were used to draw conclusions where appropriate. Worst case assumptions were used wherever scientific uncertainty was evident.

Herbicide Toxicity Profiles

Asulam

Threshold Effects. Based on the acute oral LD_{50} value in rats of greater than 4,000 mg/kg asulam can be classified as slightly toxic. Technical asulam was not a primary skin or eye irritant in laboratory animals and was not a dermal sensitizer in humans (EPA, 1985a). Subchronic and chronic studies reported the following adverse effects: vomiting, anorexia, slight decrease in activity, slight gastritis, and slight inflammation of the duodenum, fatty deposits observed in the liver, increased organ/body weight ratio in the adrenal and pituitary, increased organ weights, decreased thyroid weights, and hyperkeratosis of skin and subcutis. EPA (1985a) has determined the lowest systemic NOEL to be 1,000 ppm (50 mg/kg/day) based on a 107-week rat feeding study. Teratology and reproduction studies indicate that asulam does not cause teratogenic or fetotoxic effects in test animals. A reproductive NOEL was established at 1,000 ppm (50 mg/kg/day).

Nonthreshold Effects. Positive cancer effects of asulam were seen in two studies.

Asulam's cancer potency was based on the rate of tumor formation in thyroid cells in male rats in the 107-week feeding study. The cancer potency using the one-hit model is 0.02 per (mg/kg/day).

A *Salmonella typhimurium* bacterial assay, a cell transformation assay, and a dominant lethal mouse assay on asulam were all negative for mutagenic activity (EPA, 1985a).

Atrazine

Threshold Effects. Atrazine has a low toxicity from acute exposure based on the lowest rat oral LD_{50} of 672 mg/kg (Gaines and Linder, 1986, as cited in EPA, 1987a). Dermal exposure to rats did not produce toxicity, and a dermal LD_{50} of greater than 2,000 mg/kg was established. Subchronic and chronic effects from atrazine exposure reported for humans include red, swollen, and blistered hands with hemorrhagic bullae between the fingers. In a recently reported chronic feeding/oncogenicity study with rats, decreased weight gain, reduced food consumption, and clinical signs were observed at 500 and 1,000 ppm. The NOEL for non-neoplastic effects was established at 15 ppm (0.48 mg/kg/day as converted by EPA)(EPA, 1987a, 1986b). Systemic effects induced from atrazine exposure include: reduced food intake, increased adrenal weights, occasional tremors and stiffness in the limbs, increased liver and heart weights, and reduced body weight. Reproductive and developmental adverse effects reported include: fetal mortality, fetal resorption, decreased fetal weight, delayed skeletal development, and runting. A 2-generation reproduction study in rats established a NOEL of 10 ppm (0.5 mg/kg/day) based on decreased pup weights at the lowest effect level of 50 ppm (2.5 mg/kg/day) (EPA, 1988a).

Nonthreshold Effects. Based on the information available, EPA (1987a) has classified atrazine as a

Pileated woodpecker

possible human carcinogen (Group C). Atrazine cancer potency for this risk assessment was calculated based on the rate of mammary tumor formation in female rats in the 2-year chronic feeding oncogenicity study (CDFA, 1986a). The cancer potency in rats estimated using the one-hit cancer model is 0.03 per (mg/kg/day) (USDA, 1986). Although mutagenic results show that atrazine must be viewed as mutagenic under very specific activation conditions and at high levels of in vivo exposure, the degree of hazard to human germ cells from low levels of exposure would be minimal.

2,4-D

Threshold Effects. 2,4-D has an LD_{50} value of 375 mg/kg in rats. Based on acute toxicity, 2,4-D is moderately toxic to humans. Acute and chronic toxicity studies in mammals revealed general systemic toxic effects following ingestion of large doses of 2,4-D. Similar clinical symptoms have been observed in human cases. Even though dermal absorption of 2,4-D is limited, the herbicide has produced peripheral neuropathy (nervous system damage in the limbs) in a few individuals after accidental exposure. In a limited number of cases, the recovery has not been complete. A recent chronic rat feeding study resulted in a NOEL of 1 mg/kg/day based on kidney effects.

In reproduction and teratogenesis studies, decreases in birth weight, litter size, and fertility were observed; however, these adverse effects were caused by high doses that also caused maternal toxicity (WHO, 1984). The lowest NOEL from a rat teratology study was 5 mg/kg/day.

Nonthreshold Effects Previous chronic studies were not regarded as positive for cancer by the majority of the scientific community, although there was a consensus that more data were needed. Epidemiology studies conducted for farmworkers in Kansas have suggested an increased risk of a certain type of cancer (non-Hodgkins lymphoma) in humans exposed to phenoxy acids and chlorophenols. EPA has recently received and is in the process of completing their review of a new cancer study. The Agency considers the new study to show 2,4-D as positive for cancer. However, EPA has stated that the cancer potency values based on a previous study that are used in this risk analysis (.005 per mg/kg/day) would not underestimate the risk of cancer for 2,4-D. 2,4-D has shown variable, weak mutagenic activity in some assays, but generally has been found to be nonmutagenic in most assays.

Dicamba

Threshold Effects. Dicamba has an LD_{50} value of 757 mg/kg for rats. In experimental studies with mammals, dicamba was a mild skin irritant, a moderate skin sensitizer, and a severe eye irritant, although the effects were transient. Acute oral doses of dicamba in laboratory animals resulted in slight toxicity. A 15-week rat feeding study produced a NOEL of 15.8 mg/kg/day (EPA, 1987c). Chronic consumption by dogs and rats produced no adverse health effects, but chronic consumption by mice caused decreased body weight and increased liver weight. Dicamba caused no reproductive or teratogenic effects in rats. In rabbits, dicamba caused post-implantation losses, decreased number of liver fetuses, and decreased fetal weights. The NOEL for this study was 3.0 mg/kg/day based on maternal toxicity.

Nonthreshold Effects. No carcinogenic effects were noted in these chronic feeding studies. EPA does not consider these chronic studies adequate for the registration guidelines under FIFRA and has

requested additional studies for both chronic effects and cancer.

EPA has requested additional information on the mutagenic potential of dicamba. On the basis of a number of bacterial and *in vitro* test systems not reviewed by EPA, dicamba has not been shown to produce mutagenic effects.

Diuron

Threshold Effects. Based on the acute oral LD_{50} of 3,750 mg/kg in rats, diuron can be classified as slightly toxic. The LD_{50} for dermal exposure was found to be more than 10,000 mg/kg in rats. Diuron induced no primary eye or skin irritation. Reproductive and developmental effects observed in laboratory animals include: wavy ribs, sternoschisis, delayed calvarium ossification, and body weight depression. A reproductive NOEL of greater than 125 ppm active ingredient (6.25 mg/kg/day) (only dose tested) was established for diuron (EPA, 1984b). Systemic effects reported for laboratory animals subchronically and chronically exposed to diuron include: increased mortality, weight loss, enlarged spleens, depressed red blood cell counts, erythrogenic activity in bone marrow, elevated liver weight, and increased pigment disposition in liver cells. The lowest systemic NOEL is 25 ppm (0.625 mg/kg/day) (EPA, 1983a).

Nonthreshold Effects. Diuron is considered to be not carcinogenic in this risk assessment because studies relating to diuron's oncogenicity, reviewed in EPA (1983a) and EPA (1987d), show no clear evidence that diuron causes tumor growth. EPA (1983a) believed the results of laboratory tests suggest that diuron can enter the testes, and, if shown to be mutagenic, diuron may produce heritable mutagenic effects. The worst-case assumption for this risk assessment is that diuron is a germ-cell mutagen.

Fosamine

Threshold Effects. Based on the acute oral LD_{50} of 24,400 mg/kg in the rat, fosamine can be classified as very slightly toxic. The acute dermal LD_{50} for rabbits is greater than 1,683 mg/kg. Fosamine was negative for dermal sensitization and irritation (EPA, 1987e). Reproductive and developmental effects reported for progeny include hydronephrosis (urine in the kidney) and resorption. No adverse reproductive effects in rats were reported at the high dose level of 5,000/10,000 ppm (250/500 mg/kg/day). Systemic effects reported for laboratory animals subchronically and chronically exposed to fosamine include: changes in BUN; SGOT; SGPT; brain, kidney, and stomach weight. A systemic NOEL of 1,000 ppm (25 mg/kg/day) was the lowest NOEL reported.

Nonthreshold Effects. Although there are not data available from chronic studies to evaluate the oncogenic potential of fosamine, available evidence from other studies does not indicate that fosamine is carcinogenic. Also, the overall evidence indicates that fosamine is nonmutagenic.

Glyphosate

Threshold Effects. Glyphosate generally has low toxicity to mammals, as reflected by its acute LD_{50} value of 4,320 mg/kg in rats. It is only slightly irritating to the skin and eyes. A 2-year chronic feeding study did not indicate any oncogenic or other chronic effects at the highest dose tested (NOEL (HDT) = 31 mg/kg/day). Studies have shown that glyphosate is not teratogenic and a recent three-generation reproductive study reviewed by EPA set a NOEL of 10 mg/kg/day.

Nonthreshold Effects. In a review of preliminary data from glyphosate cancer studies using mice and rats, EPA found one study to be positive for cancer. However, in these cancer studies on both sexes of two species of test animals, the incidence of only one tumor type in one sex of one species was found to increase with increasing doses of glyphosate. This increase in tumors occurred only at high exposure levels (much higher dosing than normally used in long-term studies of pesticides) and the positive findings depended upon the presence of tumors in only 4 of 149 treated animals. To the extent that it is actually an oncogen, EPA has stated that these results indicate that glyphosate is likely to have only a weak oncogenic effect. More recently, EPA's FIFRA Scientific Advisory Panel found that the data on glyphosate's oncogenic potential are inconclusive. The Panel proposed that glyphosate not be classified until a data call-in for further studies in rats, mice, or both provides clarification of unresolved questions. Based on the information currently available, EPA has indicated that it does not expect any significant risk from the use of glyphosate in accordance with label directions. A cancer potency factor of 0.000026, however, has been calculated for glyphosate. Glyphosate is not assumed to be a germ cell mutagen.

Hexazinone

Threshold Effects. Hexazinone can be classified as slightly toxic based on the acute oral LD_{50} of 1,690 mg/kg in rats. The dermal LD_{50} in rabbits is

greater than 5,278 mg/kg with slight skin irritation, and the inhalation LC_{50} in rats is greater than 7.48 mg/l. Data on primary eye irritation indicate that hexazinone is an eye irritant, but primary skin irritation and dermal sensitization studies demonstrate that it is not a skin irritant. Systemic effects observed in animals administered doses of hexazinone include hepatotoxic effects such as increased liver weight, liver hypertrophy, liver hyperplastic nodules and focal neurosis; reduced body weight; higher white cell count; and lower albumin:globulin ratios. The lowest systemic NOEL reported in the literature was 200 ppm (10 mg/kg/day) (EPA, 1982a).

Reproductive and developmental effects reported in laboratory studies on animals exposed to hexazinone include soft tissue and skeletal abnormalities and delayed ossification. Hexazinone is not considered to be teratogenic at 125 mg/kg. The teratogenic NOEL is therefore greater than 125 mg/kg/day (EPA, 1982a). The fetotoxic NOEL for this study was established as 50 mg/kg/day (EPA, 1982a).

Nonthreshold Effects. Because there is no evidence from animal studies that hexazinone causes cancer, hexazinone is considered to be not carcinogenic in this risk assessment. EPA has placed hexazinone in Group D: not classifiable as to human carcinogenicity (EPA, 1987f). Also, hexazinone is considered in this assessment not to present a mutagenic risk to humans.

Picloram

Threshold Effects. Acute LD_{50}'s of greater than 8,000 mg/kg classify picloram as slightly toxic. Although picloram alone does not cause skin sensitization, in combination with 2,4-D it is capable of producing sensitizing reactions in humans (USDA, 1984). No birth defects have been shown in laboratory animals, but in a three-generation reproduction study, reduced fertility was observed at the highest dose tested (NOEL = 50 mg/kg/day). A six-month dog study resulted in a NOEL of 7 mg/kg/day based on increased liver weights.

Nonthreshold Effects. Cancer studies conducted by the National Cancer Institute indicate that picloram was not carcinogenic in mice or male rats and that at high sustained doses could produce benign liver tumors in female rats. EPA considers this study of questionable value and has requested additional data. A cancer potency factor of 0.00057 per mg/kg/day was calculated for picloram.

Triclopyr

Threshold Effects. With an acute oral LD_{50} ranging from 630 to 729 mg/kg in rats, triclopyr can be classified as slightly toxic. In an acute dermal study, no mortalities were observed in rabbits at 2,000 mg/kg, the only dose tested. Triclopyr caused slight dermal and eye irritation. Systemic effects observed in laboratory animals subchronically and chronically exposed to triclopyr included: decreases in body weight, food consumption, kidney output, and absolute liver weights; and increased kidney weight (EPA, 1986c). EPA has established a NOEL of 2.5 mg/kg/day for systemic effects (Dow, 1985; EPA, 1988b). Reproductive and developmental effects reported for laboratory animals exposed to triclopyr include retarded ossification of skull bones in the fetus, and decreased body weight gains and food consumption in dams. The lowest NOEL for reproductive and developmental effects is 10 mg/kg/day (EPA, 1986c; CDFA, 1986c).

Nonthreshold Effects. Laboratory evidence is equivocal on triclopyr's carcinogenicity; however, triclopyr is considered to be possibly carcinogenic in this risk assessment. However, because tumor data were not available, no quantitative cancer risk analysis was done on triclopyr. Based on the positive results in the dominant lethal rat assay, triclopyr may be mutagenic in some test systems and may present mutagenic risk to human germ cells (EPA, 1986c).

Reason for Worst Case Analysis/Risk Assessment

Regulatory Basis

At the time that the risk assessment was written for the Supplement to the Draft EIS, Council on Environmental Quality (CEQ) regulations (40 CFR 1502.22) for implementing the procedural provisions of the National Environmental Policy Act (NEPA) required a "worst case" analysis before proceeding when there were gaps in relevant information (referred to as data gaps) that could not be filled. Since the risk assessment was first prepared, however, the requirements to prepare a worst case analysis have been rescinded.

The Council on Environmental Quality amended its regulation (40 CFR 1502.22) that addresses incomplete or unavailable information in an environmental impact statement. The new regulation provides that in instances where relevant information concerning adverse impacts is not

known and the overall costs of obtaining it are exorbitant or because the means to obtain it are not known, the agency must undertake four steps in its environmental impact statement. Specifically, the new regulation provides that the agency must include the following within the document:

1. A statement that the information is incomplete or unavailable.

2. A statement of the relevance of the incomplete or unavailable information required in evaluating reasonably foreseeable significant adverse impacts on the human environment.

3. A summary of existing credible scientific evidence that is relevant in evaluating the reasonably foreseeable significant adverse impact on the human environment.

4. The agency's evaluation of such impacts based upon theoretical approaches and research methods generally accepted in the scientific community.

The new regulation also rescinded the old requirement that the agency prepare a worst case analysis on the risk of proceeding in the face of uncertainty about a proposed action's environmental effects. The Council on Environmental Quality has stated that "in environmental impact statements in progress, agencies may choose to comply with the requirements of either the original or amended regulation."

While this FEIS was prepared after the Council on Environmental Quality amended the original regulations, it nonetheless also includes a worst case analysis. It is included because the Draft EIS, as supplemented, was prepared under the original regulation. The approach maintains consistency between the FEIS and the Draft EIS as supplemented.

Incomplete or Unavailable Information

In general, there are very few studies indicating human health effects from exposure to the proposed herbicides. A number of epidemiology studies, discussed later in this section, were reviewed in the preparation of this risk assessment; most concerned the possible effects of the use of phenoxy herbicides, including 2,4-D. None of the studies is considered by experts to be sufficiently conclusive evidence of health effects to quantify human health risks for this program. Nevertheless, epidemiology studies are not considered significant data gaps in this risk assessment because the human health effects of the herbicides were evaluated using risk assessment techniques generally accepted by the scientific community (Crouch and Wilson, 1979; Doull et al., 1980). These techniques evaluate human health impacts based on studies conducted on laboratory animals. Extrapolating such information can result in many uncertainties. For example, it is not possible to prove that an event, such as getting cancer, will never occur even though all studies are negative. One can always argue that the techniques used for testing for cancer were not sensitive enough. On the other hand, one can just as legitimately argue that tumor growth related to high doses of a herbicide in a laboratory animal does not prove that the chemical will cause cancer in humans at low doses.

This risk assessment identifies a number of uncertainties or data gaps, including the following:

1. Field studies on exposure to workers for all of the herbicides except 2,4-D, dicamba, and picloram.

2. Information on exposure of the public to the 10 herbicides.

3. Field data on residue levels in plants and animals most likely to be found in and around treatment areas for some of the herbicides.

4. Mutagenicity studies for diuron.

5. The potential for atrazine, asulam, 2,4-D, picloram, and glyphosate to cause cancer.

6. Tumor data to determine triclopyr cancer potency.

7. Toxicity information on the synergistic effects from exposure to more than one herbicide.

Dermal penetration data were available only for the herbicides 2,4-D, picloram, and triclopyr. A 10-percent penetration rate was used for all of the herbicides. Worker exposure studies were available only for 2,4-D, and picloram. These studies were used as surrogates for the other herbicides. Residue data in various environmental components including plants, animals, and water are available for the herbicides but not for forestry applications. A conservative methodology was used to model the transport and fate of the herbicides in various

environmental components. Use of available data to fill the toxicity data gaps is discussed below.

Resolution of Toxicity Data Gaps

The registration process for herbicides, conducted by EPA under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), requires pesticide manufacturers to submit toxicology studies in support of registration of their product. Table 3-7 indicates what EPA considers to be toxicity data gaps for the 10 herbicides, either because a particular study has not been submitted, because submitted studies are not considered adequate according to current EPA guidelines, or because a study is still undergoing review. Although registration or reregistration of a herbicide under FIFRA requires these gaps to be filled, there are, in most instances, data available in studies already reviewed by EPA or from other sources to characterize the toxic endpoints of concern for these herbicides so that their risks can be assessed for the purposes of this EIS. Data gaps identified by the California Department of Food and Agriculture for toxicity information on the selected herbicides are summarized in table 3-8.

In addition, for studies still undergoing review (table 3-7), preliminary findings were often available for use in this risk assessment. Where EPA requires two or more studies for a specified toxic endpoint (such as chronic toxicity, oncogenicity, and teratogenicity), the existing data base may be sufficient to use in the risk assessment based on the studies that have been completed. For example, EPA requires cancer (oncogenicity) studies on two rodents—the rat and mouse—although data on just one of these species are sufficient to determine a cancer potency. The following discussion describes how the existing data were used in the risk assessment.

Asulam. EPA is reviewing chronic toxicity and oncogenicity studies on rats for asulam. The chronic systemic NOEL of 50 mg/kg/day used in this risk assessment was based on a 107-week rat study (EPA, 1985a), and asulam's cancer potency was based on increased thyroid cell carcinomas in a rat study (EPA, 1985a). EPA considers mutagenicity studies a data gap for asulam; however, no indication of mutagenic effects was found in bacteria and mouse assays on asulam according to EPA (1985a). Thus, asulam is not considered to pose a risk of germ cell mutagenicity in this risk assessment.

Atrazine. EPA is reviewing rat chronic toxicity and oncogenicity and rat and rabbit teratology studies on atrazine and considers a rat reproductive toxicity study and mutagenicity studies to be data gaps for atrazine. The risk assessment bases the systemic NOEL for atrazine of 15 ppm (0.48 mg/kg/day) on a 2-year dog feeding study reviewed by EPA (1986b); the reproductive NOEL of 0.5 mg/kg/day is based on a two-generation rat reproduction study (EPA, 1988a). The cancer potency of atrazine is based on interim results of a 2-year study on rats. Atrazine is considered mutagenic in this risk assessment based on positive test results in assays on microbial systems, mouse bone marrow cells, and human cells. However, it is not considered to present a serious risk of germ cell mutagenicity.

2,4-D. EPA considers mutagenicity studies to be a data gap for 2,4-D. The mutagenic potential of 2,4-D is judged in this risk assessment based on studies reported by Anderson et al. (1972), Styles (1973), Vogel and Chandler (1974), Magnusson et al. (1977), Rassmussen and Svalilin (1978), and reviews by WHO (1984) and Newton and Dost (1981). EPA is reviewing studies on 2,4-D carcinogenicity. This risk assessment bases 2,4-D's cancer potency on the rate of tumor formation in rats reported by Hansen et al. (1971).

Dicamba. EPA has indicated that a 21-day dermal study and a mouse oncogenicity study are data gaps for dicamba (table 3-7) and that chronic rat and mutagenicity studies are under review. Results of the 21-day dermal study are not considered necessary for the human health risk assessment because a more conservative approach is used by relying on chronic feeding studies. Benchmark toxicity levels (NOEL's) for risk comparison are set from these chronic studies at much lower doses than those tested in the dermal studies. Dicamba is considered noncarcinogenic for this risk assessment because of negative results in a recent 2-year rat study reported by EPA (1986d) and in older 2-year rat and 2-year dog feeding studies that were negative (EPA, 1986d), although these latter studies are considered inadequate by EPA (1986d).

Diuron. EPA (1983a) indicates that acute inhalation (LC_{50}), dermal sensitization, oncogenicity, mutagenicity, and teratogenicity studies are data gaps for diuron. The risk assessment assumes that diuron may be a skin sensitizer but that dermal effects should not be severe, based on only slight erythema and edema seen in acute dermal irritation studies and a dermal LD_{50} of more than 10,000 mg/kg. EPA's Office of Drinking Water Health Advisory on diuron (EPA 1987d) indicates that

Table 3-7. EPA Herbicide Data Gaps According to FIFRA Guidelines, EPA has Requested the Following Additional Toxicology Information on BLM Herbicides

Data Gaps	Asulam	Atrazine	2,4-D	Dicamba	Diuron	Fosamine	Glyphosate	Hexazinone[1]	Picloram	Triclopyr[2]
Acute Testing										
Acute oral - rat										
Acute dermal										
Acute inhalation - rat					X		R		X	
Eye irritation - rabbit										
Dermal irritation - rabbit										
Dermal sensitive - gn.pig					X					
Subchronic testing										
90-day feeding - rodent										
90-day feeding - nonrodt										
21-day dermal				X						
90-day dermal										
90-day inhalation										
90-day neurotoxicity										
Chronic testing										
Chronic-dog						X			X	
Chronic-rodent	R	R				X				
Oncogenicity-rat	R	R	R		X	X				
Oncogenicity-mouse			R	X	X	X				
Teratogenicity-rat		R			X	X				
Teratogenicity-rabbit		R			X	X				
Reproduction-rat		X				X				
Mutagenicity	X	X	X		X	X			X	

[1] No data gaps exist for hexazinone.

2 Although EPA has noted no data gaps, CFDA has noted data gaps (see Table 3-8).

X = Data gap, R = under review by EPA.

diuron is in group D: not classified (substances with inadequate animal evidence of carcinogenicity); therefore, diuron was not considered carcinogenic in the risk assessment and no cancer risk analysis was done.

The risk assessment assumes that diuron may be mutagenic because of the mutagenicity data gaps. The lowest NOEL for reproductive/developmental effects used in the risk assessment was 6.25 mg/kg/day from a three-generation rat reproduction study, thus the analysis of reproductive/developmental effects did not rely on the teratogenicity study EPA considers a data gap.

Fosamine. EPA (1987e) has indicated that no chronic data base exists for fosamine. The risk assessment bases fosamine's systemic NOEL on a 6-month study in dogs reported in USDA (1984). The reproductive NOEL is based on a rat teratology study reported by CDFA (1986d). Fosamine is considered noncarcinogenic based on negative results in the 6-month dog study and negative interim results from a 2-year mouse study.

Table 3-8. CDFA Herbicide Data Gaps

Date Gaps	Asulam	Atrazine	2,4-D	Dicamba	Diuron	Fosamine	Glyphosate	Hexazinone[b]	Picloram	Triclopyr
Chronic										
Rat	X[a]			X	X[a]	X	X			X[a]
Dog	X	X	X	X	X	X			X	X
Oncogenic										
Rat	X[a]			X	X[a]	X	X			X[a]
Mouse	X	X	X	X	X	X			X	X
Reproduction										
Rat	X	X		X	X	X	X		X	X
Dog										
Teratogenic										
Rat	X	X	X		X	X			X	
Rabbit	X	X	X	X	X	X			X	X
Mouse					X					
Gene mutation	X	X							X	
Chromosome	X	X	X	X					X	
DNA damage	X	X	X		X	X	X		X	
Neurotox		NR	NR	NR	NR	NR	NR		NR	NR

[a] *Combined chronic and oncogenic study.*

[b] No data gaps exist for hexazinone.

NR = Study not required.

X = Data Gap

Fosamine is considered nonmutagenic based on negative assays reviewed in CDFA (1986d) and EPA (1987e).

Glyphosate. EPA is reviewing an acute inhalation study for glyphosate. This study is not considered necessary for the risk assessment. Aerial concentrations of glyphosate should be extremely low because the chemical has a low volatility, large droplets are produced by the herbicide spray equipment, and strict environmental monitoring is done to avoid conditions that would lead to high aerial concentrations.

Hexazinone. According to EPA (1982a), no data gaps exist for hexazinone.

Picloram. An acute inhalation study, chronic dog study, and mutagenicity studies are considered data gaps for picloram. A rat chronic and oncogenicity study and a rabbit teratology study are under review. The acute inhalation study is not necessary for the same reasons explained above for glyphosate. The systemic NOEL for picloram of 7 mg/kg/day was based on a 6-month dog feeding study reported by Mullison (1985) and EPA (1985b), while a recent rat study reported by Dow (1987) gave a systemic NOEL of 20 mg/kg/day. The reproductive NOEL of 50 mg/kg/day was based on a three-generation rat reproduction study (EPA, 1988c). Picloram is considered carcinogenic in this risk assessment because of liver tumors in female rats (NCI, 1978). Picloram is considered nonmutagenic based on negative results in microbial and rat bone marrow assays (USDA, 1984).

Triclopyr. EPA (1988b) indicates that data gaps for triclopyr have not yet been identified. EPA reported a triclopyr systemic NOEL of 2.5 mg/kg/day (EPA,

1988b). A reproductive NOEL of 0.10 mg/kg/day used in this risk assessment was based on a rabbit teratology study (EPA, 1986c). Triclopyr is assumed to be possibly carcinogenic in the risk assessment, but tumor data from the rat study that showed benign tumors (DOW, 1987) were not available to evaluate cancer risk. Triclopyr also is assumed to present a slight mutagenic risk to humans based on positive results in a dominant lethal assay.

Neurotoxicity and Immunotoxicity

Tests of neurotoxicity and immunotoxicity were not considered significant data gaps for the assessment of human health risks in this risk assessment. Because of the difficulty in extrapolating data from cellular or animal models to humans, neurotoxicological and immunotoxicological studies are not used by toxicologists to establish NOEL's for regulatory purposes (Thomas, 1986). EPA does not require these tests in routine registration testing unless other toxicity tests or information on exposed humans indicates that these tests are warranted.

Except for 2,4-D, none of the herbicides considered here is suspected of causing neurotoxic effects. Dicamba has been tested for neurotoxic effects with negative results. Peripheral neuropathy has been reported as a result of 2,4-D exposure, but studies in rats showed no neuropathology. None of the Region 5 herbicides has been shown to cause immunotoxic effects. Section 2 of Appendix F gives more detail about testing for possible neurotoxicity and immunotoxicity of the herbicides.

Epidemiological Data

Epidemiological studies have indicated a possible association between exposure to herbicides in general and human health effects, such as cancer, birth defects, and genetic damage (Yoder et al., 1973; Burmeister, 1981; Schwartz et al., 1986). Epidemiology studies are reviewed in USDA (1984). Recent studies are discussed in section 3 of Appendix L.

Epidemiological studies exist only for 3 of the 10 herbicides, atrazine, glyphosate, and 2,4-D. Those studies are discussed in section 3 of the risk assessment (Appendix L) under nonthreshold effects of each of the four herbicides. None of the studies is considered definitive evidence of the carcinogenicity of the four herbicides. Nevertheless, atrazine, glyphosate, and 2,4-D are assumed to be possible human carcinogens in this risk assessment and their risks are characterized based on tumor incidence in chronic animal studies. Epidemiology studies on the other 10 herbicides are not considered significant data gaps because the risk assessment relies on the results of laboratory animal studies to extrapolate to possible effects in humans.

Time and Cost for Filling Data Gaps

These study data gaps and areas of uncertainty are important in deciding what is the best alternative for action; however, the cost of obtaining this information is an important consideration. From discussions with the Environmental Protection Agency, the Department of Agriculture, the Department of the Interior, and chemical manufacturers, it is estimated that the costs per chemical of conducting some of the standard laboratory toxicity tests would be $1.5 to $2 million for a chronic toxicity study with rats and dogs; $1.5 to $2.5 million for an oncogenicity test with rats and mice; and $50,000 to $100,000 for each mutagenicity and chromosomal study.

The following are the estimated costs to fill some of the specific data gaps listed above:

1. Worker exposure studies would cost approximately $200,000 per chemical.

2. No acceptable protocol is available for measuring all of the various routes of exposure of the public, but these studies would be more expensive than the worker exposure studies.

3. The cost of measuring residues in plants and animals would be between $50,000 and $100,000 per chemical per plant or animal.

4. The mutagenicity and chromosomal studies for diuron would cost approximately $225,000.

5. The additional oncogenicity studies for asulam, 2,4-D, picloram, and glyphosate would cost approximately $11.2 million.

6. Studies of synergistic effects would be extremely expensive because of the great number of tests that would be necessary; there are 45 combinations of the 10 herbicides if studied two at a time.

BLM does not have the staff, expertise, or funds to fill the existing data gaps, and the time required to perform these studies would seriously delay the execution of an effective vegetation management program. To fill all the data gaps pertaining to the carcinogenicity of the 10 proposed chemicals would require a total investment of at least $15 million

and 5 years. (See Appendix L for more information on study costs).

Most, if not all, of the research to fill the data gaps for 2,4-D is being conducted by a task force of manufacturers. Research on picloram is being conducted by Dow Chemical Company (1984). Therefore, BLM's conducting such studies would constitute unneeded duplication. Also, the courts, citing the requirements of NEPA (*Southern Oregon Citizens Against Toxic Sprays, Inc.* v *James Watt et al.,* 1982), ruled that BLM must perform a worst case analysis evaluating the risks of using herbicides and assessing the probability of the worst case actually happening. Therefore, a worst case analysis for asulam, atrazine, 2,4-D, glyphosate, and picloram is included in this EIS as Appendix L. A risk analysis for dicamba, diuron, fosamine, hexazinone, and triclopyr also is included.

It also would be extremely difficult to conduct satisfactory epidemiology studies for some of the health effects in question because of the low populations involved. For example, because none of the herbicides, even those where scientific uncertainty exist, are potent carcinogens, it would be very difficult to identify a sample population that would be large enough to differentiate between cancer induced by exposure to a herbicide and that caused by exposure to other environmental factors such as diet, smoking, polluted air, or drinking water. Therefore, the risk assessment relied on the results of laboratory animal studies to judge cancer risks and other health risks to humans.

Risk Assessment Conclusions

The risk assessment indicated that risks to the public of systemic or reproductive toxic effects from routine spraying operations are very low for all 10 of the proposed herbicides. The ratio between the safe lab animal doses and the estimated public exposures was 160 to 1 or greater for all the herbicides except atrazine, giving a large margin of safety. Sensitive members of the public could experience ill effects from aerial applications of atrazine. The possibility of toxic effects increases when the public is assumed to be exposed as a result of accidents; however, the real risks are also low here because of the extreme unlikelihood of an accident directly exposing any member of the public.

Risks to workers are higher than those of the public both in routine operations and as a result of accidents. Workers have a greater chance of being exposed than any member of the public and are likely to get higher doses than the public when they are exposed.

Cancer risks for the proposed herbicides are low. Available laboratory evidence indicates that dalapon, dicamba, diuron, fosamine, and hexazinone do not cause cancer. A cancer risk analysis was conducted for five of the six herbicides that showed positive responses in laboratory cancer studies. Data were not available to do a cancer risk analysis for triclopyr. The analysis was based on up to 30 estimated realistic and worst case lifetime exposures to the public, assuming single and multiple exposure sources. Results showed that for aerial applications the worst case cancer risk for atrazine, for 30 exposures from multiple sources, is less than 2 in 100,000. For asulam, 2,4-D, and picloram, the worst case cancer risks are no greater than 2 in 1 million. The risk for glyphosate is never greater than 4 in 100 million. Cancer risks to workers who are exposed at higher levels more frequently are higher than the risks to the public.

There appears to be little risk that the herbicides would cause heritable genetic mutations. Exposures of members of the public should be low if any occur at all. Available evidence indicates that dicamba, diuron, fosamine, glyphosate, hexazinone, and triclopyr are not mutagenic. They tested negative in the majority of mutagenicity assays reported and were not positive in available cancer tests. No mutagenicity studies were reported for diuron, but it was not shown positive in cancer tests. There is conflicting evidence of mutagenicity for asulam, atrazine, 2,4-D, and picloram because of positive and negative results in a number of mutagenicity assays and in at least one cancer study. However, there is insufficient evidence to indicate that any of these latter herbicides would likely cause heritable mutations at the levels of exposure that may occur in BLM's program.

Synergistic effects are unlikely to occur because synergism rarely occurs with chemical mixtures. The herbicide mixtures that may be used in the BLM's program have not shown synergistic effects in humans that have used them in other applications, although there is some evidence that mixtures of 2,4-D and picloram may cause skin irritation.

Cumulative effects are not likely to occur because none of the herbicides is persistent in the

environment or in the human body, no member of the public is likely to be chronically exposed in BLM's program, and no one is likely to receive simultaneous exposures from these same herbicides used in any other programs in Western Oregon.

The structure of the risk assessment, the ways in which risks tended to be exaggerated, and a summary of the risk assessment results are described below.

Risk Assessment Structure

The risk assessment consisted of three steps: a hazard analysis, an exposure analysis, and a risk analysis.

The *hazard* presented by a chemical pesticide is its inherent toxicity or poisonous quality that may cause brief, reversible effects, such as nasal irritation or nausea in humans who receive small amounts, or that in on extreme case, may cause death. All chemicals are injurious to health at some level of intake; even commonly consumed items such as aspirin, table salt, and sugar. As shown in table 3-9, the herbicides examined in this risk assessment in general are less acutely toxic to lab test animals than insecticides, fumigants, and many other common chemicals.

Exposure is the amount of pesticide in a person's immediate surroundings (in the air, on their skin, in their drinking water). The amount that enters their body—that is ingested, inhaled, or that passes through their skin, during a specified time period—is their *dose*. A person's dose is usually expressed in milligrams of chemical per kilogram of body weight (mg/kg).

Risk in the case of chemical pesticides is the expectation, under a specified set of circumstances leading to a given exposure, that a person may experience any of the range of toxic effects described above. In BLM's program, risk is the possibility of experiencing toxic effects because of an exposure to one of the 10 proposed herbicides.

The Hazard Analysis

In the hazard analysis, a review was made of toxicity studies in open literature and of publicly available summaries of proprietary data to determine the toxic properties of each herbicide. The hazard analysis included a review of relevant laboratory toxicity studies on acute (single dose), subchronic (short-term dosing), and chronic (long-term or lifetime dosing) effects caused by exposures through dermal, inhalation, and ingestion routes. The hazard analysis results are summarized in table 3-10.

The oral LD_{50} in rats (the single dose that kills half the animals tested) is the generally acknowledged benchmark of the acute toxicity of a chemical. The oral LD_{50} is usually found at test doses that far exceed any that are likely to occur in the handling and use of the chemical by humans. The rat oral LD_{50}'s for the 10 BLM herbicides are listed in table 3-10.

Long-term animal studies (subchronic and chronic studies), lasting 90 days to 2 years for most tests, are used to establish safe levels for humans. The safe lab animal level is the no-observed-effect level (NOEL) in a long-term study—the dose that a test animal can receive every day without ill effects. Additional safety factors are used to extrapolate from the safe animal dose to a safe human dose. The generally recognized safety factor is 100, based on a factor of 10 to move from animals to humans and a factor of 10 to account for variable responses in humans. Table 3-11 lists systemic NOEL's for each herbicide. A discussion of the animal studies and the choice of NOEL's is given in the Appendix L risk assessment.

Reproductive toxicity studies determine whether a chemical will affect the fetus or mother during gestation and cause abortions or malformed offspring (teratogenesis). A separate NOEL for these effects has been set for the 12 BLM herbicides. These reproductive NOEL's are listed in table 3-11a.

For the herbicides that had positive cancer tests, a cancer potency value that relates the probability of tumor formation to increasing lifetime doses is the parameter of concern. Those values are listed in table 3-10 for asulam, atrazine, 2,4-D, glyphosate, and picloram.

No comparable value can be used to estimate the likelihood of a human developing heritable mutations, so the risk of mutagenicity is considered only in a qualitative manner based on the results of mutagenicity assays and cancer tests.

The Exposure Analysis

Two human populations, workers and the general public, are at risk from herbicide applications.

Table 3-9—Acute toxicity classification and acute toxicities of the 10 herbicides and other chemicals

Toxicity Category (label signal words)	Herbicide or Other Chemical Substance	Oral LD_{50} for Rates (mg/kg)	Estimated Human Lethal Dose
IV Very slight		5,000 - 50,000 (range)	More than 1 pint
	Sugar	30,000	
	Fosamine	24,400	
	Ethyl alcohol	13,700	
	Picloram	8,200	
III Slight (caution)		500 - 5,000 (range)	1 ounce to 1 pint
	Glyphosate	4,320	
	Asulam	4,000	
	Diuron, table salt	3,750	
	Household bleach	2,000	
	Aspirin, vitamin B_3	1,700	
	Hexazinone	1,690	
	Dicamba	757	
	Atrazine	672	
	Triclopyr	630	
II Moderate (warning)		50 - 500 (range)	1 teaspoon to 1 ounce
	2,4-D	375	
	Caffeine	200	
	DDT	100	
I Severe (danger - poison)		0 - 50 (range)	1 teaspoon or less
	Nicotine	50	
	Strychnine (rodenticide)	30	
	Parathion (insecticide)	13	
	TCDD (a dioxin)	0.01	

Sources: Maxwell, 1982 (as cited in Walstad and Dost, 1984) and hazard analysis of this risk assessment..

Note: Categories, signal words, and LD_{50} ranges are based on a classification system used by the EPA for labeling pesticides.

Table 3-10 Toxicity and Cancer Potency of Herbicides

Herbicide	Rat LD50 (mg/kg)	Systemic NOEL (mg/kg/day)	Reproductive/ Developmental NOEL (mg/kg/day)	Cancer Potency $(mg/kg/day)^{-1}$
ASULAM	4,000	50.00	50.00	0.02
ATRAZINE	672	0.48	0.5	0.03
2,4-D	375	1.00	5.00	0.00503
DICAMBA	757	15.80	3.00	*
DIURON	3,750	0.625	6.25	*
FOSAMINE	24,400	25.00	50.00	*
GLYPHOSATE	4,320	31.00	10.00	0.000026
HEXAZINONE	1,690	10.00	50.00	*
PICLORAM	8,200	7.00	50.00	0.00057
TRICLOPYR	630	2.50	10.00	*

* This chemical is either considered to be a noncarcinogen for this risk assessment, or there was insufficient information to quantify carcinogenic potential.

Worker personnel such as mixer-loaders and backpack sprayers are directly involved in treatment operations. Members of the public, including forest visitors and nearby residents, may be exposed to herbicide drift, to vegetation with herbicide residues, or to accidental spraying. They could also eat food or drink water with herbicide residues.

The exposure analysis determined how high the exposures and resultant doses of workers and the public are likely to be from routine operations and possible accidents under BLM's proposed program. No analysis could consider all the possible circumstances of herbicide spraying, so scenarios were used that were simplified descriptions of spraying operations and potential routes of human exposure.

Four scenarios (helicopter, truck, backpack, and hand application) were used to estimate realistic worker doses in routine operations (routine-realistic scenarios). Four additional scenarios with the same methods of application were used to estimate the highest doses workers might get in routine operations (routine-worst case scenarios). The worker dose estimates were derived from actual worker field study data of 2,4-D doses found by urine analysis. These studies showed that inhalation exposure was a negligible contributor to a worker's total dose, so no separate estimate of worker inhalation doses was made. Scenario dose estimates were adjusted for hours worked, application rate, and the different skin penetration rates of the other herbicides.

Three of the four routine-realistic scenarios (helicopter, truck, and backpack spraying) were used to estimate public doses. The same three routine-worst case scenarios were used to estimate the highest likely public doses. Because no studies of public exposure comparable to the worker studies were available, the public's doses were estimated by a mathematical accounting (modeling) of the movement and fate of each herbicide in the area of spraying to estimate exposure levels on their skin, on their food, and in their drinking water. As in the case of workers, inhalation exposures of the public were considered negligible and were not estimated.

Dermal doses from the smaller herbicide spray droplets drifting offsite and depositing on a person's skin or from brushing against vegetation with drift residues were estimated. Doses to a person drinking water with herbicide residues and eating berries, deer meat, game birds, garden vegetables, and fish containing herbicide residues also were calculated.

Cumulative doses to five "example" members of the public—hikers, berrypickers, hunters, fishermen, and nearby residents—that receive doses simultaneously through several exposure routes were calculated.

Scenarios also were used to estimate worker and public doses from accidents. Worker accidents included a spill of concentrate or spray mix on their skin and a direct spraying. Public accidents included a direct spraying and drinking water from a pond or reservoir contaminated by a spill from a truck or helicopter.

The Risk Analysis

The risk analysis was conducted after the worker and public exposures were estimated. The scenario-based estimates of doses to workers and the public were compared with the toxicity levels detailed in the hazard analysis. These comparisons were used to determine the risk to humans under the specified circumstances of exposure.

For threshold effects, the doses were compared to no-observed-effect levels (NOEL's) determined in the most sensitive animal test species. A margin of safety (MOS), the animal NOEL divided by the smaller estimated human dose, was computed to relate the doses and effects seen in animals to estimated doses and possible effects in humans. For example, an animal NOEL of 20 mg/kg divided by an estimated human dose of 0.2 mg/kg gives an

Snowshoe hare

MOS of 100. A margin of safety of 100 is comparable to the 100-fold safety factor described in the Hazard Analysis section as being generally recognized as safe for humans. The larger the margin of safety (the smaller the estimated human dose compared to the animal NOEL), the lower the risk to human health.

When an estimated dose exceeded a NOEL, the dose was divided by the NOEL and a minus sign was attached. The result was not a margin of safety but simply a negative ratio. A negative ratio did not necessarily lead to the conclusion that there would be human toxic effects because all of the NOEL's used in the risk analysis are based on no-effect levels in long-term animal studies and the estimated doses are not likely to occur often. This applies particularly to doses that are not likely to occur more than once, such as those to the public. Doses that greatly exceeded the NOEL were also compared to the herbicide's acute LD_{50} to evaluate the risk of fatal effects.

Systemic effects were evaluated based on the lowest systemic NOEL found in a 2-year feeding study of dogs, rats, or mice (or from a subchronic study if that NOEL was lower). Reproductive effects were evaluated based on the lowest maternal, fetotoxic, or teratogenic NOEL found in a three-generation reproductive study or in a teratology study.

A worst case analysis of cancer risk was conducted for the herbicides considered to be suspect human carcinogens—asulam, atrazine, 2,4-D, glyphosate, and picloram—by comparing estimates of lifetime dose with cancer potency estimates derived in the Hazard Analysis. A worst case analysis also was conducted for those herbicides that had positive mutagenicity tests or those for which no data were available. The risk of these herbicides causing mutations was judged on a qualitative rather than a quantitative basis, with a statement of the probable risk based on the available evidence of mutagenicity and carcinogenicity. Germ cell studies *in vivo* play the most important role in mutagenic risk assessment.

Uncertainty Factors and the Exaggeration of Risks

A number of factors contributed to the uncertainty in the process of judging risks to human health in the vegetation management program, and in each of these cases, a series of conservative assumptions or factors were used that tended to exaggerate the risks.

First, the safe herbicide doses established in the laboratory are the result of tests on laboratory animals, particularly rats and mice, where doses produce no observed effects. To allow for the uncertainty in extrapolating from NOEL's in lab animals to safe levels for humans, the margin-of-safety approach was used as described previously.

A second area of uncertainty is in judging the risk to human health of doses that may be received once or perhaps a few times in a person's life (accidental worker doses and all doses to the public fall in this category) by comparing those human doses to levels of the chemical that produced no ill effects in laboratory animals even though the animals received the doses daily in long-term studies. The risk assessment uses the MOS approach discussed above in comparing one-time human doses to lifetime animal doses in all of these cases even though this leads to an exaggeration of the risks.

A different approach was required in assessing the risks to humans of chemicals that may cause cancer. Because the exact mechanisms and effective (threshold) doses that cause cancer are not known to scientists, chemicals that could cause cancer were assumed to have no threshold effects and no margin of safety comparable to that used to judge the risks of systemic or reproductive effects. Some risk of cancer was assumed no matter how small the dose.

Where there was evidence from a long-term study that a herbicide could cause an increase in tumor formation with increasing doses, a cancer potency value was taken from the lab animal study and adjusted for the differences in metabolism and lifetime duration between the lab animals and humans. Data of this kind existed for asulam, atrazine, 2,4-D, glyphosate, and picloram. The cancer potency value multiplied by an estimated human lifetime dose provides an estimate of human cancer risk.

A number of factors in the cancer risk analysis tended to exaggerate risks. The cancer potency value used to compute the human lifetime risk was derived from tumor data on the test species and sex showing the highest rate of tumor formation with increasing dose. The mathematical model used to extrapolate from the lab tumor data to likely human risk was the most conservative of the

models the scientific community used. In addition, the upper limit of the 95-percent confidence interval around this risk estimator was used instead of the average potency value.

Uncertainty was also involved in the estimation of the human doses likely to occur in herbicide use. The risk assessment overestimated doses to err on the side of safety. In reality, workers are likely to receive some low level doses because they work with chemicals routinely. However, standard safety practices and the use of protective clothing should reduce their actual dose levels below those estimated in this analysis. The same is true of the doses from any spraying or spill accidents that might occur, because the normal procedure would be to wash immediately.

If a member of the public actually receives a dose, it is unlikely to be as high a dose as estimated in this risk assessment. Normal safety practice and the remoteness of most treated areas limit the possibility of the public receiving any dose at all. Several aspects of the analysis tend to exaggerate the public doses. No herbicide degradation is assumed to occur and the public is not assumed to wash themselves or their food items after a spraying or to cook fish and game meat before consuming them. They are assumed to consume water that has received herbicide from drift or from a spill immediately after the event. Thus, the way exposures to workers and the public are estimated in this risk assessment and the way the toxicity information is used tend to exaggerate the real risks, to err on the side of protecting human health.

Risks of Systemic and Reproductive Effects

The following discussion examines the risks to the public and to workers of experiencing adverse systemic or reproductive health effects from exposure to the 10 herbicides. Tables 3-11 and 3-11a indicate the health effects seen in studies of the 10 herbicides in lab animals and thus the types of effects and target organs that may be affected in human exposures.

Risks to the Public from Routine Operations

Table 3-12 summarizes the margin-of-safety results for the public for the 10 herbicides under the routine-realistic and the routine-worst case exposure scenarios.

Public Risks from Routine-Realistic Doses

Table 3-12 shows that there are large margins of safety (greater than 150) for every category of public exposure—even cumulative exposures—under the routine-realistic scenario for 9 of the 10 proposed herbicides. Because most of the time no member of the public should be exposed, these large margins of safety mean that the public should suffer no adverse effects. This is true for all individuals, including pregnant women and most of sensitive individuals. MOS's for atrazine are less than 100 for some exposures in aerial applications. Sensitive members of the public could experience ill effects from exposure to atrazine in these cases.

Exposure routes presenting the lowest risk are direct dermal exposure to spray drift and eating animals or fish that have drift residues. The representative members of the public at greatest risk from multiple exposures are nearby residents and the berrypickers. Persons at least risk are hunters, hikers, and fishermen. These relationships are true for all 10 herbicides.

Although the routine-realistic scenarios represent what can happen under routine operations, the probability of people receiving the doses estimated here is low because there are no residents, hikers, fishermen, or berrypickers in the vicinity of most treatment units and, as described previously, these scenarios use a number of conservative assumptions that tend to overestimate the size of the doses.

Public Risk from Routine-Worst Case Doses

The routine-worst case scenarios estimate the highest likely public exposure levels from routine herbicide applications in the Pacific Northwest. The events leading to the exposures described in Table 3-12 have a low probability of occurrence. It is unlikely that anyone would receive a dose as high as those estimated here. Under these extreme assumptions, risk to individuals is very low, except for people who receive multiple exposures from a 400-acre fixed wing application.

Table 3-12 indicates that all margins of safety under the backpack and right-of-way routine-worst case scenarios are higher than 100, except for diuron because of its potential accumulation in fish. Routine-worst case MOS's are less than 100 for atrazine, 2,4-D, dicamba, fosamine, glyphosate, and triclopyr. MOS's are greater than 90 for fosamine and glyphosate, so the risk of systemic effects is

Table 3-11—Lowest NOEL's and Effects Seen at Lowest Effect Levels—general (systemic) effects.

Herbicide	Lowest NOEL *Mg/kg/day*	*Effects Noted at Higher Doses*
Asulam	50 (rat)	Reduced body weight, possible tumor formation (EPA, 1985a)
Atrazine	0.48 (dog)	Increased heart and liver weights in females at 37 mg/kg/day; reduced food intake, body weight, and hemoglobin and hematocrit values at 370 mg/kg/day (EPA, 1987a, 1986b)
2,4-D	1 (rat)	Kidney effects at 5 mg/kg/day (increased tubular brown pigment in kidney; increased vacuolization of cytoplasm of renal cortex) (EPA, 1985d)
Dicamba	15.8 (rat)	Increases in liver-to-body weight ratio (EPA, 1987c)
Diuron	0.625 (dog)	Abnormal pigments in the blood and decreased hematological values at 3.1 mg/kg/day (EPA, 1983a)
Fosamine	25 (dog)	Increased stomach weight at 250 mg/kg/day (USDA, 1984)
Glyphosate	31 (rat)	No effect at highest dose; in a 2-year mouse study, liver and kidney effects were observed at 375 mg/kg/day (EPA, 1986g)
Hexazinone	10 (rat)	Decreased body weight gain and food efficiency at 50 mg/kg/day (EPA, 1982a)
Picloram	7 (dog)	Increased liver weight at 35 mg/kg/day (EPA, 1984d)
Triclopyr	2.5 (dog)	No effects at highest dose tested; decreased body weight, food consumption and absolute liver weights at 100 mg/kg/day in rats (Dow, 1985; EPA, 1988b)

still relatively low. Risks are higher for the other chemicals mentioned above. Margins of safety calculated for combined routes of exposure to 2,4-D, dicamba, and triclopyr range from 10 to 50 in the worst case aerial application. Chronic doses of 2,4-D, as predicted by this analysis, could affect the peripheral nervous system but, in most cases, these effects are reversible. People who chronically receive triclopyr doses as high as those predicted here could experience kidney problems. Because the margins of safety were computed by comparing acute exposures with chronic no-effect levels, the risk of occurrence of these effects can be considered relatively low.

The margins of safety computed in the worst case, 400-acre aerial spraying scenario indicate that sensitive individuals could suffer some acute toxic effects from the predicted exposures to atrazine, 2,4-D, dicamba and triclopyr. For atrazine, all margins of safety less than 100 are greater than 50 except for a berrypicker who is dermally exposed for 4 hours, eats 0.9 pounds of berries and drinks a liter of water contaminated at the highest possible level. This person, as well as the people who receive multiple exposures to dicamba listed in table 3-12, could experience some systemic effects. However, that is unlikely because all of these one-time doses are all more than 10,000 times lower than the LD_{50}. The systemic NOEL for atrazine is based on weight loss in dogs. Therefore, sensitive individuals could become ill and possibly experience stomach problems. Therefore, any toxic effects resulting from these routine-worst case doses should be limited, if any.

The probability of someone receiving a dose as high as those predicted under the routine-worst case scenarios is negligible because these scenarios assume that a number of unlikely events

Table 3-11a—Lowest NOEL's and Effects Seen at Lowest Effect Levels—reproductive/teratogenic effects

Herbicide	Lowest NOEL Mg/kg/day	Effects Noted at Higher Doses
Asulam	50 (rat)	Decreased number of live births at 250 mg/kg/day (EPA, 1985a)
Atrazine	0.5 (rat)	Decreased pup weight at 2.5 mg/kg/day (EPA, 1988a)
2,4-D	5 (rat)	Decreased maternal body weight and pup weight at 20 mg/kg/day (EPA, 1986e)
Dicamba	3.0 (rabbit)	Decreased fetal weight and post-implantation losses at 10 mg/kg/day in teratology study (EPA, 1986f)
Diuron	6.25 (rat)	Delayed calcium ossification, wavy ribs, and sternoschisis at 125 mg/kg/day (EPA, 1986e)
Fosamine	50.0 (rat)	Urine in kidney, fetal resorptions (CDFA, 1986d)
Glyphosate	10 (rat)	Renal effects in male weanlings at 30 mg/kg/day (EPA, 1986g)
Hexazinone	50.0 (rat)	Decreased weight in weaning pups (EPA, 1982a)
Picloram	50 (rat)	Reduced fertility at 150 mg/kg/day (EPA, 1984d)
Triclopyr	10 (rabbit)	No effects given; in another teratology study at 200 mg/kg, rats had delayed ossification of the skull (EPA, 1986c; CDFA, 1986c)

[a]HDT = highest dose tested.

occur simultaneously. The probability of someone receiving a dose as high as is predicted here is about 1 in 1 million. The BLM's experiences in these operations indicate that the probability of the scenario events occurring simultaneously is even lower.

Public Risk from Accidental Doses

Table 3-13 summarizes the risk to the public from direct exposure to aerial applications or from eating food or drinking water that has been directly hit at the highest application rate. With the exception of asulam, every herbicide examined here produces a margin-of-safety value less than 10 in these scenarios. The predicted human dose exceeds the animal NOEL for atrazine, 2,4-D, diurón, and triclopyr, indicating that people exposed to a direct aerial application or exposed to items that received the highest application rate of these chemicals could experience some toxic effects. The extent of effects would depend upon their duration of exposure and any precautionary measures that were taken. For example, if people gathered a bushel of berries from a spray area and did not wash them but froze them and then ate them every day for a month, they would probably feel ill. However, if people bathed after being in the forest or washed food items before eating them, the doses would drop (and thus increase the margins of safety) substantially.

These are one-time, rather than repeat or chronic, exposures and the comparison of these doses with the acute LD_{50}'s shows that no one is at risk of fatal effects. Complete margins of safety computed for each chemical and application under the accidental worst-case scenarios are presented in the Appendix L risk assessment.

Worker Risk from Routine Operations

Worker Risk from Routine-Realistic Doses

In the routine-realistic scenarios, all categories of workers applying asulam or picloram have MOS's

Table 3-12 Lowest Margins of Safety for the General Public Under the Routine Scenarios

Herbicide	Routine-Realistic Scenarios	Routine-Worst Case[a] Scenarios
Asulam	All situations 6,700 or greater.	All situations at least 710.
Atrazine	All situations greater than 50 except for aerial application combinined route exposure to the berrypicker (32), the fisherman (35), and the resident (49).	All backpack and right-of-way scenarios have MOS's at least 110. Most aerial MOS's are less than 10: vegetation contact by berrypicker (8.5), berrypicker combined routes (4.5), hunter (9.7), fisherman (6.8), and resident (7.4).
2,4-D	All situations at least than 160.	All right-of-way and backpack MOS's are at least 390. All aerial MOS's are greater than 10 with the following situations having MOS's of 10 to 50: vegetation contact by picker (38), eating vegetables (48), hiker (43), berrypicker (17), hunter (32), fisherman (36) and resident (23).
Dicamba	Greater than 1000 except for berry-picker (960).	All situations greater than 100 except for vegetation contact by the berry picker (82), and cumulative exposures for berrypickers (38), hunters (75), fishermen (84), and residents (55) for 400-acre aerial application.
Diuron	At leat 190 in all situations.	All MOS's 77 or greater in all situations.
Fosamine	All at least 2,700.	All 99 or greater.
Glyphosate	All at least 1,600.	All 95 or greater.
Hexazinone	All greater than 1,200.	All greater than 150.
Picloram	All at least 4,600.	All at least 170.
Triclopyr	All at least 710.	All situations greater than 50 except for the multiple routes for berrypicker (38), and resident (34) in the 400-acre aerial application.

[a] A margin of safety of 50 was chosen as the cutoff to report values in this table for ease of comparison. It was not intended to indicate what would be considered low or high risk.

greater than 100. This indicates that even workers chronically exposed to these herbicides should suffer no ill effects. Backpack sprayers are at greatest risk based on comparisons of estimated doses with systemic and reproductive NOEL's. Except for asulam and picloram, all backpack sprayers had an MOS less than 100. Doses of 2,4-D to backpack sprayers had an MOS less than 20, and in the case of atrazine and diuron the dose exceeds the NOEL. This means that unprotected sensitive workers may experience some toxic effects from routinely applying these herbicides in certain situations. The doses and margins of safety are based exposure of 6 hours per day. Any reduction in the time of exposure would reduce the dose and increase the margin of safety proportionately.

Atrazine and diuron appear to present the greatest risk from repeated exposures to other types of workers. Backpack sprayers using these herbicides in the routine realistic scenario receive a dose that is less than the systemic NOEL.

Table 3-13 Margins of Safety of 10 or Less for the General Public in the Accidental-Worst Case Scenarios

Herbicide	MOS Less Than 10	
	Items Sprayed at Full Application Rate	Spill
Asulam	None less than 10 for either scenario.	
Atrazine	All scenarios except eating deer and vegetation contact by a hiker. Doses from vegetation contact by a berry picker and from the combined exposures for the hiker, berry picker, hunter, fisherman, and resident exceed the NOEL.	Helicopter spill into pond and truck spill into reservoir; truck spill into pond exceeds NOEL.
2,4-D	Direct spray exposure, vegetation contact by berrypicker, combined exposure routes for hiker, berrypicker, hunter, fisherman, and resident.	Truck spill into pond dose exceeds NOEL.
Dicamba	Vegetation contact by berrypicker, and combined exposure for resident, berry picker, and hunter.	Truck spill into pond.
Diuron	All margins of safety, except hiker vegetation contact and person eating deer are less than 10. The direct spray contact, berrypicker vegetation contact, and eating fish exposures and all combined exposures exceed the systemic NOEL.	Truck spill into pond dose exceeds NOEL
Fosamine	None less than 10. (Combined exposure for berry picker = 12)	Truck spill into pond.
Glyphosate	None less than 10. (Combined exposure for berry picker = 11)	Truck spill into pond.
Hexazinone	Only the combined exposure berrypicker MOS is less than 10.	Truck spill into pond.
Picloram	None less than 10.	Truck spill into pond.
Triclopyr	Combination exposure for berrypicker, hunter, and resident.	Truck spill into pond dose exceeds NOEL.

2,4-D appears to present the next highest long-term risk. Backpack sprayers using 2,4-D in the routine-realistic scenarios receive doses that have systemic margins of safety less than 10. Pilots, mixer-loaders, and both types of hand applicators of 2,4-D have MOS's less than 50.

Protective clothing can substantially reduce worker exposure by 27 to 99 percent as shown in a number of relevant field studies. Margins of safety calculated for routine-realistic and routine-worst case exposure to workers wearing protective clothing are presented in the Appendix L risk assessment.

Worker Risk from Routine-Worst Case Doses

Backpack sprayers using atrazine, diuron, or 2,4-D in the routine-worst case scenario receive doses that exceed their respective systemic NOEL's. In addition, doses calculated for truck applicators and hack-and-squirt applicators using diuron exceed the systemic NOEL. Margins of safety for the reproductive NOEL's are much higher. No applicator dose exceeds the reproductive NOEL for any herbicide in any situation.

All categories of workers, except the aerial supervisor and observer, have margins of safety less than 10 for at least one of the herbicides. Picloram and asulam are the only herbicides that always have margins of safety greater than 20 for all categories of workers.

Most of the time workers will be receiving doses less than those predicted in the routine-worst case scenario. The probability of workers receiving repeated daily doses as high as those predicted here is less than 1 in 1,000.

Risk to Workers from Accidents

The doses estimated here are based on dermal penetration levels derived in studies over many days; these chemicals do not penetrate the skin immediately but over a considerable period of time. Workers would have to ignore their own safety and *not* wash the chemical off to receive doses as high as predicted in these accidents.

With the exception of picloram, there is some certainty that workers who spill a pint of concentrate or spray mix on their skin would experience acute toxic effects if they did not wash it off. The modeling used in the analysis assumed that a certain percentage of the herbicide penetrates the skin instantaneously. In reality, penetration through skin occurs over a period of many hours. In the case of a spill of a pint of concentrate, many of the doses approach the LD_{50}. This represents a clear risk of severe toxic effects if the herbicide is not washed off.

There is some possibility that the damage caused by such a large acute dose could cause long-term damage to vital organs. Also, rare instances have occurred in which limited exposure to 2,4-D has been reported to cause permanent nerve damage. The dose and the risk is much greater for spills of concentrate than it is for the spray mix but, again, it is highly unlikely that a worker would allow the chemical to penetrate his skin for any period of time. The Appendix L risk assessment presents the complete listing of MOS's and comparisons to LD_{50}'s for each herbicide.

Risk to Workers and the Public from Large Spills

Table 3-14 summarizes the margins of safety for people drinking one liter of water contaminated by a large spill of herbicide from a helicopter or truck. Most drinking water reservoirs would dilute the herbicide below no-observed-effect levels in a relatively short period of time. BLM, in addition to EPA and the States, has procedures to minimize the risk to human health should a spill of this magnitude occur in or on the vicinity of a drinking water reservoir. When the spill has been diluted, the risk to members of the public should be much lower.

Spills into a small, stagnant pond would result in significantly higher doses and, in the event of a truck spill of 2,000 gallons, would constitute a risk of chronic effects if members of the public continued to drink from it. Spill accidents occur only rarely; most spills involved 30 gallons or less of chemical, so the chances of this type of chronic exposure are negligible. BLM has detailed spill prevention and cleanup procedures that would attempt to ensure that no member of the public was chronically exposed to a spill of this magnitude.

Cancer Risk

Cancer risks for atrazine, asulam, 2,4-D, glyphosate, and picloram were calculated based on a variety of conservative assumptions that are likely to overestimate the risks. These assumptions outlined previously are described in detail in the Appendix L risk assessment.

Table 3-14 Margins of Safety for People Drinking One Liter of Water Contaminated by a Large Spill of Herbicide[a] Compared to the Systemic NOEL

	Helicopter		Truck	
Herbicide	Into a Reservoir	Into a Pond	Into a Reservoir	Into a Pond
Asulam	26,000	810	1,300	41
Atrazine	210	6.5	10	-3.1
2,4-D	430	14	22	-1.5
Dicamba	1,300	41	65	2.0
Diuron	—	—	17	-1.9
Fosamine	3,600	110	180	5.7
Glyphosate	11,000	340	540	17
Hexazinone	5,800	180	290	9.1
Picloram	2,400	76	120	3.8
Triclopyr	540	17	27	-1.2

a Assuming that a helicopter carrying 100 gallons of spray mix jettisons the entire load in a 16-acre by 8-foot-deep reservoir and a 1-acre by 4-foot-deep pond.

Cancer risk for the general public was calculated for a single exposure, and for 30 exposures over a lifetime. The approximate cancer risks to the public for the aerial routine-realistic scenario are shown in Table 3-15. (See Appendix L, Attachment C for the presentation of cancer risks to the public for the other routine exposure scenarios.) The risk of cancer resulting from any of the routes of exposure in the typical aerial spraying scenario is less than 2 in 100,000. The cancer risk for glyphosate is never greater than 2 in 1 billion. For 2,4-D, asulam, and picloram, none of the routes of exposure in any scenario results in a cancer risk greater than about 2 in 10 million, per exposure.

Cancer risk to workers has been calculated for an expected case assuming 5 years of employment in herbicide application, and an average number of days of spraying per year. The average number of exposures per lifetime was estimated to range from 30 to 70. The risk has been calculated in the extreme case assuming 30 years of employment and a total of 288 to 480 exposures. It is unlikely that a worker would apply herbicides on the number of days assumed in the worst case. (Cancer risk to workers for the accidental-worst case scenario is shown in Appendix L, Attachment C.) The risks for each herbicide were calculated assuming that only that herbicide was used. The highest risks for workers involve atrazine use. The lifetime cancer risk to a backpack sprayer using only atrazine is about 1 in 10,000 in the expected case. In the worst case the risk is greater than 1 in 1,000. The risk is much less for the other chemicals. The highest risk for 2,4-D is about 1 in 100,000 for backpack spraying in the expected case, and in the extreme case, the greatest risk is about 1 in 10,000. Workers using asulam in the extreme case have a lifetime cancer risk of less than 1 in 100,000 in all worker categories. The risk of picloram or glyphosate use is even less for all worker categories. The risks in the expected case never exceed 3 in 10 million.

Cancer risks calculated for exposures resulting from accidental spraying are shown in Appendix L, Attachment C. Among the chemicals, the greatest risk is about 3 in 10 million for exposures to 2,4-D. Multiple incidents could be expected to result in cumulative risks. Cancer risks calculated for spill situations are also shown in Appendix L, Attachment C.

The greatest risks are for spills of herbicide concentrate directly onto clothing and skin. Workers are at the greatest risk for this type of accident. The tabled values assume that most of a person's skin has been contacted by the solution and cleanup does not occur for several hours. This is certainly contrary to standard practice. A spill of 2,4-D concentrate onto a person gives a risk of about 3 in 10,000, and a spill of spray mixture gives a lesser risk of about 1 in 100,000. The risk of cancer resulting from spills of asulam is about 1 in 100,000 for the concentrate and 1 in 1 million for the spray mixture. A spill of picloram or glyphosate concentrate gives a risk of 2 in 1 million or less. Cancer risks arising from even major spills into

Table 3-15 Lifetime Cancer Risk[a]—Exposed Public Realistic Aerial, 40 Acres by Helicopter

Routes of Exposure	Exposures per Lifetime	Risk from Exclusive Use of: Asulam	Atrazine	2,4-D	Glyphosate	Picloram
For a Single Exposure:						
Dermal, Spray	1	7.84E-11[b]	1.84E-10	1.23E-11	2.03E-13	1.68E-14
Vegetation Contact						
Hiker	1	1.12E-12	2.64E-12	1.77E-13	2.91E-15	2.40E-16
Picker	1	1.58E-08	3.71E-08	2.49E-09	4.11E-11	3.39E-12
Drinking Water	1	9.20E-09	2.16E-08	2.41E-09	2.38E-11	1.09E-10
Eating Berries	1	5.27E-09	1.23E-08	1.38E-09	1.37E-11	6.26E-11
Eating Vegets.	1	1.05E-08	2.47E-08	2.76E-09	2.73E-11	1.25E-10
Eating Deer	1	7.52E-10	1.76E-09	1.93E-10	1.95E-12	8.47E-12
Eating Fish	1	3.68E-09	4.31E-08	9.64E-10	9.54E-12	4.37E-11
Combined Routes of Exposure:						
Hiker	1	9.28E-09	2.18E-08	2.42E-09	2.40E-11	1.09E-10
Berry Picker	1	3.04E-08	7.12E-08	6.29E-09	7.88E-11	1.75E-10
Hunter	1	1.27E-08	2.98E-08	3.29E-09	3.30E-11	1.46E-10
Fisherman	1	1.30E-08	6.49E-08	3.39E-09	3.36E-11	1.53E-10
Resident	1	1.98E-08	4.65E-08	5.18E-09	5.13E-11	2.34E-10
For 30 Exposures:						
Dermal, Spray	30	2.35E-09	5.51E-09	3.70E-10	6.09E-12	5.03E-13
Vegetation Contact						
Hiker	30	3.37E-11	7.91E-11	5.30E-12	8.74E-14	7.21E-15
Picker	30	4.75E-07	1.11E-06	7.47E-08	1.23E-09	1.02E-10
Drinking Water	30	2.76E-07	6.47E-07	7.23E-08	7.15E-10	3.28E-09
Eating Berries	30	1.58E-07	3.70E-07	4.14E-08	4.10E-10	1.88E-09
Eating Vegets.	30	3.16E-07	7.41E-07	8.28E-08	8.19E-10	3.75E-09
Eating Deer	30	2.26E-08	5.29E-08	5.79E-09	5.85E-11	2.54E-10
Eating Fish	30	1.10E-07	1.29E-06	2.89E-08	2.86E-10	1.31E-09
Combined Routes of Exposure:						
Hiker	30	2.78E-07	6.53E-07	7.27E-08	7.21E-10	3.28E-09
Berry Picker	30	9.12E-07	2.14E-06	1.89E-07	2.36E-09	5.26E-09
Hunter	30	3.82E-07	8.94E-07	9.86E-08	9.89E-10	4.38E-09
Fisherman	30	3.89E-07	1.95E-06	1.02E-07	1.01E-09	4.59E-09
Resident	30	5.95E-07	1.39E-06	1.56E-07	1.54E-09	7.03E-09

[a] Cancer risks shown in this Table were calculated based on a variety of assumptions that tend to overestimate risks as explained in Section 5.

[b] E-07 means 1 out of 10 million individuals exposed to a given herbicide via a given exposure scenario. E-08 means 1 out of 100 million individuals, E-09 means 1 out of 1 billion individuals, etc.

drinking water supplies are significantly less. A 100-gallon helicopter load of 2,4-D dumped into a 1-acre pond would lead to a risk of cancer of no more than 1 in one and a quarter million for a person drinking a liter of the water. If a 1,000-gallon tank truck of mixture were spilled into a small pond, the risk for 2,4-D would be less than 1 in 1 million.

Risk of Heritable Mutations

No human studies are available that associate any of the herbicides with heritable mutations. No risk assessments that quantify the probability of mutations are available in the literature or from EPA. Laboratory studies in rodents constitute the best available information on mutagenic potential. Results of all mutagenicity assays conducted on the 12 herbicides are summarized in Table 3-16.

Asulam and glyphosate tested negative for mutagenicity in all assays conducted, and thus can be assumed to pose no mutagenic risk.

Fosamine and hexazinone were nonmutagenic in the great majority of assays conducted and were nononcogenic in all of the carcinogenicity tests performed; therefore, it can be assumed that their mutagenic risk at anticipated exposures is negligible. Dicamba was nonmutagenic in most of the assays performed and no oncogenicity was found in several long-term studies. EPA (1985c) has classified the chronic studies as "inadequate to evaluate the oncogenic potential of dicamba." Dicamba can be considered as a mutagen using a worst case analysis but based on a weight-of-evidence assessment mutagenic risk to germ cells is unlikely.

No acceptable mutagenicity studies have been conducted for diuron. The worst case assumption is that this chemical is mutagenic. The probability diuron might be genotoxic *in vivo* is low because it has not been shown to induce cancer in long term studies.

The negative oncogenic studies for diuron were classified by EPA (1984b) as inadequate to determine carcinogenic potential to mammalian organisms. The lack of positive results in any mutagenic or oncogenic tests with diuron suggests that diuron would present only minimal genetic risk to humans.

Atrazine tested positive for mutagenicity in 15 of 33 assays. The worst case assumption is that atrazine is mutagenic. However, many of the positive results were achieved through the use of biological metabolic systems that may not be relevant to evaluating mutagenic risk for humans. Some positive results in rodents were also achieved, but these in vivo responses were only observed at levels greater than 1,500 mg/kg body weight. These are exceptionally high levels and suggest that the degree of germ cell hazard from low levels of atrazine would be minimal at best and would require concentrations greater than those associated with cancer risk.

For picloram and 2,4-D, there have been only a few studies performed and these have indicated both positive and negative mutagenic potential. EPA has requested more mutagenicity test information for both of these compounds. A number of comprehensive reviews of the 2,4-D mutagenic data have indicated that it does not pose significant risk of human gene mutations (USDA, 1984). 2,4-D has been shown to be nononcogenic in the two carcinogenicity studies that have been conducted. Based on a worst case estimate, the degree of risk for heritable mutations from these chemicals would be expected to occur at exposures higher than those estimated for cancer risk.

Other Possible Effects of the 10 Herbicides

Synergistic Effects

Synergistic effects of chemicals are those that occur from exposure to two or more chemicals either simultaneously or within a relatively short period of time. For example, forestry workers exposed to the fungicide thiram have experienced skin blotching and nausea from drinking alcoholic beverages within 10 days of their thiram exposure. Synergism occurs when the combined effects of the two chemicals cannot be predicted based on the known toxic effects of the individual chemicals or when their combined effect is significantly greater than the sum of the effects of each agent given alone. For example, a mixture of the herbicides 2,4-D and picloram has produced skin irritation in test animals while neither herbicide alone has been found to be a skin irritant . Cigarette smoke and asbestos are both known carcinogens. When inhaled in combination, they have been found to increase cancer risk eight-fold above the risk of persons exposed to asbestos who do not smoke.

Table 3-16 Summary of Mutagenicity and Carcinogenicity of Proposed Herbicides

Herbicide	Mutagenicity	Oncogenic Results from Chronic Studies
Asulam	Nonmutagenic in 1 assay (EPA, 1984b)	Oncogenic in 1 study (EPA, 1985d). Nononcogenic at HDT in 2 studies (EPA, 1984b)
Atrazine	Mutagenic in 19/38 assays (USDA, 1984)	Oncogenic in 1/3 studies (EPA, 1984c; EPA 1986)
2,4-D	Nonmutagenic in 28/43 assays (USDA, 1984)	Oncogenic in 1/3 studies (EPA, 1984e, EPA, 1986b)
Dicamba	Nonmutagenic in 6/8 assays (USDA, 1984)	Nononcogenic in 2 studies (EPA, 1984h); Studies not adequate according to EPA (EPA, 1985d).
Diuron	No studies reported (EPA 1984i; USDA, 1984)	Nononcogenic in 2 studies (EPA, 1984i); Studies not adequate according to EPA (EPA, 1985d).
Fosamine	Nonmutagenic in 4/5 assays (USDA, 1984)	No chronic studies available. (EPA, 1984j; USDA, 1984)
Glyphosate	Nonmutagenic in 7 assays (EPA, 1984k)	Not sufficient evidence of oncogenicity in mice. Rat study unacceptable. (EPA, 1986)
Hexazinone	Nonmutagenic in 4/5 test systems (USDA, 1984)	Nononcogenic in 2 studies (EPA, 1984l)
Picloram	Nonmutagenic in 9/10 assays (USDA, 1984)	Oncogenic in 1/2 studies (EPA, 1984m)
Triclopyr	Nonmutagenic in 4/5 bacterial and cytogenetic assays (USDA, 1984; EPA, 1985d)	Nononcogenic in 3 studies (USDA, 1984)

Evidence of Synergistic Effects From Pesticides

Instances of chemical combinations that cause synergistic effects are relatively rare. Kociba and Mullison (1985) in describing toxicological interactions with agricultural chemicals state the following:

> Our present scientific knowledge in toxicology indicates that an exposure to a mixture of pesticides is more likely to lead to additivity or antagonism rather than synergism when considering the toxicological effects of such a combination. To be conservative and for reasons of safety, an additive type of toxicological response is generally assumed rather than an antagonistic type of response.
>
> In the case of registered pesticides, much toxicological information is developed during the research and development of each individual pesticide. In addition to this information on individual pesticides, short-term toxicity studies are always done prior to the selling of a pesticide mixture. Should synergism unexpectedly be present in a proposed commercial mixture of two pesticides, it would be identified in such cases and would then be dealt with accordingly. In toxicological tests involving a combination of commercial pesticides, synergism has generally not been observed.

The herbicide mixtures that may be used in the BLM's program have not shown synergistic effects in humans who have used them in other applications, although, as noted above, there is some evidence that mixtures of 2,4-D and picloram may cause skin irritation.

The toxic effects of the possible herbicide combinations other than the EPA-registered commercial mixtures have not been studied. Time and money normally limit toxicity testing to the first priority—the effects of the herbicides individually—and this type of information is not yet sufficient in some cases. Moreover, the combinations that could be tested are too numerous to make that testing feasible. The combinations of interest in this risk assessment include not only combinations of two or more of the 10 herbicides, but also combinations of the herbicides with other chemicals, such as insecticides, that exist in the environment. Based on the limited amount of data available on pesticide combinations, it is possible but very unlikely that synergistic effects could occur as a result of exposure to two or more of the herbicides considered in this analysis.

Likelihood of Exposure to Two Herbicides

For several reasons, it is highly unlikely that synergistic adverse effects could result from exposure to more than one herbicide applied in separate projects. First, unlike the situation in conventional agriculture, herbicide residues in plants and soil are not expected to persist from one application to another, even for the more persistent herbicides.

Second, the 10 herbicides are known to be rapidly excreted from the body. None of the herbicides has been found to accumulate in test animal body tissues, so exposure of an individual to two herbicides at different times would be unlikely to cause simultaneous residues within the body.

Third, public exposures to the herbicides should be low (except for accidents) and should occur only very infrequently. The probability of a larger accidental exposure to any single herbicide is extremely low. Because the probability of a member of the public receiving a large exposure is so low for one herbicide, the probability of simultaneous large exposures to two herbicides is negligible. This is because the probability of two independent events occurring simultaneously is the product of the probabilities of the individual events. For example, if the probability of a person receiving a given exposure is 1 in 1,000 for each of two herbicides, then the probability of receiving that exposure to both herbicides would be 1 in 1 million.

Risks From Herbicide Mixtures

Simultaneous exposure to more than one chemical is likely in cases where those chemicals are combined in a single spray mixture. Although most vegetation control projects in the region would involve only a single herbicide, some areas would be treated with a mixture of herbicides, but only mixtures that have been approved for use by the Environmental Protection Agency.

The EPA guidelines for assessing the risk from exposures to chemical mixtures (EPA, 1986a) recommend using additivity models when little information exists on the toxicity of the mixture and when components of the mixture appear to induce the same toxic effect by the same mode of action. They suggest in their discussion of interactions (synergistic or antagonistic effects) of chemical mixtures that "there seems to be a consensus that

for public health concerns regarding causative (toxic) agents, the additive model is more appropriate than any multiplicative model."

The EPA guidelines suggest using a hazard index (HI) as the model of additivity based on the dose and toxicity reference level (NOEL) for each chemical as follows:

$$HI = D_1/L_1 + D_2/L_2$$

where:

D_i is the dose of the ith component and

L_i is the level of safety (NOEL)

As HI approaches 1, the risk from the mixture becomes greater and greater.

Although the herbicides used for vegetation control are unlikely to have synergistic toxic effects, other substances occurring in the diets of exposed people may have some influence on the toxicity of the herbicides. This is one of several factors that may influence the sensitivity of individuals.

Effects on Sensitive Individuals

If the response of a population of test animals to varying doses of a chemical follows a normal distribution (bell-shaped curve), the hypersensitive individuals are those on the left hand side of the curve that respond at much lower doses than the average. A safety factor of 10 has traditionally been used by regulatory agencies (NAS, 1977) to account for this intraspecific (that is, interindividual) variation. Not all sensitive individuals will be covered by an MOS of 100, as human susceptibility to toxic substances can vary by two to three orders of magnitude (Calabrese, 1985). (These individuals could correspond to the tail of the bell-shaped curve.)

Factors Affecting the Sensitivity of Individuals

Factors that may affect individual susceptibility to toxic substances include diet, age, heredity, preexisting diseases, and life style (Calabrese, 1978). These factors have been studied in detail for very few cases, and their significance in controlling the toxicity of the proposed herbicides is not known. However, enough data have been collected on other chemicals to show that these factors can be important.

Elements of the diet known to affect toxicity include vitamins and minerals (Calabrese and Dorsey, 1984). For example, the mineral selenium can prevent the destruction of blood-forming tissues by chronic heavy exposure to benzene. Large doses of vitamin C have also been shown to protect animals and humans from toxic effects of chronic benzene exposure. Vitamin A seems to have a preventive effect on cancer induced by chemicals such as benzo(a)pyrene (found in cigarette and wood smoke) and DMBA. This effect has been seen in laboratory animals and human epidemiological studies. The food additives BHT and BHA may also be active in preventing the carcinogenicity of benzo(a)pyrene. Various levels of the B vitamin riboflavin have also been tested with mixed results. Vitamin C has been shown to prevent nitrites from combining with amines to form nitrosamines, and vitamin E seems to be at least as effective. These vitamins would be likely to prevent the formation of N-nitrosoatrazine and N-nitrosoglyphosate if conditions were otherwise favorable for their formation in the human stomach (Calabrese and Dorsey, 1984).

Genetic factors are also known in some cases to be important determinants of susceptibility to toxic environmental agents (Calabrese, 1984). Susceptibility to irritants and allergic sensitivity vary widely among individuals and are known to be largely dependent on genetic factors. Race has been shown to be a significant factor influencing sensitivity to irritants, and some investigations have indicated that women may be more sensitive than men (Calabrese, 1984).

A variety of human genetic conditions have been identified as possibly enhancing susceptibility to environmental agents. For example, persons with beta thalassemia may be at increased risk when exposed chronically to benzene. However, only one condition, G-6-PD deficiency, has been conclusively demonstrated to cause enhanced susceptibility to industrial pollutants. Several other genetic conditions have been shown to involve defects in the cellular mechanisms for repair of damage to DNA. Persons with these diseases share an increased sensitivity to the effects of ultraviolet light, which can cause cancer. Cells from individuals with at least one of these diseases, xeroderma pigmentosum, are also sensitive to a variety of chemical substances implicated as causative agents of human cancers (Calabrese, 1984).

Persons with other types of preexisting medical conditions may also be at increased risk of toxic effects. For example, sensitivity to chemical skin irritants can be expected to be greater for people with a variety of chronic skin ailments. Patients with these conditions may be advised to avoid occupational exposure to irritating chemicals (Shmunes, 1980, as cited in Calabrese, 1984).

Allergic Hypersensitivity

A particular form of sensitivity reaction to a foreign substance is allergic hypersensitivity. Except for contact dermatitis in delayed allergic reactions, these are responses to high molecular weight organic molecules or whole cells. None of the herbicides in the BLM vegetation management program is of high molecular weight so the immediate allergic reactions and the delayed allergic reactions except for contact dermatitis can be ruled out as possible toxic effects. Contact dermatitis may be induced by lower molecular weight substances such as the catechols of poison ivy, cosmetics, drugs, or antibiotics (Volk and Wheeler, 1983). Benzocaine, neomycin, formaldehyde, nickel, chromium, and thiram are all known to produce these reactions (Marzulli and Maibach, 1983).

Likelihood of Effects in Sensitive Individuals

Based on the current state of knowledge, individual susceptibility to the toxic effects of the 10 herbicides cannot be specifically predicted. As discussed above, safety factors have traditionally been used to account for variations in susceptibility among people. The margin-of-safety approach used in this risk assessment takes into account much of the variation in human response as discussed earlier by Calabrese (1985). As described in the introduction to this risk assessment, a safety factor of 10 is used for interspecies variation, an additional safety factor of 10 is used for within-species variation.

Thus, the normal margin-of-safety of 100 for both types of variation is sufficient to ensure that most people will experience no toxic effects. However, unusually sensitive individuals may experience effects even when the margin-of-safety is equal to or greater than 100. For example, there have been a few cases of peripheral neuropathy among the thousands of people exposed over the years to 2,4-D. In particular, in instances in the risk assessment where margins-of-safety are less than 100 for an exposure to a particular herbicide, it is possible that an exposed sensitive individual would experience toxic effects, whereas the average person would not. It must be noted, however, that sensitive individuals comprise only a fraction of the population at large and that it is not likely that a sensitive individual would be among those few people who might be exposed in any of the BLM's applications. It must also be noted that the great majority of public exposures that have been estimated to occur in this risk assessment are very low, and in most applications that will actually occur when the program is implemented, no member of the public is liable to be exposed.

There may be some people who develop contact dermatitis from herbicide exposure. The Roundup formulation of glyphosate, for example, has been reported to produce contact dermatitis although a controlled study in human volunteers did not show this effect (Maibach, 1986). This type of reaction would most likely be limited to workers who handle the herbicides regularly and are exposed to relatively large amounts on a number of occasions. The small, infrequent exposures of the public should limit the possibility of their experiencing this type of reaction.

Effects from Inert Ingredients in Herbicide Formulations

Inert ingredients are chemicals that are added to the active ingredient to prepare a pesticide formulation. Inert ingredients provide a carrier for the active ingredient that facilitates the effective application of the pesticide but that is not intended to supplement the pesticide's toxic properties.

This risk assessment characterizes human health risks by comparing estimated herbicide doses with toxicity levels found in laboratory animal studies. The estimated doses and laboratory hazard levels are based on the active ingredients of the proposed herbicides, not on the formulated products. This is reasonable because the active ingredients possess the intended pesticidal properties. However, consideration of the possible toxic properties of the remaining portion of the formulations, the inert ingredients, is also warranted as is the possibility of synergism from the combination of active and inert ingredients in the formulations.

Toxicity of the Inert Ingredients

With respect to the toxicity of the inert ingredients alone, EPA's Office of Pesticide Programs (EPA, 1986h) has identified about 1,200 inert ingredients that are now used in approved pesticides and has reviewed the available evidence concerning their

toxicity. The data included laboratory toxicity tests, epidemiological data, and structure/activity relationships. A particular concern in reviewing the inerts was their potential for causing chronic human health effects. On completion of its review, EPA categorized the 1,200 inerts into four lists.

> List 1 contains about 55 inerts that have been shown to be carcinogens, developmental toxicants, neurotoxins, or potential ecological hazards that merit the highest priority for regulatory action. EPA is requesting manufacturers to replace these inerts in their formulations with less toxic chemicals.
>
> List 2 contains approximately 50 chemicals that have been given high priority for testing because of available toxicity data that are suggestive, but not conclusive, of possible chronic health effects or because they have structures similar to chemicals on List 1.
>
> List 3 contains approximately 800 chemicals that are of lower priority for testing because there is no evidence from available toxicity data or from a review of their chemical structure that would place them in Lists 1 or 2.
>
> List 4 of about 300 chemicals contains those inerts generally recognized as safe. It includes substances such as corn oil, honey, peanut oil, and water.

Because EPA normally classifies inert ingredients as "Confidential Business Information," information on them does not have to be released to the public under the Freedom of Information Act (see also 40 CFR 1506.(a)). Nonetheless, the Forest Service and BLM requested that EPA review each of the formulations of the 10 herbicides proposed for use and disclose whether any of them contained inert ingredients of, or suggestive of, toxicological concern.

EPA has reviewed the formulations and has determined that none of them contain inerts on List 1 or 2 with the exception of the Esteron-99 formulation of 2,4-D and triclopyr formulations that contain a petroleum distillate (kerosene) of high priority for testing. Accordingly, a risk analysis was conducted on the petroleum distillate kerosene. Otherwise, the formulations proposed for use contain inerts that EPA has determined do not support a specific concern for toxicity or risk.

Toxicity of the Formulations

With respect to the possibility of synergism in the formulated combination of active and inert ingredients, EPA generally requires only acute toxicity data on formulated products. These data also allow EPA to address concerns about the acute toxicity of the pesticide formulations' inert ingredients. A comparison of their acute LD_{50}'s provides an indication of the toxicity of the formulated product (including inerts) versus the active ingredient alone. As shown in table 3-17, the formulations proposed for use by the BLM are less acutely toxic than their active ingredient.

However, none of the herbicide formulations proposed for use by the BLM have undergone chronic toxicity testing, including cancer testing, or any reproductive, developmental, or mutagenicity testing. The inert ingredients in the proposed formulated products might cause cancer or other long-term health effects. Given the little information that is available on each herbicide's formulation, the possibility that the formulated product is more toxic than the active ingredient cannot be discounted entirely. Neither can it be assumed to be true. The possibility that the herbicides' formulations may pose greater risk than their components is largely an untested hypothesis, and as to the herbicides' formulations acute toxicity, as table 3-17 shows, the possibility should not follow.

Turning to the competing viewpoint, and the one adopted in this FEIS, the data gaps about the herbicides as formulated products are largely beside the point because the risks posed by the herbicide's active ingredient are over stated. Any risk posed by the herbicides as formulated products is considered to be subsumed by the analysis of the active ingredients. Moreover, it is important to remember that each herbicide as a formulated product contains two types of ingredients: active and inert. Each type of ingredient has known and suspected properties. The herbicides' active ingredients have undergone cancer, reproductive, developmental, and mutagenicity tests of varying degrees. The herbicides' inerts have undergone categorization according to their toxicity and risks, if any. With only one lone exception, no specific concern exists with the herbicides' inerts. The BLM will continue to monitor the status of inert ingredients in these formulations and conduct further analysis if they are recategorized.

Therefore, based on EPA's classification of the inerts, it is assumed that the risk analysis on the active ingredients sufficiently characterizes the risks

Table 3-17 Technical Grade and Formulation Acute Oral LD_{50} Values for Rats

Herbicide	Technical Grade Acute Oral LD_{50} Values for Rats	Formulation Acute Oral LD_{50} Values for Rats
2,4-D	375 mg/kg (2,4-D acid) (EPA, 1984e)	Esteron 99 (Butoxyethyl Ester)—25,000 mg/kg, males tested; 21,000 mg/kg, females tested (Vertac, 1982) Weedar 64 (Dimethylamine salt)—1615 + 170 mg/kg males tested (Vertac, 1977)
Fosamine	24,400 mg/kg (EPA, 1984j)	Krenite—24,400 mg/kg (USDA, 1984) Krenite—>5,000 mg/kg (USDA, 1984)
Glyphosate	4,320 mg/kg (EPA, 1986h)	Roundup—4,900 to 5,400 mg/kg (USDA, 1984) Rodeo—>5,000 mg/kg (Monsanto, 1983)
Hexazinone	1,690 mg/kg (EPA, 1986j)	Velpar L—6,887 mg/kg (DuPont, 1985) Pronone 5G—>5,000 mg/kg (DuPont, 1984b) Pronone 10G—>5,000 mg/kg (DuPont, 1984b)
Picloram	8,200 mg/kg (USDA, 1984)	Tordon 22K—8,440 mg/kg (Mullison, 1985)
Triclopyr	630 mg/kg, females tested; 729 mg/kg, males tested (USDA, 1984)	Garlon 3A—2,140 mg/kg, females tested; 2,830 mg/kg, males tested (Dow, 1986a) Garlon 4—2,140 mg/kg, females tested; 2,460 mg/kg, males tested (Dow, 1986a)

of the formulated products with the exception of the petroleum distillates whose risk is discussed below.

Risk From Petroleum Distillates

The 2,4-D formulation proposed for use contains kerosene, a petroleum distillate. The oncogenic potential of petroleum fuels is directly related to refinery processing methods used to obtain the petroleum product and the crude oil composition from which the fuel was derived. An evaluation of the composition of petroleum fuels has revealed that a positive correlation exists between polycyclic aromatic hydrocarbon (PAH) content and carcinogenicity in human epidemiology studies or experimental laboratory studies (Bingham et al., 1979).

Kerosene is classified as a very slightly toxic mixture based on its acute oral LD_{50} of 28,000 mg/kg in rats (about 70 times less acutely toxic than 2,4-D). However, kerosene is a skin irritant. Kerosene was negative in five mutagenicity assays.

Although kerosene has not been shown to cause cancer, it is likely to have a slight carcinogenic potency because it contains small amounts of chemicals known or suspected to cause cancer. Among these are benzene and benzo(a)pyrene. The cancer potency of kerosene is about 6,000 times lower than the 2,4-D cancer potency; therefore, it would not add significantly to the potency of the 2,4-D formulation or mixtures.

Cumulative Effects

No one individual member of the public is likely to receive repeated exposures to any of the herbicides because of the remoteness of most treatment units, the widely spaced timing of repeated treatments, and the use of a variety of herbicides for different purposes. In addition, the precautions taken by BLM in their treatment operations make any dose at all to the public quite unlikely. This risk assessment used the lowest NOEL's found in chronic animal laboratory studies for comparison with estimated human doses. The risk analysis results showed that, except for triclopyr, margins of safety for the public from realistic treatment scenarios are greater than 200. Thus, members of the public could receive doses of these herbicides repeatedly over the years, even though the chance of receiving multiple doses is negligible, and still not suffer toxic effects. Some individuals who may be particularly sensitive to triclopyr may experience ill effects but, again, this should occur only in the unusual circumstance of repeated doses. Compared to the levels of exposure to the pesticides used in agriculture and related commercial operations in Oregon, the exposures to humans from BLM operations from year to year would be insignificant. Therefore, cumulative effects on the public should be negligible.

Cumulative effects on workers have been considered throughout this analysis. The risk of workers experiencing toxic effects, including cancer, assumes that they are chronically exposed to these herbicides. Backpack applicators are at greatest risk from cumulative effects.

Conclusions

Burning would not be expected to significantly impact human health under any alternative.

Physical injuries such as strains, cuts, and fractures would result from treating vegetation with manual and mechanical methods. Based on the number of acres treated with manual and/or mechanical methods, injuries would be most likely to occur under Alternatives 3 and 7 and least likely under Alternative 8.

All herbicides proposed for use by BLM in vegetation management have a low order of mammalian toxicity. In general, basic biochemical and physiological differences account for the relatively low toxicity of herbicides to humans. Most herbicides are designed to interfere with vital plant processes that are not duplicated in humans.

Extensive studies of the absorption, distribution, metabolism, and excretion of herbicides in most animals have shown that most herbicides and their metabolites are rapidly eliminated from animals and thus do not accumulate to harmful levels in animal tissues. This reduces the possibility that exposure would result in harmful consequences. All herbicides proposed for use by BLM have a high margin of safety when handled according to label instructions.

Direct exposure of forest workers to herbicides would be most likely under Alternative 6, and progressively less likely under Alternatives 4, 2, 1, 5, 3, 7, and 8. Under Alternative 6, the loss of aerial application would increase use of such equipment as vehicle-mounted sprayers and backpack sprayers. This would maximize workers' exposure via absorption through skin and inhalation of spray mist and vapors. Exposure probabilities under the remaining alternatives would correspond to the number of acres proposed for ground application of herbicides. Indirect exposure of tree planters to herbicides via dermal contact with treated vegetation would be unlikely due to absorption, dilution, and degradation rates of herbicides over time prior to the winter planting season.

The probability of the general public being exposed to herbicides would correspond to the number of acres proposed for treatment under each alternative. Exposure would be most likely under Alternative 3, and progressively less likely under Alternatives 2, 1, 5, 4, 6, 7, and 8. The laboratory dosages at which potential reproductive effects have been detected or at which carcinogenic and mutagenic effects have been sought are much greater in concentration and duration than any exposure that would occur in the forest as a result of vegetation control treatments. Because of the limited toxicity of the herbicides proposed for use and the low potential for exposure, the likelihood of an adverse impact on human health is negligible.

Impacts on Economic Conditions

Economic impacts are presented here for two different baselines: as changes measured from the existing condition and as changes expected if the current program direction were continued. The public is generally most concerned with how future conditions would differ from existing conditions. The program manager must know how future conditions would be affected compared to the current program direction. For comparing possible

changes in employment, the existing condition is based upon the FY 1985 harvest from BLM-administered land of 1,008 million board feet (MMBF). The current program direction baseline (1,183 MMBF per year) represents the allowable harvest levels declared in the western Oregon BLM timber management EIS decision documents except that a 3 MMBF downward adjustment was made for the newly designated Table Rock Wilderness Area. A comparison of conditions in FY 85 to conditions under the alternatives indicates substantial difference in some cases. However, most of this difference is due to the difference in harvest levels between FY 85 and the levels projected for the alternatives. A more appropriate measure of the effect of management alternatives is to compare conditions when the baseline is at full planned harvest level. The differences then would be attributable to the vegetative management alternative. This is the comparison made in this section where tables are labeled "Compared to Current Program Direction".

Impacts on employment would be phased in over a period of 2 or 3 years due to the customary time lag between sale and harvest. Table 3-18 projects the average annual employment potential of timber sales under each alternative. The projections represent the local employment which would be realized if the annual volume sold under each alternative were promptly harvested and processed.

Table 3-19 focuses on the impacts each alternative would have on public revenue. Under the O&C Act (1937) and subsequent modifications, 50 percent of the receipts from timber sales on revested O&C lands are distributed to designated county governments. The recipients are those counties in which O&C lands are situated, and the basis for distribution is established in the O&C Act (1937). Impacts on receipts would be phased in over a period of 3 or 4 years for a new level of timber sales.

Recently, bid prices for stumpage from the Bureau's western Oregon districts have varied greatly. For example, in FY 1981 the average price of timber sold was $267 per thousand board feet (MBF); however, in FY 1982 these districts recorded an average sale price of $95 per MBF. In most years since 1982, the average sale price has been somewhat higher (see Table 2-9). Table 3-19 arrays projected distributions of 0&C payments to counties based on an assumed sale price of $110 per MBF. Annual disbursements to O&C counties would vary from $45 million to $65 million, depending upon alternative.

Table 3-20 arrays, by alternative, the annual allowable cut, the cost of vegetation management and the acres of forest land (see Glossary) which could be maintained in one of three classes of conifer stocking (see Glossary - Target Stocking).

Impacts on Social Environment

BLM's vegetation management program would have direct and indirect impacts on social conditions and attitudes. Direct impacts would occur when some people's sense of personal well-being or economic security is affected by BLM's decisions regarding the use or restriction of particular vegetation management practices. Indirect effects would occur as a result of economic outcomes of BLM policies, and in response to gains or losses of recreational opportunities or access to subsistence activities. Examples of social effects deriving from economic impacts include people's reactions to changes in the availability of different kinds of jobs, their dependence on certain jobs, and the availability of public services. All of these impacts, whether direct or indirect, could affect lifestyle and community stability.

Social Dimensions of Employment

The direct economic impacts of the various alternatives on employment and personal income have been discussed in Chapter 3, Impacts on Economic Conditions. The economic impacts on individuals who obtain or lose jobs would be essentially the same wherever they live. Social effects, however, would depend on whether the jobs gained or lost were concentrated or dispersed, in small or large communities. For example, the gain or loss of 100 jobs scattered around the larger cities in western Oregon would not have significant social effects. In contrast, if those 100 jobs were concentrated in two small towns with a combined work force of 500 employees, there would be significant social impacts on those two communities.

Social impacts resulting from employment changes can be estimated, but available data do not allow identification of where those impacts would occur. Table 3-21 shows the percentages of the work force that would be affected under the various alternatives.

BLM's experience indicates that vegetation management contractors are concentrated in a few smaller cities and that they travel substantial

Table 3-18 Impacts on Employment by Alternative[1]

	Direct Employment[2]				Indirect Employment	Total Employment
	Private Sector Employment by Source			*Employment in Local*		
	Vegetation Control	Tree Planting	Timber Harvest Processing	Government Dependent on O&C Revenues[3]		
FY 1985 (1,008 MMBF)	160	76	7,056	1,270	14,042	22,604
Alt. 1 (Intg. Use)	147	146	8,281	1,489	16,503	26,566
Alt. 2 (Emph. Herb.)	136	147	8,267	1,487	16,461	26,498
Alt. 3 (No Burn)	199	138	7,973	1,435	15,982	25,727
Alt. 4 (Lab.[1]Int.)	239	146	8,260	1,486	16,615	26,746
Alt. 5 (Res. Aerial)	152	146	8,239	1,482	16,431	26,450
Alt. 6 (No Aerial)	323	137	8,232	1,481	16,684	26,857
Alt. 7 (No Herb.)	378	116	7,392	1,330	15,114	24,330
Alt. 8 (No Action)	30	99	5,712	1,028	11,265	18,134
Change in Employment[2] Compared to the Current Program Direction (1,183 MMBF)						
Alt. 1 (Intg. Use)	0	0	0	0	0	0
Alt. 2 (Emph. Herb.)	-11	1	-14	-2	-42	-68
Alt. 3 (No Burn)	52	-8	-308	-54	-521	-839
Alt. 4 (Lab.[1]Int.)	92	0	-21	-3	112	180
Alt. 5 (Res. Aerial)	5	-0	-42	-7	-72	-116
Alt. 6 (No Aerial)	176	-9	-49	-8	181	291
Alt. 7 (No Herb.)	231	-30	-889	-159	-1,389	-2,236
Alt. 8 (No Action)	-117	-147	-2,569	-461	-5,238	-8,432

[1] Modern transportation allows forest workers, logs and chips to be moved economically over long distances. As a result, economic im pacts of vegetation management and timber harvest in a particular timbershed are not necessarily concentrated within a particular county or adjoining counties. Therefore, impacts shown in this table are regional and not specific to local areas.

[2] Employment is measured in terms of full time equivalence, i.e., two jobs of 6 month duration equal one full time equivalent.

Source: Computations by EIS staff.

distances to wherever the work is in western Oregon. Because of this concentration and the sizes of the increases in the vegetation management work force (see Columns 2 and 3 of Table 3-21), Alternatives 1 through 7 would probably have beneficial, but mostly insignificant, social impacts on those communities. The number of vegetation management jobs that would be lost under Alternative 8 would not have significant social effects.

Timber sales, and the harvest and processing jobs associated with any alternative would be widely distributed over the western Oregon districts. The percentage changes in regional employment would all be quite small (see column 8 of Table 3-21), and the affected jobs would probably be scattered across the entire region. None of the alternatives would be expected to have significant social impacts resulting from employment changes in timber harvesting and processing unless the resultant increases or decreases in timber harvest led to a mill reopening or closing, or adding or dropping a shift.

Public Services

Revenues paid to the 18 O&C counties affect the availability of public services. The specific services that would be affected cannot be identified since revenue payments based on BLM harvests are not restricted. Assuming that the allowable harvests associated with each alternative are sold and cut, the effects of the alternatives on public services are directly related to harvest level. There would be no significant differences in the public services that could be provided under Alternatives 1 through 6. The greatest difference among these would be 5.9 percent between Alternatives 2 and 6 (calculated using the Allowable Harvest levels shown in Tables 1-2 and 3-20). That amount would be dispersed

Table 3-19 Projected Distribution Of O&C Payments From the Western Oregon SYU's[1] to Counties By Alternative
O&C Disbursements from SYUs Based on Sales Value of $110 per 1,000 bd. ft.

County	Percent Share of 0&C Payment (%)	Alt. 1 (PA) ($MM)	Alt. 2 (Emph. Herb.) ($MM)	Alt. 3 (No Burn) ($MM)	Alt. 4 (Lab.-Int.) ($MM)	Alt. 5 (Res. Aerial) ($MM)	Alt. 6 (No Aerial) ($MM)	Alt. 7 (No Herb.) ($MM)	Alt. 8 (No Action) ($MM)
Benton	2.81	1.83	1.83	1.76	1.82	1.82	1.82	1.63	1.26
Clackamas	5.55	3.61	3.61	3.48	3.60	3.59	3.59	3.22	2.49
Columbia	2.06	1.34	1.34	1.29	1.34	1.33	1.33	1.20	0.92
Coos	5.90	3.84	3.83	3.70	3.83	3.82	3.82	3.43	2.65
Curry	3.65	2.37	2.37	2.29	2.37	2.36	2.36	2.12	1.64
Douglas	25.05	16.30	16.27	15.69	16.26	16.22	16.20	14.55	11.24
Jackson	15.67	10.20	10.18	9.82	10.17	10.14	10.14	9.10	7.03
Josephine	12.08	7.86	7.85	7.57	7.84	7.82	7.81	7.02	5.42
Klamath	2.34	1.52	1.52	1.47	1.52	1.51	1.51	1.36	1.05
Lane	15.27	9.94	9.92	9.57	9.91	9.89	9.88	8.87	6.85
Lincoln	0.36	0.23	0.23	0.23	0.23	0.23	0.23	0.21	0.16
Linn	2.64	1.72	1.71	1.65	1.71	1.71	1.71	1.53	1.18
Marion	1.46	0.95	0.95	0.91	0.95	0.95	0.94	0.85	0.66
Multnomah	1.09	0.71	0.71	0.68	0.71	0.71	0.71	0.63	0.49
Polk	2.16	1.41	1.40	1.35	1.40	1.40	1.40	1.25	0.97
Tillamook	0.56	0.36	0.36	0.35	0.36	0.36	0.36	0.33	0.25
Washington	0.63	0.41	0.41	0.39	0.41	0.41	0.41	0.37	0.28
Yamhill	0.72	0.47	0.47	0.45	0.47	0.47	0.47	0.42	0.32
Total ($) O&C Disbursements	100.00	65.07	64.96	62.65	64.90	64.74	64.68	58.08	44.88
Change in O&C Disbursements Compared to the Current Program Direction (1,183 MM bd. ft.)		+0.0%	-0.2%	-3.7%	-0.3%	-0.5%	-0.6%	-10.7%	-31.0%

[1] Sustained Yield Units. These are administrative divisions of the EIS area for which timber harvest levels (allowable cuts) are calculated.

Table 3-20 Impacts of the Alternatives on Allowable Cut, Cost of Vegetation Management and Ability to Achieve Desired Stocking of Conifers

All Feasible Vegetation Mgt. Actions are Funded in an Effort to Maintain Highest Level of Output.	Alt. 1 (PA)	Alt. 2. (Max. Herb.)	Alt. 3 (No Burn)	Alt. 4 (Lab.-Int.)	Alt. 5 (Res. Aerial)	Alt. 6 (No Aerial)	Alt. 7 (No Herb.)	Alt. 8 (No Action)
Allowable Harvest (million bd.ft.)	1,183	1,181	1,139	1,180	1,177	1,176	1,056	816
Program Cost ($ millions)	12.1	11.3	14.8	12.8	11.7	14.8	16.0	6.9
Achieve Target Stocking (1,000 ac.)	1,400	1,401	1,249	1,382	1,373	1,348	1,126	498
Achieve Minimum Stocking (1,000 ac.)	229	228	361	247	256	280	456	731
Below Minimum Stocking (1,000 ac.)	3	3	22	3	3	4	50	409

Source: Compiled by EIS staff from BLM district estimates.

Note: Total Allowable Harvest adjusted from DEIS by 3 MMBF for the Table Rock Wilderness Area.

Table 3-21 Impacts of Alternatives on Western Oregon Work Force

Alternative	Change from 1985 Private Sector Employment in Veg. Control and Tree Planting on BLM		Change from 1985 Timber Harvest and Processing Employment from BLM Harvests		Change from 1985 Total Direct and Indirect Employment		Change from 1985 Total Region Employment
	Number	Percent	Number	Percent	Number	Percent	Percent
1	57	24	1225	17	3962	18	0.4
2	47	20	1211	17	3894	17	0.4
3	101	43	917	13	3123	14	0.3
4	149	63	1204	17	4142	18	0.4
5	62	26	1183	17	3846	17	0.4
6	224	95	1176	17	4253	19	0.4
7	258	109	336	5	1726	8	0.2
8	-107	-45	-1344	-19	-4470	-20	-0.4

around 18 counties, and the variation it would cause in public services would not have significant social effects in either a positive (under Alternative 2) or a negative (under Alternative 6) direction.

Compared to Alternative 1, the allowable harvest levels for Alternatives 7 and 8 would be approximately 11 and 31 percent lower, respectively, (again using the Allowable Harvest levels in Tables 1-2 and 3-20) and would be expected to generate comparably lower revenues. Lower revenues would reduce levels of public services enough to generate significant negative social impacts in most counties.

Attitudes and Opinions

Because of the controversy surrounding the use of herbicides, all alternatives would have social effects related specifically to the herbicide issue. Alternatives 1 through 6 all include the use of chemical methods of vegetation management and would all be perceived as having some degree of adverse impacts by people who oppose chemical methods. These impacts would be progressively less under Alternatives 3, 1, 2, 4, 5 and least under Alternative 6. Alternatives 7 and 8 would be perceived as having greatest adverse impacts by those who believe herbicides should be used in forest management.

Some people, particularly residents adjacent to aerial herbicide units, perceive helicopter spraying as threatening because they associate helicopters with military activities and/or because they feel personally helpless to avoid exposure or to stop spraying in case of unexpected drift or accidental overflight of a nontarget area. They would be adversely affected by Alternatives 1 through 4, which include aerial spraying of herbicides from helicopters. Alternative 5 also includes aerial spraying but would have a lower level of adverse social impacts because of its quarter-mile set-back provisions.

Another category of social effects related specifically to the use of herbicides includes fears and anxieties about human health and personal safety. These concerns would be related to the amount of herbicides used and, therefore, would be greatest under Alternative 3 and progressively less under Alternatives 1, 2, 4, 5 and 6. For some people concerned about this issue, Alternative 7 and 8 would have beneficial impacts.

On the other side of the controversy about chemical herbicides are the people who believe herbicides are safe to use, that the risks associated with their use are acceptable to themselves as individuals and to society at large. For these people, limitations on the use of herbicides could be perceived as threatening to their jobs and lifestyle, and in some larger sense to society as a whole. The threat they perceive to society at large is usually articulated in terms of job losses forcing some people to go on welfare.

Another social impact on attitudes and opinions is related to concern about smoke from slash burning. The direct impact of smoke is on air quality; the social impact would occur when people respond to deteriorating air quality and their perceptions that poor air quality has negative effects on their communities and lifestyle. People who are concerned about this issue would probably be

adversely affected to a similar extent by Alternatives 1, 2, 4, 5, 6 and 7. Alternative 8 would also have adverse social impacts, but they would be somewhat less because 25 percent less burning would occur. Alternative 3 would have beneficial impacts on those who are concerned about smoke.

Community Stability

Social impacts on community stability would likely occur if BLM's vegetation management program: 1) caused enough changes (either increases or decreases) in employment to disrupt normal patterns of life in communities where people work and/or where they live; 2) led to attitudes or opinions that increased interpersonal conflict or divisiveness within a community; or 3) caused anxieties and fears about health and safety that upset people's sense of personal security and social well-being.

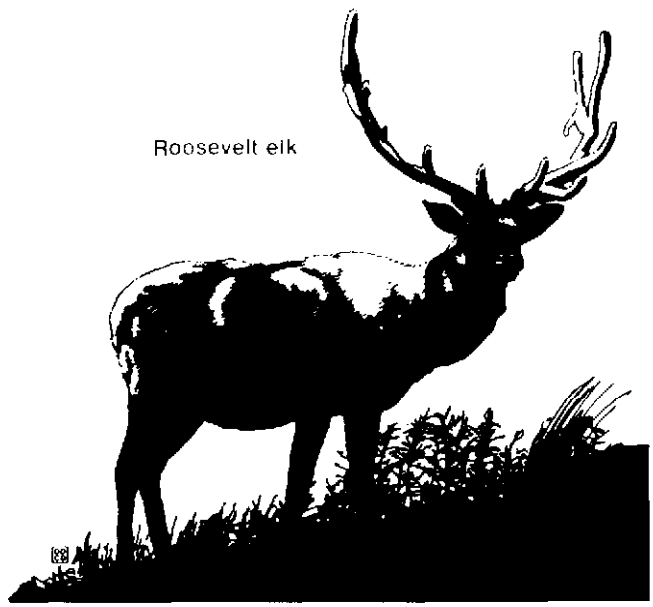
All of the alternatives have the potential for causing disruption within or between communities. Such impacts would be most likely under Alternatives 2, 3, 6, 7 and 8, and would be least likely under Alternatives 1, 4 and 5 which include more evenly balanced combinations of vegetation management practices. Alternatives 1, 2 and 3 would be most likely to cause some public concern about human health and safety. This reaction would probably be most intense in areas closest to spray sites but would also appear in more distant areas.

In Chapter 2, Social Environment, the approximate number of residences within one-half mile of BLM-administered lands is identified. Only a small percentage of those residences would be near an aerial herbicide site in any particular year.

The larger metropolitan areas would be little affected in any direct ways by vegetation management practices except burning. Those who are concerned about air quality could be affected enough to organize community opposition to prescribed burning. Although there are likely to be people in the metro areas whose perceptions and attitudes would be affected by the various vegetation management practices, the impacts would not be expected to affect community stability.

Local community disruptions as a result of conflicting opinions or incompatible attitudes about resource uses are more likely to occur under the alternatives that strongly emphasize or de-emphasize one particular approach to vegetation management. For example, Alternatives 2, 6, 7 and 8 would be most likely to generate interest and polarized reactions. Alternative 3 could generate an intense response in those communities where smoke management and air quality are sensitive issues. The other alternatives, emphasizing a more balanced and flexible program which could be responsive to local natural and social conditions, could generate some dissatisfaction (because all concerned parties would have to make some compromises), but this dissatisfaction would not likely be intense or particularly devisive.

There will be some social effects no matter what vegetation management program is followed, simply because the affected public is not homogeneous. Alternatives 2, 3, 6, 7 and 8, which emphasize particular uses or restrictions, are likely to generate some strongly polarized reactions. Alternatives 1, 4 and 5, which incorporate a variety of vegetation management practices in an attempt to respond to a wide range of public attitudes and to ensure the existence of and access to diverse forest uses and values, should generate more constructive social impacts as people debate the issues and find ways to compromise within their communities and with BLM.



Chapter 4
Consultation and Coordination on Draft and Supplemental Environmental Impact Statements

White fir

Specific Written Comments

Each person, organization or agency that provided written comments was assigned a letter number in consecutive order as received. Appendix material enclosed with letters 51 and 67 is available for review at the BLM Oregon State Office in Portland. Letters 1 through 30 were responses to the Draft EIS (June 1983). Comment letters 31 through 79 were responses to the Supplement to the Draft (Feb. 1986). Letters 67 and 68 also gave additional response to the original Draft.

Draft EIS

No. Agencies, Organizations, or Individuals

1 Lane Council of Governments
2 Corps of Engineers
3 Oregon Dept. of Forestry
4 Executive Dept. - State of Oregon - Department of Agriculture and Intergovernmental Relations Div.
5 Umpqua Regional C.O.G.
6 L-COG Areawide Clearinghouse
7 Soil Conservation Service - USDA
8 Louise Nicholson
9 Chris Matthews
10 Oregon Dept. of Fish and Wildlife
11 Oregon Dept. of LCDC
12 Judson M. Parsons
13 USDA Forest Service Region 6
14 Mr. & Mrs. M.B. Meglasson
15 BLM Spokane District
16 Lane Regional Air Pollution Authority
17 Jason Spero
18 Gordon Fansworth
19 Save Our Ecosystems
20 Audubon Society of Portland
21 U.S. Geological Survey
22 Boyd Peters (Wolf Creek Trails)
23 Eleanor A. Pugh
24 Tom E. Dunn
25 Phyllis Cribby
26 Mel Canal
27 ACOTS
28 U.S. EPA Region X
29. U.S. Fish & Wildlife
30 Umpqua Valley Audubon Society
31 USDI, Bureau of Reclamation
32 Monsanto Agricultural Co.
33 Executive Dept. (Intergovernmental Relations Division) Clearinghouse Coord. (Office of State Forestry and Oregon Dept. of Agriculture-Weed Control)
34 Oregon State University - Frank Dost
35 USDA, Forest Service, Pacific Northwest Region
36 Boise Cascade, Timber & Wood Products Group
37 Michael S. Meredith
38 Dow Chemical U.S.A.
Dow Chemical U.S.A. (corrected copy of 4/22/86 letter)
39 Southern Oregon Timber Industries Assn.
40 U.S. Environmental Protection Agency (Region 10)
41 R.E. Epstein
42 Medford Corporation
43 E.I. DuPont de Nemors & Co.
44 Jane Newton
45 R. Heiler
46 Coastal Coalition for Alternatives to Pesticides
47 Bruce P. Alber
48 James C. Kalfas and Michele Molony
49 Scott M. Liebler
50 Oregonians for Food & Shelter
51 Paul E. Merrell and Carol VanStrum
52 Sue Boigon
53 William P. Spenn
54 Freda B. Spenn
55 Kindler Stout
56 Randy Carey
57 Kai Jacobeon
58 Paul Safady
59 Richard Pecorusr
60 S.M. Jacobson
61 Brenda Amick
62 Richard A. Ach
63 Horizon School, Ms. M.B. Ach
64 Tom Wilczek
65 Isabel Kunz
66 Dept. of Environmental Quality, Thomas R. Bispham
67 Northwest Coalition for Alternatives to Pesticides
68 SONCAP
69 Marvin Turley
70 Louise Nicholson
71 Alan Venet
72 Susan Delles
73 Tom Dunn
74 Lynda Turley
75 Southern Oregon Post & Pole
76 Henry W. Kunz
77 Headwaters, Paula Downing
78 ACOTS, Christopher Bratt
79 Kenneth and Janet Nolley

1

Lane Council of Governments

NORTH PLAZA LEVEL PSB / 125 EAST EIGHTH AVENUE / EUGENE, OREGON 97401 / TELEPHONE (503) 687-4283

June 23, 1983

Bureau of Land Management
Oregon State Director
c/o Team Leader
P.O. Box 3227
Salem, OR 97302

SUBJECT: AREAWIDE CLEARINGHOUSE REVIEW
TITLE: Western Oregon Program-Management of Competing Vegetation
CLEARINGHOUSE NUMBER: 2E107

The above notification has been received and is currently undergoing areawide clearinghouse review. If you wish to contact our office about the proposal, please refer to the Clearinghouse Number.

Your proposal will be formally considered by the Lane Council of Governments (L-COG) Board of Directors on Thursday, July 28, at 7:30 p.m. in the City of Oakridge Willamette Activity Center located at 47674 School Street. You are welcome to attend. The action of the L-COG Board will be forwarded to you, along with documentation of comments received, following the meeting. If the Board defers action on your proposal, you will be notified.

Sincerely,

JoAnn McCauley
Information Coordinator

cljma95

2

DEPARTMENT OF THE ARMY
PORTLAND DISTRICT, CORPS OF ENGINEERS
P.O. BOX 2946
PORTLAND, OREGON 97208

June 28, 1983

Planning Division (PL-NR-EQ)

Oregon State Director
Bureau of Land Management
c/o Team Leader
P. O. Box 3227
Salem, Oregon 97302

Dear Team Leader:

The Portland District Corps of Engineers has reviewed the Draft Environmental Impact Statement (DEIS) for the Western Oregon Program-Management of Competing Vegetation, Bureau of Land Management, and has no comments.

Thank you for the opportunity to review this document.

Sincerely,

Davis G. Moriuchi
Chief, Natural Resources Branch

Forestry Department
OFFICE OF STATE FORESTER
2600 STATE STREET, SALEM, OREGON 97310 PHONE 378-2560

VICTOR ATIYEH GOVERNOR

July 5, 1983

William G. Leavell
Oregon State Director
Bureau of Land Management
c/o Team Leader
P. O. Box 3227
Salem, Oregon 97302

Dear Bill,

Thank you for the opportunity to review the Draft Environmental Impact Statement (DEIS) for the Western Oregon Program - Management of Competing Vegetation. We are pleased to see that this document addresses the Forestry Program for Oregon (FPFO) objectives and The Oregon Forest Practices Act and Rules.

Although the document covers most germane issues, concerns, and opportunities, additional work can be done to provide a stronger economic analysis of the situation. This is necessary to choose an existing or new alternative which would best address the issues and concerns identified in the scoping process.

3-1 Cost-effectiveness is not specifically addressed in the DEIS; it should be. A present net worth should be developed for individual treatments and proposed alternatives and should be used for alternative developement and selection. The calculus should include all reasonable costs and benefits and be specific, as much as possible, to the investments being examined. For example, costs of training and accidents (p. 76) should be included in the analysis as they will likely differ between treatments.

3-2 Present net worth comparisons would also be useful to adjust the program should full funding not be budgeted. The program assumes full funding of all activities in each alternative to achieve the allowable cut. The program should state that if full funding is not budgeted, the least cost-effective practices will be the first to dropped. Present new worth calculations would be invaluable in determining revised treatment strategies.

3-3 We agree that treatments should be both effective and reasonable and be proven by research or field experience or show promise of effectiveness based on current research efforts (p. 77, #4). However, when the number of retreatments required for achieving treatment objectives is unknown, the treatment should not be used until enough is known upon which to base a reasonable estimate of effectiveness. To limit the number of retreatments to the same number of herbicide treatments applied on difficult areas (pp 77, #6) is arbitrary, could lend to inaccurate analysis, and conflicts with guideline #4, that treatments must be proven by research or field experience.

William G. Leavell
July 5, 1983
Page 2

3-4 Unfortunately, cost data and knowledge of the effectiveness of some of the proposed treatments are not well documented. The DEIS on page 3 states that effective substitute treatments, if available, would be used where needed. This should be better specified. The program should include a mechanism for substituting alternative treatment scenarios in case some of the treatments prove to be more costly or less silviculturally effective than thought. This mechanism could use both economic and silvicultural criteria to specify when changes are needed and to choose alternative treatments.

In addition to monitoring the silvicultural effectiveness of management treatments, the economic effectiveness and social impacts of the treatments should be monitored to ensure that both BLM and FPFO goals and objectives are being met. For example, the effect of the alternatives on employment will vary with the vigor of the State and local economy. Robust economies may mean that labor intensive silvicultural practices will not add additional jobs but may instead be inflationary. If the current recovery falters, however, labor intensive practices may temporarily boost overall employment. However, in no case should treatments be chosen which would make it less economical to grow timber in Oregon.

I hope that the above comments have been useful. If either you or your staff have any questions regarding them please feel free to call.

Sincerely,

Ronald E. Smith
Acting State Forester

RS/GJL:cb
2326D

4

VICTOR ATIYEH
GOVERNOR

Executive Department

155 COTTAGE STREET NE., SALEM, OREGON 97310

July 20, 1983

Oregon State Director
Bureau of Land Management
c/o Team Leader
P.O. Box 3227
Salem, OR 97302

SUBJECT: Western Oregon Program-Management of Competing Vegetation
PNRS #OR830617-048-4

Thank you for submitting the subject draft Environmental Impact Statement for State of Oregon review and comment.

The draft was referred to the appropriate state agencies. The Department of Agriculture and Forestry offered the enclosed comments which should be addressed in preparation of the final Environmental Impact Statement.

We will expect to receive copies of the final statements as required by Council of Environmental Quality Guidelines.

Sincerely,

INTERGOVERNMENTAL RELATIONS DIVISION

Dolores Streeter/ovr

Dolores Streeter
A-95 Coordinator

DS:bm
Enclosures

5

Telephone 503/440-4231
Room 305, Courthouse
Roseburg, Oregon 97470

UMPQUA REGIONAL COUNCIL OF GOVERNMENTS

ACKNOWLEDGEMENT OF NOTIFICATION
for the
OMB CIRCULAR A-95 AREAWIDE CLEARINGHOUSE REVIEW

Bureau of Land Management
P. O. Box 2965
Portland, Oregon 97208

Notification Title *Western Oregon Program-Management of Competing Vegetation Draft Environmental Impact Statement*
Reference Number: .
Receipt Date: *June 10, 1983*

This is being distributed to the following agencies or offices for review and comment:

Douglas Timber Operators, Inc.

[ ] Your notification will be presented at the next meeting of the Umpqua Regional Council of Governments on _____ at 1:30 p.m., in Room 200 of the Douglas County Justice Building. If this meeting date is more than 30 days from areawide clearinghouse receipt, an extension of the review period is requested. The response to the notification, including formal action by the Council and documentation of all comments, will be mailed to you on _____.
For applicants that are not members of Umpqua Regional Council of Governments, a $35.00 filing fee will be requested for payment in the response mailing.

[X] Your notification will not be reviewed formally by the Umpqua Regional Council of Governments. If you receive no response within 30 days of the date of areawide clearinghouse receipt, you may assume no adverse comments to the notification. There is no filing fee for this review.

Bernadette St. Onge, Coordinator
Phone: 440-4237

6

AREAWIDE CLEARINGHOUSE CONCLUSIONS

APPLICANT: Bureau of Land Management

PROJECT TITLE: Western Oregon Program-Management of Competing Vegetation

L-COG REFERRAL:# 2E107

DATE: July 29, 1983

The L-COG Areawide Clearinghouse has reviewed your proposal and finds it to be:

X **Consistent with or supportive of areawide planning.**

Consistent, pending resolution of concerns. See comments.

Inconsistent with areawide planning. See comments.

Accordingly, the Clearinghouse has taken the following action:

X **Recommends support.**

Does not recommend support. See comments.

Recommends support, conditional on resolution of concerns. See comments.

Makes no comment.

Transmit the comments received

L-COG Review Comments:

None

cljma951

7

United States Department of Agriculture
Soil Conservation Service

1220 S. W. Third Avenue
16th Floor
Portland, Oregon 97204

August 1, 1983

Oregon State Director
Bureau of Land Management
c/o/Team Leader
P O Box 3227
Salem, Oregon 97302

We have reviewed the Western Oregon Program - Management of Competing Vegetation Draft EIS and have no comment at this time.

Thank you for the opportunity to review this document.

JACK P. KANALZ
State Conservationist

The Soil Conservation Service is an agency of the Department of Agriculture

August 1, 1983

Dear Sir,

I would like to go on the record as being opposed to the use of toxic herbicides and pesticides on BLM property. My property adjoins BLM and forest service.

The use of these chemicals is not fully researched especially for long term genetic effect and carcinogens. There is also always the
8-1 possibility - as has been documented already - of accidental spillage.

I believe that manual control is cost competitive and would put many people on welfare and unemployment to work.

Please consider this matter deeply when making your decision.

Thank you for your consideration.

Louise Nicholson
9600 Thompson Cr. Rd.
Applegate, Ore.
97530

Dear Folks

This is in response to your EIS managing of competing vegetation. It is heartening to see that at least you contemplate no aerial spraying of herbicides. This is a major step in getting out of the spray cycle. Therefore I am in favor of alternative 6 or 7.

You say you are managing the forest for the public but we all know it is really for the logging companies. Multiple use is just a euphemism for the right to clear cut. I am against your whole management program. It is time to get off the clear cut & spray cycle. Clearcuts are simply not good for forest & people around it. When the trees are gone there is nothing to hold the soil & without the soil you cannot grow trees. Young pine & fir trees that have some shade & protection when they are small & with the entire overstory removed there is neither. The erosion problem on Dead Ck is directly attributable to destructive logging practices & clear cut. It will be decades before the soil has enough humus & fluff to support pine & fir trees.

I also dislike the term stagnant growth for old growth forests. This is just a fakey term

The wildlife of the old growth forests have a right to live too. They definitely need old growth for survival & your indiscriminate cutting endangers them too

for that justifies cutting them down. Don't you think the public deserves a few old growth areas for recreation & meditation. I heartily believe you should consider some other point of view rather than the timber companies.

Let get to the health & safety issue. The chemicals you use are not "safe." Even you admit atrazine is a weak mutagen. Dicamba is a known carcinogen admittedly in strong doses. Hexazinone dosages are held as a trade secret & not released but there appears to be liver damage in mammals. MSMA is moderately toxic. Picloram in high doses induces benign tumors. The toxicity of triclopyr is similar to the phenoxy group which are known teratogens. 2,4-D is a known mutagen, ~~and~~ although carcinogens & known teratogen. How can the
9-1 BLM justify using any chemical that is toxic at all. Foresters have done fine for hundreds of years without the use of chemicals. Why take the chance of even 1 birth defect when you don't have to use them. Experts are merely highly paid prostitutes & have lied for money before & will lie again. You only believe the expert you want to believe. There are recent studies that say there are no safe limits of herbicides & pesticides because it takes an incredibly small amount to cause chemical changes in the brain. This is one area the EPA & chemical companies are criminally negligent in that they don't even look into it. Let face it chemical companies are only interested in profit not people or forests. Their experts have lied before & will lie again.

Thank you for reading this & I hope you start to get off the herbicide treadmill. Bye & good luck & thanks

sincerely
Chris Thorkelson

VICTOR ATIYEH
GOVERNOR

Department of Fish and Wildlife
506 S.W. MILL STREET, P.O. BOX 3503, PORTLAND, OREGON 97208

August 3, 1983

Mr. William G. Leavell, State Director
Bureau of Land Management
c/o Team Leader
P.O. Box 3227
Salem, Oregon 97302

Dear Bill:

The Oregon Department of Fish and Wildlife (ODFW) has reviewed the Draft Environmental Impact Statement for the Western Oregon Program - Management of Competing Vegetation.

Our comments will consist of a short general discussion of herbicides as they impact the wildlife resource followed by specific references to items in the DEIS.

Herbicide Use in Wildlife Habitats

Overall effects on fish and wildlife resources depend upon the size of area treated, season applied, species of vegetation targeted, chemical used, and method applied.

Broadcast application for site preparation on a fresh clearcut has adverse impacts on wildlife by preventing normal establishment or regrowth of native vegetation. Broad spectrum herbicide treatments prohibit establishment of diverse big game forage plants, leaving only conifer seedlings. Without other forage available, the tree seedlings are vulnerable to browsing by big game and other mammals. Broadcast herbicide application can result in a disrupted or unstable ecosystem by reducing wildlife habitat diversity and habitat effectiveness. Another alternative is to apply the herbicide only around the base of the conifer seedling which treats only the competing vegetation, and leaves sufficient big game forage in the untreated areas. This method is found to be economically competitive with broadcast application mehtods.

Aerial herbicide application for conifer release has more opportunity to benefit big game mammals. Target areas are normally characterized by dense, tall stands of mature brush species overtopping established conifers, with forage out of reach of deer or elk. By using proper rates of herbicide application only the crown of the brush stand is killed or retarded, resulting in basal sprouting of usable big game forage. Herbicide application for conversion of large stands of hardwood species is not encouraged. These stands may be heavily used by big game as thermal cover and breeding

areas in the summer and as forage areas in the winter. Certain hardwood stands may be crucial to maintaining ruffed grouse populations and there is some evidence that some stands may be essential to elk survival in the Coast Range. Other stands such as oak woodlands are important to mast-dependent species such as the western grey squirrel and wild turkey, and to cavity excavators such as the acorn woodpecker. Conversion eliminates important wildlife values and also reduces valuable habitat diversity.

Herbicide treatment of big game forage producing areas reduces the carrying capacity in proportion to the total area treated.

Recommendations for herbicide use in wildlife habitats, as expressed in ODFW Forest and Rangeland Goals and Standards are as follows:

- o To maintain big game forage and habitat diversity in conifer plantations the Department recomments application of herbicides only to the base area around each tree seedling.
- o Hardwood conversion plans should take into consideration big game and other wildlife needs of the area to be treated and should include measures and modifications which minimize adverse wildlife impacts. Large areas of big game forage should be divided into two or three parcels with only one parcel scheduled for herbicide treatment each season. This will prevent a sudden serious depletion of forage supply and allow deer and elk to adjust more readily to reduced food supply.
- o Widespread conversion of hardwoods should not be implemented which will cause a serious depletion of indigenous wildlife species.

Specific Comments - DEIS

Page 2, paragraph 4. Alder stands can be important elk thermal summer-spring cover and the impacts of conversion on elk can be greatly negative. Other species such as ruffed grouse may also depend heavily on these stands for
10-1 part of their life cycles. What percentage of hardwood lands will be retained and what percentage will be converted?

Page 10, paragraph 7. We concur that, "sheep, when properly managed, can be effective in reducing low brush without damaging conifers (Newton and Dost, 1981)." We recommend this alternative be applied whenever possible.
10-2 What criteria are used in the cost/benefit analysis comparing grazing to
10-3 chemical vegetation control? To what extent does BLM anticipate the use of sheep as a vegetation control measure in Western Oregon?

10-4 Page 12, Table 1-4. What rationale is used by the BLM to justify a Proposed Action that further reduces habitat diversity for cavity nesters, song birds and small mammals when their "existing condition" states

that their populations are at moderate levels and are declining?

Page 16, Table 1-5. Under discussion of fish and wildlife areas and habitats, "Short-term benefits to some terrestrial animals would occur
10-5 under all alternatives." Please define what is meant by "short-term" and list what "benefits" are anticipated.

Page 51, paragraph 5. We agree that, "adverse impacts on wildlife populations could be reduced by treating no more than 25 percent of the 0-15 year seral stages within a wildlife habitat area during any three-year period." Since adverse impacts will occur under the Proposed Alternative, we would expect that no more than 25 percent of the 0-15 year seral stages
10-6 be treated during any three-year period and suggest that the wording "within one-mile radius of the spray unit" be substituted for "wildlife habitat area" in the above quotation. This allows managers and the public to know specifically what is to be done. It has biological meaning in that Coast Range home range of deer would approximate a one-mile diameter, while the home range of elk would approximate a one-mile radius. Thus forage supplies can be managed using this distance. Additionally, small mammals and songbirds can be managed by only spraying a small percentage of clearcut units in a three-year period. Most populations of these animals will recover in two to three years after spraying, so great fluctuations in their populations affecting their functioning in the ecosystem can be avoided by this mitigation. It is consistent with the philosophy of ecosystem management.

Page 79, Buffer Strips. Pages 59 and 54 contain discussion relative to fish habitat protection. How do the minimum widths for protective buffer strips meet streamside requirements for Riparian habitat protection? A
10-7 minimum width should be established through consultation with ODFW biologists based on stream conditions in each BLM district. How can habitat requirements be met when vehicle and hand application of herbicides are allowed 25 and 10 feet (respectively) from the stream itself?

General Comment

10-8 What wildlife mitigation measures are anticipated when reduction of wildlife habitats and species occur through implementation of the Proposed Action? The BLM Vegetation Management with Herbicides - Western Oregon Final Environmental Statement - Volume 1, 1978 identifies mitigation measures for wildlife on pages 4-1 and 4-2. Will these mitigation standards be adhered to in the current Management of Competing Vegetation document?

We appreciate the opportunity to review this Environmental Statement and look forward to your treatment of our concerns in the Final Environmental Impact Statement.

Sincerely,

Jack

John R. Donaldson, PhD
Director

JRD:sjw

cc: LCDC

11

Department of Land Conservation and Development

1175 COURT STREET N.E., SALEM, OREGON 97310 PHONE (503) 378-4926

VICTOR ATIYEH GOVERNOR

August 3, 1983

Oregon State Director
Bureau of Land Management
c/o Team Leader
PO Box 3227
Salem, OR 97302

Dear Sir:

The Department has reviewed the Draft Environmental Impact Statement Management of Competing Vegetation in Western Oregon. The Department believes that most of our concerns have been addressed at this time with the exception of Statewide Planning Goal 17, Coastal Shorelands. If the management of competing vegetation will effect areas within the shoreland planning area of coastal estuaries, lakes, or ocean shorelands, the table on page 17 should be modified in the Final Environmental Impact Statement to address this. Of particular relevance are requirements for the protection of significant shoreland habitats and riparian vegetation. 11-1

The Department is also responsible for determining if the management plan is consistent to the maximum extent practicable with the Oregon Coastal Management Program. This determination will be made at the time of the Final Environmental Impact Statement. Thank you for the opportunity to review the DEIS. 11-2

Sincerely,

James F. Ross
Director

JFR:PS:llt
5059B/7B

12

JUDSON M. PARSONS
3405 HILLCREST ROAD
MEDFORD, OREGON 97504

Aug. 5/1983

Oregon State Director
Bureau of Land Management
P.O. Box 3227
Salem, Oregon 97302

Dear Sir:

I support the use of herbicides on B.L.M. timberlands.

I have used herbicides on private timberland with ground application equipment. If instructions on the label are followed, herbicides are safe and efficient.

Judson M. Parsons

13

United States Department of Agriculture — Forest Service — Pacific Northwest Region — 310 S.W. Pine, P.O. Box 3623, Portland, OR 97208

Reply to: 2150

Date: AUG 1 1983

Mr. William G. Leavell, State Director
Bureau of Land Management
C/O Team Leader
P.O. Box 2965
Portland, Oregon 97208

Dear Mr. Leavell:

Your "Draft-Western Oregon Program Management of Competing Vegetation - Environmental Impact Statement" (DEIS) has been received and reviewed by the Region 6 Regional Office Staff. The issue of vegetation management, herbicides, and environmental documents is a complex, dynamic and highly controversial area. The Forest Service realizes that it would be impossible to produce an EIS on the subject which would please everyone. I would like to commend you, though, on this DEIS. I feel it is a good document which attempts to present a balanced, factual, and informative description of vegetation management and your alternatives, as well as the various factors which comprise or are affected by this type of program. Following are a few general comments on the DEIS. After those are specific remarks about items in the DEIS listed by page.

The DEIS is well written and easy to follow. The format and graphics contribute greatly to the presentation of information. The bibliography is extensive and appears to list the principal references relevant to vegetation management and herbicides. The various appendices present pertinent information and are a positive addition to the content of the DEIS. We are very pleased with your presentation on the scoping process used (Pages 72-75). The presentation on Pages 40, 41, and 65 of public attitudes on vegetation management is a good synopsis of this subject.

Pages 6 and 7 -- Regardless of how you emphasize "estimated," any deviation from these acres or change to other chemicals will be viewed as a change in the program and challenged. We recommend a much briefer version of this table which does not list specific chemicals but would probably be every bit as useful.

Pages 14 to 17 -- Is this extensive an explanation of State laws necessary? We feel that a much simpler statement of coordination with State agencies would be appropriate.

William G. Leavell 2

Page 43 -- If possible, a more detailed discussion of how impacts under different alternatives are derived and quantified would be helpful.

Pages 56 to 61 -- The source of the information in "Impacts on Human Health-Chemical" section should be better identified. It appears that much of this is the same as the material in the worst-case analysis prepared for BLM by Dr. Frank Dost. Critics might claim that no one among the preparers of the DEIS is qualified to make the calculations and extrapolations found on Pages 59-60. 13-1 13-2

Page 52 -- The comment that the "overall impact.....would be to reduce wildlife populations" is a rather broad generalization. Use of herbicides follows a recent management activity, cutting, which has drastically altered habitat and changed wildlife populations from what they were previously. Herbicide use accelerates a return to the normal forest ecosystem. Wildlife which prefer the seral stages between cutting and mature forest are the wildlife species adversely affected.

Thank you for the opportunity to comment on the DEIS. I hope our comments are useful.

Sincerely,

For JEFF M. SIRMON
Regional Forester

cc:
Kent Churchill, PD&B

FS-6200-11b (7/81)

08 AUG REC'D

14

Central Point, Or.

August 6, 1983

State Director, BLM

Salem, Or.

Dear Sir:

We are, and always have been against herbicide spraying. We are retired couple, and do not use or grow marijuana. We feel people are being subjected to too many poisons in the environment.

We much prefer manual control. People need work and this would provide jobs. We believe able bodied men and women should be given the choice of working on these projects, or having their welfare and food stamps cut off.

When we were young people, there was no such thing as welfare. You either worked or you starved.

It is costing too much to hire helicopters, regardless of the propaganda that is being put out to the contrary.

Sincerely,
Mr & Mrs M.E. Mcgleasson
Mr. and Mrs. M.E. Mcgleasson
675 Judge Lane
Central Point, Or. 97502

15

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Spokane District Office
East 4217 Main Avenue
Spokane, Washington 99202

IN REPLY REFER TO:

4410 (130.1)

August 17, 1983

Oregon State Director
Bureau of Land Management
% Charles E. Hawkins, Team Leader
P. O. Box 3227
Salem, Oregon 97302

Dear Mr. Hawkins:

We have reviewed your draft EIS on Western Oregon Program-Management of Competing Vegetation, and have only 10 comments to issue regarding this document. I hope you will find them useful.

Comment

Draft page 8

IV. Alternative #2 Maximum effective use of Herbicides: This alternative has 53,000 acres of herbicide application whereas alternative #3 has 59,000 acres of application. It would appear that 6,000 acres treated in alternatives 3, 5 and 6 state they are the "same" as alternative 1 except...., it would be more correct to state those alternatives are "similar" to alternative #1. This also appears on pages 3 and 5.

5. Vegetation Management Treatments and Design Feature: Paragraph 3, it doesn't appear as an interdisciplinary team approach is to be used in writing herbicide EA's.

8. Site preparation: 2nd paragraph, stating that slash piles would be burned to reduce habitat of animals that damage conifers, this statement should be rewritten eg. Slash piles would be burned to mutigate negative impacts associated with concentrated rodent populations.

9. Plantation Maintenance and Release: How many maintenance or release treatments would be conducted in this period, would there be cumulative effects?

26. Vegetation Terrestrial: 4th paragraph "Grass dominance is a major problem, particularly when it sustains gopher population". Confusing statement, Is grass dominance the problem, or are gophers the problem, and if gophers are the problem how can they be if the grass sustains them? Try promotes or encourages rather than sustains.

28. Animals Terrestrial: Last paragraph, the discussion about snags is interesting but should be reworked and brought to the quality of the preceding paragraphs.

46. Impacts on Water Resources: A very good section in draft, but it is purely a statement of research. There is essentially no analytical process here between trade-offs. As an example, how would nitrate-nitrogen etc., Suspended sediments, herbicide presence and temperature affect water quality using salmonoids as an indicator? Also on page 54 "Fish" states .... excessive sediments have the greatest impacts of all factors..., this study was released in 1973, whereas the majority of the disolvec chemicals and herbicide studies post date that.

54. Threatened or Endangered Animals: What will happen if a nest or roost site has been declared abandoned? The last sentence makes one feel that only sites presently known will be protected.

56. Manual and Mechanical Treatments: Second paragraph, second sentence change "pesticide" to herbicide.

Thank you for the opportunity to comment on this Draft EIS.

Sincerely yours,

Albert H Martin

Roger W. Burwell
for District Manager

16

LANE REGIONAL
AIR POLLUTION AUTHORITY

(503) 686-7618
1244 Walnut Street, Eugene, Oregon 97403

Donald R. Arkell, Director

August 9, 1983

Oregon State Director
Bureau of Land Management
c/o Charles E. Hawkins
EIS Team Leader
P. O. Box 3227
Salem, OR 97302

Re: Comments on the "Western Oregon Program-Management of Competing Vegetation"

Dear Mr. Hawkins:

We appreciate the opportunity to review the draft EIS for the "Western Oregon Program - Management of Competing Vegetation".

The concerns of LRAPA are primarily confined to air quality. The discussions about air quality in the draft EIS are generally correct technically, except as noted below. Please refer to the air quality portions of Chapters 2 and 3.

16-1 We think the discussion in Chapter 2 should mention the non-attainment status of the major metropolitan areas (e.g., the metropolitan areas of Portland, Eugene-Springfield, are designated as non-attainment areas for the Federal Secondary Standard for particulate (150 ug/m^3); Medford is designated as non-attainment for the Federal Primary Standard for particulate (260 ug/m^3). The Clean Air Act Amendments of 1977 require that emission reduction, or non-attainment control strategies be developed and implemented in these areas to achieve and maintain the ambient air quality standards.)

16-2 It is somewhat misleading to conclude in Chapter 3 that slash burning would not exceed the secondary (or primary) 24-hour particulate standard of 150 ug/m^3 (260 ug/m^3). This conclusion appears to ignore the fact that there are other sources of particulate which also contribute to the total concentration of ambient air contaminants. It is not correct to consider slash burning, or any other single source category in a vacuum. An average 24-hour contribution from slash burning of 3 - 15 ug/m^3 in Eugene-Springfield, as predicted by the 1976 EPA study, is significant. Further, a contribution of something like 84 ug/m^3 for 24-hours is most significant, and could represent the single most important cause of standard violation during an air pollution episode.

The federally-mandated non-attainment strategies are typically based on proportional contributions of air contaminants from multiple sources. These strategies must collectively demonstrate attainment of the National Ambient Air Quality Standards.

Clean Air Is a Natural Resource - Help Preserve It

Mr. Charles E. Hawkins
August 9, 1983
Page 2

The Eugene-Springfield AQMA plan recognizes and accommodates the existing levels of slash smoke (under the Oregon Smoke Management Plan) as a contributing factor to our present status of non-attainment.

It is of some importance to recognize in the EIS that an extensive effort has been expended by LRAPA and DEQ to generate plans to achieve and maintain the TSP standards in non-attainment areas through control of local industrial and area sources.

If a significant increase in the amount of slash burning occurs, as a result of BLM's Vegetation Management Plan, we could reasonably expect an increase the incidence of slash smoke intrusions, even under Oregon's Smoke Management Program. Our concern under those circumstances is that non-attainment plan revisions may be needed with the resultant economic and social effect.

Again, we appreciate the opportunity to comment on the draft EIS. We hope these comments will be incorporated into the final document. If you have any questions or require clarification, please call me at 686-7618.

Sincerely,

Donald R. Arkell

Donald R. Arkell
Director

DRA:ceh

17

Jason Spero
P.O. Box #16
Williams, OR 97544
August 10, 1983

Oregon State Director
Bureau of Land Management
c/o Team Leader
P.O. Box 3227
Salem, Oregon 97302

This letter is written in comment on the Western Oregon Program - Management of Competing Vegetation Environmental Impact Statement Draft.

17-1 I have some concerns regarding this E.I.S. Draft. First, none of the herbicides proposed for use have been registered unconditionally based on completed tests, and the Environmental Protection Agency has not certified that any of them do "not present an unreasonable hazard to health or the environment when used according to the manufacturer's label". The chemicals were either "inherited" by the E.P.A. already registered when the agency was created, or have been registered pending the outcome of certain not yet completed tests. All of these chemicals must be considered as experimental. It must be remembered that each pose both known and unknown risks. None of us know which of them will be banned when the final results are in. We do not know all of the effects these "economic poisons" on human health, on the ground water and the biological communities that depend on it, or on the soil microbes essential to the breaking down of forest soil organic matter. Given this we must approach this method of management of competing vegetaion with considerable caution. I suggest that herbicides be used only when other methods of control will not work, and in those cases it should be kept on the ground (by backpack or ground based mechanical sprayer) where minimum exposure to other than target species can be maintained.

17-2 My other principal concern is that the E.I.S. calls for treatment of over forty thousand acres per year, and calls for no decline in this amount over time. Unacceptable levels of competing vegetation are primarily the result of poor forest management practices. A properly prepared and quickly replanted site, using good quality site adapted stock and trained,conscientious planters, should not later need release. The conifer should be able to outcompete the vegetation with little growth lost to brush or hardwoods. Site preparation can also be cut by minimal burning (only that slash that is so dense that it will be unplantable) , and by replanting before the brush has a chance to get established. With proper forest management the acreage needing treatment should decline substantially as the backlog is cleared up. I share your concern for a productive forestry. However there should be a clear goal to minimize all treatments,as much as possible without substantially decreasing the productivity of the lands managed primarily for timber. Most methods of controlling competing vegetation have adverse effects as well as benefits, and all of them cost money. It should be a stated goal to cut treated acreage in half over the next ten years.

Sincerely,

Jason Spero

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B L M MEETING, MEDFORD, JUNE 27, 1983

THIS WILL BE ON THE SUBJECT OF WATER QUALITY AS IT RELATES TO HERBICIDAL SPRAYING. I WILL MAKE IT AS BRIEF AS POSSIBLE, BUT QUITE SPECIFIC AND TO THE POINT WITHOUT LENGTHY INVOLVEMENT WITH TECHNICAL TERMS THAT APPEAR UNNECESSARY.

FIRST OF ALL, I WILL QUOTE WHAT SOME BUREAU OF LAND MANAGEMENT PERSONNEL WROTE AFTER MONITORING A HERBICIDE SPRAY PROJECT, AS FOLLOWS: "THIS CAREFUL REVIEW, AFTER AN EXTENSIVE LITERATURE SEARCH, LEADS TO A SCIENTIFIC CONCLUSION THAT RESEARCHERS HAVE CONDUCTED VERY LITTLE WORK ON LOW LEVEL, LONG TERM TOXIC EFFECTS OF HERBICIDES 2,4,5-TP AND 2,4-D ON AQUATIC COMMUNITIES, MOST AQUATIC STUDIES HAVE BEEN RELATED TO ACUTE TOXICITY LEVELS FOR FISH. THIS LACK OF WORK ON LOWER TROPHIC LEVELS MEANS THAT AN ENORMOUS DATA GAP EXISTS. . . THE LACK OF RESEARCH DATA ON THE BASE OF THE FOOD PYRAMID MAKES IT IMPOSSIBLE FOR FIELD PERSONNEL INVOLVED IN THESE PROJECTS TO EVEN REMOTELY UNDERSTAND THE OVERALL IMPACT OF HERBICIDES ON AQUATIC COMMUNITIES . . ."

PLEASE NOTE THE SENTENCE: "MOST AQUATIC STUDIES HAVE BEEN RELATED TO ACUTE TOXIC LEVELS FOR FISH." YOU WILL ALSO NOTE THAT THIS BLM REPORT ADMITS THE EXISTENCE OF AN AQUATIC"FOOD PYRAMID", and it further suggests, BY IMPLICATION, THAT HERBICIDES MAY HAVE AN ADVERSE EFFECT ON THE AQUATIC PLANTS AND INSECTS THAT ARE PARTS OF THIS "FOOD PYRAMID" OR FOOD CHAIN.

I WOULD LIKE, NOW, TO POINT OUT SOMETHING BASIC AND IMPORTANT, AND THAT IS THAT THE SMALLER THE AQUATIC ORGANISM THE MORE SUSCEPTIBLE IT IS TO CHEMICAL POISONING. A SMALL AQUATIC PLANT OR INSECT MAY BE SERIOUSLY AFFECTED, EVEN KILLED BY AN INFINITELY SMALLER AMOUNT OF POISON THAN THAT WHICH CAN KILL

18-1 A FISH. IN THAT EVENT A FISH, THEN, IS EITHER DEPRIVED OF THESE VITAL FOOD SOURCES OR ELSE IT PARTAKES OF THE POISONED FOOD. THE FISH MAY SURVIVE AFTER

2

A FASHION, BUT OVER THE LONG TERM ITS HEALTH WILL BE AFFECTED, IT BEING EITHER STARVED AND/OR POISONED.

INCIDENTALLY, FISH ARE VERY SENSITIVE TO TRACE LEVELS OF CHEMICALS IN WATER.

IT NEEDS ALSO TO BE MENTIONED THAT THE SMALLER THE FISH, JUST AS FINGERLINGS, THE MORE SUSCEPTIBLE THEY WILL BE, JUST LIKE INSECTS, TO CHEMICAL POISONING.

THIS BLM DRAFT EIS IS QUITE CORRECT WHERE IT STATES ON PAGE 90 "SINCE YOUNG SALMON AND TROUT FEED PRIMARILY ON AQUATIC AND TERRESTRIAL INSECTS, ABUNDANCE OF SALMONID POPULATION IS DEPENDENT UPON HEALTHY INSECT POPULATIONS." THE WORD "HEALTHY" COULD HAVE BEEN ADDED, ALONG WITH "ABUNDANCE" IN REFERRING TO SALMONID POPULATIONS.

THE CALIFORNIA WATER RESOURCES CONTROL BOARD, WITH THE COOPERATION OF THE E P A, HAS CONDUCTED EXTENSIVE RESEARCH ON THIS SUBJECT, AND IT HAS NOW ESTABLISHED THE PERMITTED CONCENTRATION OF 2, 4-D (2 ppb OVER A 24-HOUR PERIOD) ABOVE WHICH AQUATIC ORGANISMS CAN BE ADVERSELY AFFECTED. THIS PERMITTED LEVEL OF CONCENTRATION IS CONSIDERABLY LESS THAN THAT WHICH THE STATE OF OREGON ALLOWS IN DRINKING WATER, ON THE BASIS OF OUR HAVING A GREATER TOLERANCE FOR POISON THAN AN INSECT.

THERE APPEARS TO BE A NUMBER OF UNRESOLVED QUESTIONS REGARDING THE LENGTH OF HERBICIDAL PERSISTENCE IN THE AQUATIC ENVIRONMENT. VARIOUS POSSIBILITIES,

18-2 HOWEVER, HAVE TO BE ACKNOWLEDGED, SUCH AS LONG-TERM PERSISTENCE AT LOW ppb IN QUIET WATERS AND IN BOTTOM MUDS, IN WHICH CASE THERE COULD WELL BE A CUMULATIVE EFFECT. THERE MAY BE SERIOUS BIOLOGICAL COMPLICATIONS IN SUCH POSSIBILITIES.

REFERRING TO PAGE 114 OF THE DRAFT E I S UNDER "APPENDIX J HERBICIDE ANALYSES OF STREAMFLOW SAMPLES", THE BLM LISTS WHAT IT DESCRIBES AS " THE ONLY AVAILABLE WATER QUALITY DATA IN PROBLEM GROUND STREAMS", THOSE WHICH WERE OBTAINED FROM THE U.S. GEOLOGICAL SURVEY. YOU WILL NOTE THAT THIS DATA WAS OBTAINED FROM RIVERS, NOT FROM SMALLER BODIES. THIS IS EXTREMELY IMPORTANT BECAUSE, FOR THE REASON THAT A CHEMICAL CAN BE DILUTED TO LARGER CONCENTRATIONS THAN SMALLER THE [illegible] TO TRACE

MAY BE MEASURABLY DETECTABLE IN A RIVER. IT SHOULD ALSO BE NOTED THAT IN SOME CASES EVEN THE U.S. GEOLOGICAL SURVEY'S WATER SAMPLING OF THE RIVERS SHOWED HERBICIDE CONCENTRATIONS IN EXCESS OF THOSE PERMITTED BY THE STATE OF CALIFORNIA.

THOUSANDS OF OREGON CITIZENS LIVE ALONG SMALL STREAMS. THEY ARE NOT ONLY CONCERNED FOR THE PURITY OF THEIR STREAMS IN TERMS OF A HEALTHY AQUATIC ENVIRONMENT, BUT FOR THE PURITY OF DOMESTIC WATER SUPPLIES FOR THEMSELVES AND THEIR LIVESTOCK. OF PARTICULAR CONCERN, PERHAPS, IS ABOUT SERIOUS CONTAMINATION RESULTING FROM ACCIDENTAL TRUCK OR HELICOPTER SPILLS, WHICH, INCIDENTALLY, HAVE ALREADY OCCURRED. WE BELIEVE THAT THE

18-3 CITIZEN IS ENTITLED TO A DEFINITIVE SPILL CONTINGENCY PLAN, WITH SPECIFICS ABOUT WHAT EFFECTIVE MITIGATING MEASURES WOULD TAKE PLACE IMMEDIATELY AFTER SUCH A SPILL TO PROTECT THE AQUATIC ENVIRONMENT AND DOMESTIC WATER.

WITH RESPECT TO THE POINTS THAT I HAVE BROUGHT UP, THE PRESENT BLM DRAFT EIS IS WOEFULLY INADEQUATE. THERE IS SOME REFERENCE TO PROPOSED MITIGATING MEA URES, BUT THEY ARE MUCH TOO GENERAL AND FAIL TO ADDRESS THE SPECIFIC PROBLEMS ATTACHED TO INSURING WATER QUALITY AS HAS BEEN OUTLINED HERE. ALL THE NECESSARY WATER QUALITY STANDARDS, INSPECTIONS AND CONTROLS NEED TO BE INITIATED AND SUPERVISED BY A HIGHLY QUALIFIED SCIENTIFIC ENTITY, ONE THAT IS PARTICULARLY QUALIFIED TO PROTECT THE AQUATIC ENVIRONMENT AND, I HOPE OUR, HUMAN WATER NEEDS. SEPARATE CRITERIA AND STANDARDS NEED TO

18-4 BE ESTABLISHED FOR WHATEVER PARTICULAR HERBICIDE IS TO BE USED. IN THIS CONNECTION, IT WOULD SEEM IMPORTANT AND NECESSARY TO HAVE THE DILUENT FOR THE HERBICIDE IS OTHER THAN WATER TO CAREFULLY RESEARCH THE POSSIBLE ADVERSE EFFECTS OF THE DILUENT ITSELF. SETTING UP SIMILAR RULES FOR HANDLING AS FOR THE HERBICIDE ITSELF.

A FINAL EIS SHOULD BE SUBJECT TO A DRASTIC REVISION AS REFLECTING WHAT WE SUGGEST IS THE VERY VITAL PROTECTION OF ALL AQUATIC LIFE.

GORDON FARNSWORTH

1474 THOMPSON CREEK ROAD, APPLEGATE, ORE. 97530

SAVE OUR ECOSYSTEMS (S.O.S.)

CITIZENS FOR ALTERNATIVES TO TOXIC SPRAYS (C.A.T.S.)

August 11, 1983

William G. Leavell
Oregon State Director
Bureau of Land Managment
% Team Leader
P.O. Box 3227
Salem, Oregon 97302

Dear Mr. Leavell,

Here are our comments on the Draft Western Oregon Program-Management of Competing Vegetation Environmental Impact Statement (EIS).

Our initial comments were made at the public meeting in Eugene on July 28, 1983. We provided the team with a copy of

19-1 2,4-D, An NCAP Information Packet (Draft, June 1983). This packet contains source material on the toxicology and environmental behaviour of 2,4-D which should be incorporated into the EIS.

19-2 At the meeting we asked that the EIS discuss the "ecological" stable-brush-community alternative for roadside vegetation control.

19-3 We stated that the EIS fails to discuss responsible opposing views on herbicide efficacy, such as those of economist Dr. Jan Newton and forestry researcher Dr. Howard Horowitz.

In the following comments on chapter 3 and appendices F and K of the EIS we follow the order of the EIS text.

CHAPTER 3 ENVIRONMENTAL CONSEQUENCES

Chapter 3 begins by refering to Table 1-4, "Summary of Impacts" of alternatives. Under Human Health for the herbicide-use alternatives we read: "Negligible probability of impact."

BLM has chosen these words carefully. At the recent hearings in NCAP v. Block (D. Oregon, Eugene, August 3,4,5,1983) statistician Dr. Crump testified that if we assume 2,4-D is carcinogenic, we can use the existing animal data and his one-hit model to estimate the probability of cancer in humans. Dr. Crump thus calculates that the chances of getting cancer from one direct exposure to 2,4-D are less than from smoking one cigarette. This is apparently what BLM means by "negligible probability."

However, since Dr. Crump also testified that he received one-hundred dollars an hour to propare this calculation, we might suspect that the probability of human cancer from BLM herbicide use is not 10 to the minus nine, as he states, but more on the order of one in one-hundred thousand or higher. It is unclear whether BLM would even consider this last more than a "negligible probability." (On page 57 the Draft EIS states that one in a million is "generally considered to represent an effect of virtually zero.")

19-4 The first paragraph of Chapter 3 also states that the scoping process revealed that the proposed program would have no significant impacts on, among other things, energy, wilderness, wetlands and aquatic vegetation, and these topics are therefore not discussed. We hold that these componenets may be negatively impacted by herbicide use and should be discussed in the EIS.

Impacts on Air Quality

19-5 The EIS fails to discuss possible effects of aerial drift and volatization of herbicides on air quality. On short-distance drift see Cameron and Anderson (1977) in 2,4-D, An NCAP Information Packet (hereinafter refered to as the NCAP 2,4-D packet), and on long-distance drift see Robinson and Fox (1978) in the NCAP 2,4-D packet. (See also pages vii-ix of the NCAP 2,4-D packet, and in general when we refer to sources in the 2,4-D packet we ask you to read the description of them in the Annotated Table of Contents thereto.)

19-6 Also missing is discussion of the presence of herbicides, dioxins or other contaminants, or additional toxic combustion products in smoke from the burning of previously sprayed units.

19-7 There is also no discussion in either chapters 2 or 3 on the possible effects of the smoke and particulates on the health of people in areas like Eugene with major air quality problems, which may be significant even if intrusions do not exceed established concentration standards.

Since the EIS discusses the use gelled gasoline we note that we are very strongly opposed to the use of napalm-type products on our forests, and that this proposal demonstrates the analogy between BLM policies and the waging of war on the environment.

Impacts on Soils

The EIS states that only slash burning and scarification will significantly impact soils. There is no discussion of possible

19-8 increased erosion due to killing of brush cover, nor of possible loss of slope-stabilization provided by brush root-systems. There is no discussion of possible loss of litter and humus build-up due to killing broad-leaved plants, nor of loss of nitrogen-fixation due to killing of leguminous species, nor of possible herbicide toxicity to beneficial soil insects or microbes.

Impacts on Water Resources

19-9 The EIS states that brush control will have "no effect on overall groundwater movement and streamflow," but moisture retention in ecosystems is highly dependent on the vegetative cover and root systems. The significance of local increases in inflow to streams is that less moisture is retained on site for biological productivity and microclimatic influences.

19-10 The EIS documents significant increases in nitrate-nitrogen, ammonia-nitrogen and manganese in streams following slash burning, but does not discuss the environmental consequences of these increases.

19-11 While noting that the amount of soil erosion reaching streams is generally proportional to the amount of bare soil, the EIS fails to discuss the possibility that defoliation by herbicides may increase soil erosion and nutrient influx into streams.

19-12 The EIS states that the possibility of water contamination depends on the persistence and mobility of the herbicides, but the treatment of these questions in Ghassemi (1981) and USDA, FS (1981) is incomplete. On 2,4-D behaviour in soil see Zemansky (1978) in the NCAP 2,4-D packet and also the HALTS report (1980). Zemansky cites numerous examples of 2,4-D movement through soil and groundwater.

19-13 Measurements of herbicides in streams over time following applications, by Norris and others, show that there are often high concentrations during the first major precipitation, and that herbicides may still be detected more than a year later. In evaluating the water monitoring results the EIS fails to discuss the toxicological significance of low doses over a long time period. Doses below "recommended" regulatory levels or even below the limits of resolution of the monitoring (1 ppb) may be significant for chronic exposure or genetic toxicity. That herbicides do contaminate streams is well established.

19-14 The discussion of stream contamination by aerial drift is overly generalized and fails to discuss the many factors involved (climatic conditions, formulation of herbicide and carrier, application equipment) or the variations in the reported results (Cam-

eron and Anderson cite a study which found that 20-80% of aerially applied herbicides drift off-site).

19-15 The EIS also fails to discuss Cameron and Anderson's finding that streams were contaminated by overflight and pilot error. It likewise fails to discuss the likelihood of spills and other accidents. The regular occurence of such accidents is well documented in the records of operational programs.

19-16 Zemansky (ibid) cites a body of evidence which shows that herbicides can contaminate groundwater by leaching through the soil.

Impacts on Vegetation: Terrestrial Vegetation

Burning

19-17 Burning can damage the soil, destroy nutrients, and cause increased erosion and nutrient losses by leaching. The resulting losses in soil productivity are not discussed in the EIS.

Chemical Treatments

As Dr. Jan Newton shows (1979, part II), resprouting is often a problem with chemical treatments.

19-18 Dr. Jan Newton, Dr. Howard Horowitz, the U.S. GAO, the Center for Natural Areas, and an internal Forest Service report on TSI activities, have all found that agencies do not collect adequate pre-treatment and post-treatment data on vegetative conditions, and that they therefore cannot demonstrate the actual effectiveness of operational uses of herbicides in increasing conifer survival or growth. The EIS fails to disclose this responsible opposing view.

19-19 The single paragraph on release research, which cites Gratkowski and Lauterbach, is grossly inadequate as a discussion of the effects of chemical release on conifer growth. To begin with, the existing research as a whole does not demonstrate the utility of aerial applications (Dr. Jan Newton, Testimony before the EPA, 1981). Then there are problems in the research which make the relevance to field conditions highly questionable. Also, the variability of site- and species- specific field conditions make difficult any generalizations from small research plots to large operational programs. Finally, there is a dearth of adequate field data or long-term studies of operational programs.

19-20 The EIS also fails to discuss possible adverse effects on conifers from herbicide use. These include possible direct toxi-

city to conifers, falling of brittle herbicide-killed brush on seedlings, and loss of beneficial site contributions of target vegetation. Beneficial contributions of target vegetation may include humus build-up, erosion prevention, nitrogen fixation, reduction of animal browse, soil moisture retention, micro-climatic influences, and harsh-site amelioration through shading in summer or sheltering in winter.

19-21 The EIS does not mention possible mutagenicity of herbicides to plant species resulting in degradation of native plant micro-genotypes.

Manual Treatments

19-22 The EIS discussion of effects of manual treatments on vegetation is as inadequate as the discussion of effects of chemical treatments. According to Dr. Horowitz, resprouting of species such as alder can be controlled by timing the treatments. There is a lack of data on the efficacy of manual treatments since manual methods have been less used and researched than chemical methods. Retreatments needed because of resurgence of brush are generally overestimated for manual treatments and underestimated for chemical treatments. If brush is cut at the right stage of development of the stand the conifers may achieve dominance despite resprouting. The high incidence of conifer damage in the Roberts studies was due to the inexperience of the non-contract labor used, since these problems are rare in actual contract experience.

Biological Treatments

The discussion of grass-seeding and sheep-grazing as vegetation control alternatives is a welcome addition to the EIS.

Impacts on Vegetation: Threatened or Endangered Plants

The first paragraph of this discussion states the basic situation accurately, but the true magnitude of the hazard to endangered plant species can only be seen in the overall context of diminution of forested land and of clear-cutting, burning and herbicide use on forest plantations. BLM's policy of maximum timber production and reforesting with dense monocultures of Doug Fir is only obtained at the expense of species diversity and risks to endangered plants.

Impacts on Animals: Terrestrial Vertebrates

We are relieved to see that the EIS recognizes that "the overall long-term results of controlling competing vegetation

would be reduced habitat diversity with a corresponding reduction in wildlife species abundance and diversity."

Burning

This discussion correctly indicates that adverse effects of burning can be reduced by the alternative of burning slash piles instead of broadcast burning. Piling the slash would leave small ground cover for small animals, large branches and logs for food chain insects, and snags for cavity nesters.

Chemical Treatments

The EIS states that destruction of grasses, brush and hardwoods reduces habitat diversity, thereby eliminating animals that use the grass and brush seral stages. But it does not reveal that a dense young conifer stand is the most sterile of all stand compositions in diversity of both plant and animal species (Franklin et al., 1981).

19-23 The EIS says: "Chronic (long-term) effects of herbicides on wildlife are not anticipated!" In the absence of adequate data this conclusion is premature, and the EIS fails to disclose this absence of adequate data on chronic effects on wildlife.

The EIS assumes that animals will not be exposed to repeated treatments. This is not a reasonable assumption in view of the widespread use of herbicides by BLM and other agencies. The EIS should discuss the factual data provided by Norris and others on levels of herbicides found in deer and other game.

19-24 Excretion of herbicide residues from animal tissues does not mean that herbicides cannot do significant damage. While in the body the herbicides can cause types of damage that are not readily repaired, such as membrane damage and genetic damage. Some genetic injuries are irreversible and hence accumulate from exposure to exposure.

19-25 Small or sensitive animals could be acutely poisoned by herbicides at the proposed application rates. Acute poisoning can result in death or long-term deficits which reduce the animals capacity for survival.

19-26 Chronic poisoning is possible from absorbing small daily doses in contaminated air, water, or food. A small amount of herbicide can persist in and on plants for a long time, and there is evidence that plants may concentrate some herbicides in the berries. Chronic exposure of animals could result in

functional deficits, reproductive problems, tumors and cancer, or even behavioral malfunctions.

19-27 Animals can also be adversely affected by herbicide toxicity to insects or smaller animals on which they rely for food.

19-28 While the EIS briefly discusses some adverse impacts of diesel oil carriers, it does not mention the possible chronic toxicity to wildlife of herbicide contaminants, break-down products, additives such as surfactants and so-called "inerts," or other types of carriers and solvents used in the formulations.

Impacts on Animals: Fish

19-29 The EIS says that "excessive sediments have the greatest impact of all factors affecting aquatic life." Yet while burning would increase sediments in localized stream reaches, "increases would not be expected to significantly affect fish habitat." It is unclear just what the effects will be, but it seems likely that fish spawning could be adversely impacted in some stream reaches.

19-30 The EIS mentions the importance of insects as fish-food organisms, but it fails to discuss possible toxicity of herbicides to such insects.

19-31 As with animals, the EIS ignores the possiblity of chronic toxicity of herbicides to fish. The EIS mentions lethal doses for fish, but does not report the observation of Cameron and Anderson (1977) that lethal doses for fry and eggs are lower than for mature fish. Nor does it discuss Cameron and Anderson's conclusions about the lack of data on chronic toxicity to fish and uncertainty about what constitutes a significant dose for chronic toxicity. Chronic toxicty to aquatic organisms could cause tumors, reproductive problems, or disabilities leading to reduced survival.

Impacts on Animals: Threatened or Endangered Animals

19-32 Under Impacts on Terrestrial Animals the EIS mentions some risks to habitat and raptor nesting sites, yet the paragraph on endangered animals concludes there will be no adverse impacts. This is a contradiction. All of the risks we mention above, including habitat loss and chronic toxicity, can adversely affect endangered species.

Impacts on Recreation and Visual Resources

The EIS discussion concentrates on the visal impact of

treatments, which in the case of herbicides and burning is adverse. But the effects of smoke and herbicides on recreation use are not adequately discussed. Smoke intrusions have an adverse impact on recreational use. Units sprayed with herbicides should be posted and avoided for at least six months after applications and
19-33 probably longer. This has a direct adverse effect on recreational use of those units and an indirect adverse effect on recreational use of the whole forest, since concerned users will have to take special precautions to avoid sprayed sites and spraying activities and may be deterred from any recreational use of the forest during spray seasons.

Impacts on Special Areas

The EIS acknowledges that aerial drift could damage adjacent special areas.

Impacts on Human Health

Burning

As mentionaed above, the EIS does not discuss possible health impacts in areas with air pollution problems to begin
19-34 with. Breathing of suspended particulates and combustion products can adversely affect human health even if below regulatory levels.

Manual and Mechanical Treatments

Rick Koven of Northwest Forestry Workers Association has testified that the accident rate in manual brush cutting contracts by local forestry workers' groups has been low and the accidents are mostly minor. Pesticide poisonings on the other hand tend to go unrecognized and unreported. Short-term symptoms are difficult to distinguish from cold, flu, headache or aches and pains, while long-term illnesses like cancer may not show up for years or decades. Extensive monitoring is needed to establish a causal connection in pesticide poisoning, and extensive epidemiological surveys are required to establish the effects of occuptational herbicide exposure. A recent Stanford Research
19-35 Institute (SRI) epidemiological survey found a significant increase in miscarriages in a group of wives of young forestry workers.

Chemical Treatments

As an analog of the auxin indoleacetic acid, the herbicide 2,4-D does stimulate plant growth, but it is likely that the basic toxic mechanism of 2,4-D in both plants and animals is the

same: direct interference with gene structure and function within the cell nucleus, and disruption of the process of cell division. BLM may be unaware of the basic similarities between plant and animal physiology; in many ways one is the mirror image of the other, and the same disruptive agent disturbs each system, only in a different direction. (Seiler, "The Genetic Toxicology of Phenoxy Acids Other than 2,4,5-T," Mutation Research, 1979?) Also, it should be noted that indoleacetic acid plays a role in human physiology, only as a factor in neural transmission instead of as a growth regulator.

19-36 The discussion of herbicide impacts on human health in this EIS is in many respects invalidated by the failure to disclose scientific uncertainty or to perform a worst-case analysis. Thus the conclusion that the herbicides "are not considered to have significant mutagenic or carcinogenic impact" ignores the scientific uncertainty and data gaps and fails to consider the worst-case. Since there is no threshold or no-effect dose for mutagenesis or carcinogenesis, or for true teratogenesis for that matter (Shearer, 1980, chapter 1), the significance of these potential effects has not been properly evaluated. Possible mutagenicity and carcinogenicity of 2,4-D in humans is documented in the sources in the NCAP 2,4-D packet.

19-37 As discussed above regarding animals, rapid excretion of herbicides does not preclude the accumulation of irreversible "hit-and-run" genetic or other injuries.

19-38 The EIS does not reveal that acute lethal toxicity has no correlation with chronic toxicity. For example, Ahmed et al. (1977, see NCAP 2,4-D packet) found that 2,4-D was the least toxic of several chemical at higher doses but the most toxic at lower doses.

19-39 It is meaningless to state that very few chemicals in commerce have been shownto cause cancer when very few registered pesticides have been adequately tested for cancer. Dr. Dost states that 2,4-D has "weak" mutagenic potential, but this is only relative to certain other agents. The studies in the NCAP 2,4-D packet demonstrate that 2,4-D can cause statistically significant increases in mutations in mammalian and human cells.

19-40 If the probability of genetic effect can be calculated from animal data using a linear dose response, why doesn't BLM attempt such a calculation using various worst-case doses?

19-41 To cite a FIFRA - EPA panel on the controversy between Reuber and Hansen is to abdicate your research responsibilities

to the EPA. The BLM EIS should review Hansen's and Reuber's reports in the originals, presenting the authors' own conclusions and BLM's interpretations thereof. Hansen's and Reuber's reports are given in the NCAP 2,4-D packet. See also the HALTS report therein for another evaluation of the controversy.

19-42 Your discussion of the Swedish epidemiological studies is not up-to-date. In the NCAP 2,4-D packet there is a recent study by Eriksson et al (1981) which shows that exposure to 2,4-D results in a 4.2 times over-risk of soft-tissue sarcomas.

To depend on EPA evaluation of proprietary data without disclosing the gross uncertainty in relying on data that is not subject to scientific peer review is to abdicate to the EPA.

Before you can conclude that the exposure and probability of genetic effect is so small as to be negligible, you must perform the required worst-case analysis.

To rely on EPA's conclusion, especially without revealing the extent of data gaps, is again to abdicate your research responsibilities to the EPA. Prior to performing a worst-case analysis, BLM must investigate and report the nature, extent and significance of data gaps on the herbicides.

The monitoring of occupational exposure, while subject to criticism of its methods and conclusions, at least demonstrates that applicators are exposed to doses of herbicides. Your estimates of environmental exposures are not supported by adequate data and do not consider proper worst-cases.

Your reference to EPA registration standards is again abdication of your research responsibilities, to the extent that you rely on those registrations without conducting an independent review of the data. EPA cannot claim that herbicides are "safe when used according to labels" and BLM should not be allowed to do so either.

Impacts on Economic Conditions

The EIS discussion of economic impacts focuses largely on the Allowable Cut Effect (ACE) and creation of jobs in timber harvesting. The ACE assumes that vegetation control treatments
19-43 produce yield increases, but the EIS fails to examine the extent to which these yield increases are unsubstantiated.

19-44 The economic impacts of vegetation control should be evaluated in terms of economic efficiency (benefit-cost ratio) and employment

impacts.

As discussed above under Effects on Vegetation, the EIS fails to disclose the controversy about the cost-effectiveness of herbicide use. Critics such as Dr. Jan Newton observe that the long-term benefits of release are not adequately substantiated either in the research or in the field, and that the costs of vegetation managment alternatives are not correctly estimated. Estimates of costs of herbicide use are incomplete in that relevant costs are not included. Some agency costs are omitted due to incomplete records, while no external costs to the public or environmental resources are included in agency estimates. Costs
19-45 of manual alternatives tend to be inflated by overestimates of the number of retreatments needed and other assumptions. Costs of manual alternatives would further come down if more contracts were let, giving agencies and contractors increased experience

The effects of alternatives on jobs are indicated in Table 3-4, which shows that manual methods are more labor-intensive than aerial herbicides. The creation of additional forestry jobs would significantly benefit the local economy. Another consideration is the preference of segments of the work force for jobs which do not involve toxic hazards.

APPENDIX F

General Descriptions and Summaries of Fates and Impacts of Chemicals Proposed for Use

Of the 14 herbicides discussed in this appenix, we will review only one, 2,4-D. The problems found in this discussion generally exist for the others as well, except that they are compounded because there is less data on other herbicides than on 2,4-D.

2,4-D

Summary

We addressed behavior of 2,4-D in soil and water under Impacts on Water Resources above.

Toxicity

These issues have been in part addressed above under Impacts on Human Health.

The positive results in the existing cancer studies, particu-

larly in Hansen et al., must be taken as evidence of a possible hazard (Reuber, 1979; Shearer, 1980).

On reproductive toxicity, see Konstantinova et al. (1976) in the NCAP 2,4-D packet and the discussion on page v of the packet. The internal hemorrhages in the foetuses occured at low doses, and the effect was magnified when 2,4-DCP was also present. Shearer indicates that there is probably no threshold for true teratogenesis- the threshold in teratogenesis testing occurs only when the developmental toxicity is due to the poisoning of the mother animal.

The opinion of some scientists that 2,4-D mutagenesis does not represent a hazard must be seen in the regulatory context. A mutation is a serious injury in its own right (Shearer), but regulatory professionals faced with a veritable flood of toxicants consider only the most extremely toxic agents as candidates for regulation. This says more about the regulatory standards of our society than it does about the actual toxicity of the chemicals at issue.

Dr. Dost acknowledges scientific uncertainty when he says regarding carcinogenicity that "we must await data presently being generated," but he does not perform the necessary worst-case analysis of this uncertainty, i.e. that 2,4-D may be carcinogenic.

Hazard Assessment

Some of the many problems with these estimates of exposure were addressed in SOS v. Watt (Civil No. 83-6090-E, D.Oregon, 1983) in plaintiffs' arguments. There is no disclosure of scientific uncertainty (data gaps) concerning actual environmental exposures and no consideration of proper worst-case scenarios. A no-effect dose does not apply to carcinogenesis, mutagenesis or true teratogenesis.

2,4-D Contaminants

Shearer (1980, page 14 of the NCAP 2,4-D packet) states that the experiment by Boutwell and Bosch (1959) indicates that 2,4-D is either a skin carcinogen in mice or a co-carcinogen with benzene which is not carcinogenic by itself in this system.

The study by Konstantinova (cited above) indicates a synergistic developmental toxicity of 2,4-D and 2,4-DCP. Since 2,4-D in the environment undergoes a gradual process of breakdown into 2,4-DCP and further toxic products, these chemicals would be

found together in the environment. Since there is no threshold for the genetic injuries of concern, low levels of exposure do not preclude significant effects, and Dost moreover fails to acknowledge uncertainty about actual environmental levels. The concern here is particularly for the synergistic interaction of 2,4-D and 2,4-DCP.

Regarding DCDD, Dost reveals that tests have shown some fetal toxicity and have suggested a carcinogenic effect in male mice. While the doses of DCDD in 2,4-D would be very small, there is some concern since DCDD would be expected to bioaccumulate, which is not disclosed in this appendix.

For additional discussion of the US testing of 2,4-D for DCDD, see the first paragraph on page 49 of the NCAP 2,4-D packet.

APPENDIX K

Toxicity of Dioxins in Herbicides Proposed for Use

19-46 In the absence of adequate testing of nearly all of the 75 dioxins, the conclusion that only 2,3,7,8- T4CDD has toxicological significance is at the least premature.

As noted by Shearer (1981, NCAP 2,4-D packet, page 49), when the US 2,4-D samples were tested by another lab for higher resolution confirmation, concentration of DCDD up to 184 ppb was found, and most samples were not assayed using the most sensitive testing procedure.

We hope that BLM will revise the EIS to incorporate the above criticisms and additions, and we especially ask that a worst-case analysis be included in this EIS.

Sincerely, Michael Slattery

Michael Slattery
342 Monroe St., Eugene, Oregon, 97402
for:

Save Our ecoSystems (S.O.S.), Inc.

Citizens for Alternatives to Toxic Sprays (C.A.T.S.)

AUDUBON SOCIETY OF PORTLAND

A Branch of National Audubon Society

PHONE 292-6855 5151 NORTHWEST CORNELL ROAD PORTLAND, OREGON 97210

TO: Charles E. Hawkins, EIS Team Leader
Salem District Office
Bureau of Land Management
1717 Fabry Road S.E., P.O. Box 3227
Salem, Oregon 97302

FROM: Lynn Herring, Conservation Chair
Portland Audubon Society
5151 N.W. Cornell Road
Portland, Oregon 97210

SUBJECT: Comments for DEIS -- Proposed Western Oregon Program for the Management of Competing Vegetation

DATE: August 15, 1983

The Portland Audubon Society is a 3700-member chapter affiliate of the National Audubon Society. We are concerned about the protection of wildlife and wildlife habitat. Accordingly, with respect to the DEIS -- Proposed Western Oregon Program for the Management of Competing Vegetation, we consider the use of herbicides as a threat to the wildlife and habitat base of the affected areas and consequently oppose the use of herbicides as the preferred mechanism for management of unwanted vegetation. We oppose herbicide application on 41,000 acres in the preferred alternative, #1 and likewise object to proposed herbicide use in alternatives #2,3,4,5, and 6. We favor manual brush control as a preferred alternative.

The BLM has abdicated its responsibility for the knowledge and safety of the proposed herbicides to the Environmental Protection Agency (EPA), p. 14 in the DEIS with reference to 40 CFR 162. On p. vi, the DEIS states, "Herbicides proposed for use under this EIS present no significant risks of toxicity to humans when used according to EPA- and State-approved labels." On p. 27, the DEIS states, "As many as 200-300 wildlife species might use a single vegetative treatment area." Then, on p. 13, the document notes that in alternatives #1,2, and 5, moderate reductions in population levels can be expected in big game, cavity nesters, song birds, and small mammals. In view of recent findings regarding EPA research data gaps and errors, we do
20-1 not consider simple registration of chemicals by EPA sufficient. Research must be performed by the agency taking the action. We note the Bureau's own admission on p. 14, DEIS, "EPA's determinations are based upon research
20-2 data supplied by the applicant for registration." Furthermore, we are concerned about the lumping or combined use of herbicides as outlined in Table 1-3, "Herbicide Use by Alternative." Where in Appendix F is the toxicity and hazard assessment for the combined use of herbicides?

Portland Audubon Society -- Comments for Vegetation Management DEIS

20-3 In the presence of scientific uncertainty, the BLM must go beyond the analysis presented in this DEIS and prepare a worst case analysis (WCA) of the adverse biological impact of herbicide use upon not only human health but also upon wildlife. Furthermore, the WCA should include the possibility of error during the chemical treatments.

20-4 The Bureau must present a plan to inventory and monitor all forms of wildlife in the proposed vegetative management plan --- not just "big game, cavity nesters, song birds, small mammals, and fish," Table 1-4,"Summary of Impacts." These categories are grossly superficial and neglect primary indicators of the stability of the food chain such as insects. Claims about impact upon wildlife are impossible to substantiate without full knowledge of the affected wildlife base and monitoring of that base both pre- and post-treatment.

Proposed treatment methods must favor protection of critical habitat areas such as riparian, snag, and down timber, noted on p. 28,29, and seral stages such as grass-forb and brush-seedling, noted on p. 26, 28. Habitat protection for endangered, threatened, and sensitive animal and plant species, noted on p. 27,29,30, is of course of the utmost importance. In addition, timing of treatment methods should be carefully considered to avoid interference with reproduction and care of young.

In conclusion, the Portland Audubon Society expresses grave concern about the use of herbicides in the DEIS -- Proposed Western Oregon Program for the Management of Competing Vegetation due to perceived adverse biological impact upon wildlife and wildlife habitat.

END

21

United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VA. 22092

AUG 12 1983

In Reply Refer To:
EGS-Mail Stop 423

Memorandum

To: State Director, Bureau of Land Management
Salem, Oregon

From: Assistant Director for Engineering Geology

Subject: Review of draft environmental statement for management of competing vegetation, Western Oregon Program

We have reviewed the draft statement as requested in your notice.

The proposed plan would result in doubling in the number of water samples containing herbicide residues (table 1-4, p. 12). This is surprising in view of the statement that this "EIS is needed to address the increasing emphasis on nonchemical vegetation management treatments" (p. 2, par. 1).

21-1 It would be useful to include a comparison of acres to be treated under the current 1978-87 plan and the newly proposed plan, and an explanation of why herbicide residues in streams would increase under the new plan.

21-2 We suggest further analysis of potential effects of the use of herbicides on ground water in areas of sandy or gravelly soil and in areas where fractured rock or permeable basalt or limestone may be found at shallow depth. Such analysis would seem to be especially needed for those herbicides that have a half-life of appreciable length and those that are poorly absorbed in soils. Particular attention should also be given to areas of high water table. A useful reference for this purpose is Sanborn, J. R., Francis, B. M., and Metcalf, R. C., 1977, The degradation of selected pesticides in soil: EPA-600/9-77-022. (For example, page 139 records for picloram a leaching depth of 2,400 centimeters (cm) in silty clay loam, 244 cm in sand or clay loam, and 120 cm in forest soils.)

for James F. Devine

22

Aug. 14, 1983

Gentlepeople:

Unless and until herbicide effectiveness and dangers are more carefully quantified alternative seven seems the best choice of those offered, though eight has much in its favor. As usual there is a huge gap between no action and anything else. Many questions remain unanswered in this document as you plunge us further into over cutting and unknown poisoning of our environment. Some of the questions which remain are:

① How much, if any, increase in the cut should be allowed for intensive management practices? Computer models are not sufficiently site specific. Therefore projections allowing present increased harvest are wrong. And further, can the public believe your economic analysis on other points? I find it propagandistic in that losses are computed using your maximized present harvest or as you claim "sustained yield. Because of past and present intensive forest management practices future soil productivity and component diversity are compromised. How much? Jobs are not dependent upon a given amount of stumpage. Jobs and community stability are dependent upon a healthy forest. The herbicide treadmill forces us to look only at immediate gain, which is

②

itself sometimes fictitious. Are we providing for a sustainable forest related economy?

22-1 ② Can aerial herbicide applicators control or even predict drift? Recent scientific data confirms less formal experience in stating categorically no. Heretofore unmeasured winds of less than two miles per hour commonly spread these poisons over a mile from target. Proposed buffers hardly seem serious.

③ Can wildlife and human health effects be firmly established so the consequent question of risk vs. benefit be addressed? While

22-2 listing present scientific wisdom on individual poisons no discussion of combinations is offered. Animals and plants already harbor a variety of unwanted contaminants. What is their interaction with the batch of herbicides you propose?

④ Are recreation, fisheries and a multitude of other forest related industries enhanced and protected by the proposed action? The question is how much have they been compromised. How great is the loss? These questions are at the heart of what an EIS is mandated

③

to accomplish. As the timber harvest continues its inevitable decline recreation, for instance, continues its inevitable increase; witness use on the Wild & Scenic (!overused) Rogue River. How many jobs, present and future, are lost because recreational resources are not now seen for their true economic value?

The June 1983 Western Oregon Program-Management of Competing Vegetation EIS is to this reader less confounding and more informative than past documents. Unfortunately as some problems are finally admitted and other information made clear much greater questions clamor for attention. Please notify me as to whether this response has been received within the prescribed comment period.

thank you

Boyd Peters
Wolf Creek Trails
PO Box 43
Wolf Creek, Or.
97497

Methods-Alternatives: 6,7 preferred; definitely NOT 1 or 2; i.e., limited, preferably non-aerial, herbicide use//diversity toward stability of forest and wildlife. 23 (Dear F (BLM))

Principles: 1) Health-promoting food, water, and shelter -- as for humans -- is essential for all wildlife.
2) Thus, methods that favor non-contamination, enhanced shelter and wildlife food (i.e., diversity) are far more preferable. These can be done compatible with timber-harvesting to a large extent.
3) Methods that promote faster regeneration of trees and wildlife repopulation of cutover lands are to be favored.
4) The most valuable and productive (therefore essential in frequent and accessible locations) wildlife habitats must be safeguarded (i.e., riparian).
5) Timing of vegetation control, including harvesting, may be critical for wildlife survival and reforestation.
6) Monitoring of effects is also important in quality and quantity.
7) Think all forms of wildlife, not simply "deer and elk," in considerations. These are poor, even if politically and publicly favored, species. A variety of breeding birds, butterflies, are better indicators.

Reasons: 1) In this western Oregon forest area under consideration, mountains, valleys and streams predominate in the landscape. Tricky and unpredictable air currents complicate aerial spraying for safety of resources, timing for effective vegetation control and safe wildlife (or human) uses -- and drift. The latter must occur even in calm air,
23-1 due to thermal updrafts and no satisfactory methods of either prediction, measurement of spread, or monitoring at the time. The EIS doesn't speak to this substantial problem that I can find.
2) By all odds, the most valuable wildlife and general ecological habitat for shelter and protection is in the riparian vegetation (and marshes, estuaries, and the like). Not just Class I streams, and not simply for cooler waters for fish, this -- and as much as possible -- must be considered for effective protection. Here, broadleaf vegetation needs to thrive -- not merely exist! All hoofed mammals -- and especially cattle -- must be restricted from large-scale destruction of these streamside plants. I strongly urge at least two feasible methods of protection and enhancement:
   a) allowing only limited access for cattle to streams of all kinds. Stockmen should help, physically and financially, to fence their stock out, except for occasional watering areas.
   b) Much larger buffer zones to all streams from any sort of vegetation control -- especially herbicides.
3) I suggest that a small portion of every timber sale contract and management area be allowed to offer plant diversity for food to wildlife -- i.e., berry-producing trees and shrubs such as dogwood, berry thickets, oaks, etc. -- and to offer brushy areas such as ceanothus and manzanita for enhancement of conifer seedling nutrients (nitrates from ceanothus), and shade protection from soil-drying summer sun -- especially in S.W. Oregon. These offerings of diversity need to be frequent and accessible in the general forest landscape pattern and for snags -- more often than BLM minimums.
4) Manual brush control, especially if the brush is simply cut and left lying around the roots of sapling conifers as a mulch would greatly speed forest timber regrowth. It might be necessary to control general public access for fire prevention for 2 years, but this method has proven most productive of fast tree growth at Orville Conn's forest woodlands near Selma -- and labor expense saving, too. It also provides wildlife shelter, if not cut until after young trees peek thru the tops of the shrubs.

5) It has been shown by field studies that "dispersal corridors," even if cattle-grazed, roaded, and narrow, will provide essential routes for repopulating cutover, even clearcut, timber sale tracts from a small old-growth (or undisturbed climax or near-climax) patch of forest. Strip census and/or regular station surveys will show diversity of species. This richness of variety, evidenced by warblers, vireos, flycatchers, and invertebrates which are declining, but important, forms of forest pest predators, is marked and found to depend upon the thin, but complete, path of forest canopy from climax forest to young forest regrowth succession. Leaving such narrow, radiating strips from small "cores" of old-growth should be planned continually.
6) Timing of vegetation management actions may be all-important in timber production and wildlife habitat(as well as watershed and recreation) values. Bearing in mind that the most critical wildlife survival times are in the late winter for breeding stock survival, and during late-spring-early-summer reproduction, these times should be avoided for drastic control methods such as spraying herbicides and other active vegetation controls. Check by strip surveys.
23-2 7) Finally -- a most important aspect hardly covered in the EIS is the matter of monitoring both quality and quantity of the methods of vegetation controls.
   a) Are the prescribed and contracted safeguards actually carried out in the woods? Logging-oriented laborers are notoriously non-caring, perhaps even lazy, about environmental care in general. Are riparian buffer zones adequately taken care of?
   b) Are snags that are left, for example, ones that wildlife really use?..or simply some close to the road or otherwise conveniently out of the way. (Wildlife, generally, of course, won't mix with heavy equipment use, but easily can be detected, with a little looking, as making actual use of certain suitable, therefore valuable, snags to leave.)
23-3 c) Wn t happens to your monitoring methods in actual continual programming in the (probable) event of budget cuts and declines? This question, if adequately included in your program, would, I think, help quiet a lot of the public's prejudices against spreading of poisons and "Oops, so sorry" attitudes of forest management of the environment that means so much to all of us.
23-4 d) One thing increasingly evident in EIS's is the claim that specific chemical herbicides are relatively harmless, and this is becoming increasingly misleading. The data given seldom matches actuality, which is the increasingly cumulative exposure to a number of chemicals together! There is no way to predict harmless effects of atrazine at one time and place on top of hexa-inone another time, along with malathion for mosquito abatement near towns, as well as roach poison at the last restaurant one had a meal, etc. -- except all agencies avoiding use of even low toxic poisons everywhere!

Eleanor A. Pugh
POBox 25
Wolf Creek, OR 97497
12Aug83

Eleanor A. Pugh

24

August 23, 1983

11001 Takilma Rd.

Cave Junction, Oregon 97523

Charles E. Hawkins
Bureau of Land Management
Environmental Impact Statement Team Leader
Salem District Office
1717 Fabry Rd. S.E.
P.O. Box 3227
Salem, Oregon 97302

Re: Program for the Management of Competing Vegetation

Dear Mr. Hawkins;

Attached is a typed copy of my comments of August 17, 1983 that were previously sent to you. Please note on my table, Labor Days per $1,000 Investment, there has been a correction in the site preparation by ground chemical option. Employee Days should read 5.0 instead of .5 .

Sincerely,

Tom E. Dunn

Tom E. Dunn

August 17, 1983
11001 Takilma Road
Cave Junction, OR 97523

Charles E. Hawkins
Bureau of Land Management
Environmental Impact Statement Team Leader
Salem District Office
1717 Fabry Road S.E.
P.O. Box 3227
Salem, Oregon 97302

Re: Program for the Management of Competing Vegetation

Even though these comments on the draft copy of Western Oregon Program Management of Competing Vegetation are a few days late, I hope I can provide some useful comments on the proposed program. As a reforestation contractor with Green Side Up, Inc., I have been involved in primarily in post harvest forest work for the past nine years. My comments will reflect heavily on the area from Roseburg south, where, generally speaking, vegetation management is considered a must to insure successful regeneration.

Seedling Quality

I believe seedling quality is still one of the most critical aspects of reforestation that is regularly overlooked. Healthy trees, planted in a timely manner soon after timber harvest, make most release operations totally unnecessary. I realize more trees are being checked prior to planting in growth chambers. But I still find significant mortality in some stock I bring home at the end of a planting day and replant in my irrigated garden. Many silviculturists regularly go to nurseries when their stock is being lifted to insure proper handling. They have told me plenty of horror stories. More districts should test plant sample seedlings in irrigated areas to determine if the conifers are capable of vigorous growth without stressful on site conditions.

I did note that recent reforestation acreage was 27,120 acres annually.
24-1 Since this was double the 13,500 acres burned annually, it seems there was significant replanting. Please include the second planting annual acreage. At what stocking levels do you decide to replant a second or third time?

Partial Cutting

Another major aspect in establishing conifers after timber harvest is increasing the partial cutting acreage. By tempering the logging sites, the increasing numbers of harsh sites we face in the coming years will stand a better chance of successful reforestation. The best, most productive sites have been cut, and the remaining unentered areas must be treated in a more selective manner.

24-2 The reviewer would be helped in evaluating the impact of different logging practices if definitive values were given on the average timber volume removed in clearcuts and partial cuts. What is average standing volume left in partial cuts? Can you provide the average annual clearcut and partial cut acreages?

Burning/Soils

More effort should be directed to analyzing the effect of large scale burning of logging debris on soils. Very strict controls should be put on burning timetables. Fall burns, after a drying summer, invariably destroy duff and topsoil layers. As noted, "Because long-term growth data is not available from past burns, effects of burning on soil productivity cannot be quantified." By taking random soil samples immediately prior to burning, and two years later, when most leaching has decreased, changes in nutrient content could be easily determined.

Your quoted values of 17% soil productivity losses after burning, during a 17-year period in northern Oregon, could alone at least impact second growth timber potential by at least 17%! Douglas fir at age 90 yields about 27,000 BF/acre. An impact of 17% would be equivalent to a per acre loss of revenue of $1225 at stumpage values of $267 MBF! It seems ironic that chemical versus manual alternatives cost differences of a few dollars per acre are highlighted when soil productivity is worthy of much more concern.

Management Alternatives

24-3 The Impact Statement summary seemed quite skewed. It was very difficult to evaluate the presented alternatives without being given the potential harvest credit being claimed for the varying site preparation, release, and precommercial thinning operations. This had to be done by someone but it was not shared with the reviewer. This information is necessary to create a cost effective mix of options.

24-4 In Table 1-4 for vegetation altered by manual treatment, the values given are sums of site preparation, release, precommercial thinning and biologically treated acreage in Table 1-2. The value for alternative 7 (no herbicide) was presented as 48,812 acres when I believe the value should be 40,993 acres. Program cost would decrease accordingly.

24-5 The allowable harvest for the different alternatives was most directly affected by the amount of site preparation acreage. Three treatment methods that were varied very little or only to extreme conditions were mechanical scarification, gross yarding, and precommercial thinning. Appendix B shows gross yarding costs of $300-600 acre ($450/acre average) and manual spot clearing/scalping/piling at $50-250 per acre ($150/acre average). By decreasing gross yarding from the general value presented of about 7,000 acres to 3,000 acres and increasing, at the same cost, manual spot clearing/scalping acreage, 12,000 acres of manual work could be provided. The manual option provides ten times the jobs per dollar invested! The net gain in site preparation would be 8,000 acres.

24-5 Alternative 4 (labor intensive) would then have 51,723 acres of site preparation and an associated harvest level of about 1,313 MMBF. There would be the highest level of jobs provided. Alternative 6 (no aerial) would increase site preparation acreage to 50,563 acres while Alternative 7 (no herbicides) would increase to 42,127 acres of site preparation. The allowable harvests for both these options would increase significantly. This little exercise shows how easy the numbers can be adjusted. It also stresses the point that to accurately portray harvest levels derived from different forest operations, the relative importance of each operation must be presented in a numerical fashion.

To sum up, your summary that Alternative 7 (no herbicides) would cost the state so many jobs was unfair. The modified Alternative 4 (labor intensive) with decreased aerial acreage, increased ground application, increases manual cutting and spot clearing/scalping provides a potential harvest to program cost ratio that is more cost efficient than any other presented. Although with high seedling quality and timely reforestation, site preparation (other than light burning and gross yarding) and release could be eliminated almost totally without impacting harvest levels.

Economic Calculations

My earlier statement about site preparation acreage being the key indicator to your harvest level calculation was summarized from analyzing the following options:

Relationship of Harvest to Forest Operations

	Harvest (MMBF)		Site Prep.(Acres)		Release (Acres)		Thinning (Acres)	
Alt. 1	1186	(0%)	45,562	(0%)	27,413	(0%)	12,668	(0%)
Alt. 2	1188	(0%)	46,195	(1%)	28,929	(6%)	12,673	(0%)
Alt. 4	1185	(0%)	43,723	(-4%)	29,670	(8%)	12,728	(0%)
Alt. 7	957	(-19%)	34,127	(-25%)	26,232	(-4%)	10,961	(-13%)
Alt. 8	818	(-31%)	27,811	(-39%)	-0-		-0-	

24-6 It is especially noticable in Alternative 7 (no action) that site preparation acreage is the parameter that most affects harvest level as presented by BLM. The use of site preparation other than gross yarding and burning is usually done as remedial action because of late reforestation. Gross yarding could be decreased a great deal and still leave access to tree planters. Currently much less debris is left in the forest after logging than a natural, unmanaged forest ecosystem.

The most prevalent harvest method is clearcutting and use of burning for initial preparation for reforestation. If reforestation occurs in the spring after winter burning or during the following spring, no other site preparation is needed. Chemical site preparation is virtually unneeded when timely reforestation is achieved. Also the plantation established during the first two years after harvest has a much higher rate of survival than one planted four or five years after harvest. The conifers develop in a codominate manner with these pioneering brush species. Under these conditions, release operations are not cost effective when calculated under a discount rate and present net worth economic analysis.

24-7 The Impact Statement did not sufficiently recognize the relative cost parity in chemical and manual release treatments. Appendix B shows a cost difference of only 30% between chemical and manual techniques. It is noteworthy that Appendix B underestimates the true cost of chemical usage by not including impact statement costs, litigation, and extra training for government personnel that are needed to support chemical spray programs. These costs can be $20 per acre additional costs for chemical programs. Average chemical method costs of $89 per acre rise to about $109 per acre or 15% less than manual methods. When costs are this close there are many areas where manual treatment can be cheaper and more effective than chemicals. The Impact Statement alone has 28% of its pages devoted to exclusive chemical sections. Other treatments were given a few percent of the documents pages.

The following table shows that manual cutting produces 34 times the jobs aerial spraying does at the same investment level:

Labor Days per $1000 Investment

Site Preparation	Acres/Day (Table 2-9)	Cost/Acre (Appendix B)	Employee Days Per $1000
Mechanical			
Gross Yarding	2.5	$450	.9
Manual			
Cutting	2	$138	3.6
Spot Clearing/Scalping	.75	$150	8.9
Chemical			
Aerial	28	$ 85	.4
Ground	2	$101	5.0
Release			
Manual			
Cutting	.5	$118	17
Chemical			
Aerial	28	$ 68	.5
Ground	1	$103	9.7

The manual option produces 1.8 times the jobs ground release spray provides at the same cost. The tendency has been to release sooner after planting than has been the practice in the past. As aerial costs remain independent of site conditions, the relative cost of manual cutting will be reduced compared to aerial methods because smaller brush will be cut. As the practice of intensive on site forestry widens, manual methods will be cheaper and more effective than chemical use. Combining chain saw release operations with precommercial thinning at costs of $150 per acre has saved $80 per acre. Progressive contracts like these make on the ground manual practices more cost effective than chemical usage.

Cost/Benefit Analysis

24-8 Without a rigorous cost benefit analysis which includes the use of reasonable discount rates, the present document does not show how cost effective the forest operations are. Determining present net worth would indicate if federal money is being wisely used in the development of second growth forests.

Manual Methods

24-9 The impact statement says that "correct timing in applying herbicide sprays is essential in releasing young conifers...," but totally ignores timing importance in effective manual brush control. Recent work has shown how important cutting time is in reducing alder resprouting. Tanoak has much fewer sprouts and sprout lengths when cut in July as compared to February, April, and October.[1]

The impact statement quotes a study by Roberts in 1980 that says "manual cutting could result in injury to more than 20% of released conifers..." In reality, timber contracts protect leave trees by being able to fine loggers for damaged trees. Similar clauses in manual cutting contracts keep careless contractors out of the bidding market. Contractors can be penalized for nicking saplings with chainsaws. This is different from operational levels of chemical spray contracts. Potential damage to conifers does not become evident for sometimes weeks or months after treatment.

Release

24-10 The results of the chemical release study of Gralkowski and Lautenback, 1974, was used to demonstrate high conifer growth rates following treatment. A picture of the test site shows young conifers that were planted or naturally seeded below an existing brush cover. These conditions in no way duplicate present reforestation methods of planting on freshly burned or site prepared clearcuts before brush encroachment. There is very little growth difference between released and unreleased conifers when timely planting occurs.

24-11 A more recent study by Prof. Mike Newton in southwest Oregon, where it is more generally accepted that release is necessary, showed much different results.[2] The untreated plots exhibited conifer growth up to three times better than two of the chemical treatments. The untreated plots grew better than the other four chemical plots and manual plot.

24-12 The other old report quoted was by Lauterback in 1967. This study evaluated release of conifers that ranged from 5 to 20 feet in height. The standard planting and replanting methods used now make such a range of heights impractical in a promptly reforested harvest site. A large range in tree heights generally indicates reforestation failure and late replanting or natural seeding. Most current young plantations have a majority of conifer heights within a 3 foot height range. When brush grows for many years as late restocking occurs, release can bring dramatic growth gains for a few years; but these conditions are not typical of current forest management techniques.

Work Injuries

The Impact Statement seemed to relish trying to determine potential injuries due to manual brush control. The Bonneville Power Administration found 2.5 to 10.3 injuries per 200,000 man-hours of cutting. At maximum manual brush cutting rates in Alternative 7, this would mean 2 to 8 injuries per year. But the logging death rate is totally ignored. Gross yarding should be included in timber harvest budgets because it is done by the logging contractor on logs usually generated by the harvest. Since it is included as site preparation (I assume to increase "management" acres) in this analysis, a discussion of logging-related deaths or serious injury seems much more important than stressing infrequent chain saw injuries. 24-13

Sincerely,

Tom E. Dunn

Footnotes

1. Kay, Burgess L., Oliver A. Leonard, James E. Street, Control of Madrone and Tanoak Stump Sprouting, Weeds, 9:369-373.

2. Newton, Mike, Forestry Intensified Research, FIR Report, Summer, 1982.

P.O. Box 325
Grants Pass, Oregon 97526

13 August 1983

Oregon State Director, Bureau of Land Management
c/o Team Leader, Mr. Charles Hawkins
Salem District BLM
P.O. Box 3227
Salem, Oregon 97302

Dear Sir:

Southern Oregon Citizens Against Toxic Sprays have been attempting to participate in Oregon BLM planning processes since 1977. We strongly believe that the "full and fair" disclosure and discussion required by NEPA will result in better decisions on programs affecting public lands, and we have commented on BLM planning documents including the Josephine, Jackson-Klamath, and South Coast Timber Management Plans, the 1981 Field Guide to Policies and Procedures Required for Vegetation Management with Herbicides, the 1978 Vegetation Management EIS (letters 22 & 35), and numerous EAs. The 1983 Vegetation Management DEIS includes some improvements over past documents, has an attractive and efficient format, and was accompanied by public meetings which enabled free discussion, but we find that most of our previous comments are still applicable to this EIS.

Since no clear need seems to exist for a new EIS (according to the BLM's position that the present one is adequate), we are still searching for the reason one is being issued. The 1978 EIS was intended to be applicable for a ten year period (until 1987) "unless it is determined through the Bureau's annual review process that it does not adequately describe the environmental effects"; annual assessment of site-specific environmental impacts of each district's program was to be "described in a supplement" to the EIS (p. 1-1). Any identified deficiencies could have been rectified in a supplement or revision. Although it has been our belief that the 1978 EIS and its supplemental EAs have not complied with NEPA, the BLM has consistently and repeatedly claimed those documents fully meet NEPA requirements. The new EIS belies any intent to correct the deficiencies identified in Oregon District Court ("Recent court decisions affecting BLM's herbicide use in western Oregon were not taken into account in the draft." June 14, 1983 news release). While it is also stated that the FEIS "will reflect the decisions of the Circuit Court of Appeals after they are rendered", we do not understand why the Draft was published prior to these decisions. We are aware of the agency's statements of confidence in winning the appeals, but surely the chance that the District Court decisions might be sustained bears consideration, because a number of changes will be necessary if they are.

One of the District Court's judgments against the BLM involves non-compliance with 40 CFR §502.22; in this case the BLM seemed to rely on the fact that the 1978 EIS preceded the current CEQ NEPA regulations. Regardless of the Appellate Court's decision on this case, the regulations surely unquestionably apply to a new EIS, yet the Draft neither "makes clear" the scientific uncertainty and data gaps relevant to the proposed program, nor does it claim that the information lacking is not essential to a reasoned choice among alternatives. The assumptions and conclusions in the DEIS imply the information is not significant, but the public cannot adequately respond to vague implications. NEPA requires clarity. Apart from other important data gaps on nearly every aspect of the program, does the BLM contradict the EPA's judgment on their review of one of the herbicides scheduled for use (2,4-D) that "significant information gaps exist on the effects of 2,4-D" (after deferring to EPA's expertise for so long)? Of course, that statement was made three years ago, 25-1

and perhaps the major gaps have now been filled, but we have seen no reports to that effect (either in the news or in the DEIS). Several months ago we asked the EPA which of the required tests had been submitted, and were told that only one (an acute toxicity test) had been turned in. Even if the EPA proceeds to waive most or all of these data requirements for forestry use registration on the assumption of lack of human exposure with that use, that would not relieve the user of NEPA obligations. And, exposures which have occurred cannot be ignored, as they have been in this DEIS. 25-2

Returning to the question of why a new EIS is being issued, our first idea was that the agency wanted to be able to use Silvex and 2,4,5-T (which agency personnel have been predicting would soon be available again for forestry use). It appears the new EIS would facilitate the addition of these herbicides to the agency's chemical "tools" or armada, whereas the 1978 EIS prohibits their use. "Requirements for Further Environmental Analysis" (p. 14 of DEIS) states:

> ... Chemicals authorized for forestry applications after publication of this EIS will undergo analysis and documentation prior to use on BLM-administered lands.

After studying the entire EIS, we note that another relatively inconspicuous factor carries major implications for the program. The 14 "Project Design Features" listed on pp. 1-45 through 1-47 of the 1978 EIS have undergone a transition into a somewhat different list of "Application Contract Requirements" in Appendix D of the new EIS. Item 8 in the new list (which is from the BLM's Western Oregon Field Guide to Policies and Procedures Required for Vegetation Management with Herbicides) makes an important wording change in a restriction (item 11 in the 1978 EIS) which "confined" aerial herbicide application to periods of certain wind and weather conditions; the new language is that "aerial spraying operations will usually be prohibited" under the specified conditions (underlining added). About two years ago, we noticed this subtle but significant change in the Medford District EA, and it was subsequently reverted to conform with the EIS (although other Districts apparently retained the new wording). Having the Secretary of the Interior approve the 1978 EIS had its advantages for the BLM for awhile, but it also made it difficult to change requirements. Under the new rules, a requirement in the 1978 "Features" has ironically been transformed into a discretionary feature in the new "Requirements". Does this conform to the Oregon Forest Practices Act? The new EIS states that BLM minimum standards meet or exceed State rules (p. 15). 25-3

Posting of spray areas is another practice described in Appendix D of the DEIS which has become a discretionary "requirement" ("Posting of areas treated with non-restricted pesticides is not required where the local manager judges there is no likelihood of public exposure"), despite serious (unforeseen) problems involving exposure of unnotified citizens. Previous policy was apparently to post units at the beginning and/or after an operation; this does not protect hikers or hunters who enter an area prior to the posting and arrival of the crew. Persons already on the unit are not always seen by agency personnel or contractors during the required reconnaisance, and can be directly sprayed, as has reportedly occurred. However, this is not considered in "risk assessment", and instead of strengthening posting practices, they have been made more lax. Also, the sign which has been used is very small (about 5½" x 8½") and does not convey any warning or even caution; instead it states that the herbicide applied has been found "safe" by the EPA, which is absolutely incorrect. 25-4

Although "accepted mitigation measures" are mentioned on page 7 of the DEIS, we do not find that any are proposed or assured. A possible mitigating measure ("Adverse impacts on wildlife populations could be reduced by treating no more than 25 percent of the 0-15 year seral stages within a wildlife habitat area during any 3-year period") is accompanied by no indication of whether it is intended or seriously considered; descriptions of the alternatives seem to accept the fact that the preferred program 25-5

or any that have a chance of being selected, will have adverse impacts on wildlife, as well as other components of the environment which the Bureau is mandated to protect.

The "Attitudes and Opinions" section of the DEIS (pp. 40-41), besides containing some amazing conclusions and insulting remarks about that portion of the "public" which opposes certain management practices, also includes observations that should point the way toward NEPA compliance. A good look at the agency's preferred alternatives (Both past and present) amply demonstrates that the BLM does not have "a bias against using herbicides" and is not "in the middle" of the controversy. The proposed programs and alignments in current litigation speak for themselves. Opponents" concerns are described by emotional words like "fear" and "anxiety", while allies' views are presented as sound and reasonable. If agency documents would include full and fair disclosure and discussion, the basis for proponents' confidence in herbicide "safety" would be removed. The "public" is also not wholly "non-professional"; critics of BLM policies and practices include professionals in many fields, including forestry. Even non-professionals should not be demeaned and belittled when the agency cannot (or refuses to) answer pertinent and important questions. A program based on unsupported assumptions demands public attention and scrutiny. BLM foresters and managers are supposed to be accountable to the public and are supposed to encourage public involvement.

It is exactly because "parties to the controversy do not even agree on the identification of credible sources of information and analysis or on the definition of legitimate scientific research" (p. 41) that scientific disagreement and uncertainty must be discussed as required by NEPA. Unless the BLM does not consider information on long-term effects important to a reasoned decision, the following passage quoted from page 41 of the DEIS clearly explains why "worst-case analysis" is necessary:

> ...In some cases (especially concerning long-term effects) the scientific evidence may simply be inconclusive. Therefore, questions concerning the effects of using a particular chemical, though they appear to be scientific questions, may have to be answered today in social and political terms. Conclusive scientific analyses may not be available for years.

We expressly request the BLM to identify and attribute the "sound scientific conclusions" which "some segments of the public may distrust or reject ... because they cannot understand the analytical process leading to the conclusions and/or because they have come to consider all scientific studies concerning herbicides to be inconclusive or dubious." The only distrust or rejection we have felt or observed in regard to conclusions (including conclusions other than those involving herbicide studies) has arisen from the agency's inability or refusal to disclose "the analytical process leading to conclusions". If the analytical process is available and the non-professional public is not able to understand it, there is a professional public who can, and they can explain it to the non-professional public if the agency is unwilling to do so. From the manner in which certain studies are described in the DEIS, it appears that it was not expected that the public has already read (or will read) those references.

On the subject of references and scientific studies, we believe that a literature review supplement should be required annually. The DEIS has carefully avoided any definite commitments for supplements, which is another possible reason for its existence. In its comments on USFS's R6 Programmatic EIS, the EPA recommended yearly supplements.

The above comments have principally addressed the process of the EIS. In regard to content, we will focus on three major subjects: alternatives, herbicide information, and forest ecology.

Alternatives

Appendix A describes "Results of Scoping" (meetings and correspondence). While some of the alternatives developed for the EIS directly or reasonably relate to those suggested in the scoping process (M=2, L=5, F=6, P=7, B=8), it is highly unlikely that any of the "extreme" alternatives or those that do not make all methods available would be selected by the BLM. Our members were particularly interested in seeing a feasible alternative to a herbicide-dependent program presented. It was brought out in the meetings that such an alternative would incorporate most of the non-herbicide suggestions (A through K, N through S, and even M, using different assumptions). However, some of these suggested methods or features have taken unexpected turns, or have disappeared. H and I are described as elements of A, and K is shown as an element of D, which are then dropped because they are assumed to be included under all alternatives and "used whenever feasible". Experience has shown they are not going to be

25-6 "feasible" unless included as specific objectives. It can be deduced from the brief "Specific Guidelines by Alternatives" in Appendix 6 that some of the alternatives emphasize preventive treatments more than others, but this important fact is not mentioned in the descriptions or evaluations of alternatives.

Integrated Pest Management (IPM) is based on preventive practices. While we realize

25-7 that IPM "was often defined differently" in the meetings, a basic tenet is that chemicals are used as a last resort. The IPM suggestion (D in scoping) is transformed in the DEIS into the BLM's preferred alternative which features herbicide use (herbicide use is projected for more than twice the acres of any other method of treatment); this is rationalized by a Glossary definition of IPM which states "Use of several techniques ... as one system to gain control of animals or plants existing in areas where they are unwanted." We strongly object to this definition and the designation of Alternative 1 as IPM. "Unwanted" is a term antithetical to IPM in the sense that the BLM uses it. IPM begins with a thorough investigation into the role of a plant or other "pest" in an ecosystem and aims toward ecosystem stability. We do not find that ecosystem stability is an objective of Alternative 1, but it was essential to the alternative we wanted to see developed.

25-8 We doubt if any of the suggestions for increasing labor-intensive practices were aimed at increasing back-pack spraying, but those suggestions were transformed into Alternative 4 which projects more spraying than any other method. We believe the suggestions came from people who wanted more non-chemical manual work and increased utilization of forest products that are presently being poisoned and burned.

25-9 Alternative 4 also has a big loophole for substituting aerial herbicide application "where ... objectives could not be met by manual methods"; other alternatives have the same type of clauses and could end up being markedly similar to the preferred alternative.

In dropping Alternative A (page 72), it is claimed that "Under all alternatives, efforts will be made to use competing vegetation where markets for it exist." The BLM must look beyond existing markets; conditions have been changing rapidly in the last few years. Certain needs and trends towards better utilization are evident. There must be conscious planning to stop wasting resources. Table 1-6, which shows the relationship of the various alternatives to LCDC goals, reveals the BLM's inaction on this issue; regarding Goal 9 ("To diversify and improve the economy of the State"), the DEIS states, "Economic diversity would not be affected by any alternative." Economic diversity <u>could</u> be affected under the alternatives that were discarded or disregarded from scoping; those methods and objectives all fit together toward that goal. If implemented, the aggregate product value of the material utilized could balance the

25-10 cost of "treatment", creating a truly cost-beneficial program. We did not find the economic analysis that "will be a part of each alternative" (according to item R on page 73 of the DEIS), but we doubt that any of the alternatives can actually be cost-beneficial as described. Where are these analyses, and where are the formulae used

25-11 for the revisions of the Allowable Cut figures? Have assumptions of efficacy for herbicides and lack of efficacy for other methods been substantiated yet? We requested that if the BLM now has analyses of field data, that they be included with the EIS.

The suggestion to treat vegetation management as a thinning project (G in scoping, page 72) was dismissed because it "would not represent a viable alternative during a stand's early stages of growth." However, people <u>are</u> using this method to profitably manage forest lands, and it could be applicable to BLM lands through both conventional and stewardship contracts. A combination release and pre-commercial thinning is accomplished in the first entry, and this is followed by thinning re-entries at 5 to 10 year intervals, each re-entry netting increasing value.

The feasibility of handpulling is not adequately described; it is applicable to a

25-12 wider range of species and age of plants than indicated in the DEIS. The BLM should explain the reasons for excluding Horowitz's work on this and other subjects. The advantages of selective retention of brush and hardwood species on conifer plantations does not appear to be considered at all. Also, the different specifications required for different types of treatments are not discussed. Although small manual contracts involve relatively more administrative work in setting up the contract than

25-13 large-scale non-selective operation contracts, it is admitted on page 12 that continuous administration is required for herbicide and burning operations. How does this balance out in man-hours, and are the advantages of selective treatment figured into the cost/benefit analysis? Are any long-term studies underway regarding conifer

25-14 damage or other effects from spraying? We do not find any specifics about efficacy monitoring in the DEIS. Table 1-4 should be referenced to the data base for figures

25-15 and conclusions; if they are estimates, that should be clearly stated and the basis for the estimate referenced.

25-16 Many of the assumptions attending the alternatives seem unwarranted, such as those concerning suitable weather conditions for programmed treatments. The EIS should disclose the acreage of past prescriptions that were not accomplished for such reasons. For instance, over the past few years, how much burning was planned that could not be done because of smoke management restrictions or other conditions? If any, did it delay treeplanting?

25-17 Although accident hazards of manual cutting are discussed, we find nothing about accidental burns or the possibility of any accidents with drip-torch ignition. The word "napalm" is entirely avoided in defining gelled gasoline, and the hazard of misapplication, pilot error, or transportation spills are not covered. Combustion products of burning sprayed vegetation are not mentioned; DEQ monitors air only for particulates, as stated on page 14 of the DEIS. Incidents and spills involving

25-18 herbicides have been accompanied by the same (or more stringent) requirements as those currently "assured"; they were surely not expected, so why should the BLM not expect others?

Are undisclosed treatment acreage targets the "musts" of program planning? If so, this subject must be explained.

At the scoping meetings, we suggested and requested that someone (such as an NCAP representative) be allowed to review the Draft before it was finalized. A primary reason for this was to try to insure an acceptable alternative that we could support. This was not allowed, and an alternative which does not appear to be feasible cannot

25-19 garner support from either the public or the agency. The methods and objectives to which we referred in scoping could all be included in Alternative 7, but it was not presented that way in the EIS.

Herbicide Information

While the DEIS contains some accurate and informative material on herbicides and toxicity, it is interspersed with inaccuracies, misleading and one-sided statements, and unattributed opinions presented as fact. There is no attempt to evenly report scientific disagreement. Most of these problems could easily have been resolved by allowing the material to be reviewed prior to publication, but they are too numerous to cover in these comments. We will mention only a few points at this time.

25-20 We have repeatedly raised the issue that reliance on material based on proprietary data violates 40 CFR 1502.21. The 1981 USFS Herbicide Background Statements contain much information based on proprietary data, and it is possible that some of the other references used by the BLM do also. The cited section of the NEPA regulations states:

> ... No material may be incorporated by reference unless it is reasonably available for inspection by potentially interested persons within the time allowed for comment. Material based on proprietary data which is itself not available for review and comment shall not be incorporated by review and comment shall not be incorporated by reference.

If the agency holds otherwise our point should be refuted, not simply ignored. We have also cited other reasons for the unsuitability of relying on these Background Statements, including incorrect information and their failure to show authorship. 40 CFR 1502.17 states:

> The environmental impact statement shall list the names, together with their qualifications (expertise, experience, professional disciplines) of the persons who were primarily responsible for preparing the environmental impact statement or significant background papers, including basic components of the statement. ...

The 1981 USFS R6 Programmatic EIS did not identify the preparers of the Herbicide Background Statements, and this information was not even divulged in response to an FOIA request. The BLM could use substantiated non-proprietary information from the Background Statements, but it is our understanding that they should not be incorporated by reference.

The description of the analysis of the 1971 Hansen study on pages 57-58 of the DEIS is inaccurate. Until the recently-contracted review of the histopathologic data from this study, Dr. Melvin Reuber was the only pathologist who had reviewed the slides since the original analysis. For the past two years, BLM documents have been claiming that the slides had been reviewed by the Armed Forces Institute of Pathology, and that their findings were negative (in conflict with Reuber's findings). After repeated inquiries for the AFIP report, we were informed that was a misunderstanding, yet the same information was included in 1983 EAs. After challenging it again, we were informed by the Regional Solicitor that Dr. Robert Squire had examined the data, and that the AFIP reference would be dropped. However, the important point is that the Squire examina-

25-21 tion was <u>inconclusive</u> (we have not yet been able to obtain the report so are only repeating the information conveyed by the Regional Solicitor). On page 58 the DEIS is a statement concerning this matter:

> EPA has since contracted an additional review of the histopathologic data which did not support these contentions. (Reuber's) BLM currently knows of no substantiation for Dr. Rueber's (sic) interpretation of these studies.

Does this refer to the Squire review? Why is it not referenced? Does "inconclusive" equate with "did not support these contentions"? If so, does it support the contentions of the original report? If not, why is that not mentioned? This is just one example of unattributed, misleading information.

Another example is found on pages 107-108 regarding "2,4-D Contaminants". This unattributed piece derides unidentified and undefended "allegations based on incorrect evaluation of the data". Unsupported opinion like this should not be presented as fact in an EIS. Most of these claims have been rebutted in court. The only dioxin discussed here is DCDD, which is considered to be the least toxic of 75 dioxins.

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9-13-83

TO: B.L.M.

Dear Sirs

I think your E.I.S. Stinks. I thought you were supposed to reevaluate it because of the herbicide controversy. And so you decide to use more sprays. That's not right. The people who live in these watersheds dont want toxins in their water or air. We want more jobs, such as manual release jobs, so when the timber industry leaves we will have something to work with. I used to think the Govt. would look out for our health. But now I believe ~~they~~ you ~~only~~ consider economic interests first and foremost and leave health + long term interests to take care of themselves.

Sincerely
Mel Cahal
Humbug crk Rd.
Applegate or 97530

27

A.C.O.T.S.

Applegate Citizens Opposed to Toxic Sprays
P.O.Box 291 Applegate, OR. 97530

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Madeline Rosenstein
EDUCATION
Richard Duree
FOREST MANAGEMENT
"Slats" Salisbury
FUND RAISING
L. E. "Gene" Baker
HEALTH
Lynn E. Anderson, M.D.
Mary C. ODonahue, R.N.
LEGAL
David Ah Soon
LEGISLATIVE
Dolores Lisman
NEWSLETTER
Margo Rosenstein
PUBLICITY
Gordon Farnsworth
T.E.L.A.V.
Chant Thomas
WILDLIFE
Joan Peterson

August 13, 1983

Oregon State Director
Bureau of Land Management
C/O Team Leader
P.O. Box 3227
Salem, Oregon 97302

Re: DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR WESTERN OREGON PROGRAM MANAGEMENT OF COMPETING VEGETATION

Dear Team Leader:

The Applegate Citizens Opposed to Toxic Sprays (ACOTS) considers the Bureau of Land Management (BLM) June 1983 Draft Environmental Impact Statement on Vegetation Management (EIS) to be wholly inadequate. ACOTS will try to outline these inadequacies and needed changes in the proposed EIS as it has during the public meetings held in the Medford area, with the hope that the decision maker may see the folly of the continued emphasis on chemical use in forestry and reject the proposed Alternative Number 1.

27-1 1. It seems since BLM is presently carrying out and continues to plan a program of "intensive timber management", a detailed discussion should be included in the EIS relating to each alternative to these practices. If all the proposed alternatives were matched first against this criteria, it would make a difference as to how alternatives are formulated and whether that can meet those "intensive timber management" goals.

27-2 2. The Eis does not set up each alternative equally based on General Assumption #2 on pg. 77 which calls for meeting stocking and allowable harvest goals. How can the decision maker possibly make a reasonable decision when each alternative meets a different target stocking level and cut level? It seems the allowable cut goals and target stocking levels should be the basic ingredient that all alternatives must have in common. Otherwise, the EIS is being planned only for the proposed alternative and simply because it is required by law.

27-3 3. The stated purpose of this new EIS on pg. 2, -"an updated EIS is needed to address the increasing emphasis on non-chemical methods and will also provide more recent information on herbicides", is incapable of being justified or defended, given the proposed increased use of chemical treatment in BLM Medford. (The 1982 Medford EA treats 10,000 acres chemically, the new EIS

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27-4 proposes 13,000 acres treated chemically each year). Where in the Eis does it address the increasing emphasis on non-chemical vegetation management treatments"? Except for a few unexplained references to manual treatment studies, and "field experience", or the inclusion of the scoping meetings (appendix A), there is no addressing of non-chemical vegetative management treatments. The difference of 11,000 acres treated annually under site preparation (Pg 4, table 1-2) between chemical and manual treatment is a good example. There is no discussion anywhere as

27-5 to why there is a total of 14,561 of Site Preparation acres assigned to manual treatment and 25,562 acres assigned to chemical Site Preparation.

4. The proposed EIS proposes nothing new and gathers irrelevant data instead of stating the real problems connected with selecting alternatives and finding solutions. The lack of public involvement and the yawns of those people who did attend the scoping sessions is a good example of the public's lack of confidence in BLM solutions to problems. The issues and concerns addressed by the citizens that did attend the scoping meetings is a good example of well-articulated problems, but the EIS shows indifferent solutions.

5. We believe the proposed EIS and Alt. 1. is promising more than it can deliver. In a recent statement about the Pacific Coast States, Brian Wall, a Forest Service Economist says, "all our projections show they

27-6 can't sustain the volume of harvest - the inventory is dropping dramatically." This means that the Sustained Yield Harvest levels claimed for Alternatives 1 and 2 (pg. 3 Alternatives), may not be met without lowering the allowable cut and therefore makes the other alternatives more viable. The EIS also promises more than may be true with regard to the health effects and the cumulative and synergistic effects of herbicide use. There is considerable evidence as proved by the recent legal judgements that declare the BLM has failed adequately to examine the human health impacts of herbicide application.

27-7 6. There is little or no discussion of the effectiveness of manual vegetative management treatments. There is a paucity of research and actual data on manual treatment. We recently asked BLM Medford to establish research through their Forestry Intensive Research (FIR) program on the effectiveness of manual treatment. They refused on the basis that it must be studied in conjunction with a control plot and an herbicide plot. We cannot see BLM's reluctance to verify the effectiveness of manual treatment on its own merits on various sites and then compare that effectiveness with similar herbicide sites. The effectiveness of various treatments is a major issue in this EIS and deserves much more discussion than it has been given.

27-8 7. The cost effectiveness of manual treatments vs. herbicide treatments is not treated equally in the EIS. The EIS admittedly does not include costs of litigation, EIS preparation or other external costs outside the timber industry. Though claimed as fixed costs by the EIS preparers these unentered cost figures must be added to the herbicide alternatives. It is nothing but speculation on the part of BLM that these costs would be incurred on other management alternatives.

8. The prevailing approach of the EIS is to prescribe herbicide application regardless of other management options available. The BLM has remained resistant despite mandated policies and guidelines to use the concepts of Integrated Pest Management (IPM). BLM needs to integrate IPM into its management practices and move away from its narrow goal of broadcast

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aerial herbicide application. What more appropriate time than now while a new EIS is being drawn and a large portion of BLM is prohibited from spraying herbicides by the Federal courts?

9. The inclusion of Precommercial Thinning in every alternative except the No Action alternative leads to the misconception that there is more manual treatment involved than is really true. Precommercial Thinning has long been established in its own right as a power saw operation on trees 10 to 25 years of age, and where herbicide applications are used infrequently. BLM should be considering Precommercial Thinning as part of a separate timber sale program and not consider it as part of vegetative management. Deleting the precommercially-thinned acres makes a much more realistic picture of how many acres are really being managed manually under the proposed Alternative I. The Manual Management would be approximately 7% of the herbicide program. We would consider that percentage as not truly addressing non-chemical treatment as stated in the purpose on pg. 2. If Precommercial Thinning is going to continue as

27-9 part of the vegetative management program, the EIS should address the forest by-products that should be utilized and not wasted from the thinning operation. The same should be true of Gross Yarding.

10. The Eis represents a definite bias in favor of the use of herbicides. On pages 48 and 49 the EIS sings the praises of chemical treatments while citing studies (Roberts 1980) on how brush density would increase five-fold and 20% of released conifers would be injured by manual re-

27-10 lease. The reference to the Roberts study failed to mention that this study utilized a non-operational performance specification (the clear cutting of all brush, regardless of crop conifer location). The Roberts study is not representative of operational conditions.

27-11 The inference that extra costs would be incurred "due to the use of less effective practices such as manual cutting (pg 76) is unfounded. Tabulation of awarded contract bid prices for manual cutting actually averaged above $100 per acre with a wide variation on either side de-

27-12 pending on site and market conditions (Koven and Miller, 1979). Few Federally managed districts have made serious efforts at utilizing manual/brush control, although those few (including most notably Mapelton District, Siuslaw National Forest) have had substantial success in their efforts. The worker injury frequency rates attributed to manual

27-13 treatment on pg. 56 sound quite hazardous, when in reality, worker injury rates, reported from current situations is not significant, involving mostly cuts and bruises (Koven 1981).

We could write on concerning BLM's bias toward herbicide use and their judgements based on projected low treatment costs and assumed benefits from increased growth, and the pressures to intensify management programs. But suffice to say that their huge aerial spray programs have come to dominate planners minds and dominate vegetation management.

27-14 11. The EIS is faulty in that it is not specific for each BLM District. References to salmonberry and vine maple sprouts (pg. 49) have little to do with problems in BLM Medford. There should be vast differences in management procedures as there are in rainfall, temperatures, soils, etc. BLM is trying unsuccessfully to lump all vegetative management into one EIS when geographic conditions warrant individual EIS's.

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27-15 12. BLM's EIS has failed to incorporate the cumulative management effects of other Federal agencies and private land holders using chemicals and burning on adjacent lands. A BLM program that may not be significant by itself could have a hazardous effect when coupled with another agency or land holder. If 54% more acres are to be burned each year by BLM, and other Federal agencies and private land holders increase their burning by the same percentage, is there not the possibility that the air quality, soil productivity, and water quality could be significantly affected? There is no discussion of the cumulative effects of these particular actions within the BLM. Neither is there a discussion of the degree of degredation that will be allowed. BLM guidelines call for improvement of existing problems, but we see only an increase in the degredation of the environment.

27-16 13. BLM's EIS has failed adequately to examine the human health impacts of pesticide application. Three different judges have ruled that BLM must prepare a worst case analysis to comply with Federal law. If BLM is really interested in "increasing emphasis on non-chemical vegetation management treatments" they would comply with the courts' ruling and proceed to reduce their dependence on these hazardous chemicals. They cannot abdicate the users' responsibility to ascertain safety.

14. We do not believe BLM has acted in good faith towards the public in the preparation of this EIS. As we have pointed out, the EIS is inadequate, misleading, based on faulty assumptions, and breaks the law and BLM guidelines. It forces ordinary citizens to take hours of their time to protest and appeal practices that should not be incorporated by BLM in the first place. It costs the tax payers vast amounts of money for litigation and other unnecessary procedures. When will BLM recognize that good vegetative management does not always have to entail chemical use, that citizen input is necessary and should be used, and that their primary goal should be enhancement of the forest and its environment, and not the attainment of the allowable cut?

Sincerely,

Christopher Bratt

Christopher Bratt - Co-Chairman

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U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION X

1200 SIXTH AVENUE

SEATTLE, WASHINGTON 98101

REPLY TO ATTN OF: M/S 443

AUG 15 1983

William G. Leavell, Oregon State Director
Bureau of Land Management
P. O. Box 3227
Salem, Oregon 97302

Re: Draft EIS - Western Oregon--Management of Competing Vegetation Program

Dear Mr. Leavell:

The Draft Environmental Impact Statement (DEIS) for the Western Oregon--Management of Competing Vegetation Program is a substantial improvement over previous BLM environmental impact statements on this topic. We had the opportunity to work with your staff during scoping for this EIS, and are pleased to see that your office has addressed many of the issues raised at that time.

Vegetation management, and the potential widespread use of herbicides over an especially large area (i.e., Western Oregon), is a matter of considerable concern to this office. Several important points and questions were identified during this review. These are enumerated in the two attached appendices:

A: General comments
B: Specific comments regarding environmental consequences.

EPA has rated this Draft EIS LO-2 [LO-Lack of Objection; 2-Insufficient Information]. We appreciate the opportunity to review the report. Should you wish to discuss our comments and recommendations, please contact Richard Thiel, Environmental Evaluation Branch Chief, at 442-1728 or (FTS) 399-1728.

Sincerely,

for Ernesta B. Barnes
Regional Administrator

Attachments: Appendices A & B

19 AUG REC'D

ADDENDUM TO EPA REGION 10 COMMENTS
Draft EIS - Western Oregon--Management of Competing Vegetation Program

APPENDIX A - GENERAL COMMENTS

1. Chapter III: Environmental Consequences (especially pages 56 - 61).

28-1 There are several errors, misrepresentations, and instances where information and conclusions are "too absolute" or unsubstantiated. Assessing the environmental consequences of herbicide chemistry and use must account for scientific and experimental error or information not fully known. We have identified several situations which require only minor substantive or editorial changes. These are marked with an asterisk in Appendix B. We recommend that the Final EIS be edited carefully so that information and conclusions are presented accurately in light of what is known and what is unknown. This editing will result in a more accurate discussion of consequences.

2. Appendix F: General Descriptions and Summaries of Fates and Impacts of Chemicals Proposed for Use.

28-2 This appendix should be supplemented with an analysis of environmental persistence for each herbicide. The analysis should be included in the analysis of each herbicide.

3. Appendix I: BLM Administered Lands in Municipal Watersheds.

28-3 Seventy-four cities are listed which use watersheds affected by BLM's vegetation management strategies. Each of these affected cities should be given the opportunity to: (a) assess the impact of the vegetation management program, and (b) provide BLM with an analysis of anticipated effects of this program on their water quality and watershed operations, and recommendations for measures to ameliorate potential harm. These evaluations should be included as an appendix to the Final EIS.

ADDENDUM TO EPA REGION 10 COMMENTS
Draft EIS - Western Oregon--Management of Competing Vegetation Program

APPENDIX B - SPECIFIC COMMENTS REGARDING ENVIRONMENTAL CONSEQUENCES

This addendum enumerates specific comments and changes needed in two sections of Chapter III - Environmental Consequences. These sections, under the title "Impacts on Human Health," are: (a) Chemical Treatment, pages 56-60, and (b) Conclusions, pages 60-61.

For reference, we have numbered the paragraphs in each section separately. The following comments are referenced to the numbered paragraphs.

Section - Chemical Treatment:

28-4 #1 - line 1: "They are ..." should read "Most are ...". *

28-5 #1 - last line: should read "... toxicity of most herbicides ...". *

28-6 #2 - line 9: "... to have significant mutagenic or carcinogenic impact." More information and supporting authority is needed to establish a quantitative meaning for this phrase.

28-7 #5 - last sentence: The statement is misleading, especially in the use of the word "few." We believe the sentence should be rewritten to more accurately reflect conclusions of laboratory research relating to mutagenicity and carcinogenicity. For example, the National Toxicology Program and National Cancer Institute have identified scores of chemicals that are proven animal carcinogens in one test system or another. However, it is unknown for a large number of these same chemicals whether they might also cause cancer in humans.*

28-8 #7 - line 2: "... having carcinogenic ..." should read "having significant carcinogenic ...".*

28-9 #12 - line 1: should "amino" be "amine"?

28-10 #13 - line 8 and #14 - line 3: the correct spelling is Umea.

#17 - sentences 2 & 3: The arguments that "... the risk associated with either occupational or environmental exposure is so small as to be essentially equal to zero." and that there may be "... no significant risk ..." may be theoretically true, but should be supported with factual evidence relevant to the proposed use of herbicides on Oregon forests.

#20 - line 1: 2,4,5-T can no longer be applied.

28-11 #23 - last sentence: "... would not result in absorption ..." should be substantiated or modified to indicate a threshold of absorption.*

Section - Conclusions:

28-12 #3 - line 2: "... low order of mammalian toxicity ..." should be supported by indicating quantitative values where appropriate. This may be a factor to include in the analysis presented in Appendix F.

28-13 #3 - last sentence: should begin "Most herbicides ...".*

28-14 #4 - line 3: "... that herbicides ..." should read "... that nearly all herbicides ...".*

29

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Division of Ecological Services
Portland Field Office
727 N. E. 24th Avenue
Portland, Oregon 97232

Reference: CC:mm

August 23, 1983

MEMORANDUM

To : Oregon State Director, Bureau of Land Management
Salem, Oregon

From : Field Supervisor, Ecological Services, Portland, Oregon

Subject: Review of the Western Oregon Program--Management of Competing Vegetation Draft Environmental Impact Statement

We have reviewed the draft environmental impact statement (EIS) on the Western Oregon Program for the Management of Competing Vegetation and find that the document is generally well prepared. Essential elements of the plan and their probable impacts are presented in a straightforward and objective manner. However, we have a number of concerns which are discussed in the following comments and should be addressed in your preparation of the final EIS.

General Comments

29-1 Based on the information submitted, it appears that the proposed management plan could have a significant adverse impact on area fish and wildlife resources. The document does not specifically discuss impacts of the preferred alternative on anadromous and resident fish. Such a discussion should be included in the final EIS. In addition, the loss of wildlife through habitat reduction should be discussed in more detail in the final document. It should also be clarified whether wetland areas within the management unit will be affected.

29-2

29-3

29-4 It is our belief that proper guidelines and selected mitigative measures should be fully coordinated with appropriate state and federal resource agencies and incorporated in any future management or operational plans that you subsequently adopt. The final document should also consider all practicable means and measures that could best satisfy identified needs while at the same time protecting, preserving, and enhancing the quality of the environment and minimizing unavoidable adverse effects. We are especially concerned about the application of herbicides on and adjacent to riparian buffer strips associated with stream corridors.

Specific Comments

29-5 Page vi. There is no indication of which animals would be impacted or benefited. This should be categorized.

29-6 Page 2. It should be shown where the commercial hardwood lands are located.

29-7 Page 27. The wetland and aquatic section should be detailed and expanded. There is no indication what would be affected.

29-8 Page 51. **The unidentified populations of threatened or endangered plant species that would be impacted should be documented. We suggest that you make the following contact to assist in complying with the Endangered Species Act.**

Mr. James Bottorff
Endangered Species Team Leader
U.S. Fish and Wildlife Service
2625 Parkmont Lane
Olympia, Washington 98502
Phone: (206) 753-9444

29-9 Page 51. There is no discussion of impacts to terrestrial vertebrates. This should be included in the final document.

29-10 Page 53. Fishery data are incomplete and should be expanded to include what species and habitats would be impacted.

29-11 Page 54. The proposed action would unavoidably reduce animal populations and diversity. It should be documented how this action relates specifically to threatened and endangered animals.

We urge reconsideration of those aspects of the plan which would adversely affect fish and wildlife resources. Please feel free to contact us if you have any questions concerning our comments. We would also appreciate receiving a copy of the final statement when it becomes available.

Russell D. Peterson

Russell D. Peterson

30

Umpqua Valley Audubon Society

P.O. Box 381, Roseburg, OR 97470

December 20, 1983

Oregon State Director
Bureau of Land Management
c/o Team Leader
P.O. Box 3227
Salem, Oregon 97302

RE: The Western Oregon Program - Management of Competing Vegetation, Draft Environmental Impact Statement

Our organization would like to offer the following comments on the Draft Environmental Statement referenced above. Although the deadline for comments has passed I understand that the final EIS has not yet been prepared. If possible, we would like these comments to be considered in preparing the final EIS; otherwise please consider these comments in the decision process.

30-1 The EIS is inadequate in addressing the impact that the various alternatives will have on wildlife and the habitat supporting the wildlife. The statement does not quantify the impact of each alternative on each wildlife population nor does it specify the species involved. It would be helpful if indicator species for each habitat could be identified and the impact on the indicator species under each alternative described.

30-2 The economic analysis uses the years 1978 through 1981 as the current condition. Employment and earnings for each of those years should be described. More important, however, would be the inclusion of 1982 and 1983, if possible. Employment conditions for the previous ten years on a year-by-year basis should be included so that a reader of your EIS can determine whether the years 1978 through 1981 are representative of the employment and earning conditions in Western Oregon.

Sincerely,

James A. Arneson
Conservation Chairperson

JAA:sf
cc: Roberta Amott

31

United States Department of the Interior

BUREAU OF RECLAMATION
PACIFIC NORTHWEST REGION
FEDERAL BUILDING & U.S. COURTHOUSE
BOX 043 - 550 WEST FORT STREET
BOISE, IDAHO 83724

IN REPLY REFER TO PN 150
120.1

MAR 25 1986

Memorandum

To: Oregon State Director, Bureau of Land Management (935), P.O. Box 2965, Portland, Oregon 97208 (Attention: R. Gregg Simmons)

From: Acting Regional Environmental Officer, Bureau of Reclamation, Boise, Idaho

Subject: Supplement to the Western Oregon Program-Managment of Competing Vegetation (DES 86-7)

The subject document has been reviewed by appropriate members of our staff, and we have no objection to the contents. Please let us know if we can be of further assistance in the review process.

Douglas J. James

cc: Commissioner, Washington, D.C., Attention: 150

32

Monsanto

MONSANTO AGRICULTURAL COMPANY
800 N. Lindbergh Boulevard
St. Louis, Missouri 63167
Phone: (314) 694-1000

April 4, 1986

Oregon State Director
Bureau of Land Management (935)
c/o R. Gregg Simmons
P. O. Box 2965
Portland, Oregon 97208

Dear Mr. Simmons:

This letter is written in response to the Draft EIS entitled "Supplement to the Western Oregon Program - Management of Competing Vegetation," dated February, 1986. We are pleased to be afforded the opportunity to comment on this document.

We wish to update the discussion on page L-109 of this draft EIS concerning glyphosate oncogenicity information issued by the EPA in mid-1985. In this summary, the EPA had concluded that glyphosate should be classified in Category C. This category is used for chemicals which have shown limited evidence of carcinogenicity in animals in the absence of human data. This issue as well as the suggestion by Dr. Edward Calabrese for an independent pathologist review of the Monsanto data have now been resolved.

32-1 In early 1986 the EPA referred the glyphosate mouse oncogenicity question to its Science Advisory Panel. The panel met on February 11, to consider the proposed category C classification as well as the premises upon which the Agency had considered glyphosate to be a weak oncogen. On February 12, the panel issued a statement in which it concluded that no oncogenic effect was demonstrated in the glyphosate chronic mouse study when the data were compared to concurrent control (untreated) animals. The SAP recommended that glyphosate be classified in group "D" which is intended for agents with inadequate animal evidence for oncogenicity.

Mr. R. Gregg Simmons
April 8, 1986
Page 2

Additional information and evaluations provided by Monsanto to the EPA and subsequently to the Science Advisory Panel included histopathology reviews by Marvin Kuschner, M.D., Dean, School of Medicine, State University of New York (Stonybrook), Klaus L. Stemmer, M.D., Institute of Environmental Health, University of Cincinnati, and Pathco, Inc., Potomac, Md., a firm of consulting pathologists. In addition, Robert A. Squire, D.V.M., Ph.D., Ruxton, Md., Robert E. Olson, M.D., Ph.D., Professor of Medicine, State University of New York (Stonybrook), reviewed the data. All of these eminent scientists independently concluded that glyphosate was not oncogenic in the subject mouse study.

We maintain that glyphosate is one of the most thoroughly tested pesticides registered today. Its complete and contemporary toxicology data base demonstrates that glyphosate has a favorable toxicity profile. Using this toxicity data and various worst case exposure scenarios, the authors of this EIS were able to develop a number of hypothetical assessments of risk to workers and the public. The very large margins of safety for systemic and reproductive effects plus the minuscule added lifetime risk (a mathematical probability never greater than 2 in 1 billion) underscores the fact that glyphosate may be used without harm to man or the environment.

Again, we thank you for the opportunity to comment on this Draft EIS.

Sincerely,

Robert W. Street
Manager, Product Health & Safety
-- Quality Assurance

/ac

33

Executive Department
155 COTTAGE STREET NE., SALEM, OREGON 97310

April 15, 1986

Gregg Simmons
Bureau of Land Management
Oregon State Office
P.O. Box 2965
Portland, OR 97208

SUBJECT: Supplement to the Western Oregon Program-
Management of Competing Vegetation
PNRS #OR860307-023-4

Thank you for submitting your draft Environmental Impact Statement for State of Oregon review and comment.

Your draft was referred to the appropriate state agencies for review. The Departments of Agriculture and Forestry offered the enclosed comments, which should be addressed in preparation of the final Environmental Impact Statement.

We will expect to receive copies of the final statement as required by Council of Environmental Quality Guidelines.

Sincerely,

INTERGOVERNMENTAL RELATIONS DIVISION

Dolores Streeter
Clearinghouse Coordinator

DS:bm
Enclosure

OREGON INTERGOVERNMENTAL PROJECT REVIEW

State Clearinghouse
Intergovernmental Relations Division
155 Cottage Street N. E.
Salem, Oregon 97310

Marion, Linn, Doug., Coos, Curry, Jackson, Josephine Counties

Phone (503)378-3732 or Toll Free in Oregon 1-800-422-3600

STATE AGENCY REVIEW

Project Number OR 860307-023-4 Return Date: APR 11 1986

To Agency Addressed: If you intend to comment but cannot respond by the return date, please notify us immediately. If no response is received by the due date, it will be assumed that you have no comment and the file will be closed.

PROGRAM REVIEW AND COMMENT

TO STATE CLEARINGHOUSE: We have reviewed the subject Notice and have reached the following conclusions on its relationship to our plans and programs:

( ) It has no adverse effect.

( ) We have no comment.

( ) Effects, although measurable, would be acceptable.

( ) It has adverse effects. (Explain in Remarks Section.)

( ) We are interested but require more information to evaluate the proposal. (Explain in Remarks Section.)

(X) Additional comments for project improvement. (Attach if necessary.)

REMARKS (Please type or print legibly)

Agency Forestry By

IPR 82 Phone Number 375-5387

Forestry Department
OFFICE OF STATE FORESTER
2600 STATE STREET, SALEM, OREGON 97310 PHONE 378-2560

April 10, 1986

R. Gregg Simmons
Oregon State Office
Bureau of Land Management
P.O. Box 2965
Portland, Oregon 97208

Dear Mr. Simmons:

The State Forestry Department has reviewed the Supplement to the Western Oregon Program - Management of Competing Vegetation Environmental Impact Statement. We agree with the general conclusions of the "worst case analysis"; however, our review will point out a number of concerns.

The supplement provides an indepth expression and assessment of the state of the art usage of herbicides on forest lands.

33-1 We find the supplement to be a highly technical document which uses unfamiliar terminology and involves a complex subject. For example, the reader must refer to other text sections in order to interpret tabular data in many instances.

33-2 The introductory overview and text include references to both BLM and Forest Service lands; however, the abstract describing the administrative proposal addresses the SEIS as an action of the U.S. Department of Interior-BLM only. These references are confusing.

33-3 We suggest the need to temper the "worst case analysis" with the real world for ease of understanding, and note that Table 3-1 includes common household substances at each toxicity category. This helps to put the relationship between herbicides and other more familiar chemical substances into perspective. Further discussion in the text is needed to clarify this relationship, however.

33-4 In various tables throughout the analysis, the number of herbicides presented varies. The introduction discusses the use of 14 herbicides and omits Ammate, Diquat and MSMA. The Risk Analysis overview includes 11 herbicides in Tables 2, 3 and 4 (pages 3 and 4), Table 3-1 (page L-27)

omits Diuron, while the Risk Analysis Overview and Appendix cover 16 herbicides. The disparity in numbers is confusing, and the omission of herbicides should be explained or corrected.

In tables, such as Tables 3 and 4, it is difficult to grasp the significance of the very large numbers used to express risk, doses and margins of safety. We suggest that the footnote
33-5 used for Table 8 be used throughout to clarify these data tables. The use of equivalent human dose amounts in Table 3-1 (page L-27) is another way of maximizing the readability of these tables.

Thank you for the opportunity to review and comment on the supplement. We hope these concerns will be useful in preparation of the Final Environmental Statement.

Sincerely,

H. Mike Miller
State Forester

HMM/RM:jp

OREGON INTERGOVERNMENTAL PROJECT REVIEW

State Clearinghouse
Intergovernmental Relations Division
155 Cottage Street N. E.
Salem, Oregon 97310

Marion, Polk, Yamhill, Clackamas, Clatsop, Columbia, Coos, Curry, Jackson, Josephine, Counties

Phone (503)378-3732 or Toll Free in Oregon 1-800-422-3600

APR 8 1986

STATE AGENCY REVIEW

Project Number OR 860307-023-4 Return Date: APR 11 1986

To Agency Addressed: If you intend to comment but cannot respond by the return date, please notify us immediately. If no response is received by the due date, it will be assumed that you have no comment and the file will be closed.

PROGRAM REVIEW AND COMMENT

TO STATE CLEARINGHOUSE: We have reviewed the subject Notice and have reached the following conclusions on its relationship to our plans and programs:

( ) It has no adverse effect.

( ) We have no comment.

( ) Effects, although measurable, would be acceptable.

( ) It has adverse effects. (Explain in Remarks Section.)

( ) We are interested but require more information to evaluate the proposal. (Explain in Remarks Section.)

( ) Additional comments for project improvement. (Attach if necessary.)

REMARKS (Please type or print legibly)

WE BELIEVE THE WORK COMPLETED IS ACCEPTABLE. WE ARE INTERESTED IN MAINTAINING COMMUNICATION ON ANY CHANGES THAT MAY OCCUR. THANK YOU!

Agency Agri. Oregon Dept. of Agriculture Weed Control By [signature]

IPR 82 Phone Number (503) 378-4987

34

Department of Agricultural Chemistry
College of Agricultural Sciences
Oregon State University
Corvallis, Oregon 97331-6502 (503) 754-3781

April 16, 1986

Oregon State Director
Bureau of Land Management (935)
c/o R. Gregg Simmons
P. O. Box 2965
Portland, Oregon 97208

Dear Gregg:

I have been asked by Alice Morgan of Dow Chemical to comment on
34-1 the use of the dog in determining a no-observed-effect dose for Triclopyr, as described in the Supplement. My comments are attached for your consideration.

Sincerely,

Frank N. Dost, D.V.M.
Extension Specialist in
Toxicology and Chemistry

sjc

cc: Larry Gross

COMMENTS ON USE OF THE DOG IN SETTING THE NOEL FOR TRICLOPYR

Summary

In the "Supplement to the Western Oregon Program- Management of Competing Vegetation" a No-Observed-Effect Level of 2.5 mg/kg/day for triclopyr is employed, based on data from the dog which is acknowledged to be highly conservative because of the unique sensitivity of the dog. I have been requested by the registrant to comment on the validity of the low NOEL utilized. In my view it is clear that the figure of 2.5 mg/kg/day is not appropriate, for reasons expressed in the pages below. I have not derived a substitute for the criticized figure.

In assessing the non-genetic risks associated with use of pesticides, the concept of a threshold or no-effect dose is widely used. The no-effect dose as determined in the laboratory is divided by the estimated or measured dose in the field and the difference represents a safety factor. Obviously, the larger the safety factor, the less likelihood of adverse impact, and when the factor is 100 or more, given sufficient data on the chemical, the prospect of effect is negligible.

In my capacity as Extension Toxicologist I have been requested by the registrant to comment on the use of data arising from canine experiments for determining no-observed effect levels or doses of Triclopyr (Garlon), as described in the BLM Supplement to the Western Oregon Program-Management of Competing vegetation. As the document points out, "The effects found in the dog studies are not representative of effects expected in humans because dogs have a limited capacity for organic anion transport in the kidney." It is then stated that the half time for excretion of triclopyr in dogs is 96 hours, compared with 1.5 hours in the rat and 3.1 hours in the monkey.

These findings are entirely in keeping with other research dating back into the 1940s, which shows that dogs, among mammals, have lower capacity for renal excretion of organic acids (anions) than other species, including humans.

The family of molecules that are called organic acids include the phenoxy herbicides (notably 2,4-D, 2,4,5-T, Silvex, MCPA), Triclopyr, various metabolic products arising from such endogenous biological substances as adrenalin and other neurotransmitters, a large group of substances used for diagnostic purposes, such as diodrast and para-aminohippuric acid and many others. All of these materials are moved from the circulation into the kidney tubule for excretion by two processes. The first is by mass movement with the total glomerular filtrate of cell and protein free fluid from the blood at the beginning of the kidney tubule. The second is the mechanism we are concerned about, which is an active (energy requiring) excretion process across the cells of the tubule wall from the blood into the tubule. It is this last process that is different in the dog, and for whatever reason, the system does not have the capacity

found in other species. The system in all species is saturable, which means that it has a finite upper limit, just as, for example, a sump pump does. When the load is greater than the handling capacity, the material builds up in the circulation and tissues, awaiting movement out through the kidneys. In the dog, the point of saturation is lower than in other species. The system is also characterized by competetive inhibition among organic acids, which means that excretion of any member of the group will be inhibited by the presence of any other member of the group, if the total exceeds the capacity of the "pump".

This kind of mechanism is found in many other locations in the body, for movement of substances across membranes. A very similar pump is found in the choroid plexus of the brain, to move organic acids out of the central nervous system to the blood.

It is characteristic of any intoxicant that as residence time in the body is increased, toxicity increases. This is true of any agent in an animal or human with impaired kidney function, or impaired liver function in the case of a compound that must be metabolized to a less toxic form. The same consequence will follow in a species that has a normally low capacity. For the same reasons, there is a greater tendency for kidney injury in a species with low transport capability, because a chemical excreted by active transport across the kidney tends to reside in relatively high concentration at the kidney.

A considerable literature exists on the renal excretion mechanism for phenoxy acids, which include triclopyr for purposes of discussing renal excretion mechanisms, because it is so similar in structure to the phenoxies. Among this work are papers by Piper et al (1973), Erne and Sperber (1974), Stroo et al (1979) Orberg (1980a, 1980b), Hook et al (1974,1976), and Colburn (1978). All show, in various species, that this group of compounds is processed in the kidney by the same organic acid transport system described above.

The first comparison of dogs and humans and their capacity to excrete these substances was by Homer Smith, one of the fathers of kidney physiology, in the early forties. His group (Smith et al. 1944) noted the plasma clearances of a large number of anions in human patients and found them to be consistently several times greater than the clearances in dogs. ("clearance" is the amount of plasma cleared of a substance in a given time, usually on a per minute basis. If plasma contains 0.1 gm of a substance per 1000 ml, and 0.01 gm is removed by the kidney per minute, the clearance is 100 ml per minute. All of the material in the equivalent of 100 ml of plasma is removed.) The intent was not to compare the species, but rather to examine the process in two species. The data was based on ratios of clearances between test substances and anions that were considered more or less standard. Because of the similar behavior of the respective chemicals in any species, the ratios between clearances were similar in both species, which is to be expected at all levels of efficiency when pairs of compounds of this class are placed in the circulation. When the raw clearance data are compared, however, striking differences between the two species appeared, the dog having a much lesser capacity.

Hook and his co-workers assessed the difference between rats and dogs in vitro, using isolated kidney slice preparations and showed that kidney tissue from rats have a much greater capacity to transport para-amino hippuric acid (PAH) than do those from dogs (Hook et al 1974). They then examined kidney function in intact dogs, finding a low absolute clearance (No other species was examined in this work.) and also finding evidence in vitro that transport was impaired by tight binding of 2,4,5-T to plasma protein. The latter influence would interfere with mass transport in the fluid that crosses the glomerulus or filter of the kidney, because that structure is not normally permeable to plasma protein.

Low relative clearance of this group of chemicals by the dog has been found in the case of 2,4,5-T by Piper et al. (1973), who observed a half time in the dog of 77 hours compared to 4.7 hours in the rat. Registration data for triclopyr show that at a dose of 20 mg/kg the half-time for dogs was 96 hours, and was 14 hours at trace doses. In rats the half time was two hours for a 100 mg/kg dose, and less at lower doses. Half-time for clearance of 30 mg/kg by the monkey was about three hours, again vastly faster than by the dog, at a higher dose. Specific data for Triclopyr in humans is apparently not available, but numerous observations of 2,4-D and 2,4,5-T have been made in humans, showing half times of 13-23 hours. (Gehring et al, 1973; Kohli et al, 1974; Feldmann and Mailbach, 1974; Saverhoff et al, 1977.)

Doses at which general toxicity occurs are also lower in the dog, another consequence of uniquely slow renal excretion. The median lethal doses (LD50) for 2,4-D is about 100 mg/kg in the dog, compared to about 350 and above for other species, and a similar difference is found for 2,4,5-T. Triclopyr itself demonstrates similar difference, while the pyridinol metabolite of triclopyr shows less toxicity than the parent compound in the dog and the same toxicity as the parent in the rat. The difference between the two is that the parent compound is an acid and the derivative is a pyridine alcohol.

The conclusion must be drawn from these data that the dog is indeed a different species in terms of its sensitivity to compounds which depend in part or entirely on the mechanism of excretion discussed here. It is clear that the dog does not represent primates in this regard. It seems inappropriate to me that the dog, in its demonstration of sensitivity, should be used as a basis for setting safety margins that apply to human exposure to triclopyr.

References

Colburn, W.A. A model for the dose-dependent pharmacokinetics of chlorophenoxy acid herbicides in the rat: the effect of enterohepatic recycling. J. of Pharmacokinetics and Biopharm. 6:417-426. 1978.

Erne, K. and I. Sperber. Renal tubular transfer of phenoxyacetic acids in the chicken. Acta. pharmacol. et toxicol. 35:233-241. 1974.

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Gehring, P.J., C.G. Kramer, B.A. Schwetz, J.Q. Rose, and V.K. Rowe. The fate of 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) following oral administration to man. Toxicol. and Appl. Pharm. 26:352-361. 1973.

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Orberg, J. Effects of low protein consumption on the renal clearance of 2,4-dichlorophenoxyacetic acid (2,4-D) in goats. Acta. pharmacol. et toxicol. 46:138-140. 1980.

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Sauerhoff, M.W., W.H. Braun, G.E. Blau, and P.J. Gehring. The fate of 2,4-dichlorophenoxyacetic acid (2,4-D) following oral administration to man. Toxicology. 8:3-11. 1977.

Smith, H.W., N. Finkelstein, L. Aliminosa, B. Crawford, and M. Graber. The renal clearances of substituted hippuric acid derivatives and other aromatic acids in dog and man. Dept. of Physiol., New York Univ. Col. of Med., New York, New York. 1944.

Frank N. Dost, D.V.M.
Extension Specialist in
Toxicology and Chemistry

United States Department of Agriculture | Forest Service | Pacific Northwest Region | 310 S.W. Pine P.O. Box 3623 Portland, OR 97208

Reply to: 2150

Date: APR 16 1986

Mr. William G. Leavell, State Director
Bureau of Land Management
P.O. Box 2965
Portland, OR 97208

Dear Bill:

This is in response to your Supplement to the Western Oregon Program-Management of Competing Vegetation-Draft Environmental Impact Statement.

As you know, the Human Health Risk Assessment for the Use of Herbicides (Appendix L) has been a joint effort between the Bureau of Land Management, Oregon State Office and the USDA Forest Service, Pacific Northwest Region. This has afforded an opportunity to better address issues such as cumulative management effects and to avoid unnecessary duplication of effort. We consider the Assessment to be scientifically credible, based on the most appropriate information available, and to be state-of-the-art in terms of methodology.

Comments received during your 60-day review period will also provide the Forest Service with some insights into how this information can be utilized in the implementation of our vegetation management programs. My staff and I will continue this cooperative effort as we deal with this most difficult issue. We have no additional comments on the Supplement.

Sincerely,

for Richard A. Fenaroli

JAMES F. TORRENCE
Regional Forester

cc:
WO-FPM
ENG.
TM
R&WS
PLAN

36

Boise Cascade

Timber and Wood Products Group

Western Oregon Area
P.O. Box 100
Medford, Oregon 97501
503/776-6666

April 18, 1986

Oregon State Director
Bureau of Land Management
Attn: R. Gregg Simmons
P.O. Box 2965
Portland, OR. 97208

Dear Mr. Simmons:

On behalf of Boise Cascade Corporation, I have reviewed the "worst case analysis" supplement to the DEIS and find that it is more than adequate to meet legal requirements.

The document is well put together and eminently "readable." It undoubtedly goes beyond the judicial requirements set out by Judge Burns and demonstrates the minute risks of herbicide use when used correctly.

We at Boise Cascade appreciate the time and effort expended on this project. The product is just what is needed to re-establish herbicides as one tool to promote more productive forests.

Thank you for the opportunity to comment.

Sincerely,

Russell J. McKinley

Russell J. McKinley
Chief Forester
Western Oregon Region

RJM:vm

Michael S Meredith
5200 Camp Baker Rd.
Medford OR 97501
April 22, 1986

Mr. William Leavell
Oregon State Director - BLM
Box 2965
Portland OR 97208

Dear Mr. Leavell:

I have examined the Supplement to the Draft Environmental Impact Statement (SEIS) for the Western Oregon Program - management for competing vegetation. This document was prepared as required by law because of "data gaps" in relevant scientific information; the filling of these gaps by BLM would be beyond current short-term scientific ability and/or costs of obtaining this information would be exhorbitant.

All chemicals analyzed in this SEIS are currently registered for use in forestry by the EPA, and have passed their strict safety requirements. These chemicals have been used on farms, forests, and range (some for over 30 years) with excellent safety records and enormous benefits in terms of productivity. Filling all gaps in scientific information with 100% certainty is probably impossible, and if possible would be very expensive.

I have worked with herbicides in both aerial and ground projects as a professional forester. The worst case scenarios presented here are about as severe as can be imagined - an operator would have to deliberately misapply these chemicals to come close to some of these cases. In all cases, the SEIS assumes the worst - from application to contact with humans. The resulting margins of safety are therefore all underestimated for normal application.

I believe this document has more than adequately met the requirements of the law on assessing risks, and is well written and understandable. I am more convinced that herbicides properly used are safe to applicators and the public. The enormous benefits of herbicide use in the practice of forestry are not covered in this document, and do need to be addressed in the Final.

Sincerely,

Michael S Meredith

38

DOW CHEMICAL U.S.A.

9008 BUILDING
April 29, 1986

POST OFFICE BOX 1706
MIDLAND, MICHIGAN 48640

Oregon State Director
Bureau of Land Management (935)
c/o R. Gregg Simmons
P. O. Box 2965
Portland, OR 97208

Dear Mr. Simmons:

Attached please find a corrected copy of my April 29, 1986 letter. In the rush to get this letter to you, a few typographical errors were made. In the last paragraph on page 1, the name "Reuben" should have been "Reuber". In the first paragraph on page 3, the second sentence should have read "The probability of someone receiving a dose as high as postulated in this draft is on the order of 1 out of 1 million people exposed." In the sixth paragraph "oncogenicity" was misspelled.

Please accept my apologies for these mistakes.

Sincerely,

Robert D. Fears

Robert D. Fears, Manager
Herbicide Products Development
Agricultural Products Department

lmd

Attachment

AN OPERATING UNIT OF THE DOW CHEMICAL COMPANY

Quality Performance Means More At Dow

DOW CHEMICAL U.S.A.

POST OFFICE BOX 1706
MIDLAND, MICHIGAN 48640

9008 BUILDING
April 29, 1986

Oregon State Director
Bureau of Land Management (935)
c/o R. Gregg Simmons
P. O. Box 2965
Portland, OR 97208

Dear Mr. Simmons:

A copy of the Draft Environmental Impact Statement entitled "Supplement to the Western Oregon Program - Management of Competing Vegetation" has been reviewed by scientists of The Dow Chemical Company. As a result of this review, we would like to offer the following comments concerning information presented on 2,4-D, piclorm and triclopyr.

Peripheral Nerve Damage

38-1 On pages 8, 10 and 33, reference is made to 2,4-D as the causes of "permanent nerve damage" in a few humans. Although certain publications have attempted to prove causation, the case is weak for the reasons discussed in the attached paper prepared by Dr. Mattsson and entitled "Comments on the Improbability of 2,4-D as a cause of Peripheral Neuropathy." Also there has been the lack of such an effect in animal models - see Mattsson, et al and Toyoshima, et al (also attached). It might be more accurate to state that a few cases of 2,4-D "related" peripheral neuropathy have been alleged and reported. However, extensive animal tests have failed to show that 2,4-D causes peripheral nerve damage, even after exaggerated doses.

Piclorm Carcinogenicity

38-2 The decision to use a "worst case" analysis based upon the NCI bioassay for a positive oncogenicity response of piclorm is not valid since new 2-year rat dietary study has been completed. See attached abstract. Piclorm is not a carcinogin. References to its nononcogenic effect in 3/5 studies must rely on the Reuber report as one study. However this is not clear in the document and the Reuber report should not be considered a study - it merely reports a re-read of an already validated work done by other.

AN OPERATING UNIT OF THE DOW CHEMICAL COMPANY

Quality Performance Means More At Dow

R. Gregg Simmons
April 29, 1986
Page 2

Triclopyr Threshold Toxicity

38-3 On page 35, a nicely worded discussion of the dog NOEL as overly-conservative leads one to the distinct conclusion that it would be much more realistic to use a NOEL of 30 mg/kg/day based on rodent, monkey and human data. Pharmacokinetic and toxicity data show the dog to be unusually sensitive.

38-4 Table 8 p. 12 has a typo in the glyphosate column/30 Exposure/Drinking Water (Should be 10^{-10}).

Chronic Toxicity Studies (p. 29)

38-5 Teratology studies are not generally conducted over several generations - but only for one gestation period in one group of maternal animals. Doses used in teratology studies are frequently higher than doses used in reproduction studies. A teratology study is really a sub-chronic study.

2,4-D Threshold Toxicity

38-6 There is no reference for the last entry - repro/rats/NOEL at 25 mg/kg/day.

Mutagenicity

38-7 On page 35 it is stated that "the most reliable mutagenic assays are in vivo cell studies and germ cell or gonadal studies" - Is "reliable" the correct word? - wouldn't "relevant" be more appropriate?

Risk Assessment Issue

38-8 It is logical to calculate an average exposure scenario as well as some sort of a worse than average situation, but the worse than average assessment should correspond to some realistic scenario. For instance, FDA and EPA often calculate a 90th percentile exposure or 95th percentile exposure.

In the present document, the routine worst case scenarios are so extreme as to have no practical use. In some instances, the conclusion is that the margin of safety is small or non-existent, but the scenario is so unlikely as to be virtually impossible. It is difficult to evaluate the meaning of this conclusion. A second problem with this approach it that although the exposure situations are qualified as to their usefulness, e.g.:

R. Gregg Simmons
April 29, 1986
Page 3

> "The probability of someone receiving a dose as high as those predicted under the routine worst case scenario is negligible because these scenarios assume that a number of unlikely events occur simultaneously. The probability of someone receiving a dose as high as postulated in this draft is on the order of 1 out of 1 million people exposed. Historical records indicate that the probability of the scenario events occurring simultaneously is even lower."

There is a definite potential for the tables to be used out of context, and to infer a potential risk for these extreme situations. It would be much more useful to calculate margins of safety corresponding to plausible exposure situations.

Cancer Risk Upperbounds

38-9 On pages 10, 11 and 12 cancer risk upper bounds are calculated along with the appropriate qualifications that these are upper limits on real risk. In the test on page 11, however, the qualifications on upper bounds are missing and the risks are translated into personal risks without the appropriate upper bound limitations.

Mutagenic Potential

38-10 In Appendix L-36, the novel methods for estimating mutagenic potential are not felt to be appropriate.

38-11 a) In cases where mutagenic data are missing or inconclusive, a worst case assumption is made that the compound it a mutagen. This is not a realistic assumption.

38-12 b) The logic that oncogenicity implies mutagencity is backwards, particularly since many of the positive oncogenicity findings are a direct result of massive doses resulting in organ toxicity and do not involve any measurable direct genetic events.

38-13 c) Qualifications of mutagenic risk from modelled oncogenic risk is novel and speculative and should not be used until the science base can demonstrate a quantitative correlation. It is difficult enough to estimate the magnitude of the qualitative correlation between oncogenicity and mutagenicity, much less use a quantitative correlation in reverse, (mutagenicity estimated from carcinogenicity).

R. Gregg Simmons
April 29, 1986
Page 4

We trust that this information clarifies our position regarding the Draft Environmental Impact Study. Our comments concerning the draft should help clarify a few points as well as provide additional information.

Sincerely,

Robert D. Fears

Robert D. Fears, Manager
Herbicide Products Development
Agricultural Products Department

lmd

39

SOUTHERN OREGON TIMBER INDUSTRIES ASSOCIATION
2680 NORTH PACIFIC HIGHWAY • MEDFORD, OREGON 97501 • PHONE (503) 773-5329

April 23, 1986

Oregon State Director
Bureau of Land Management (935)
c/o R. Gregg Simmons
P.O. Box 2965
Portland, OR 97208

Dear Gregg:

On behalf of the members of the Southern Oregon Timber Industries Association (SOTIA), I have reviewed the "Supplement to the Western Oregon Program-Management of Competing Vegetation Draft Environmental Statement" (February 1986).

The Supplement appears to comply with the worst-case analysis requirement of the National Environmental Policy Act (NEPA). In accordance with NEPA, the Supplement identifies the data gaps in the scientific information available on the herbicides, and estimates the total cost of collecting the data to fill them. Since the overall cost of filling the data gaps would have been exorbitant, a worst case analysis was conducted for the areas where information was either unavailable or uncertain. I also found the Supplement plainly written and understandable.

SOTIA supports the use of herbicides in the management of competing vegetation and urges the BLM to resume their spraying program, once the Court has ruled on the adequacy of the worst case analysis. SOTIA is concerned about the probable long-term negative effects on timber supply, and the subsequent socioeconomic impacts, should herbicide spraying be lost as a forest management tool.

Sincerely,

Roxi K. Smith
Staff Assistant

cc: Board of Directors
Timber Policy Committee
Dave Dietz

Serving Forest-Related Industries and Community Interest in Southern Oregon

40

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 SIXTH AVENUE
SEATTLE, WASHINGTON 98101

APR 23 1986

REPLY TO ATTN OF: M/S 443

William Leavell
Oregon State Director
Bureau of Land Management (935)
P.O. Box 2965
Portland, Oregon 97208

Dear Mr. Leavell:

In accordance with our responsibilities under Section 309 of the Clean Air Act and the National Environmental Policy Act we have reviewed the Supplement to the Western Oregon Program - Management of Competing Vegetation, Draft Environmental Impact Statement (SDEIS). This SDEIS presents a risk assessment and worst-case analysis of impacts on human health from using herbicides.

40-1 Our main concern is that the SDEIS evaluates only human health effects, and focuses entirely on the endpoint of cancer. In our view, the primary risk of using these compounds in forest plantations is more than human or cancer oriented. There is also an environmental risk. The impact of these materials on stream quality, fisheries, wildlife, groundwater, and eutrophication should also be presented. It is not clear to us if this will be evaluated in the Final EIS.

If these materials are applied (or in a worst case situation, spilled) in wildlife and fishery sensitive areas, especially during rainy periods, one can readily theorize the possibility of short term adverse effects such as fish kills and effects upon the biota. Picloram, for example, is extremely persistent and is well known for its migration through soil into groundwater.

40-2 The document as a whole seems to give only the common names for the various chemicals to be used. It should also specify the exact chemical nomenclature for each of the chemicals, so that the reader is able to know more definitively what is being discussed. Just specifying "Asulam", for example, is not adequate to describe or define the chemical for the reader. Also, no chemical structures for the herbicides are given. This should be provided as part of the Final EIS.

2

In summary, we find the document to be of very good quality in terms of attempting to estimate worst case human risk. Although not quantifiable through the same methods, the risks to wildlife should be presented in the Final EIS.

Based on our review we have rated this Supplemental DEIS EC-2 (Environmental Concerns - Inadequate Information). If you have any questions about our comments, please contact Wayne Elson at (FTS) 399-1463.

Sincerely,

Robert S. Burd
Director, Water Division

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April 23, 1986

Oregon State Director
Bureau of Land Management (935)
c/o Gregg Simmons
P.O. Box 2965
Portland, OR 97208

Dear Mr. Simmons:

This letter is a particular comment I have to make concerning the Draft Environmental Impact Statement of February 1986, which solicits public comments.

My basic concern involves the total lack of human dignity and personal concern which this report and the BLM has given to a significant personal health problem which I, and several other million persons in this nation have, asthma.

My property borders BLM land, and I have asked the Medford BLM office in the past to please notify me when they plan to spray herbicides near my home, due to my health problems. They told me several years ago that they most certainly would and should notify me, however, twice the area surrounding my home was sprayed, and the BLM office NEVER Ever called to notify me. After the first spraying I lodged a formal protest with the Medford BLM office and I was told that it would never happen again, that I most assuredly would be notified in advance of any spraying in my area.

However, the following year I was struck with a sudden asthma attack and had to be rushed to the Josephine Memorial Hospital for emergency treatment (at a very high cost to me). It was not untill the following day that I read in the local newspaper that the Blm had again sprayed the area next to my house. Why had the BLM broken its promise to me to notify me? I asked.

Page 2 BLM

I called the BLM office and they "refused" comment to me, and told me to write them another letter to place in their file, that I should be notified about spraying for health reasons! -- Is this the way the BLM responds to United States citizens!!!

I want to stress that on the day I had to go to the local hospital, the doctor in charge of the emergency room had told me that I was the seventh (7th) patient that day to be treated for asthma (I want there in the afternoon), and the doctor noted to me that the hospital usually only treats that many patients for severe asthma in one month! -- Yet the hospital treated that many people in one day following the BLM spray plan.

41-1 I would like to know the environmental impact statement does not mention asthma or any other lung-function/breathing problems in its report? Isn't that too part of the impact of BLM spraying on the environment?

I have requested the BLM to notify me when they spray, and twice they never had. How do you suggest that they comply with their promises to help out people with health related handicappe?

Sincerely,

Lie Epstein

cc: Southern Oregon Northwest Coalition for Alternatives to Pesticides

41-2 P.S. Have you investigated hospital and doctor office records concerning any possible public health related effects following spray programs?

42

MEDFORD CORPORATION

P.O. BOX 550, MEDFORD, OREGON 97501 ★ TELEPHONE 503 · 773 7491

April 25, 1986

Oregon State Director
Bureau of Land Management (935)
c/o R. Gregg Simmons
P. O. Box 2965
Portland, OR 97208

Gentlemen:

I have had the opportunity to read in the Supplement to the Western Oregon Program - Management of Competing Vegetation DEIS 1986.

I find it easy to read and understand. The risk factors are carefully discussed and tabulated. The document will serve as a useful reference for us.

The Supplement appears to comply with the worst-case analysis requirements of NEPA.

Herbicides are an essential tool to forest management. After the court rules on the adequacy of the Supplement, I urge you to resume with your spraying program.

Sincerely,

MEDFORD RESOURCES CORPORATION

Bruno C. Meyer

Bruno C. Meyer
Head Forester

BCM/dl

Preferred Quality MEDCO Forest Products

43

AG-103 REV. 11-84

DU PONT

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WALKER'S MILL, BARLEY MILL PLAZA
WILMINGTON, DELAWARE 19898

AGRICULTURAL CHEMICALS DEPARTMENT

April 25, 1986

Oregon State Director
Bureau of Land Management
c/o R. Gregg Simmons
P. O. Box 2965
Portland, OR 97208

Comments on Supplement of Draft EIS
for Western Oregon Program
Management of Competing Vegetation

We appreciate the opportunity to comment on the supplement to the Draft Environmental Impact Statement (SEIS) for the Western Oregon Program. Our comments are limited to the accuracy of statements about, and reported data on, the Du Pont herbicides included in your report. Our comments are attached.

We do not expect our comments to materially affect your worst case risk analysis. However, because of the wide circulation documents such as this receive, we feel it is important that the data they contain be accurate. Consequently, we hope you will be able to include these corrections in your final document

Sincerely,

Robert B. Fugitt
Governmental Affairs
Specialist - USA

RBF:dmf

Attachment

cc: Mr. Larry L. Grass
Pesticide Specialist
USDA/Forest Service
12th and Independence Ave., SW
P. O. Box 2417
Washington, DC 20013

Comments of E. I. du Pont de Nemours & Co., Inc.
Agricultural Products Department
Regarding
Supplement to the Draft Environmental Impact Statement
For The
Western Oregon Program - Management of Competing Vegetation

Bromacil

43-1 Page L-38 states: "The mutagenicity studies submitted for the registration of bromacil were deemed unacceptable by EPA, and no other validated mutagenicity studies have been completed (EPA, 1984d)."

This is incorrect. Attachment I is a copy of the appropriate pages from the FIFRA section 3(c)(2)(B) data call-in notice on bromacil related to the Registration Standard which was concurrently issued. As can be clearly seen, the mutagenicity studies conducted with bromacil were considered adequate to satisfy the mutagenicity data requirement (column 5) and no additional data is required by EPA (column 7).

Bromacil is not considered mutagenic by EPA. In studies conducted by non-Du Pont laboratories, bromacil has been reported to be non-mutagenic in 5 of 6 point/gene mutation studies, 6 of 6 primary DNA damage studies and 3 of 4 tests for chromosomal effects.

43-2 On page L-40, no mention is made of the fact that male mice have a high background incidence of liver tumors, that liver tumors were seen in male mice at the high dose level only and that neither carcinomas nor adenomas considered separately were statistically significant. The only statistically significant increase in tumors was for combined carcinomas and adenomas (i.e. - total liver tumors) in male mice at the high level; there was no substantial dose-related increase in benign, malignant or combined liver tumors. Based on this, it should be noted that there is very limited evidence for bromacil being an oncogen and that it is not a carcinogen (i.e. - causing statistically significant levels of carcinomas). Considering this along with the negative genotoxicity and mutagenicity data, the weight of evidence suggests that bromacil should be included in the "herbicides for which there is scientific controversy about their ability to cause cancer" group on page L-69, rather than "herbicides for which there are positive cancer studies" group.

Diuron

43-3 The report states on pages 4, 13, L-37, L-38, and L-88, that there are no validated mutagenicity studies for diuron. There are eight mutagenicity studies which EPA judged not to be valid. Of these studies, seven showed no mutagenic effects. As part of the EPA reregistration process for diuron, Du Pont has submitted four new mutagenicity studies. Of these studies, 3 are negative for mutagenic effects (Salmonella Typhimurium, CHO/HPRT point mutation, and unscheduled DNA synthesis). The remaining study (in vivo chromosome aberrations in rat bone marrow) indicated that diuron may be weakly clastogenic.

Fosamine

43-4 The data of table 3 on page 3 indicated a rat oral LD_{50} of 24,40 mg/kg. This appears to be a typographical error. The correct value should be 24,000 mg/kg.

31409 Petersen Rd
Philomath OR 97370
April 26, 1986

Oregon State Director,
Bureau of Land Management (935)
% Gregg Simmons
PO Box 2965
Portyland OR 97208

Greeetings!

This is to congratulate you on moving to a DEIS-WCA on herbicides that would elicit the level of support it received from Oregonians for Food and Shelter.

I would only add that in addition to the irony(of not protecting recreation areas from being called back into the production base if we fail to achieve reforestation on commercial land) there is another irony.

It is that the national forests have not given the same scrutiny to vegetation management alternatives as they have focused on herbicides. I enjoy thinking what kind of information more comprehensivly applied WCA's would turn up. I believe you would be left with herbicides as the only truly viable tool.

Sincerely,

Jane Newton

Jane Newton

And very good luck in your future weed-control programs.

BLM,

Your herbice report is a joke. It reminds me of one I wrote in high school that I got an F+ on.

You dont address the problem.

On page 1 you state "BLM does not have the staff, expertise, or funds to fill in existing data gaps, and the time required to perform these studies would seriously delay the execution of an effective vegetation management program."

What a joke! Before you begin you say you wont find the answers to the questions. Time, money, expertise wouldn't stop me from answering the question → How many people will we maime and kill with our program?

On page M-1 you re-certify your problems and shuck em on us.

So say that my life is worth more than 3.5 million to find the answers to 2,4-D. You had better start or else eliminate all chemicals from your program.

Your worse case scenarios is not acurate enough.

Take for instance a worker in private contracts for BLM. Say one person get the contract on 40 acres. He will be there for 90 days or more eating, sleeping in, drinking water of, picking berries off, and wasting in treated acres. What are his chances of disease after 20 years of solid toxicity?

It better be in your final DES along with all the reports you dont want to do on M-1.

You state that you assume that there is hazards for all these chemicals. When ones chances are 1 in a million does that mean 1 person with a strange body will be there to die first?

Get your act together and use no poison till you know what your killing and then dont use it anyway.

R. Heller

46

Coastal Coalition
for Alternatives to Pesticides
P.O. Box 126
Seal Rock, Oregon 97376

April 27, 1986

Oregon State Director
BLM (935)
c/o Gregg Simmons
PO Box 2965
Portland, Or. 97208

Dear Sir:

Here are my comments on the BLM's Draft Environmental Impact Statement of the Western Oregon Program Management of Competing Vegetation. These are both my personal opinions and the official position of Coastal Coalition for Alternatives to Pesticides.

I consider the draft EIS to be inadequate on many points.

In general the EIS does not address adequately the accumulative and synergistic effects of herbicides. It appears from reading this document that much of the scientific work involved in risk assessment occurs in a vacuum; i.e. not in the real world.

46-1 P. 2 notes that EPA, USFS and BLM have ongoing research and monitoring programs, with results unavailable. Whenwill the results be in? P. 2 notes uncertainties and data gaps identified, including synergistic effects.

46-2 P. 5 regarding the probability of members of the public getting a routine-worst case dose is less than 1 individual out of 100,000 exposed. I have been personally sprayed by a helicopter spraying unknown compounds while I was riding my horse, clearly visible, on a public (county) road. I have been exposed to drift. I have seen my neighbor's milk cow grazing for days on roadside recently sprayed. I reside in an open-range area for livestock. I have seen people picking berries from roadsides sprayed where the vegetation hadn't shown visible effects and there were no warning signs.

page 2

46-3 My water source comes from a unit of timber land where herbicides were applied. My family eats fish, deer and game birds from forest areas surrounding our home. In June 1980, 2300 gallons of water and 2,4-D were spilled directly into Spout Creek when a tank truck crashed. I see nothing in the EIS that addresses our real world exposure to herbicides.

46-4 As a registered nurse, I find your cancer risk estimates to be biased, misleading, and avoiding data that could be, or possibly already has been, collected. I work with cancer patients almost daily; I believe there are clusters of cancers + birth defects in populations of the public exposed to herbicides that to my knowledge have not been investigated. I would like to see the results of the Five Rivers Health Study, where some of these people once resided. One mutated cell, under the right conditions, can lead to an individual developing cancer. The risks you portray are totally unrealistic. Where's the data?

P. 13 notes that no human studies are available that associate herbicides with heritable mutations. How can we know what will surface several generations down the line? The same page notes studies classified by the EPA as inadequate.

46-5 Page 13 discusses synergistic effects inadequately; most spraying projects near my home utilize herbicides in combinations; the fact that these are registered for use with the EPA based on inadequate chemical company data is not reassuring.

P. 13 discusses cumulative effects; as I've noted previously, my real world exposure is quite different from your risk analysis. The EIS is incorrect when it states that "no one individual member of the public is likely to receive repeated exposures to any of the herbicides because of the "remoteness of most treatment units".

46-6 On P. 19 the EIS says in "brown and burn" operations herbicides are used to "dry the vegetation which several months later is burned". This is misleading; in fact, herbicides are commonly applied within 2 weeks prior to burning; I have State Forestry records which show this.

page 3

46-7 P. 37 Table 3-4, the summary of mutagenicity and carcinogenicity of pesticides shows many uncertainties. "Amitrole...a probable human carcinogen. Bromacil...no validated studies reported. 2,4-D...scientific uncertainty as to carcinogenicity. Dalapon...no studies reported. Dicamba...studies inadequate according to EPA. Diuron...no studies reported, studies not adequate. The possible mutagenic and carcinogenic effects of the breakdown products of these herbicides is not considered at all.

46-8 P. 55 "It is extremely unlikely that a member of the public will receive simultaneous herbicide doses through more than two of the exposure routes described (hiker, berrypicker, hunter, fisherman, nearby resident). Where's your data? I have received exposure from all five routes myself, and many of my neighbors have all five "public exposure" routes and work in reforestation on top of it. We all cut firewood in the forest, I jog on forest roads, and my children walk or ride bikes over a mile to the schoolbus on roads which have been sprayed.

46-9 P. 58 shows the routine worst-case aerial scenario with a person receiving exposure 50 feet laterally from the spray; I have been directly sprayed, and our homesite was accidently sprayed; this is inadequate.

46-10 P. 60 deals with residues in water inadequately, and doesn't consider the accumulation, for instance, of herbicide residues from runoff from above-stream units, and their possible accumulation in stream sediments. Residues in fish with bioaccumulation factors of 10 and 20 are inaccurate. P. 61 deals with dermal exposure inadequately; I know of a berrypicker who was scratched by a freshly-sprayed brush who developed an abcess, rare from berry scratches alone.

46-11 P. 62 mentions accidental spills of 1000 gallons from a batch truck; how about the 2300 gallon spill on Spout Creek?

page 4

P. 73 states the risk of a member of the public being directly hit by an aerial spray operation is very small. Once again, I was sprayed without warning by a helicopter on a public road, and I know of other people directly sprayed also. So much for the probability level of 0.0002. Basing risk estimates on probability factors such as this is ridiculous and inaccurate.

46-12 P. 74 deals with so-called brown and burn operations. The EIS states time between spraying and burning is 5 to 7 months; actually it is often within 2 weeks. Units average 30 acres according to the EIS; where I live 120 acres is common, and sometimes 3 times that. Your data on half-life of herbicides - their levels at time of burning are therefore inadequate, being based on the 5 month factor. Those neat statistics about what's in the smoke are useless; smoke doesn't behave as it does in a test tube. No studies have been done as to herbicide conversion products by pyrolysis IN THE FIELD. The probability of dioxins and other toxics, as well as the well-recognized carcinogenic PNAHs, deserves field study. This should have been collected long ago.

P. 76: risk of workers under routine worst case: many reforestation workers are unilingual Mexicans who don't read English. They often camp out on the sites and have multiple exposure routes. Washing and laundry facilities are poor or nonexistent. Its dangerous to assume they are safe. And to state that even if a worker were to feel ill for a day or two he would not be expected to suffer permanent damage is another dangerous assumption. Where's your data? Is anyone looking at workers in the real world? My husband worked with spraying and burning for the Forest Service; his fellow crewworkers and he have suffered between them acute short-term illnesses, chronic conditions and recurring reactions after being sensitized by previous exposures, cancer and birth defects in their children. This is also well documented with Vietnam veterans.

The exposed populations are here to study. Why not check them out, and their current health, before exposing more? Although cause and effect relationships are hard to prove, a correlation is obvious to me. Want a test batch? Investigate Five Rivers residents of 10 years ago and their current health status - if they're alive. Or workers on the Brush Disposal crews 15 years ago. Or workers at the Oregon State Prison Reforestation Camp near Tillamook; an ideal controlled population who uses herbicides regularly. The statistics in the EIS look very neat and safe on paper, but my personal experience tells me things are different.

46-13 P. 80 deals with cancer risks: where's the data considering synergistic effects with other carcinogens we are exposed to daily? Example: Amitrole is a cancer promoter.

46-14 P. 80 on heritable mutations: carcinogenicity datais inadequate to measure mutational effects by; many mutations are recessive and may not be expressed for generations. Once again, where's your data?

46-15 P. 89 on synergistic and cumulative effects: based on limited amount of data. It is dangerous to assume that people are only exposed to one herbicide at a time. Some spray seasons there are multiple spraying operations going on simultaneously around our farm. These are dangerous assumptions to make; where's the data?

P. 90 mentions that a possible explanation for the carcinogenicity expressed in animals by atrazine and simazine might be from some other ingredients in the formulation.

46-16 The EIS doesn't address the additives, scent and drift control agents, and other non-active ingredients in the compounds, and covered by trade secrets. Where's the data on their safety?

I've noticed that some of the papers referred to in this EIS were studies under questionable conditions. I'm familiar with some of the work by some researchers, particularly Bost and Newton. Some of their papers, for example, are full of holes, tangential, misleading, biased, and have statistics based on inaccurate factors. I wonder if this is typical for other references in the EIS? It's important that studies not be done with tunnel vision.

I think some of the research done doesn't take into consideration the actual world we live in. I'd say they can't see the forest for the trees, but sometimes I can't either - the forests and trees turn so quickly into stumps.

Anyway, the draft EIS is inadequate.

Sincerely,

Kathy Williams

Kathy Williams
Mem., Board of Dir.
Coastal Coalition for
Alternatives to Pesticides

April 27, 1986

Oregon State Director
Bureau of Land Management (935)
% R. Gregg Simmons
P.O. Box 2965
Portland, OR 97208

Dear Sir:

I have carefully read the Supplement to the Western Oregon Program - Management of Competing Vegetation Draft Environmental Impact Statement of February 1986. I was impressed with the thoroughness of the data included in the document. The Draft EIS was clear and easy to understand.

I have been involved in forest herbicide spraying for eleven years and the worst case scenarios were well chosen, such as a mixer-loader getting exposed to the concentrate when a hose breaks or during mixing. The worst case scenarios for public exposure are far in excess of any accidental exposure I believe have ever occurred in forest spraying in the Pacific Northwest. The calculations of margins-of-safety is a very good method of risk analysis, in order to put a given risk into proper perspective.

Nothing we do in our daily lives is done without any risk whatsoever and this report helps put the use of herbicides in a forest

environment into perspective for the public to understand.

Sincerely,

Bruce P. Alber

Bruce P. Alber
Forester
6195 Thurston Road
Springfield, OR 97478

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April 27, 1986

Gregg Simmons
Environmental Coordinator
BLM Oregon

Dear Mr. Simmons,

After reviewing your recent "Supplement to Western Oregon Competing Vegetation DEIS", I find I must take some exception to your conclusions. I am a twelve year resident landowner in Southern Oregon with significant exposure to BLM practices in my vicinity.

48-1
- I feel you inadequately address NOEL levels in terms of real human exposure in real human situations.
- Similar to BLM efforts in the past to justify the use of toxic chemicals, you again use the old "Canadian proof" method whereby having first assumed that X plus Y plus Z equals safety you can then go on to prove that X plus Y plus Z equals none other than safety.
- With gaps in the data and randomly collected studies you do not demonstrate that there is an acceptable margin of safety in real use. There is a great deal of difference in the way risk assessment is calculated depending on whether one is downstream and downwind from potential health hazards or one is in the confines of a controlled laboratory or Portland office.
- There is no proof that in the worst case analysis the toxic subetances will simply disappear without seriously threatening those at greatest risk- the workers and the neighboring human and animal populations.

48-2
- Have you really addressed the synergistic effects of these chemicals? Have you really addressed the cumulative effects of these chemicals? I think not.

Come on now; we are almost in the twenty-first century. There is no demonstrated need to blanket our area with chemicals of still unknown toxicity; the method is antiquated and your intellectual justification of it is antiquated. Thank you for your consideration and having provided a forum for public input.

Respectfully,

James C. Kalfas
Michele A. Molony

James C. Kalfas
Michele Molony
1960 East Fork Rd.
Williams, Oregon
97544

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RE. Comments on Supplement to Western Oregon Competing Vegetation DEIS

4/27/85

Dear Mr. Simmons, My Name is Scott Liebler. I am a new resident of the Williams Valley. My partner & I have Recently purchased land along Williams Creek. It's fine Timber land and we plan to put an orchard on it. Having lived in agricultural areas I have seen & Experienced the effects of Dioxin and other Herbicides, (Roundup etc.) in your immediate living area. Having a Master Degree in Biology I consider myself a pragmatic and fairly non-biased person. I have read your Reports on the Proposed Risks and benifits of herbicide spraying And from what I can see, Much of the Research doesn't address the actual Risks-now and long term of these substances in our imediate living environment. Regardless of questionable findings based on Lethal Dosages on Rats and Worst case analysis Etc. I believe that the risks far outweigh the benifits. There is now quite a lot of evidence that Herbicides cause mutations in cells even inhibiting the production of White blood cells. I plan to make Williams my home for many years to come. I hope the Bureau of Land Management will seriously Research other alternatives to Herbicides such as Hand brushing which will stimulate the local economy Rather than the coffers of Monsanto and Dow. Regardless of your Demographic findings there are many people that live Here and would not benefit from spray programs. Yours truly,

Scott Liebler
P.O. Box 64
Murphy, Or. 97533

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Oregonians for Food and Shelter

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Jim Harris
Oregon Wheat Growers League

Dick Stonex
Longview Fibre Company

"For balance in facts about use of pesticides"

April 28, 1986

Oregon State Director
Bureau of Land Management (935)
c/o R. Gregg Simmons
P.O. Box 2965
Portland, Oregon 97208

RE: "Supplement to the Western Oregon Program - Management of Competing Vegetation," draft environmental impact statement (DEIS).

Dear Mr. Simmons:

We have carefully read the above referenced DEIS and offer the following comments for your review.

Oregonians for Food and Shelter, Inc. (OFS) is an Oregon non-profit corporation. OFS is a coalition of pesticide users, including agricultural, timber, labor, small business and citizen interests. OFS is dedicated to the factual treatment and resolution of pesticide concerns and controversies.

OFS intervened as a party defendant on behalf of the government in the litigation that resulted in an injunction against the use of herbicides on all BLM and USFS lands in the state of Oregon.

That injunction, ordered on March 1, 1984, can be dissolved if the BLM/USFS develop a judicially adequate "worst case analysis" for continued use of herbicides. Your DEIS is an attempt to meet this requirement.

Before specifically commenting on the DEIS, we would make the following observations.

The need for herbicides as one tool in the BLM/USFS kit for vegetation control appears clear. Since the 1984 injunction, we have witnessed timber harvest level reductions and slower, more costly conifer regeneration and release programs, in part due to loss of herbicides as a management tool.

Further, range land maintenance and improvement programs have been damaged, noxious weed control efforts crippled and road side maintenance efforts made less efficacious and more costly.

Mr. R. Gregg Simmons
April 28, 1986
Page two

While no one would support herbicide use just for the sake of using herbicides, the need for these products has, in the "real world", proven itself. And, as commercial timber land bases are reduced and current surpluses (buy-backs) are eliminated, the need for future intensive land management can only accelerate.

We thus believe that meeting the judicial requirements for an adequate worst case analysis is imperative.

COMMENTS

The DEIS, in our opinion, is more than adequate to meet the court imposed requirements for providing a legal environmental impact statement (EIS).

This DEIS logically approaches the accumulation and analysis of information needed to construct a "worst case analysis." The DEIS errs on the side of conservatism, clearly over-estimating the "worst case" risk of cancer and other chronic or sub-chronic injuries.

All possible data gaps have been clearly identified and scientific uncertainties, even when the overwhelming weight of scientific opinion argues against uncertainty, are acknowledged.

These "gaps" and "uncertainties" are then meticulously reviewed and estimates of potential risk and hazard are then made.

This should satisfy what the courts have demanded. During the course of the litigation regarding the earlier DEIS, specifically the "NCAP case," Judge James Burns repeatedly queried OFS expert witnesses on the availability of their information to the BLM/USFS for inclusion in an EIS and worst case analaysis.

Our OFS witnesses states that the information was indeed available, as they had, during the course of their testimony, provided what was required to satisfy the adequacy of an EIS with a worst case analysis.

Paraphrasing Judge Burns again, he several times "wondered" why this expert information was not being used by Chief Forester Peterson.

In our opinion, the "wondering" can end because the BLM/USFS have used not only some of the expert witnesses provided by OFS, but have reached out and tapped the talents of a number of other highly credible and credentialed experts.

In the simplest sense, then, the BLM/USFS have met the information and analytical mandates as established from the bench by Judge Burns.

But, this DEIS goes well beyond those mandates heard in August of 1983.

Several specifics stand out, including:

1. The DEIS is well organized. It begins with a summary, proceeds to point-by-point and herbicide-by-herbicide review, provides a glossary and reference list, and concludes with the calculations (tables) relied on to arrive at in-text conclusions;

2. The DEIS is readable. Inevitably, when dealing with science and medicine, terms of art that are at first blush complex must be used to provide accuracy. But, the DEIS authors have limited the use of such terms, explained them well and often, and have provided numerous charts and tables for illustration. The DEIS is both readable and understandable;

3. The DEIS deals forthrightly with "edge of technology" subjects. Specifically, the DEIS addresses "pesticide sensitive" individuals, cumulative effects and synergism with realism. The DEIS rightly states that margins of safety are designed, in part, to protect the sensitive individual, but also rightly holds that not all sensitivities can be anticipated or guarded against — with pesticides or any number of substances (e.g. penicillin). The DEIS estimates cumulative impacts — but the point must be made that estimating cumulative impact possibilities could become a never ending game of "what if"? Such speculation is not warranted and the DEIS chooses a reasonable, supportable "worst case" possibility for estimation purposes. Finally, I found the DEIS treatment of synergism informative and one of the better discussions of the issue I have seen. It is succinct, accurate and properly conveys the difficulty in attempting to determine effects with multiples of products; and,

4. The extraordinary conservatism of this DEIS bears repeating. The courts demanded a "worst case analysis" and this provides more than a worst case. Circumstances that simply would not be expected on any rational probability scale have been selected for estimating purposes. The nature of herbicides (i.e. they affect plant systems), the remoteness of applications and the infrequency of applications for timber vegetation management control are, if anything, grossly overstated. These "built-in" safety factors, plus the actual conservative numbers used to estimate risk and hazard, assure the reader that herbicide use can be carried out with deminimous, if any, real risk to humans or the environment.

If there is any criticism to be leveled at this DEIS, I would offer the following thought. Estimates for indirect exposure (eating berries, consuming game that has foraged, etc.) are generally based on off-site drift.

This is eminently logical, because game animals avoid foliage that has been treated and berries would almost immediately show signs of treatment, making them undesirable to pickers, as two examples.

50-1 But, obvious conclusions like these may not be apparent to the average, interested reader. It may, and I emphasize the may, be appropriate to: first, explain the logic behind using off-site deposits for estimating purposes; and, second, explain that the off-site calculations would differ insignificantly from risks associated with inadvertant, unexpected on-site consumption of exposed edibles.

Beyond this one thought, we can only applaud the efforts put forth by the BLM and the USFS. You have spent countless hours, a great deal of thought and a considerable sum of money in constructing this DEIS. While this was a vitally necessary effort to meet the letter of the law as judicially interpreted, public policy will now be best served by permitting a continuation of proper public lands management.

That is essential if future fiber needs are to be met and agricultural productivity enhanced. Further, wildlife habitat diversity and noxious weed control can only be enhanced if all the available management tools are readily at hand.

Finally, as a last point, the irony of not having herbicides available as a production tool has always struck me as odd. If we cannot manage suitable commercial forest lands to their highest and best use, inevitably more land will be turned to production. This could reduce wilderness areas, roadless areas and recreation/aesthetic/etc. opportunities.

This loss of environmental flexibility does not have to happen if forest productivity is encouraged. For this reason, above many, we thank you for your good works. Please know we shall stand by you to argue that these works are adequate.

Sincerely,

David H. Dietz
Program Director
OFS

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PAUL E. MERRELL
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April 28, 1986

Oregon State Director
USDI Bureau of Land Management (935)
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P.O. Box 2965
Portland, Oregon 97208

Re: Interim comments on February, 1986 Supplement to the Western Oregon Program-Management of Competing Vegetation Draft Environmental Impact Statement

Dear Mr. Simmons:

These are our interim comments on the above document. In making these comments, in no way do we waive our objection to your failure to provide us with requested documents underlying the draft, as requested by Paul Merrell in his April 12, 1986 request, received by your office on April 13. Your non-response is a clear and direct violation of CEQ Regulations, the National Environmental Policy Act, and the Freedom of Information Act. That denial of our reasonable request for you to produce the key data upon which your "risk assessment" is based demonstrates that in fact, your agency has not complied with the Ninth Circuit's injunction in S.O.S. v. Clark, 747 F.2d 1240 (9th Cir. 1984), and that the BLM is continuing to play hide-and-seek games with information crucial to judging whether your herbicide program will cause human death and only slightly less-severe injuries such as mutations, cancer, and birth defects.

Your agency's willingness to play fast and loose in the face of direct court orders is only exceeded by your apparent

willingness to rely on "scientific" risk assessment that is totally devoid of underlying data and rationality.

The EIS supplement, purporting to present "a risk assessment and worst-case analysis of impacts on human health from using herbicides," is based on such flawed and unfounded assumptions as to preclude meaningful comment. The comments below are intended only to demonstrate the necessity for further supplementation and are supported by references which are by no means exhaustive, but are simply what come readily to hand. We nonetheless request that if you choose to proceed with your program despite the information provided below, your final supplement fully explain the rational basis for relying on information not available either to you or to us, or to the decisionmaker for his or her inspection. S.O.S., supra.

I. Inadequate disclosure of chemicals intended for use

The risk assessments in the supplement address only the active ingredients in pesticide formulations BLM proposes to apply. While it is unclear from what hat BLM pulled its numbers in the tables on pp. 113-178, it is abundantly clear from the references cited that the risk assessments are based on laboratory experiments performed on clean lab animals with technical-grade active ingredients. As any herbicide label demonstrates, the active ingredients in herbicide formulations comprise, on the average, about 50% of the product; the rest of the product consists of unidentified "inert" ingredients.

As EPA notes, Exhibits, pg. 7, "an inert ingredient is defined as any ingredient in a pesticide product which is not

pesticidally active. This definition includes all intentionally added inerts, such as solvents, surfactants, aerosol propellants, dyes, or stabilizers in the formulated product, and non-pesticidally active impurities in the technical grade of the active ingredient or formulation."

In a preliminary June 19, 1985 "List of Inerts of Toxicological Concern," EPA identifies 55 inert ingredients of concern based on documented evidence of neurotoxicity, oncogenicity, teratogenicity, reproductive effects, and ecological effects such as bioconcentration or toxicity to aquatic organisms. Exhibits, pg. 22. The list includes many substances also registered as active ingredients, some of which have been withdrawn as active ingredients because of "sufficient human" carcinogenic evidence, neurotoxicity, developmental and reproductive toxicity, central nervous system depression, liver and kidney effects, and potential groundwater contamination.

EPA notes that a large number -- "approximately 700-800" inerts -- are of "unknown toxicity" but not "innocuous," emphasizing that some 50 of these have a high priority for testing "based on their structural relationship to chemicals with demonstrated health or ecological effects. . . . Inert chemical groups with high potential for toxicity and in need of testing include glycol ethers and petroleum hydrocarbons." Exhibits, pg. 4. Indeed, several glycol ethers (Ethanol, 2-ethoxy; Ethanol ethoxy acetate; Ethanol, 2-methoxy; Ethanol methoxy acetate) are identified on the 6/19/85 list, Exhibits, pp. 29-30, as are petroleum hydrocarbons such as benzene and its numerous derivatives. The

incredibly toxic effects of glycol ethers are well known both to industry and to EPA and other federal agencies. Exhibits, pp. 39-40.

When discussing petroleum hydrocarbons, EPA itself notes that "the Agency is also concerned about petroleum distillates which occur in about 80% of all pesticide formulations as inerts or actives and pose significant regulatory problems. . . . The polynuclear aromatic components of petroleum distillates have a high potential for carcinogenicity and the aliphatic content may pose problems as well." Exhibits, pg. 16.

The June 19, 1985 list includes at least four chemicals (hexachlorophene, pentachlorophenol, dinitro-o-cresol, dinitrophenol) that are on EPA's "possibly contaminated with dioxin" list. Pesticide & Toxic Chemical News, February 20, 1985, pp. 34-38.

51-1 The BLM "risk assessment" fails to consider or assess the effects of inert ingredients either in isolation or in combination with the active ingredients of the herbicides proposed for use. Because many of these inert compounds are known to pose a significant risk to human health and the environment (see Exhibits, pp. 23-38), and because EPA recognizes the "high potential for carcinogenicity" of petroleum distillates in some 80% of all pesticide formulations, BLM's failure to provide information on inert ingredients requested by Paul Merrell in his FOIA request invalidates the "risk assessment" entirely. The only publicly-available information indicates that there is an 80% likelihood that the "inert" fraction of the pesticides proposed for use are carcinogenic. It is impossible to comment

meaningfully on a risk assessment that addresses only a portion (average 50%) of the material BLM actually intends to apply, particularly where the substances omitted from the risk assessment are very likely (at least 80%) to be extremely toxic. The failure to address the "inert"ingredients involved in the proposed program compounds the already significant failure to address additive and synergistic effects and to evaluate the state of the existing environment in preparing any risk assessments, as discussed below.

II. Inadequate description of the existing environment:

The BLM's failure to address already existing levels of toxic pollutants in the environment invalidates all its risk assessments and precludes any meaningful comments thereon. The risk assessments not only fail to address the significant "inert" portions of the herbicide formulations, but also are based on the dangerously false assumption that the active ingredients discussed will be released into a pristine, uncontaminated environment. The laboratory studies from which the risk assessments primarily derive are undoubtedly no different from those available in the public literature, i.e., performed on specially bred and reared lab animals that are isolated from all pollutants other than the test substances. As BLM's few human studies demonstrate (Lavy, et al), the real world into which BLM proposes to introduce these herbicides is already contaminated with pre-existing levels of herbicides, other pesticides, and a broad range of other, highly toxic pollutants. The BLM acknowledges that its program represents but a small fraction of the pesticides applied in

agriculture and related commercial operations (supplement, pp. 13; 90). The failure to consider those admitted existing levels of toxic pollutants -- from agricultural pesticides, industrial
51-2 chemicals and wastes, and from other governmental spray programs -- in assessing the risk of BLM's proposed chemical use is scientifically and ethically indefensible.1/ To estimate the effect of a single chemical on humans or environment, it is imperative first to assess both the levels and effects of already-existing active substances in human tissues and the environment.

The BLM need not look far to find numerous, completed studies demonstrating a wide range of pollutants in the environment affected by its proposed program. The Oregon Department of Agriculture, for example, maintains extensive monitoring records under federal-state contract programs, illustrating widespread water, soil, fish, and vegetation residues of forest-use herbicides. See e.g., Exhibits, pp. 41-43. The U.S. Forest Service also keeps extensive monitoring records, which BLM could easily consult before attempting to prepare its risk assessments. Indeed, the risk assessment purports to be a joint project with the Forest Service.

Additionally, the BLM, the Forest Service, the Oregon State Highway Division, and the Oregon Department of Forestry

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51-2 1. Why did the BLM not address well-known studies demonstrating a cumulative mutagenic hazard in herbicide applicators, such as that performed by Yoder, J., M. Watson, and W. W. Benson? "Lymphocyte Chromosome Analysis of Agricultural Workers During Extensive Occupational Exposure to Pesticides." Mutation Research 21:335-340 (1973). (Chromosome damage in herbicide-exposed group was 25 times greater during spray season than in off-spray season.) Considering the number of times this study has been litigated, this study's omission is at least gross negligence.

(which monitors private forest spraying) keep records of herbicides used for forest and right-of-way management. Such records are essential to assessing the impact of further spraying in any given area or watershed, as indicators of existing herbicide residues, contamination by persistent contaminants, breakdown products, and metabolites, and already-existing accrued damage (e.g., Oregon State Highway Department records, Exhibits, pp. 44-50). Such information has been compiled for the Oregon Coast Range by EPA in its 2,4,5-T cancellation proceedings and are readily accessible to the BLM. (Indeed, BLM was a party to those proceedings and was served with copies of all documents in the record.) Oregon's Pesticide Analytical Response Center (PARC) also maintains pesticide residue monitoring records (e.g., the residues found on the road running through our farm which were provided to your attorneys in Merrell v. Block, Civil No. 81-6138-E, (USDC Oregon)).

Food tolerances -- levels of pesticides that EPA allows to remain on marketed food products, provide further "reasonably foreseeable" exposure to the population. 40 CFR 180 et seq.

The U.S. EPA has also conducted extensive monitoring for dioxin (TCDD) in coast range forests subjected to herbicide treatments. EPA found TCDD in tissues of deer and elk, wildlife samples, human mother's milk, and sediment from domestic water supplies, in studies designed to determine dioxin exposure from herbicide use in the coast range; these studies are also readily available to BLM in the EPA's 2,4,5-T cancellation record from 1979-83. Of particular significance to BLM -- given the number of

inert and active herbicidal ingredients on EPA's "possibly contaminated with dioxin" list, supra -- is EPA's finding of a four-fold increase in dioxin levels in its only resampling effort, seven years after the emergency suspension of 2,4,5-T (Exhibits, pp. 51-103, "Durbin" samples), and its suggestion that TCDD levels in fish would parallel the sediment levels. Increasing levels of dioxin in the affected environment must be included in factoring the risk of applying further pesticide doses.

EPA has also monitored levels of toxic hydrocarbons in human mothers' milk, finding levels of DDT and its metabolites; Dieldrin; Heptachlor; heptachlor expoxide; Chlordane; benzene hexa-chloride; Hexachlorobenzene; and Transnonachlor in the Northwest and other parts of the nation.2/

While not an exhaustive list, these sources of information are cited merely to demonstrate your agency's utter failure to describe the polluted state of the existing environment, a condition in no small part caused by the BLM's past mistakes. Should you decide to comply with the law and issue an adequate supplement for public comment, you should also take into account the fact that the only study done of the relative reliability of results from exposure testing laboratories indicates that such laboratories nearly always understated the

2. See particularly, results on sample provided by a Five Rivers, Oregon mother, Exhibits, pg. 104. See generally, Eldon P. Savage, "National Study to Determine Levels of Chlorinated Hydrocarbon Insecticides in Human Milk," U.S. Environmental Protection Agency, Human Effects Monitoring Branch, Epidemiological Studies Program, Colorado State University (1976). The Five Rivers sample is excerpted from documents surrounding the Savage Study. (The mother's name has been purged in respect for her right to privacy.)

levels in samples tested. Since this is one of the Forest Service's own studies, it seems particularly appropriate for your "risk assessment" to reflect that the identified exposure levels are likely understated. Exhibits, pp. 105-135.

To assess the risk to humans of exposure to further toxins without taking into account the toxic burden already accrued in their tissues is sheer folly; one does not gauge the risk of adding another straw to the camel's back without first measuring the load the camel already bears. Numerous studies are available to BLM suggesting that the toxic burden in human tissues is already taking its toll.

EPA's Alsea Study and related testimony in the 2,4,5-T cancellation record strongly implicate previous forest and right-of-way spraying of dioxin-contaminated herbicides with increased reproductive problems in humans. See also Exhibits, pp. 51-103; 172-179. EPA has also conducted epidemiological studies on all forest-use pesticides in its Forest Use Chemical Project (FUCP); this information should at the very least be the base-line for any risk assessment on forest-use chemicals. BLM's active involvement in the FUCP was heavily documented in Merrell v. Block, Civil No. 81-6138-E (USDC Oregon), and those documents were already provided to your attorneys.

Both the EPA (in its Alsea Study) and the U.S. Centers for Disease Control have studied the incidence of human birth defects in connection with herbicide use in the forests of Oregon and elsewhere. See e.g., Exhibits, pp 191-201. Clearly, CDC does not share BLM's optimism about herbicide effects. The possibility

that unborn children are already being maimed by exposure to chemicals the BLM proposes to spray is crucial to assessing the risks of its spraying. Similarly, studies demonstrating increases in fish cancers3/ must be taken into account in calculating the risks of unleashing known carcinogens into the environment -- both inert and active ingredients.

III. False and contradictory assumptions about cumulative and synergistic effects

51-3 On the one hand, BLM asserts that because its own spray operations are insignificant compared to pesticide exposure from agriculture and related commercial operations, "cumulative effects on the public [from BLM spraying] should be negligible." On the other hand, BLM assumes no prior exposure in formally assessing the risks of its own spraying. The two positions are grossly incompatible.

"'Cumulative impact' is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions." 40 C.F.R. Section 1508.7. At the very least, BLM must consider the accrued contamination and impacts of its own previous spray programs as well as those of other agencies such as the U.S. Forest Service, Bonneville Power Administration, Federal Highway

3. E.g., Morell, V. "Fishing for Trouble." International Wildlife, July-August, 1984, pp. 40-43 (see especially fish cancer map developed from Smithsonian Institute's Lower Animal Tumor Registry); see also Mix, M. C. "Neoplastic Disease of Yaquina Bay Bivalve Molluscs." Proceedings of 13th Annual Hanford Biology Symposium, pp. 369-386 (1975).

Administration, etc.4/ (For example, the Forest Service has been spraying herbicides in the Coast Range since at least 1948; the accrued contamination and damage from nearly 40 years of herbicide spraying cannot be ignored in factoring risks of present and future spraying. Similarly, federal, state, and local agencies have been spraying roadsides throughout Washington and Oregon for many years, with up to 16 times the concentrations of chemicals used in forestry; the cumulative impacts of these past operations must be included in any scientifically-defensible risk assessment.)

Residues from such past operations may be extraordinarily persistent and toxic; e.g., dioxins in wildlife from roadside use of 2,4,5-T (see 2,4,5-T cancellation record and 1978 Forest Service Vegetation Management EIS), breakdown products of the herbicides themselves (e.g., dichlorophenols from 2,4-D;

4. EPA has concluded that genetic factors may be responsible for at least 10% of all human disease and that mutagenic chemicals "have been found widely distributed among drugs, food additives, cosmetics, industrial compounds, pesticides, and consumer products. . . . [I]t is believed that increases in the mutation rate above the spontaneous level will lead to an accumulation of deleterious mutations in the human population. . . . [M]inimizing exposure to mutagens is among the best available means to protect against further deterioration of the human gene pool." U.S. Environmental Protection Agency, Proposed Guidelines for Mutagenicity Risk Assessments, 45 Fed. Reg. 74984, November 13, 1980. Such basic information necessarily defeats the EIS's unsubstantiated assumption that the risk from mutations is no greater than the single-generation effects of cancer. See also, id., "Any risk assessment should clearly delineate the strengths and weaknesses of assumptions made, the uncertainties in the methodology, and the rationale used in reaching the conclusion, e.g., similar or different routes of exposure, metabolic differences between humans and test animals. The results should be expressed in terms of the excess of genetic disease per year or per lifetime, or the fractional increase in the *assumed background spontaneous mutation rate of humans*, or the radiation equivalency." (Emphasis added.)

and the tetrachloroazobenzenes from diuron documented in Merrell v. Block, supra). Add to these the reasonably foreseeable

51-4 continued increase in dioxin and other toxic chemical levels from forest and field burning,5/ agricultural and related commercial spraying, municipal incinerators such as the facility under construction in Salem (see Exhibits pp. 202-204), and industrial and consumer uses of products such as glycol ethers in some 250,000 products, including solvents used in Oregon's thriving electronics industry (Exhibits, pg. 40). BLM cannot rationally assume its spraying takes place in a vacuum, and its failure to assess the incremental impact of its program when added to other past, present, and reasonably foreseeable actions invalidates its risk assessments and conclusions entirely, precluding meaningful comment. Such broad examination of toxic exposures in a regional environment is not infeasible, and in fact has already been conducted: the National Research Council's recent report on the Great Lakes area pollution problems provides an excellent model for such a study. See Exhibits, pp. 205-218.

The BLM's failure to address cumulative impacts

51-5 compounds its deficient discussion of synergistic effects. BLM acknowledges (supplement, pg. L-89), that the subject of synergism must include "not only combinations of 2 or more of the 16 herbicides, but also combinations of the herbicides with other chemicals such as insecticides, that exist in the environment"

51-4 5. E.g., Sullivan, T.J. & M. C. Mix. "Persistence and Fate of Polynuclear Aromatic-Hydrocarbons Deposited on Slashburn Sites in the Cascade Mountains and Coast Range of Oregon." Archives of Env. Contam. & Toxic. 14(2):187-192 (1985).

(emphasis added). With absolutely no discussion of what "other chemicals" exist in the environment, BLM then dismisses the

51-5 possibility of synergism on the basis of a single combination of two proposed herbicides (2,4-D and picloram) purportedly studied by Dow Chemical Company scientists. BLM has not, however, provided the data in response to our FOIA request. BLM also discusses "a review of acute LD/50's for mixtures of 2 or more of the 16 herbicides used in this analysis that have been submitted to EPA," but does not state how many such mixtures were reviewed and has not provided that material under FOIA, either.

Had BLM looked beyond its own 16 herbicides and Dow's conclusory claims, it could have found a wealth of credible scientific opinion on the subject of synergism, including studies involving the very chemicals in the BLM supplement. 2,4-D, for example, has been shown to have synergistic effects in trout when combined with carbaryl, a common ingredient in consumer products such as garden sprays and flea, mite, and tick control compounds, as well as commercial farm products and large-scale government pest-control programs for gypsy moths, grasshoppers, and other insects.6/ Given the widespread use of carbaryl, it is certainly reasonable to assume that trout -- and people and other animals --

6. The studies also demonstrated synergism with several other pesticides. Statham, C.N. and J. J. Lech. "Potentiation of the acute toxicity of several pesticides and herbicides in trout by carbaryl," Toxicol. Appl. Pharmacol. 34(1):83-87 (1975). Statham and Lech. "Synergism of the acute toxic effects of 2,4-D butyl esther, Dieldrin, rotenone, and pentachlorophenol in rainbow trout by carbaryl." Toxicol. Appl. Pharmacol. 33(1):188 (1975). Statham and Lech. "Studies on the mechanism of potentiation of the acute toxicity of 2,4-D-n-butyl esther and 2',5'-dichloro-4'-nitrosalicylanilide in rainbow trout by carbaryl." Toxicol. Appl. Pharmacol. 36(2):281-296 (1976).

exposed to BLM's 2,4-D might also be exposed to carbaryl.

Numerous studies on dioxins (particularly TCDDs and HCDDs) demonstrate synergism between dioxins and other common substances such as anaesthetics, phenoxy herbicides and/or chlorophenols, and chlorinated dibenzofurans. The synergistic effects include enhancement of tumor induction, enhancement of some anaesthetics and impairment of others; immunotoxic effects; and increased conversion of some chemical carcinogens to mutagens.7/

The 2,4-D/carbaryl and dioxin studies underscore the importance of adequate synergism studies and illuminate the false, unfounded assumptions on which the BLM bases its discussion of synergism. The BLM's false assumptions on synergism are further invalidated by the failure to provide evidence of a lack of synergism between any of its 16 herbicides (alone or in combination) and chemicals that already exist in the environment, or synergism between the inert ingredients of those herbicide products and their active ingredients or other chemicals that already exist in the environment.

IV. Conclusion

BLM's unfounded assumptions and failure to examine the real-world environment into which it plans to spray toxic

7. See U.S. EPA, "Health Assessment Document for Polychlorinated Dibenzo-p-Dioxins," Office of Research & Development, Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, Ohio. EPA/600/8-84/014F, September, 1985, Final Report, pp. 11-1 to 11-140; 12-1 to 12-2. See also Exhibits, pg. 219 (dioxins widespread in environment).

chemicals shatter any semblance of common sense or scientific integrity in this supplement. Conscientious risk assessment involves far more than juggling numbers and exponents, as former EPA Administrator William D. Ruckelshaus recognized in discussing how to cope with the risk of pollutants:

> It will not be easy, because we must now deal with a class of pollutants for which it is difficult, if not impossible, to establish a safe level. These pollutants interfere with genetic processes and are associated with the diseases we fear most: cancer and reproductive disorders, including birth defects. The scientific consensus is that any exposure, however small, to a genetically active substance embodies some risk of an effect. Since these substances are widespread in the environment . . . we must assume that life now takes place in a minefield of risks from hundreds, perhaps thousands, of substances. We can no longer tell the public that they have an adequate margin of safety.

Exhibits, pp. 58-60. Ruckelshaus, W. D. "Science, Risk & Public Policy." Science 221: 1026-28. September 9, 1983.

Extending Mr. Ruckelshaus's analogy, BLM proposes to add yet more mines to the minefield, yet falsely represents to the public that its own mines present the only risk and perpetuates the illusion that margins of safety exist.

EPA's current Administrator Lee M. Thomas ranks pesticides at the top of EPA's list of "most urgent problems." Exhibits, pp 220-221. At the very least, BLM should take heed from our present and former EPA administrators and re-examine its so-called "risk assessments" in the light of reality.

NEPA requires more than a "bureaucratic shuffle."

Your supplement is so inadequate that it defies meaningful comment. A rational basis for its conclusions is

disproved by your inability to produce the purported "data" that the "risk assessment" is based upon. This document is not the product of good government. The best that can be said of it is that it follows in the best tradition of "widespread fraud" in the testing of pesticides. S.O.S., 747 F.2d 1240.

Lawfully, the supplement should be withdrawn and an adequate draft circulated. After a decade of dealing with your agency, we have no doubt that you will nonetheless force these issues into litigation. You were warned in Mr. Merrell's FOIA request and initial comments. We warn you again. We will seek sanctions against the responsible officials personally if we are forced to litigate the same issues again.

PAUL E. MERRELL

CAROL VAN STRUM

4-28-86

52

To whom it may concern,

I would like to comment on the Draft Environmental Impact Statement for the Western Oregon Area released by the Bureau of Land Management, concerning herbicide spraying on human health.

We on the Illinois Valley are most affected by the spraying. As cited on pg 70 of the statement, "the greatest risk occurs in contacting vegetation that has just been sprayed with one of the herbicides while picking berries and in eating vegetables that have received spray drift."

52-1 Based on this sentence alone it is obvious the impact to the environment of the sprayers to people, the water table, wood cutters, loggers, hikers, and anyone who happens to enjoy picking berries all are in danger. Anyone who enters the forest will be at risk.

The way the statement is written ~~it~~ ~~is~~ implies that they are trying to minimize the dangers. I voice my opposition to the report and the concept of spraying whereby spraying can only hurt the environment and the people.

Sue Beagon

53

4-28-86

RE: COMMENTS ON SUPPLEMENT
TO WESTERN OREGON
COMPETING VEGETATION DEIS

DEAR MR. SIMMONS,

YOU must find an alternative to herbicide straying.

1. FIRST OF ALL YOUR DOCUMENT IS VERY WORDY + VAGUE. IF it is for public REVIEW please write in laymans terms. Break it down to apples + oranges so all people can read + understand it.

53-1 2. THE NOEL DOSE IS unfounded because toxic reaction cannot be calculated in day or even months of observation, CANCER and Genetic mutations can OCCUR YEARS after exposure.

3. IF reforestation was possible prior to spraying in 1976 then I request you to not use it now.

53-2 4. I DONT TRUST ANY CHEMICAL TOXICITY TEST DONE BY THE COMPANIES SELLING THE CHEMICAL in question.

53-3 5. ON PAGE 8 you SAY "THERE ARE No residents, hikers, fishermen, or berry pickers in the vicinity of the vast majority of treatment limits. This is crazy. I live + hike and pick berries ~~at~~ ~~or~~ less than ¼ mile of ~~4~~ 4 of your proposed clearcuts. I have three children and I dont want them exposed to your poisons. WITHIN 3 miles are over 30

clearcut or proposed clearcuts. I go to a lot of trouble to grow unsprayed food and want to drink + breath non toxic water + air.
My opinion is that there are not any safe levels of exposeur to herbicides. I will personally devote my life against this atrocity if
53-3 you start spraying and I or my children get so much as a runny nose.
IF YOU SPRAY YOU MAKE THE FOREST UNSAFE TO HIKE PICK BERRIES ECT... I am registered in Josephine co with the ROAD DEPARTMENT TO NOT SPRAY ALONG THE ROAD IN FRONT OF MY HOUSE.
5. MANY OTHER PEOPLE LIVE LESS THAN A MILE FROM YOUR Sites.
6. WORST CASE. WHAT IF THE CHEMICAL TRUCK WRECKS NEAR MY HOUSE, TOWN, SCHOOL, STORE? I DON'T THINK the risk is worth it.
7. IF ONE PERSON GETS CANCER OR DIES OR GENES BECOME MUTATED it's NOT WORTH IT. THERE'S enough death and misery in the world without legalizing and producing and lawfully, purposely using it.
8. IT COSTS MORE TO TEST THE CHEMICALS (inadequately) than to manually weed around the young fir trees.
9. YOUR METHOD OF COMPUTING THE MARGIN OF SAFETY, ON PG 6 is unfounded and therefore the entire RISK
53-4 assessment is unsubstantiated
There is no basis for calculating human margin of safety using end animal LD50.
10. ON PAGE L-74 you say that the health risks
53-5 of spray are "negligible" and "pose no risk to health." Yet you admit that benzene, tolene, acetic acid

54

4-28-84

RE: Comments On Supplement To western Oregon Competing vegetation DEIS

Dear Mr. Simmons,
This letter is to bring your attention to herbicide spraying.

① I am a mother that lives in the Williams Valley. I am raising 3 children here. I was very disappointed to hear that B.L.M. is planning to use herbicide sprays again after it has already been banned for several years. In my eyes it is very dangerous to use any of these chemicals to spray because the invisible effect it has on the plant, grass, air, water, most important human beings. How can tests be done on rats be compared to how it will effect humans. I am conserned for mine and my childrens future that you reconsider why you are spraying in the first place.

② Alot of people here are willing to manual release rather then see spraying happen > less cost, no hazard to anyone's health why wouldn't you consider this alternative?

③ Have you considered what the worst case would be? How spraying effects everything around us? Has anyone in your family been effected by herbicide spraying? or anyone you know personally? These are question you should ask yourself instead of putting so much energy into testing rats to see how it would effect us. We know that it effects us no matter how much we are exposed to these toxic sprays.

53-5 are formed. Benzene is a form of Polynuclear Aromatic Hydrocarbons, (PNAH's) which is known to cause leukemia and cancer.
DIOXIN is also released when slash is burned. See secondary references in Slash Burn Polution + Degradation of Resource Values. by Roger Hart of OR.
53-6 State Univ. 1985 and EPA 245 T Cancellation HEARING.

I hope I have made my point. DON'T USE HERBICIDES!

William P. Spann

2125 KINCAID RD
WILLIAMS OR
97544

~~It Still Effects~~.

We are sestive people that are trying to raise our families in a non-violent, non polluted enviroment. We also need to be heard for our rights as legal citizens. In just what your plans are for spraying we are not being consulted.

Frieda B Spann
2125 Kincaid Rd.
Williams, Oregon 97544

55

April 28, 1986

re: Comment on Suppliment to Western Oregon Competing Vegetation DEIS

Dear Mr. Simmons,

We breath the air and grow our food downwind from BLM land in Southern Oregon near the center of the town of Williams.

55-1 ① The suppliment states that a vast majority of spray sites are away from residents, sportspeople, etc. I am convinced that the ~~harmful~~ toxic (to humans) drift from chemical herbicides travels far from the source. Evidence for this is presented in the book: Herbicides And Human Rights.

55-2 ② The suppliment does not include the record of worker exposure – as if this weren't a real problem. "Margin of Safety" statistics may be appropriate if no health effects have appeared in the past. Industry and government are known to evade responsibility for health damage and death. Thank goodness there are courts and lawyers. There are alternatives to the herbicides; manual control hires more local people (more people altogether) and is cost/effective.

55-3 ③ The worst case analysis EXAMPLE the BLM dreamed up seems to be less extreme than real problems that have already come up in the Northwest, so the study (suppliment) lacks much force.

Thank you for reading this.

Kindler Stout
555 Tetherow
Williams OR 97544

①

56

4-28-86

RE: Comments on the Supplement to Western Oregon competing Vegetation

To Mr Simmons,

My name is Randy Carey and I recently bought a farm in Williams, Ore. I learned recently that the Gov't wants to spray alot of herbicide in the clear cut area's near and around Williams Oregon. Since Williams Creek runs through my property, I was interested in learning more about the spraying. I've figured a copy of the worst case analysis (W.C.A.) and am amazed at the ~~the~~ lack of clarity in the Document.

56-1 All of the streams from the areas in question of being sprayed flow into the two forks of Williams creek and then into the main-fork Williams creek on into the Applegate River which flows to the Rogue River through parts of Grants Pass and into the ocean. Anyone along this water route – spraying site to the ocean – has got to be somewhat afraid of the uncertain effects!

①

Just the fact that there is a cancer risk chart in the W.C.A. scares me. I also cannot clearly follow the correlation between the Hazard anal., the Exposure anal., and the Human Health risk analysis. I don't understand the computation or formula for determining the effects on HUMANS! In fact the entire document is a bit difficult to understand, and I think further studies should be performed before spraying. Also more people should be better informed, as this came as a surprise to me. I was fortunate enough to see a pamphlet on a meeting about the spraying but many people who live along the water systems are unaware that this may come down and directly collect and therefore effect their homes, lives, and property.

It seems to me that a group of people physically chopping down competing vegetation would be much cheaper than operating costly helicopters and planes.

Please don't spray in our area, this issue needs more research!!

RANDY CAREY
Box 27, Williams Ore 97544

57

Kai Jacobson
Box 181
Williams, Or.

Dear Mr. Simmons – comments on: Suppliment to western oregon competing Vegetation DEIS

57-1 I wish to share with you some ~~feed~~ back about your hazard and effice of the toxicity of herbicide. Personally I could help noticing the lack of information on the effect on the collection & burning of ~~fire~~ wood ~~of~~ that has been sprayed – It is my understanding that when burned many of these herbicides change chemically to extremely dangerous material.

Secondly I have a friend who lived in New Zealand a # of years ago – He and his wife (who was 6 months pregnant at the time) got sprayed by mist the by a farmer with 2-4-D – Their baby was born with classic deformed limbs due to the toxic exposure – He died three months later – They are currently in involved in 5 million dollar court case – Please do not allow the spraying of these toxic materials in our forest & Water shed – Thank you

Kai Jacobson

4-28-86

R: Worst Case Scenario Study
DEIS. STATEMENT.

1. This Report is virtually unreadable and not understandable by myself, my friends, or I'm sure, most average citizens. Something so important as herbicides, should be highly understandable & easily read; not meant for the Pros or your average scientist!!

2. Where are the comments made by folks who have used back pack sprayers and others directly in contact by air or touch!

3. I mean, how many rats really equal me, my wife, my family??!!

4. When you say on page 8 lower left. "... minus sign... no longer termed margin of safety but is called SIMPLY negative ratio", How can you use the term "SIMPLY a negative ratio" !!! It wouldn't be so simply negative to me or to you I'm sure if we got sprayed.

5. I live in a water shed that was sprayed 2 years ago - Powell Cr. in Williams, OR - There are 17 separate families on my road; none were noticed of possible drifting mist, or water contamination, But when we all heard we were all highly offended!

6. I would urge strongly a halt to any & all herbicide use anywhere on government land. for the reasons that this DEIS. on worst cases is totally incomplete and obviously slanted to ABLM outlook & persuasion!
Why is the immediate and long term public affects always whitewashed with rat studys, no real hard studys from those who have experienced various exposures, and figures like mos = $\frac{\text{Animal NOEL}}{\text{Est. human dose}}$

7. The Result is so incredibly vague & irritating, that I Believe it actually makes those not involved/interested jump into the controversy!

Me & my family are strongly opposed to her bacides on our Earth — Please take note & pay strong attention to folks who feel as we do —

Paul Safary
370 Glenlyn
Williams, OR 97544

4/28/86

RE: Comments on supplement to western Oregon Competing vegetation.
DEIS

Dear Mr Simmons,

I have recently been encouraged to right a letter concerning the misuse of toxic sprays as herbicides in our local eco system, Southern Oregon. My experience with the lethal dose that we as humans cannot withstand is evident in [redacted] children who have walked irrigation ditches of 2,4D contamination and died of cancer just from playing in an irrigation ditch in a tomatoe field. I understand that this is a different case regarding the spraying in my local ecosystem Williams Oregon. Yesterday I watched a spray truck in action on Williams highway and once again saw the deathly energy of a toxic chemical being haphazardly squirted into the ditch in a residential area. It just seems useless to controll weeds with chemicals. I grew up in New York State where the undergrowth vegetation is far more tenacious than our country roads in Oregon and never did I see spraying predominate the roadside. They simply where maintained with good

59-1

mowing and clipping equipment.
2,4D poisoning is obviously dangerous in even the smallest doses. I've seen lymphoma and also thyroid reactions in friends who've been exposed to down wind spraying.
Alternatives is our only answer to the madness of toxic chemicals. The living organism of the earth does have all the remedies and solutions to what we have created as hazardous situations due to clearcuts and the abandonment of the Earth's natural Covering with leaching and erosion problems more acute chemicals can travel in waterways and natural end up in low lying places where homes and children with pets may be playing are living.
It would be a great improvement on our overall ecological lives to become more tuned in to the real solutions concerning this corporate issue. With a good study of our living biosphere and where the answers really lie we can make it a better world to live in. Thanks for your consideration.

Richard Peterson
1130 Tetherowroad
Williams, Oregon 97544

4/28/86

RE: Comments on Supplement to
Western Oregon Competing Vegetation

Dear Mr. Simmons:

#1 First of all, I feel the document itself is very difficult for the layperson like myself to decipher; the terminology, language is difficult to understand, to say the least.

I am amazed that herbicide spray is still a considered alternative in BLM practice. Before moving to California, I lived in Mendocino County, California, where herbicide spray was banned + is now up again for renewal of herbicide spray procedures. I would like to see this issue decided against for once + for all. I am talking about the toxicity of the spray + the horrible side

#2 effects + risks to human safety, your method of computing the MARGIN OF SAFETY, as explained on

60-1 page 6, is unprovided, and therefore the entire RISK ASSESSMENT is unsubstantiated. There is no basis for calculating human margin of safety using an animal LD_{50}. I know there is a great risk to human life + well-being.

#3 You state on page 8 that there are no residents, hikers, fishermen, or berry pickers in the vicinity of the vast majority of treatment units." This is not true here in So. Oregon where home + more rural

60-2 areas are being populated next to BLM land. Therefore, your conclusion that few people would be exposed is unprovided. I live in the Williams area where myself + many of my friends/families all live surrounded by BLM land. We grow our food next to the forests + our children play all around. Spray into creeks + our water systems is a total possibility of being contaminated + we are at stake.

#4 Your worst case analysis (using rats as subjects) is not in alignment w/ my own. The heard cases of trucks turning over + spray

60-3 leaking over into the creek + immediately into the water supply. Or spraying the roadways + people picking blackberries + getting really ill — even to death in a case I heard of in Washington State.

#5 I can't imagine the toxicity levels of the proper w/ backpack sprayers or from trucks — this poison KILLS people, it kills unborn fetuses + causes incredible birth defects + genetic mutation.

#6 Does you care at all about human welfare + the continuation of the human race, reconsider this document + worst case analysis. Humans are not rats + not at all similar + it is impossible to compute those differences in toxicity levels. Rats C-1 thru C-60 use NOEL levels that have not

60-4 been reduced to account for (1) human body weight differences + human vulnerability. In similar analyses by the EPA, NOEL levels for rats were reduced 100 times to account for the increased potency to humans.

#7 It also seems that there are data gaps in this document and missing studies are not adequately disclosed.

Still the Potter represent myself, my husband, + my 2 children. PLEASE listen to my comments + others like me.

Separa M. Jackson Williams, Ore.

Comments on Supplement to Western Oregon Competing Vegetation DEIS

Dear Mr. Simmons:

Your worst case study is not [redacted] honest or complete. Why don't you accept the facts of miscarriages, leukemia, birth defects as bad enough already? You know better than any of the misinformed public how truly terrible and horrifying your poison spray practice really is, but you don't care. You only care about your pile of green paper. But we do care,

we the people who live in the mountains and appreciate the few remaining vestiges of the miracle of the creation of the bio-sphere. We come here to escape the poison of your society, we have children, who deserve what God made for them. You state on page 8 that there are no residents or sportsmen in your spray areas. This is a lie. There are many people bordering and using your land, and every watershed, official or not, is used. We don't want your spray in the environment. You know how spray accumulate and last forever, and through all your effort to keep the numb public uninformed there are those of us who know, to enough of an extent that we say NO!

I worked on a manual release contract. I was paid $20 an hour, as were ten others, and the inspector told us that we underbid the spray helicopter. I know you speak + think in terms of money, cost effectiveness! Why not let the people who care cut the brush? It's a more effective + long-lasting solution and CHEAPER! We know that you are effectively owned by DOW, but you don't have to destroy the earth to harvest timber, we pray to God to turn your minds + hearts in favor of the future of the world.

You have the technology, but you find that the monopoly is more rewarding to your monetary gain than the socialistic approaches.

DO not spray herbicide anywhere

Brenda Smick
Williams, Oregon

4/28/85

62

Dear Mr Simmons,

I have been awaiting opportunity to comment on the Supplement to Western Oregon competing Vegetation D.E.I.S., with hopes that it would take a reasonable tack in describing potential problems in the use of herbicides.

As an organic farmer, certified for three years by the Tilth Producer Certification program, and a father of three children who hike and play in the woods, I do not feel comfortable with tests which liken human vulnerability to the vulnerability of rats. It is my experience that spray ~~drift~~ drift does occur, and that water sources are contaminated by aerial application of pesticides. At the very least, proximity to spraying would make us lose our organic certification, a financial burden to us. Why perpetrate a form of agroforestry which endangers humans — the gains cannot be worth the cost.

You state on page 8 that "there are no residents, hikers, fishermen, or berrypickers in the vicinity of the vast majority of treatment units." What about the folks who are exposed in the minority of these cases? Aren't they important? Why isn't it? Doesn't seem as if we need to employ much imagination to envision a more weighty accident than your "worst case analysis."

Richard A Eich
P.O. Box 69 Williams, OR 97544

63

Horizon School
1960 East Fork Rd
Williams, OR 97544
April 29, 1986

Gregg Simmons
Environmental Coordinator
BLM Oregon
P O Box 2965
Portland, OR 97208

Dear Mr. Simmons:

Concerning the revised worst case analysis, I question the accuracy of this document in representing the real risk in employing herbicides in the forest.

#1 You cannot equate the effects of herbicides on rats to the effect of herbicides on humans, except that it is harmful to both species at any level. This portion of the document is unreadable and unconvincing.

#2 Herbicides are a potent poison. It says so right on the label. Why take the risk that mishandling will cause injury to people? Why put brush control over safety of human beings?

Sincerely concerned,
Wayne Bennett Eich
preschool & kindergarten teacher

64

OREGON STATE DIRECTOR
BLM (935)
% R. GREGG SIMMONS
P.O. BOX 2965
PORTLAND, OR. 97208

APRIL 30, 1986

DEAR LAND MANAGERS,

THANKS FOR THE OPPORTUNITY TO COMMENT ON YOUR DEIS SUPPLEMENT, EVEN THOUGH I'M A COUPLE DAYS LATE. THERE'S JUST A FEW LITTLE THINGS THAT ARE QUESTIONABLE.

64-1 YOU ADMIT ON PAGE 1 THAT "SCIENTIFIC UNCERTAINTY" EXISTS REGARDING 2,4-D AND PICLORAM CARCINOGENCITY, YET ON PAGE M-1, "NEITHER 2,4-D NOR PICLORAM HAS BEEN SHOWN TO BE A POTENT CARCINOGEN." CONSIDERING THE CONTROVERSIAL NATURE OF THESE CHEMICALS, INNOCENT UNTIL PROVEN GUILTY IS HARDLY JUSTIFICATION FOR THEIR USE. APPROPRIATE JUSTIFICATION BY MEANS OF ADEQUATE TESTING AND RESEARCH IS PASSED OFF AS "EXORBITANT" IN COST SO THE QUICKER WORST CASE ANALYSIS CAN EXPEDITE THE FINAL EIS/DECISION PROCESS. 3.5 TO 4.2 MILLION DOLLARS IS THE VALUE ESTIMATED FOR THIS RESEARCH. SOUNDS LIKE A LOT SINCE NO RELATIVE COMPARISON IS GIVEN. LET'S COMPARE IT WITH BLM TIMBER INCOME... D.O.I/BLM. PUBLICATION "PUBLIC LAND STATISTICS - 1984", page 180 LISTS OREGON'S TIMBER SALE RECEIPTS FOR 1984 AS $150 MILLION. THE DEIS, page 14, STATES "5 TO 10 YEARS" AS THE APPLICABLE TIME FOR THESE DOCUMENTS.

AVERAGING AND CALCULATING:

(7.5 YEARS) × ($150,000,000/YEAR) = $1.125 BILLION

HMMM.... LET'S SEE HOW EXORBITANT IT WOULD BE TO RESEARCH ALL THE CHEMICALS IN APPENDIX M, WHICH TOTALS $15,466,817.

15,466,817 ÷ 1,125,000,000 = 1.37 %

RESEARCHING 2,4-D ALONE WOULD BE 0.3 % OF THE TIMBER RECEIPTS FOR THE E.I.S. PERIOD. HOW THIS AMOUNT COULD BE CONSIDERED EXORBITANT IS BEYOND MY COMPREHESION. ESPECIALLY SINCE ONE OF THE ASSUMPTIONS OF THE DEIS (page 77) IS THAT UNLIMITED FUNDING IS AVAILABLE!

64-2 TABLE 3 ON PAGE 3, FOOTNOTE 2 CONTAINS FALSE INFORMATION. THE NOEL IS THE HIGHEST, NOT LOWEST, AMOUNT OBSERVED TO HAVE NO EFFECT. PAGE L-29 DEFINES NOEL CORRECTLY, BUT CONTRADICTS THE FOOTNOTE. I POINTED THIS OUT TO THE LOCAL COOS BAY BLM ENVIRONMENTAL SPECIALIST, BUT FEEL IT'S IMPORTANT ENOUGH TO REPEAT HERE.

64-3 REGARDING MARGINS OF SAFETY: I HAVE NO QUALMS WHEN MOS VALUES ARE STATED AS "GREATER THAN..." A CERTAIN AMOUNT AS IN TABLE 5. THE GREATER, THE SAFER. BUT WHEN STATED "LESS THAN 10" AS IN TABLE 6, IT IS LEFT FOR CONJECTURE EXACTLY WHAT THE SAFETY FACTOR IS, IF ANY. FOR EXAMPLE, FOR 2,4-D, THE BERRYPICKER ROUTINE WORST-CASE MOS IS 40% OF THE HIKER. BUT FOR THE ACCIDENTAL WORST-CASE, BOTH ARE LISTED AS SIMPLY "LESS THAN 10." EXTRAPOLATING THE ROUTINE RATIO YIELDS AN M.O.S. OF LESS THAN 4 FOR THE BERRYPICKER. I CAN SEE WHY YOU DIDN'T PRINT THE EXACT NUMBERS!

64-4 THE BERRYPICKER SCENARIO IS FURTHER QUANTIFIED IN THE APPENDIX BY HYPOTHESIZING WHAT SUCH A PERSON WOULD CONSUME. HUMANS HAVE THEIR GASTRONOMICAL LIMITS, NO DOUBT. ANOTHER SCENARIO NOT CONSIDERED BUT CERTAINLY VALID IS THE DAIRY GOAT OR COW FEASTING IN THE SAME LOCATION CHOSEN FOR THE BERRYPICKER. ANY CAPRINE OR BOVINE ENTHUSIAST CAN VOUCH FOR THE ANIMALS ABILITY TO FAR SURPASS CONSUMPTION LIMITS OF PEOPLE. PEOPLE WHO, UPON MILKING THE ANIMAL AND CONSUMING THE PRODUCT ARE RECEIVING A CONCENTRATION OF THE DAYS FODDER. BECAUSE I LIVE IN THE COAST RANGE, SURROUNDED BY B.L.M. LANDS, FEEDING GOATS MILK TO A BABY WHO CAN DRINK MORE MILK THAN I COULD EVER EAT BERRIES, SUCH A SCENARIO IS RELEVANT. I DRINK MILK, TOO, AND ACCUMULATION OF DOSES I MAY RECEIVE FROM DRINKING WATER AND EATING BERRIES AND VEGETABLES AND DEER AND FISH AND BIRD AND CONTACTING VEGETATION IS TRULY A WORST CASE NOT PROPERLY ADDRESSED. PERHAPS WORSE-CASE ANALYSIS WOULD BE A MORE ACCURATE DESCRIPTION.

TOM WILCZEK
DORA, OREGON

65

April, 30, 1986

Isabel Kunz
P.O. Box 190
Williams, Or.
97544

Dear Mr. Simmons,

Many years ago I came to Oregon with my husband and three children hoping to buy a farm and settle down. When I learned that the BLM was using 2-4-5-T, I knew that my plans would not be realized. Having lived in Maine where the hazards of 2-4-5-T had already been established, I could not conscientiously expose my family to such health risks. So we went back to Maine, and in September of 85 we returned to Oregon believing that herbicide use had been banned. Now that our house is in progress I hope that we will not be forced to leave again.

As you read this letter please keep in mind that in Oregon as well as in Maine we were always assured by government and forestry officials that 2-4-5-T was safe. However, doctors and biochemists were not able to give us the same assurance. Must we be used as guinea pigs again to determine if all herbicides are harmful to humans?

The worst-case analysis has many gaps in toxicity knowledge. It presents the worst-case as if it takes place in a sterile laboratory rather than an ever changing environment already burdened by natural and man made toxins.

65-1 The worst-case analysis doesn't consider synergistic effects, pregnant women, infants and children, the elderly, or extra sensitive people. It presents its case as if we are all healthy adults. It seems to me that the worst-case analysis raises more questions about our safety than it answers. Until we are certain that a chemical has no deleterious effects it is immoral and dangerous to introduce it into the environment.

Please consider to what extent the public's best interest is being served. Is the public being considered fairly; or is it being ignored in favor of strong chemical company lobbyists? Short term profits are not necessarily good for the quality of life on earth.

Sincerely,

Isabel Kunz

66

STATE OF OREGON 1859 VICTOR ATIYEH GOVERNOR

Department of Environmental Quality

522 S.W. FIFTH AVENUE, BOX 1760, PORTLAND, OREGON 97207 PHONE (503) 229-5696

May 2, 1986

Oregon State Director
Bureau of Land Management (935)
c/o R. Gregg Simmons
P.O. Box 2965
Portland, OR 97208

Mr. Simmons:

Thank you for giving us the opportunity to review and comment upon the Supplement to the Draft Environmental Impact Statement for the Western Oregon Program - Management of Competing Vegetation. Our interest is in the release of pesticide and pesticide by-products during the burning of forest residues. We have two comments on your analysis of this issue.

66-1 First, with respect to your analysis of the direct release of pesticides, we see that it is very sensitive to the decay rate of the pesticide and therefore to the period of time assumed between application and burning. Your assumption of 5 months was based on the stated "typical" time period between application and burning. Our question is whether shorter times ever actually occur. If so, we would suggest that analysis assume a reasonable "shortest" time rather than a typical one.

66-2 Second, we note that the brief analysis of pesticide combustion products is based on laboratory studies carried out at temperatures from 800 to 1000 degrees C. We question whether these studies are applicable to the fate of the pesticides during real combustion conditions. If average temperatures during the burning of forest residues were even close to these levels, there would be relatively complete combustion and no smoke problems. Clearly this is not the case. Therefore, our opinion would suggest that this analysis be based on studies done at lower combustion temperatures.

66-3 In addition, we were surprised to find that in the Section 4, Exposure Analysis, the inhalation of pesticide sprays was discounted as insignificant. The results from the worker studies which you cite do not appear to be conclusive for workers. In light of the uncertainties surrounding public exposure, we believe additional consideration is necessary.

Again, we appreciated the opportunity to review your analysis and would be pleased to have our staff review these comments with you.

Sincerely,

Thomas R. Bispham
Administrator
Air Quality Division

DEQ-1

NCAP
NORTHWEST COALITION for ALTERNATIVES to PESTICIDES
P.O. BOX 1393 EUGENE, OREGON 97440 (503) 344-5044

67

COMMENTS ON THE DEIS FOR WESTERN OREGON PROGRAM
MANAGEMENT OF COMPETING VEGETATION

The following comments are offered to the Oregon State BLM specific to the DEIS for western Oregon forest vegetation management that was first released for public review in June, 1983. It is the opinion of the Northwest Coalition for Alternatives to Pesticides that a substantial portion of the DEIS is no longer adequate for a meaningful analysis of the alternatives that were identified in the Draft. In addition to new information being available, the DEIS has some serious flaws that would best be remedied by writing a new DEIS that incorporates the comments on the 1983 Draft EIS and the 1986 Draft Supplement.

I. Writing One Draft Document Avoids Unnecessary Confusion

The public has just witnessed an incredible series of EIS documents prepared for the USDA National Gypsy Moth Program. This NEPA process produced a Draft and Final EIS, a Draft and Final Supplement, and a Draft and Final Addendum. Although the District Court has ruled these documents to be legal, the EIS is under appeal since contradictory information in contained in the various portions of the documents. It would be most prudent at this time for the BLM to take a clear and concise, integrated approach to its documents and avoid the bandaid strategy employed by the USDA.

II. The EIS Needs Better Documentation

67-1 Some of the information most integral to analysis in the DEIS is not referenced which is in violation of 40 CFR 1502.24. Often the DEIS makes general statements that support the purpose of the program without indicating the scientific basis for the statement. As a result, the DEIS appears to be a document that justifies a proposed action rather than one that assesses the impacts of various alternatives. Some examples of these general and unreferenced statements are:

1) "Control of competing vegetation increases conifer growth and chances for survival of an acceptable number of well-spaced trees per acre on as many acres as possible..." (p. 2) This is the purpose of managing vegetation, but nowhere is the scientific validity properly identified.

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2) "The primary treatment objectives [of site preparation] are to provide planting spots and planting crew access by reducing slash and to improve plantation success by reducing vegetation that competes with conifers." (p. 8)

"Burning would temporarily eliminate or supress competing vegetation, improving conifer survival." (p. 48)

"However, growth of this [lightly burned] vegetation will be delayed, providing more competition-free growing time for conifers than would be available in most unburned areas." (p. 48)

3) "Maintenance treatments promote the survival and establishment of conifer seedings. Release treatments reduce competition between shrubs or grass and existing commercial conifer seedings and promote dominance and growth of established conifers" (p. 9)

"Fast-growing brush and harwoods such as vine maple, ceanothus, red alder and tanoak overtop and suppress slow-starting conifer seedlings. Brush and hardwoods grow rapidly, shutting out essential light and competing for water during the dry summer. On most sites, grass and forbs also compete effectively for water. The degree and type of competition vary by site. With reduced competition, conifers grow beyond the point where they can be overtopped and further supressed by surrounding vegetation. When this growth is achieved (approximately 3 to 10 years from planting), no further control of competing vegetation is necessary except precommercial thinning." (p, 9)

"Chemical release would increase the growth rate of young conifer seedlings stressed by competing vegetation." (p. 48) Despite considerable debate among silvicuturalists about this assumption, only two studies are provided to substantiate this statement; Gratkowski and Lauterback 1974 (for heigtn growth), and Lauterback 1967 (for diameter growth).

"Many competition problems occur when understory vegetation remaining after logging is already in the tall shrub stage." (p. 23)

"Regeneration problems can often be severe following timber harvest in this [Interior Valley] zone, primarily due to moisture limitations caused by grass and brush encroachment." (p. 23)

"Extra costs would be incurred under some alternatives due to the use of less effective practices such as manual cutting." (p. 76)

4) "Soil productivity could be enhanced or reduced by the destruction of soil microorganisms [after burning], but impacts would be minor and short-lived." (p. 46) This section on

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impacts on soils is usually documented, but this is an example of where it is not. Interestingly, the only documentation in the section that describes soils (p. 22) is to a study that discusses how soil microorganisms break down herbicides. The DEIS appears to be a justification document.

Without documentation of the assumptions made in the DEIS, the public has no way to assess if valid scientific method is used to make important silvicultural conclusions. Under contract with the Forest Service, a comprehensive literature review was done at Oregon State University in March, 1985 by D.A. Perry, J. Tappeiner, and B. McGinley entitled A Review of Literature Pertaining to Vegetation Management on the Siuslaw National Forest: Phase I--Early Successional Patterns, Competition Between Trees and Associated Vegetation, and Efficacy of Vegetation Control Techniques. The BLM may find this review of assistance in documenting and referencing materials for the EIS.

III. New Information is Available that Warrants Updating the EIS

67-2 In addition to the literature review cited above, there is other new information that will update the document and trigger new analysis of the alternatives.

Most importantly since 1982, a body of field information about the efficacy, cost and range of non-chemical alternatives should be available to the BLM. Starting in the fall of 1982, data should be available to document what has been accomplished since injunctions were imposed by three judges in various Northwest lawsuits. Seedling survival figures should be available for mulching projects on various districts. Conclusions from post-treatment evaluations for biological, mechanical and manual alternatives should be incorporated into the BLM assessment.

67-3 Current information on costs (using information that has been generated since 1983) needs to be used to rewrite Appendix B.

67-4 The section on biological alternatives (pp. 10 and 50) can be expanded, as there is considerably more experience and information on grazing with sheep, cows and goats.

67-5 A section on the use of a clearing saw would enhance the discussion of manual alternatives. A good source would be the June, 1985 report to the British Columbia Ministry of Forestry, Silviculture Branch, Victoria, B.C. by Michael Conway-Brown entitled Manual Control of Red Alder with Clearing Saws: Operations Report and Equipment Assessment. An update on pulling techniques would also be useful for decisionmakers who evaluate these alternatives.

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67-6 The economics section of the DEIS would be substantially different with an update of new information. The "basic assumptions of the analysis are that sufficient funding and personnel will be available for implementation of the final decision..." (p. 44). With dramatic changes in the timber and federal economies since 1983, further analysis of these assumptions is necessary.

67-7 BLM should explain how the timber buy-back bill and Congressional budget constraints imposed by legislation like Gramm-Rudman affect reforestation programs. The discussion on page 36 about the effects of timber harvest on public revenue needs to include more recent data. Timber related jobs, local county revenues from BLM lands, and percentage projections about taxes levied have undergone tremendous changes since the early 1980's. For instance, Table 2-14 (p. 38) does not calculate the tremendously reduced receipts from FY 82. This reduction has continued and should be assessed in the EIS for inclusion in the economics discussion. Table 2-15 calculates figures for FY 1981-1982, which is different from the FY 1981 or 1982 figures in the previous table. What is the difference in these two Fiscal Years? This information needs to be clarified, as it is confusing. Projections about the impacts of reforestation practices may be dwarfed by the impacts of legislation to accommodate over-speculation by timber buyers and the soaring federal deficit.

67-8 BLM should explain how a shift from old growth processing mills to second growth processing mills affects jobs. Retraining and reemployment of workers who have lost jobs in the forest products industry in the last few years can shed light on the reemployment discussion (p. 64). Job impacts caused by export of raw timber and imports of Canadian lumber should also be included. This information is important to the discussion of how vegetation management practices fit into local and regional economic outlooks. Without a discussion of the other factors that influence the economic health of the region, the projections are meaningless. Let's have the whole picture.

67-9 The DEIS projected a drop in the allowable cut (overall 19.7%) should no herbicides be available or should the no action alternative be selected (34%). An update on what has happened since the ban is needed. This update should include costs spent on what types of vegetation management projects and acres treated. Some districts or resource areas may have come close to the no action alternative. If so, the effects those strategies have had on the allowable cut need to be clearly explained.

67-10 Smoke management concerns are not only expressed in Eugene and Medford as indicated in the DEIS (p. 41). The Department of Environmental Quality has been holding a series of hearings since the summer of 1985 on smoke management issues, and it is clear that there are concerns expressed in numerous communities outside these metropolitan areas. The DEIS should incorporate the

expanded geographic area into the DEIS and consider it in their assessment. Also, much information has come to light since 1983 on human and environmental health risks associated with burning. This information must also be included and evaluated in the section that deals with the impacts of the proposed program. A copy of two articles that appeared in NCAP's quarterly journal in 1984 and 1985 are attached. 67-11

IV. A More Rigorous Exploration of the Alternatives is Warranted

NEPA regulations require agencies to "rigorously explore and objectively evaluate all reasonable alternatives" (40 CFR 1502.14(a)). The DEIS contains a range of alternatives, but the document varies widely in the standards that are used to evaluate alternatives. 67-12

In the discussion of vegetation management treatment and design features, for instance, hand cutting operations are described as follows:

> Cost and biological effectiveness are highly dependent on terrain, soils, season of treatment, age and size of conifers to be released and the species, age, quantity annd size of target vegetation. (Page 10.)

The discussion immediately following it is about herbicide applications. Reference is made to Gratowski's work specific to timing of herbicide applications, but the same criteria mentioned for evaluating cutting are not mentioned fir herbicides. This reinforces the bias of the document. Without question, the same factors would affect chemical applications. The public has no reassurance that the BLM has used or will use an equally critical and evaluative eye for all alternatives. It's as if the chemical alternative is assumed to be effective, while other techniques are subject to standards that the chemical alternative is never evaluated for.

Another example is the disclosure about lack of long-term conifer growth data from sites that have been previously burned and the consequent inability to assess the effects of buring on soil productivity (p. 45). A similar lack of data makes it impossible to assess the effects of silvicultural practices on an entire rotation, but the benefits of vegetation management practices are not evaluated in the document. They are simply assumed (and generally unreferenced).

No alternative is described in the DEIS that has an ecosystem approach to vegetation management. Such an alternative would consider the role of all species in the productive forest environment, from microorganisms to wildlife and fish. This alternative would enhance forest diversity, fertility, and sustainability. The current alternatives are species specific (with a preference for conifers), disregard questions of longterm 67-13

fertility, and demand a high level of artificial inputs to maintain production.

The no action alternative must be looked at again more closely. Many sites are establishing without use of maintenance sprays. Coniferous species on many sites dominate without release. With questions unanswered about the longterm benefits of vegetation management over a full rotation, the no action alternative may offer the best option to managers.

CONCLUSION

The DEIS as supplemented must be rewritted in one document to avoid a crazyquilt pattern that leads to confused and unsound decisionmaking. Substantial portions of the 1983 document are so outdated as to undermine the usefulness of the information in reaching a good decision. A new draft could include the wealth of information that has been gained since 1983 on the various alternatives that are available for vegetation management. Further, an alternative that is based in an ecosystems appoach to management need inclusion in the BLM's statement.

Sincerely yours,

Norma Grier

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May 2, 1986

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May 11, 1986

Comments on Supplement to the Western Oregon Program - Management of Competing Vegetation Draft Environmental Impact Statement

Background

The following comments are offered on behalf of the Northwest Coalition for Alternatives to Pesticides (NCAP). Although the official comment period ended on April 30, 1986, Gregg Simmons indicated to NCAP by phone on April 21, 1986 that our comments could arrive on May 12, 1986 since the BLM would not be meeting prior to that for discussion of the comments. Mr. Simmons indicated that these comments will receive the same consideration as comments that had arrived by April 30.

Although NCAP sent a Freedom of Information Act request on March 5, 1986 to the U.S. Environmental Protection Agency (EPA) to obtain unpublished documents referenced to the EPA in the Supplement to the Western Oregon Program - Management of Competing Vegetation. Draft Environmental Impact Statement, we have still not received five of the documents. We will send in comments based on those documents when they are received and expect that such comments will be adequately considered and responded to prior to the issuance of a Final EIS.

On March 5, 1986, NCAP requested that copies of all upublished references be sent to the Eugene District BLM for review by NCAP during the comment period. This request was denied. Mitch Lucas, a student at the University of Oregon, requested copies of the unpublished references and was granted his request. After intervention by attorney Michael Axline on behalf of NCAP, copies of most of the unpublished references were sent to NCAP on April 23, six weeks after the original request. NCAP has not had sufficient time to read those documents, as their arrival coincided with preparation of documents to appeal the BLM decision to implement the program sketched in the BLM Northwest Area Noxious Weed Control Progam - Final Environmental Impact Statement.

NCAP believes the State BLM office in Portland should have had all unpublished referenced material available at its office for distribution to the interested public the day this Draft Supplement was released. The published reference material should have been available at the Portland office for review by the interested public, since many of the published articles are not available at local libraries and are not easily obtained within the comment period through interlibrary loan. In the comments that follow, NCAP will indicate that it is crucial that the documents BLM references be reviewed, because many of the documents reviewed in fact provide information that differs greatly from the conclusion(s) attributed to them. 67-14

General Comments

The Draft Supplement must be rewritten and recirculated as a Draft Supplement because as it now stands, (a) it is unreviewable by the public; (b) its summary of referenced material is frequently false; and (c) its quantification and science are fundamentally erroneous.

(a) The Supplement is unreviewable by the public. The calculations that produce the 160 tables of "margins of safety" for the exposed public and workers (L-131 - L-178) are unreviewable because the Supplement does not indicate what formulas were used to arrive at the figures and does not indicate the precise numbers that were entered into the formulas or where those precise numbers came from. NCAP is therefore unable to comment on either the logic, science, or mathematics that yielded the thousands of numbers that presume to tell the public and workers their risk from BLM's herbicide program. 67-15

(b) The Supplement's summary of referenced material is frequently false. The majority of this Supplement (i.e., Appendix L, "Human Health Risk Assessment for the Use of Herbicides in the Vegetation Management Programs of the U.S. Forest Service in Washington and Oregon and the Bureau of Land Management in Western Oregon) was prepared by Labat-Anderson Incorporated (L-1). The reporting by Labat-Anderson of the mutagenicity and carcinogenicity of the pesticides from EPA documents in Table 3-4 (L-37) is fraudulent and should in and of itself require an entirely new Supplement. It has taken NCAP dozens of hours to compare the EPA documents cited in Table 3-4 to the summary offered by Labat-Anderson in that Table and to the accompanying text written by Labat-Anderson. As a result, numerous other documents have not been reviewed. In the absence of time to conduct such an intensive review, it must be presumed that other conclusions drawn by Labat-Anderson from other documents are equally flawed. NCAP is angry that BLM has produced such a shoddy document. It makes a travesty of the NEPA process.

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(c) The Supplement's quantification and science are fundamentally erroneous. The numbers in the 160 tables of "margins of safety" are meaningless because they are based on laboratory-determined systemic and reproductive NOELs that are determined by testing only the active ingredient of each herbicide. As indicated in an EPA memorandum[1], discussion,[2] and list,[3] neither the EPA nor the pesticide registrants necessarily know precisely what inert ingredients are present in a pesticide, but even if the inert ingredients are known to the EPA, the public is not allowed to know, because the information is trade secret. 67-16

The EPA indicates that at least 85 of these inert ingredients are "toxicologically significant"[2] in that they are known to cause cancer, nerve damage, other chronic damage, or reproductive effects in humans and/or laboratory animals.[1] The EPA does not know which of the 45,000 registered pesticides contain these 85 ingredients.

The EPA indicates that the toxicity of another 700-800 inerts are not known, but that these inerts include glycol ethers and petroleum hyudrocarbons with "high potential for toxicity."[1] EPA notes that 80% of all pesticide formulations contain petroleum distillates as inert ingredients and these "pose significant regulatory problems... The polymuclear aromatic components of petroleum distillates have a high potential for carcinogenicity and the aliphatic content may pose problems as well."[2]

The 85 inert ingredients already listed by the EPA include asbestos (human carcinogen), benzene (known human carcinogen), cadmium compounds (carcinogenic by inhalataion, neurotoxic, chronically toxic to aquatic organisms at 0.1 part per billion, and a bioaccumulator in all aquatic organisms), carbon tetrachloride (carcinogenic, central nervous system depressant, and potential groundwater contaminant that is being cancelled as an active ingredient), and hexachlorophene (contaminated with dioxin, neurotoxic).[3]

Obviously, it is meaningless to say that the "margin of safety for the exposed members of the public for right-of-way routine-realistic scenario, 2,4-DP sprayed on 12 acres" is 39,000 times after eating berries (Table C-65) if the berries are covered with benzene. There is no margin-of-safety table in this EIS that means anything in light of the fact that neither the BLM nor the public knows what is in any of the pesticide formulations.

The BLM will simply have to scrap all tables and all quantitative risk estimates of the hazard of these pesticides based on any testing that does not include the inert ingredients (i.e., intentionally added inerts as well as contaminants in combination with the active ingredient(s)).

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NCAP and its member organizations and individuals have been saying for years that the federal agencies do not know the hazards posed by these pesticides because (a) inert ingredients are present (e.g., Ruth Shearer pointed out in the NCAP v. Block case that a surfactant in Roundup appeared to be more toxic to fish than the active ingredient, glyphosate); (b) health damage testing on the active ingredients is incomplete, fraudulent, and/or flawed; (c) pesticides are sprayed in combinations that have not been tested for synergism; (d) testing is not done on chemically sensitive or young or ill animals; and (e) pesticides are already present in our soil, water, bodies, and air, combining in unknown ways with the pesticides the agencies spray. The issue of toxicologically signficant inert ingredients merely places this uncertainty in undeniable form.

If these uncertainties indicate that quantitative risk assessments are meaningless (and NCAP contends they do), then the BLM must abandon attempts at quantitative risk assessment of their pesticides. Numbers are not magic: if nothing is known about 30% - 95% of a pesticide formulation except that it might contain extremely toxic chemicals, then numbers cannot be cooked up to look like the toxicity of that pesticide is understood.

The BLM needs to prepare a new Draft EIS (not just Supplement), employing on the writing team people who understand the toxicological uncertainties surrounding pesticides, who comprehend the limitations data place on quantitative assessment, and who understand that public lands can be managed without depending on unidentified chemicals of unknown toxicity.

This latter is the major claim that NCAP wishes to make in these comments.

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Specific Comments

NCAP had hoped to make comments on specific Supplement statements and classify each statement/comment under the NEPA regulation violated by the statement in question. Time has run out and we cannot do that today, but the following NEPA regulations are those that are most frequently violated by this Supplement:

1) 40 CFR 1502.1: Statements must be supported with evidence that the agency has made the necessary environmental analyses; and

   The EIS must provide a full and fair discussion of significant environmental impacts.

2) 40 CFR 1502.16: The EIS must provide a full discussion of signficant environmental impacts, including both direct and indirect effects.

3) 40 CFR 1502.21: The EIS must not incorporate by reference material that is not reasonably available for inspection by the interested public during the comment period.

4) 40 CFR 1502.22: (April 25, 1986 version as well as the original version): The EIS must make clear that there is incomplete or unavailable information regarding reasonably foreseeable significant adverse effects;

   The EIS must state the relevance of the incomplete or unavailable information to evaluation of reasonably foreseeable signficant adverse impacts; and

   The EIS must evaluate such impacts.

5) 40 CFR 1502.24: The EIS must make explicit reference by footnote to the scientific and other sources relied upon for conclusions; and

   The EIS must insure the professional integrity, including scientific integrity, of its discussions and analyses.

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SUPPLEMENT TO THE DEIS
(pp. 1-13)

BLM 1. The BLM claims that to fill all the basic toxicological data gaps would be exorbitant and so a worst case analysis will be done. (p. 1)

NCAP 1. The BLM has not looked at the possibility that filling some data gaps, particularly gaps in knowledge about the field use of the herbicides, might not be exorbitantly expensive. The BLM cannot claim exorbitance by looking only at basic toxicological data gaps and by looking only at filling all data gaps.

Some research that the BLM might fruitfully and feasibly undertake includes:

(a) Measuring offsite plant residues. Plant residues had to be estimated for the risk analysis, L-60 and this is listed as a data gap on L-17. Such studies are not expensive.

(b) Doing a survey to assess the validity of spill reporting for estimations of probability of spills. It is hard to believe that in eleven years, pesticides were spilled only 24 times by the Forest Service and BLM (the sources are not cited for this figure) L-80. 67-17

(c) Measuring persistence of the herbicides on plant surfaces. The BLM indicates "...[S]pecific data were not available for most of the 16 herbicides regarding persistence on plant surfaces" L-63.

(d) Doing field studies on the public's exposure to the pesticides. The BLM indicates that because "no field studies existed on actual doses to the public comparable to those used for estimating worker doses, public doses were estimated..."(p. 4) This is the kind of data gap that is properly addressed by the BLM in the context of their program. It is not the type of study that is required of a pesticide registrant. Costs of such a study could easily be documented, based on the worker studies cited. This is precisely the kind of data gap the public is often most concerned about.

Until the BLM indicates that it has (a) considered some research other than basic toxicological research that fills data gaps indicated by the BLM in their risk analyses, (b) documented the costs of some of this other research, and (b) filled some data gaps as opposed to all data gaps, NCAP regards the BLM claim of exorbitance unfounded.

BLM 2. The BLM indicates that uncertainty regarding cancer is the trigger for analysis of impacts under 40 CFR 1502.22. (p. 1)

NCAP 2. 67-18 This is false. There is a great deal of uncertainty regarding a whole range of impacts of these herbicides. The BLM fails to lay these data gaps out (see Attachment A for data gaps as identified in the registration standards for 8 of the herbicides. Read the Interior Board of Land Appeals decision on an appeal brought by Idaho Natural Resources Legal Foundation, August 28, 1985 (IBLA 85-527).

BLM 3. The BLM indicates that "uncertainties and data gaps were identified, including...the potential for amitrole, asulam, picloram, and glyphosate to cause cancer..." (p. 2)

NCAP 3. Positive carcinogenicity results have been obtained for each of these four herbicides (see Table 3-4). Those are not data gaps.

On the other hand, the BLM indicates on L-37 that no adequate oncogenicity studies exist for dicamba and diuron. These are data gaps.

67-19 Diuron is closely related to linuron, a suspected carcinogen, and so it is reasonably forseeable that diuron is a carcinogen.

Dicamba contains nitrosamines as contaminants and nitrosamines are potent carcinogens.[11] According to the EPA registration standard for dicamba, the manufacturing process has potential to result in traces of some isomers of dioxin.

List dicamba and diuron as having data gaps for cancer.

BLM 4. Table 3, p. 3.

67-20 NCAP 4. Atrazine is given a cancer potency of zero, but the BLM reference given for atrazine carcinogenicity (EPA

1984c) makes no statement that atrazine is nononcogenic for the 2 "supplementary" studies by IBT or the 1 "supplementary" study by Hazelton Laboratories. You can't have a cancer potency of zero if you don't have an adequate cancer study.

Diuron cannot have a cancer potency of zero; no adequate oncogenicity studies exist.

Dicamba cannot have a cancer potency of zero; no adequate oncogenicity studies exist.

67-20 Fosamine cannot be given a cancer potency of zero; no oncogenicity studies are listed.

What do the 0, 25.0, 750.0 and 0 belong to that are above glyphosate's line?

What do the 5 and 0 belong to below diuron's line?

In a 1982 summary of glyphosate studies on file, EPA indicates the systemic NOEL found in Biodynamics study #77-2062 is 3.0 mg/kg/day.[4] In its 1984 summary of the same study, a systemic NOEL of greater than 31 mg/kg/day is stated.[5] NCAP has a Freedom of Information Act request into EPA regarding this discrepancy. BLM indicates the NOEL is 30 mg/kg/day. Perhaps BLM should look into this discrepancy as well.

What is the 24,40 for fosamine?

BLM 5. Table 4, p. 4.

NCAP 5. 67-21 Secondary sources are cited here and throughout the Supplement. If these studies are available to the public, then they should be listed with superscripts referenced to an extensive list in the back of the Supplement. If these studies are not available to the public, then the BLM cannot rely on them.

It is improper to state that dicamba and diuron are nononcogenic in inadequate studies. If a study is inadequate, it has not shown anything.

Your bias shows in this table: you say picloram is nononcogenic in 3 of 5 studies. Why not say it is oncogenic is 2 studies? That's what people are concerned about.

This table does not substitute for a table that lays out data gaps. A table needs to be supplied that indicates the data gaps that have been identified during the development of each herbicide's registration standard. That is where a pesticide's studies are evaluated for adequacy and where basic data gaps are identified.

Attachment A is a series of pages that summarize individual pesticide registration standards for eight of the pesticides. These pages clearly identify crucial data gaps.

67-22 If BLM can do a table like Table 4, it can do a table of what information is missing according to the EPA. Mutagenicity and carcinogenicity are not the only two endpoints of concern.

BLM 6. The margin-of-safety is determined by dividing an animal NOEL by the estimated human dose. (p. 6)

NCAP 6. The idea that a "margin of safety" can start at a NOEL (e.g., that a dose two times below a NOEL provides a "margin of safety" of two) is toxicologically inaccurate and no reference is offered for this "methodology." The method commonly employed by regulatory agencies is to reduce the NOEL by a factor of 100 to establish a threshold for humans. This is 67-23 because it is generally estimated that on a body weight basis, humans are generally about ten times more vulnerable than experimental animals; another generalized estimation is that sensitivity among the general human population[6] varies by about ten times. By taking both of these factors into account, a "threshold" for human "safety" is generally established by reducing the laboratory animal NOEL by two factors of ten (i.e., a factor of 100).

Your method lacks scientific integrity.

BLM 7. "...[A]ll of the NOEL's used in this risk analysis are based on (or take into account) long-term multiple 67-24 exposures during animal studies." (p. 6)

NCAP 7. No longterm studies exist for fosamine ammonium (EPA 1984j).

BLM 8. If a person's exposure exceeds the NOEL, "it does not necessarily lead to the conclusion that there will be human toxic effects because all of the NOEL's used in this risk analysis are based on (or take into account) longterm multiple exposures during animal 67-25 studies. This applies particularly to doses that are not likely to occur more than once, such as those to the public." (p. 6)

NCAP 8. What happens after three months' exposure can happen after one day.

BLM 9. Table 5 purports to show margins of safety for the general public. (p. 7)

NCAP 9. Every figure is 100 times too high, see NCAP 6.

What does the footnote to Table 5 mean?

BLM 10. "Reproductive effects are evaluated based on the lowest 67-26 maternal, fetotoxic, or teratogenic NOEL..." (p. 6)

NCAP 10. Males can experience reproductive effects such as low sperm count or infertility. This Supplement fails to mention male reproductive effects.

BLM 11. The BLM summarizes that there are such large margins of safety, "that the public should suffer no adverse effects. This is true for all individuals including pregnant women and sensitive individuals." (p. 6)

NCAP 11. The margins of safety referred to are in Table 5 and are all 100 times too high (see NCAP 6). The threshold 67-27 of 100 times below the NOEL will then be exceeded in many routine-worst case scenarios.

Cite your evidence that exposure to these herbicides should produce no adverse effects for sensitive individuals.

BLM 12. "...[T]here are no residents, hikers, fishermen, or 67-28 berrypickers in the vicinity of the vast majority of treatment units." (p. 8)

NCAP 12. Cite your evidence.

BLM 13. "Chronic doses of 2,4-D, as predicted by this analysis, could affect the peripheral nervous system which, in most cases, would be a reversible effect." (p. 8)

NCAP 13. Cite your source.

The EPA's Recognition and management of pesticide poisoning writes, "The medical literature contains 67-29 several reports of peripheral neuropathy following what seemed to be minor dermal exposures to 2,4-D."

Contrary to BLM's characterization of the damage, peripheral neuropathy may persist many months, it may frequently go undiagnosed, it has happened after single doses, and its occurrence is so idiosyncratic that it may occur to peculiarly sensitive people, or may be due to other toxic chemicals in the formulation. It

involves pain, numbness, and/or paralysis of toes, fingers, legs, and arms.[8-10]

BLM 14. The discussion of sensitive individuals indicates that they could "suffer some acute toxic effects from the worst-case exposures doses for atrazine, 2,4-D, dicamba, and triclopyr." Since atrazine's NOEL is based on weight loss in dogs, "Sensitive individuals could become ill and possible experience stomach problems. Any toxic effects resulting from these routine-worst case doses, however, should be limited." (p. 8)

67-30

NCAP 14. This is a totally inaccurate and inadequate picture of the effects experienced by chemically sensitive individuals when exposed to minute amounts of any of a variety of chemicals. Their symptoms are not the symptoms of the NOELs they come closest to: they often experience extreme respiratory distress, fatigue, headaches, etc.

Rewrite this discussion after consulting with someone who has treated and studied chemical sensitivity.

Cite your sources for your discussion of what sensitive people will experience when exposed to BLM herbicides.

BLM 15. Table 6 indicates those situations for which there will be "margins of safety less than 10" for the general public. (p. 9)

67-31

NCAP 15. There is no such thing as a margin of safety of 10. The Table 6 figures indicate humans would have crossed a threshold of "safety" 100 times below the NOEL (for the active ingredient). (See NCAP 6.)

BLM 16. When the BLM estimates that a NOEL for diuron could be crossed (for some unstated effect in some unidentified study), it says "This means that unprotected sensitive workers could experience some toxic effects from routinely applying these herbicides in certain situations." (Emphasis added, pp. 9-10)

67-32

NCAP 16. Since the BLM does not indicate precisely what numbers are used to estimate worker exposure and precisely what studies it is basing these estimates on, how do we know that the estimate is not based on workers that had protection?

If the NOEL is crossed by average workers, why would it be "sensitive" workers that might experience toxic effects?

BLM 17. The BLM indicates that worker margin of safety (MOS) values for diuron, 2,4-D, and triclopyr are less than 100 for routine-realistic doses. (p. 10)

NCAP 17. The BLM does not identify the kinds of health damage for which the workers are at risk when their MOSs "are less than 100" and thereby fails to inform decisionmakers of potential impacts.

Even short-term skin exposure to dilute 2,4-D has in some cases resulted in severe peripheral neuropathy[7-9] involving pain and paralysis in limbs (see NCAP 13.).

Diuron contains, as a contaminant, 3,3',4',4'-tetrachlorazobenzene (TCAB). TCAB has the same potential as 2,3,7,8-tetrachlorodibenzodioxin (TCDD) to cause chloracne (i.e., at 0.5 micrograms).[12] Chloracne is the severe, disfiguring skin disturbance that has been suffered by some of the people exposed to Agent Orange (containing TCDD) in Vietnam and by people living near the Seveso, Italy 2,4,5-T factory whose pipe ruptured, sending a cloud of dioxin (TCDD) into the air.

67-33

Nowhere in the EIS is this problem of diuron described. Instead, the BLM (or more precisely, Labat-Anderson) has reduced all health effects to numbers. Numbers for NOELs whose health damage is not spelled out, whose studies are not referenced. Numbers for margins of safety that are meaningless because they do not consider the whole pesticide formulation with its inert ingredients. Numbers for doses to people and workers that are unreviewable because the BLM doesn't say precisely what numbers went into precisely what formula from precisely what studies to derive those doses. The whole thing is a sham. Workers are concerned about pesticides like diuron because they might get chloracne, not because their exposure to diuron is "an MOS value that is less than 10 in the routine-realistic case."

No registration standard has been issued for triclopyr, so the EPA has not even gone through the files of triclopyr to review the adequacy of the chemical companies' health damage studies or to identify data gaps. When, as the BLM points out, triclopyr "has at least 2 margins-of-safety for workers (including those for backpack sprayers) that are less than 100," what kinds of damage are those workers at risk for?

Describe risk in plain English, not meaningless numbers.

BLM 18. "In the case of a spill of a pint of concentrate [on workers' skin], many of the doses approach the LD 50. This represents a clear risk of severe toxic effects providing the herbicide is not washed off." (p. 10)

67-34

NCAP 18. Who are you kidding? An LD_{50} is the dose that kills half of a test population. Approaching an LD_{50} represents a clear risk of death.

BLM 19. "(Note: Cancer risks computed for the sum of the BLM and Forest Service programs are portrayed in this section.)" (p. 10)

67-35

NCAP 19. What does this mean? Sum of acres? Years? Pesticides?

BLM 20. Table 7, p. 11

NCAP 20. The margins of safety, according to the table's title, are based on the systemic NOEL. Is this the lowest known NOEL for (the active ingredient) of all of the herbicides? The dicamba reproductive NOEL, for instance, is cited by the BLM as being lower than the systemic NOEL (Table 3-2, L-31). Which NOEL for dicamba was used in Table 7?

67-36

RISK OF HERITABLE MUTATIONS

BLM 21. "Risk of Heritable Mutations" on p. 13 summarizes the risk of genetic damage for all the herbicides.

NCAP 21: This section, like the longer section on which it is based ("Mutagenicity of the 16 Herbicides," L-35 -L-38) are fraudulent. The following eight comments (NCAP 22-NCAP 29) deal with the section on p. 13.

BLM 22. "No human studies are available that associate any of the herbicides with heritable mutations."

NCAP 22. This is entirely misleading if no human studies have been done to associate any of the herbicides with heritable mutations.

67-37

What kinds of studies are you talking about? What would they consist of?

BLM 23: "...[G]lyphosate tested negative for mutagenicity in all assays conducted, and thus can be considered to pose no mutagenic risk." (p. 13)

67-38

NCAP 23. Glyphosate has been shown to cause a significant increase in the number of sister chromatid exchanges (SCEs) in human white blood cells.[13] This type of test is listed in Table 3-3, L-36.

Having been shown to be carcinogenic, glyphosate would be suspect for mutagenicity.

BLM 24: "Fosamine, hexazinone, and triclopyr were nonmutagenic in the great majority of assays conducted....therefore, it can be assumed that their mutagenic risk is slight to negligible." (p. 13)

NCAP 24: The statement that somehow mutagenic risk is determined by majority vote among mutagenicity assays is made many times throughout this Supplement and it is absolutely contrary to standard toxicology and violates NEPA regulations regarding scientific integrity.

67-39

A battery of mutagenicity assays is done on pesticides because any one chemical is likely to cause only one type of mutagenicity and any one assay detects only one type of mutagenic activity. If a chemical causes point mutations, for instance, but does not cause chromosomal aberration, unscheduled DNA repair, sister-chromatid exchanges, etc., it is still a mutagen.

Triclopyr was positive for dominant-lethal effects in rats, indicating it has the potential to reach the gonads (USDA 1984).

Both fosamine and hexazinone were found to be positive for chromosome damage in hamster ovary cells (USDA 1984).

Eliminate all statements that imply mutagenic risk is a matter of how many types of mutagenic activity are detected. It only takes one kind of mutagenic action to cause genetic damage and there is no safe dose for a mutagen.

BLM 25: "The probability that dalapon or diuron would cause heritable mutations is low because they have not been shown to cause cancer in any long-term studies." (p. 13)

67-40

NCAP 25: This is another statement frequently made in this Supplement that utterly defies toxicological science. A chemical can be a mutagen without cancer being induced.

Eliminate all statements that imply a noncarcinogen is likely to be a nonmutagen.

Moreover, the statement is fraudulent in terms of dalapon: Dalapon has no oncogenicity studies on file with the EPA (EPA 1984g) and none are cited by this Supplement. The only thing that can be said about dalapon with any scientific integrity is that there is, uncertainty about dalapon's mutagenicity and carcinogenicity potential because no information exists.

67-40

BLM 26: "The lack of positive results in any mutagenic or oncogenic tests with diuron suggests that diuron would present only minute risk to humans as a mutagen." (p. 13)

NCAP 26: This statement is fraudulent. Diuron has no mutagenicity studies on file with the EPA. None are cited by the BLM. The reference to "oncogenic tests" is deceitful: There is one oncogenicity test on file with the EPA and no core grade has been given the study, indicating that the EPA has not yet reviewed it for its adequacy. The registration standard for diuron (9/30/83) indicated 0 oncogenicity tests on file, and 2 required.

BLM 27: "Atrazine tested positive for mutagenicity in 15 of 33 assays.... However, many of the positive results were achieved through tests that may not be relevant to evaluating mutagenic risk in humans. Some positive results in rodents were also acheived, but these responses were only observed at levels greater than 1,500 mg/kg body weight. These are exceptionally high dose levels and suggest that the degree of germ cell hazard from low levels of atrazine would be minimal at worst." (p. 13).

67-41

NCAP 27: If it weren't so disgusting scientifically and so sad in terms of BLM's contempt for human danger, it would be amusing to note how the BLM discounts all risk, no matter how grave. Here we have an herbicide that BLM states is mutagenic in 15 assays, and the BLM excuses it by saying many of the positive results were achieved through tests that may not be relevant to humans and that the degree of germ cell hazard would be "minimal at worst."

All mutagenicity tests are relevant to humans because DNA is similar in all living organisms, and what

affects the DNA of one creature should affect that of all.

Cite your evidence in the toxicological literature that any mutagenicity tests are not relevant to humans and that the particular tests done on atrazine may not be relevant to humans.

Atrazine is of great concern to people because it is activated into a mutagen in plants. Once activated, atrazine has caused mutations in yeast, a plant, a fly, and mammalian cells.[14-16] It has been found to be mutagenic in bacteria injected introvenously and recovered from mice treated with single or multiple doses of atrazine.[17]

67-41

The BLM statement that germ cell hazard is probably minimal is belied by BLM statements on L-38: "Three...positive responses were in tests with the fruit fly that measured gene mutations in germ cells. Positive results were also obtained in tests with mice which measured chromosome alterations in germ cells. Positive responses in these types of assays indicate a potential for mutagenic hazard." (Emphasis added.)

There is a human study that is of concern and the Supplement fails to cite it, either for atrazine, 2,4-D, or amitrole, anywhere in the Supplement: Agricultural workers exposed predominantly to 2,4-D, amitrole, and atrazine were found to experience a 25-fold increase in chromatid breaks and a 4-fold increase in chromatid gaps during mid-season as opposed to off-season times of the year.[18] Atrazine has been shown to cause chromosome breaks in mouse bone marrow.[19]

BLM 28: "A number of comprehensive reviews of the 2,4-D mutagenic data have indicated that it does not pose significant risk of human gene mutations." (p. 13)

NCAP 28: Cite these numerous "comprehensive reviews."

The only review cited on L-38 (concluding that although 2,4-D has been shown to be mutagenic it is "without significance as an environmental mutagenic hazard") is Newton and Dost (1981). Neither of these men are toxicologists, they are known for their defense of pesticides in general, and Frank Dost, at least in the past, has been notorious for his rather scientifically isolated position of maintaining that there are safe doses for carcinogens.

67-42

Notwithstanding BLM's count of 2,4-D being positive in eight mutagenicity assays (USDA 1984) in Table 3-4 (L-37), 2,4-D has been found positive in 15

mutagenicity assays (USDA 1984). What kind of evidence is needed for BLM to consider that a pesticide poses risk of mutations for humans?

BLM 29: "Based on a worst-case estimate, the risk of heritable mutations from [2,4-D and picloram] would be no greater than the cancer risk."

NCAP 29: Cite your evidence for this statement from toxicological literature (and not a personal communication from David Brusick, please). There are chemicals that can be mutagenic without causing cancer. I am not aware that cancer risk (whatever that is, given the uncertainties of extrapolation from animals) is considered a measure of mutagenic risk in the scientific community.

67-43

If you can't cite evidence for this theory, drop it from the Supplement. I'm under the impression it is not based in the general toxicological literature.

SYNERGISTIC EFFECTS

BLM 30: "It is possible but unlikely that synergistic effects could occur as a result of exposure to two or more of the herbicides considered in this analysis." (p. 13)

NCAP 30: There is no evidence for this statement and the BLM cites no evidence here, or on L-89 ("Synergistic Effects"). It is particularly meaningless in the absence of information about the inert ingredients present in each of the pesticide formulations.

In its registration standard for picloram, the EPA notes that human sensitization study indicates the combination of 2,4-D and picloram is capable of producing sensitizing reactions which neither of the herbicides produce singly.[20]

67-44

A Dow Chemical Company study found that whereas sheep are not harmed by 30 daily doses of 72 mg/kg picloram, some sheep are killed by five daily doses of 36 mg/kg picloram mixed with 134 mg/kg 2,4-D.[21]

The BLM notes atrazine and simazine in the combination, Folgard S, indicated carcinogenicity in one test and concluded that synergism is a possibility.

Remove the statement that synergism is unlikely unless supporting evidence in the scientific literature is cited. (An article in the trade magazine, Farm

Supplier, by longtime Dow worker and 2,4-D proponent WR Mullison, is not an appropriate reference. L-89.)

BLM 31: "EPA has considered the possibility of synergistic effects in these cases [i.e., combinations of herbicides used by the BLM] and found that the risk is not significant." (p. 13)

67-45

NCAP 31: (a) Which combinations are being considered?

(b) No reference is given here or on L-89 for this statement. Remove it if you cannot cite evidence that the EPA has in fact "considered the possibility of synergistic effects" among the combinations.

CUMULATIVE EFFECTS

BLM 32: "No one individual member of the public is likely to receive repeated exposures to any of the herbicides..."

NCAP 32: This entire discussion of cumulative effects, in defiance of NEPA, makes no mention of the fact that the public is exposed to all kinds of pesticides repeatedly and in fact carry residues of some of the pesticides in their bodies. You are not spraying into a pristine environment.

The comments of Carol Van Strum and Paul Merrell submitted to you for this Supplement (April 28, 1986) document some of the evidence available that must be considered when considering the effects of adding more herbicides to the environment.

67-46

BLM 33: The BLM indicates that agriculture and related commercial operations exceed BLM and Forest Service operations from year to year, making any cumulative effects from the BLM program negligible.

NCAP 33: While this argument is attractive in terms of avoiding responsibility, it has no validity biologically. Cumulative impacts are cumulative and for any one person, the straw that breaks their back can as easily be a tiny one as a large one.

This is not a minor technical point. The reason a large number of people are opposed to chemical forestry is because they are concerned about all unnecessary additions of toxic chemicals into their world whose

chemical poisoning is chronicled in the media every day.

BLM 34: "Cumulative effects on workers have been considered throughout this analysis."

NCAP 34: (a) The BLM does not cite any of numerous epidemiological studies showing higher incidence of cancer and other chronic and acute damage among pesticide applicators. (See Attachment C for several.)

67-47

(b) How has the BLM considered cumulative effects on workers other than for cancer risk?

(c) Two of the three Lavy studies cited by the BLM for worker exposure to herbicides were available to me (the BLM refused to send down a copy of the USDA report, Lavy, Mattice and Norris, 1984 to the Eugene District BLM office or to me directly for review during the comment period). In both Lavy, et al. 1982 and Lavy, et al. 1980, the researchers found that several of the workers came into the study with low levels of herbicides in their urine even though they had not sprayed within two weeks. The researchers were unable to account for this, other than guessing that perhaps the workers' clothes had some pesticide residues on them or they had come in contact with herbicides from their spray equipment. It doesn't matter: the fact is, pesticide applicators are around pesticides all the time and they do not come into BLM programs unburdened with pesticides.

67-48

(d) For cancer risk, the BLM assumes that a worker employed 5 years will be exposed from 30 to 70 times. Thirty years' employment is estimated to yield 288-480 exposures. (L-23-L-24)

Cite evidence for these estimates. A simple survey of pesticide applicators hired for BLM work and Forest Service work will indicate whether they are exposed 6 to 16 or more times a year on BLM and Forest Service projects and in other projects as well. The BLM is constrained by NEPA to consider programs other than its own when determining cumulative impacts. If every employer of humans for pesticide applications considers only the days the applicators work for them, the workers' elevated rates of cancer and other chronic disease will be accounted for by no one.

67-49

APPENDIX L:

Human Health Risk Assessment for the Use of Herbicides in the Vegetation Management Programs of the U.S. Forest Service in Washington and Oregon and the Bureau of Land Management in Western Oregon

WORST CASE ANALYSIS REQUIREMENTS

BLM 35: The BLM lists 6 data gaps identified by the risk assessment. (L-17)

NCAP 35: The BLM needs to identify all major health damage data gaps, not just those for mutagenicity and carcinogenicity for all herbicides. For instance, on L-29, it is mentioned that there are no chronic studies for six of the herbicides.

67-50

Attachment A will give BLM a start on a list of data gaps for the 16 herbicides.

BLM 36: "Worker exposure studies would cost approximately $200,000 per chemical." (L-17)

NCAP 36: Document this from worker studies that have been done on a single chemical.

BLM 37: "The cost of measuring residues in plants and animals would be between $50,000 and $100,000 per chemical per plant or animal." (L-17)

67-51

NCAP 37: Document this. Numerous individuals, agencies, and cities have had tests run for residues of a known pesticide following an aerial or other spray program. Document the costs of some of these simple residue tests. NCAP doubts measuring 2,4-D on berries following an aerial spray project would cost $50,000.

BLM 38: The BLM indicates synergistic studies would be expensive because there are 120 possible pairs of the 16 herbicides. (L-17)

NCAP 38: Choose a pair that is priority because of its likelihood or indicated danger (e.g., 2,4-D and picloram).

BLM 39: Filling the data gaps is considered exorbitant. (L-18)

NCAP 39: Filling all data gaps will always be exorbitantly expensive. Filling priority data gaps will not.

67-51

BLM 40: The BLM estimates $50,000 to $100,000 for each mutagenicity test. (L-17)

NCAP 40: Document this. Dr. Ruth Shearer supervised the conduct of several crucial endothall mutagenicity tests for Seattle Metro for $30,000 total. These tests settled a discrepancy between chemical company tests showing no mutagenicity and independent studies showing mutagenicity. Mutagenic potential of endothall at very low doses and in tests considered indicative of carcinogenicity was found.

BLM 41: "The probability of mutagenic activity was based on available cancer data." (L-18)

67-52

NCAP 41: Document the toxicological soundness of this. See NCAP 25.

BLM 42: "The worst case analysis for synergistic effects assumed that these effects could occur."

67-53

NCAP 42: Where? What analysis of what that might mean took place regarding "these effects"?

BLM 43: The BLM indicates there is an oncogenicity study with negative results for glyphosate. (L-18)

67-54

NCAP 43: Cite it. The EPA (1984k) reference cited by the BLM as indicating "nononcogenic at HDT" lists no oncogenicity studies. It does cite a feeding study, but that is not an oncogenicity study.

BLM 44: The BLM indicates there are three oncogenicity studies for picloram that are negative. (L-18)

67-55

NCAP 44: Cite them. The EPA reference given by the BLM (EPA 1984m) cites one positive oncogenicity study and one negative. The Mullison 1985 reference cites the same two studies, plus an invalid IBT study and a feeding

study that has gone 12 months with no indication that tumors have been looked for.

67-55

It is distressing (not to say illegal) for the BLM or Labat-Anderson or whoever to falsely report the content of references and cite invalid studies.

BLM 45: The BLM indicates there is a negative oncogenicity study for bromacil. (L-18)

NCAP 45: Cite it. The EPA (1984d) reference notes one positive oncogenicity study. It indicates that there is another feeding/oncogenic study, but gives no oncogenicity results for it. The EPA (1985e) reference was requested by NCAP in a Freedom of Information Act request on March 5 and it has not been sent.

67-56

BLM 46: The BLM indicates there are two negative oncogenicity studies for 2,4-DP. (L-19)

67-57

NCAP 46: Cite them. The EPA (1984f) reference cited by the BLM lists only two oncogenicity studies: one negative and one positive at all doses tested.

HAZARD ANALYSIS

BLM 47: "EPA has compiled 'science chapters' on many of the herbicides (amitrole, bromacil, dicamba, diuron, hexazinone, picloram, and simazine) and these are also available from EPA."

67-58

NCAP 47: They are not, at least yet. Dr. Ruth Shearer has had a FOIA request into the EPA for science chapters on atrazine, amitrole, bromacil, dicamba, diuron, and simazine since February 12, 1985. They have not arrived.

BLM 48: "In no cases were studies used that have been invalidated by EPA." (L-25)

67-59

NCAP 48: Wrong. See, e.g., NCAP 44. 67, 70, 71.

BLM 49: The BLM indicates that results of laboratory toxicity tests can be "directly extrapolated to humans with some adjustment made for differences in body weight and body surface area." (L-26)

67-60

NCAP 49: No. Indeed, adjustments need to be made for species differences (a 10X factor for extrapolation from

67-60 laboratory animals to humans and a 10X factor for normal variation in heterogeneous populations). This resulting 100X factor does not account for sensitive individuals. Although the BLM indicates that this toxicity testing discussion is drawn from Doull et al. (1980) and Doull makes it very clear that these two factors need to be considered (p. 23 and p. 26), the BLM never mentions it.

67-61
BLM 50: "Subchronic toxicity studies...usually last from a few days to 3 months (3 to 90 days)..." (L-26)
NCAP 50: Subchronic studies last a few weeks to 3 months.

BLM 51: "Chronic studies...normally last 2 to 7 years but generally more than one-half the test species' lifetime." (L-26)
NCAP 51: Cite your reference for this.

67-62 There's no such thing as "chronic studies." There are "chronic effects studies" and "chronic testing." Chronic testing includes chronic health effects, oncogenicity, teratogenicity, and reproductive studies. Chronic health effects studies generally last 1-2 years. Oncogenicity studies last more than one-half the test species' lifetime. Teratogenicity studies don't go on 2-7 years. Reproductive studies go for 2 or 3 generations and, depending on the animal, can be completed in less than one year.

BLM 52: "Toxic symptoms displayed by the animals are recorded throughout [acute toxicity studies]." (L-26)
NCAP 52: Cite your reference.

67-63 Some acute toxicity studies record grossly obvious symptoms such as whether the animal can't get up on its legs. Most acute studies don't do that.

67-64
BLM 53: Table 3-1 is entitled "Acute toxicity classification and acute toxicities of the 16 herbicides and other chemicals," and is a listing of oral LD_{50}s. (L-27)
NCAP 53: The title is not accurate. Never talk about "acute toxicity" when you are talking about "acute lethal dose."

67-65
BLM 54: Those chemicals listed as of severe toxicity are cited as having an LD_{50} of 0-50 mg/kg.
NCAP 54: What chemical kills half a population of test animals at 0 mg/kg?

67-66
BLM 55: On p. L-29, two sections are called "Subchronic Toxicity Studies" and "Chronic Toxicity Studies."
NCAP 55: These must be called "Subchronic Testing Studies" and "Chronic Testing Studies."

67-67
BLM 56: "Reproduction studies...determine the effect of the chemical on reproductive success as indicated by fertility (production of reproductive cells), fetotoxicity (direct toxicity to the developing fetus), and survival and weight of offspring." (L-29)
NCAP 56: These are inaccurate. The sentence should read, "....fertility (whether or not reproductive cells produce a zygote or embryo), fetotoxicity (weight and litter size at birth), and postnatal survival..."

67-68
BLM 57: "Carcinogenicity tests (cancer studies or oncogenicity studies) examine the potential for a chemical to cause cancerous (malignant) tumors when fed in the diet over the animal's lifetime." (L-29)
NCAP 57: Inaccurate. Should read "Oncogenicity tests examine the potential for a chemical to cause benign and malignant tumors..." The observation of benign tumors is generally extrapolated to concern that humans will experience cancer, since benign tumors are often precursors of malignant tumors.

67-69
BLM 58: "Threshold Toxicity of the 16 Herbicides" summarizes results of dozens of subchronic, chronic, reproductive, and teratogenic studies. (L-29 - L-35)
NCAP 58: No studies are cited, merely EPA "tox one-liners."
There are no clinical reports discussed for any of the 16 herbicides. Such reports are important, since all of these toxicity tests are performed only on the active ingredient and clinical and epidemiological studies record results of exposure to full formulations.

67-70
BLM 59: The EPA describes chronic results for two simazine 2-year feeding studies (rat and dog) and then states EPA has determined that chronic toxicity could not be determined from either of these studies. (L-35)
NCAP 59: If the studies are inadequate for determining chronic toxicity, then don't cite them for chronic toxicity and don't use them in Table 3-2 for "lowest systemic NOEL."
In 1984, the EPA registration standard for simazine indicated that it had zero tests on file for chronic toxicity, oncogenicity, teratogenicity, or mutagenicity. And yet the BLM produces precise numbers for simazine in its 160 margins-of-safety tables.

67-71
BLM 60: "Dogs excrete triclopyr at a slower rate than...humans."
NCAP 60: Cite your evidence.

67-72
BLM 61: "A systemic NOEL of 30 mg/kg/day [triclopyr] was established for both rat and mouse 2-year feeding studies (EPA 1984p; USDA, 1984)." (L-35)
NCAP 61: No feeding studies are cited in EPA 1984p. In fact, this April 30, 1984 EPA summary of studies on file for triclopyr cites zero chronic toxicity, teratogenicity, mutagenicity, or oncogenicity studies. The only studies cited are acute studies.
All chronic toxicity studies cited in USDA (1984) are referenced to a 1983 Dow Chemical Company "technical data sheet" and the Weed Science Society of America Herbicide Handbook. If these studies cited by Dow on their 1983 data sheet are adequate, why does the EPA have no chronic toxicity tests on file for triclopyr by mid-1984?
It is unacceptable to cite proprietary data and the Weed Science Society herbicide handbook as sources for triclopyr toxicology information.
EPA reviewed a draft of this EIS and the reviewer of the BLM's treatment of triclopyr indicated that BLM would not be able to establish a margin of safety for triclopyr: "[A] margin of safety cannot be established for Triclopyr - the studies used to establish rat oncogenic potential and an ADI were found inadequate (IBT data).... [N]either the 6-month dog subchronic study nor the rat chronic study meet minimum standards, and are not adequate to establish an ADI. The

oncogenic potential of Triclopyr, at present, remains unknown." (EPA, 1985d).
Why does the BLM cite the 6-month dog subchronic study and the rat chronic study? Has it reviewed them independently and found that EPA's evaluation of the studies as inadequate is wrong?
Cite the authority for establishing margins of safety for triclopyr among the 160 margin of safety tables. For instance, how did BLM determine that the public would have a margin of safety of 4,500 from eating bird after 40 acres were sprayed with triclopyr with a helicopter? (Table C-123, L-162). Can't we agree that that quantification is inappropriate? Even aside from not having the faintest idea what inert ingredients are in the triclopyr formulation?

67-73
BLM 62: The BLM indicates that it doesn't know what symptoms were observed in the diuron dog feeding study it uses for its lowest NOEL. (L-34)
NCAP 62: This illustrates the absurdity of looking only at secondary sources. The BLM is calculating margins of safety from a NOEL in a feeding study whose health damage the BLM knows zero about. The EPA has apparently not evaluated the study because it has not given it a core grade (EPA 1984i). The BLM can't inform the public about the potential effects of diuron because it hasn't looked at any of the studies.
Diuron is the pesticide that contains TCAB, which has the potential of causing chloracne at levels as low as TCDD-caused chloracne (see NCAP 17).

67-74
BLM 63: The chronic toxicity studies cited for dalapon are a 1960 study in Agricultural and Food Chemistry and two unpublished Dow Chemical company teratology studies from 1971. (L-33)
NCAP 63: As of 1982, the EPA had zero chronic toxicity, oncogenicity, teratogenitity, or reproduction studies on file for dalapon (EPA, 1984g).
Indicate the data gaps for dalapon.

Mutagenicity of the 16 Herbicides

BLM 64: Table 3-3 indicates that tests for detecting primary DNA damage are not applicable to determine human mutagenicity. The reference for this is a personal communication with David Brusick in the 1985 USDA gypsy moth EIS.

NCAP 64: Cite a source other than personal communication with David Brusick for a determination that one entire set of mutagenicity assays is "not applicable" to human mutagenicity. The BLM is under a NEPA obligation to insure that its methodology has scientific integrity. The April 25, 1986 40 CFR 1502.22 speaks of the requirement to rely on "theoretical approaches...generally accepted in the scientific community."

67-75

Either cite a published reference in a respected toxicological source for this novel idea or get rid of it.

All mutation tests are relevant to human mutagenicity because DNA is universal among living organisms.

BLM 65: Table 3-4 summarizes mutagenicity and carcinogenicity data on the 16 herbicides. (L-37)

NCAP 65: This table has an extraordinary number of falsehoods in it. Since this is the only table NCAP studied intensively, it brings into question all that BLM cites in this entire EIS. The following 10 comments (NCAP 66-75) refer to this table.

BLM 66: Amitrole: "Nonmutagenic 63/69 assays (USDA 1984); Amitrole does not present potential for heritable genetic effects (EPA, 1985a)."

NCAP 66: Amitrole: Mutagenic 11/62 assays (USDA 1984). EPA (1985a) has not been made available to NCAP despite a March 5, 1986 FOIA.

BLM 67: Asulam: "Nonmutagenic in 3 assays (EPA, 1984b)."

67-76

NCAP 67: Asulam: Nonmutagenic in one assay; the other two assays have been judged invalid (EPA, 1984b).

BLM 68: Atrazine: "Mutagenic in 15/33 assays (EPA, 1984c)."

67-77

NCAP 68: Atrazine: Nonmutagenic in 2 assays; 2 other assays judged unacceptable (EPA, 1984c).

Hmm. Perhaps the BLM meant to refer to USDA (1984) in which atrazine was positive in 19/38 assays.

See NCAP 27.

BLM 69: 2,4-D: "Nonmutagenic in 23/31 assays (USDA, 1984)."

67-78

NCAP 69: 2,4-D: Mutagenic in 15/44 assays (USDA, 1984).

BLM 70: 2,4-DP: "Nonmutagenic in 4/8 assays (EPA, 1984f)."

67-79

NCAP 70: 2,4-DP: Mutagenic in 3/7 assays; an 8th assay judged invalid. (EPA, 1984f).

BLM 71: Glyphosate: "Nonmutagenic in 8 assays (EPA, 1984k)."

NCAP 71: Glyphosate: Nonmutagenic in 7 assays; an 8th assay judged unacceptable, a 9th assay an invalid IBT study (EPA 1984k).

67-80

Is the BLM citing the unacceptable study or the invalid study as its 8th?

BLM 72: Hexazinone: "Nonmutagenic in 5/6 test systems (USDA, 1984)."

67-81

NCAP 72: Hexazinone: Mutagenic in 1/5 test systems (USDA, 1984).

BLM 73: Picloram: "Nonmutagenic in 9/10 assays (USDA, 1984)."

67-82

NCAP 73: All tests cited in USDA (1984) are tests done in 1972-1978. As of 1984, the EPA had zero mutagenicity tests on file for picloram. Why?

BLM 74: Simazine: "Nonmutagenic in 12/14 studies (USDA 1984)."

NCAP 74: Like atrazine, simazine is not mutagenic in the Ames test. However, both atrazine and simazine are mutagenic after plant activiation. Simazine has been found to be positive for mutagenicity in bacteria,[22] plants,[23-26] and Drosophila (a fly)[27]. Plewa writes of simazine, "Thus, the majority of data reported in the investigations outlined above indicate that...simazine...induce[s] both mitotic and and meiotic chromosome aberrations and [is] biologically activated into agents that induce point mutations."[24]

67-83

Look up these sources and cite them unless you find them unacceptable. If you do, make sure you review all the other 12 nonmutagenic tests, too.

BLM 75: "Nonmutagenic in 4/5 bacterial and cytogenetic assays (USDA, 1984; EPA, 1985d)."

NCAP 75: USDA 1984 cites three 1983 Dow Chemical Company studies. The organism is unknown in all three, the bacterial assay system is unspecified and the cytogenetic assay is unspecified. So how does Irving Mauer of the EPA write in his review of this DEIS (EPA, 1985d) that "In addition, we show negative BM cytogenetics, and negative bacterial repair"? How does Irving Mauer, let alone the BLM, know the two bacterial assays are different and the two cytogenetic assays are different?

67-84

Why, if the studies are 1983 Dow Chemical Company studies, are there zero mutagenicity studies on file for triclopyr at the EPA as of the April 30, 1984 update of the file? (USDA.1984p).

This Table 3-4 is a disaster. So is its interpretation.

BLM 76: "EPA has determined that amitrole does not present a potential for genetic effects. The chemical induced transformations in four in vitro assays with mammalian cells (EPA, 1985a). EPA has stated that these results support cancer potential, but not necessarily mutagenic potential." (L-36)

NCAP 76: EPA (1985a) has not been provided to NCAP although it is referenced in this DEIS and NCAP requested it via FOIA on March 5. NCAP is anxious to learn how an herbicide that is positive in 11 mutagenicity assays does not present a potential for genetic effects. NCAP will also be interested to learn how amitrole can cause cancer, but not genetic damage.

BLM 77: "Although these results [i.e., positive in a number of mutagenicity assays including alterations in mice germ cells] show that atrazine must be viewed as mutagenic at high levels of exposure, the degree of hazard to humans from low levels of exposure would be minimal." (L-38)

67-85

NCAP 77: Cite your source for discussion of high levels of exposure and estimation of minimal hazard. Atrazine is cited as being positive in 19 assays in USDA 1984.

Sudden Finish

With time running out and a headache from sitting 15 hours straight at this computer, NCAP respectfully bows out of continuing a point-by-point review of this DEIS. The following general warnings about the rest of this EIS are offered:

1. The text discussion of the herbicides' mutagenicity and carcinogenicity is unsupportable by the evidence cited and is unsupportable by standard toxicological thought.

2. The carcinogenicity half of Table 3-4 is as flawed a piece of reporting as the mutagenicity half. (E.g., See NCAP 43-44).

3. The cancer potency presentation is unreadable and no formulas are given so that the public can determine how the cancer risk is ultimately determined using all factors.

4. The exposure analysis makes numerous statements that cannot be made without direct reference to supporting evidence.

5. The exposure analysis indicates various factors that are purportedly taken into account but variously fails to indicate

   (a) the exact numbers that were plugged into the risk analysis for that factor;

   (b) the sources for the numbers that were plugged in; and

   (c) the formulas into which the numbers were plugged.

   The result is that the exposure analysis is unreviewable.

6. The comparison of exposure to hazard to estimate risk is for nought if the inert ingredients and their toxicity are not plugged in.

67-86 7. The risk section inadequately informs the public of impacts because it speaks in terms of numerical margins of safety instead of in terms of specific symptoms.

67-87 8. A major source of information regarding risk from these pesticides has been ignored by the Supplement: reports of damage that have been recorded following exposure

to these pesticides in the clinical literature, in California's state pesticide incident reporting system and in BLM and Forest Service worker files.

67-88 7. Critical published experimental literature has not been cited in many instances (see Attachment B, the narrative statement of Ruth Shearer in NCAP v. Block, for a plain English presentation of some of these studies).

The following problems are endemic throughout the DEIS and require that it be reissued as a new DEIS:

1. Many statements are not referenced to supporting evidence.

2. References cited do not support the statements to which they are referenced.

3. Conclusions are drawn using methodology that is not toxicologically professional.

4. Crucial literature has not been located.

NCAP suggests that the BLM reissue its DEIS after a major rewrite because the document lacks basic scientific integrity in its present form. If the BLM feels that it would be helpful for NCAP to complete its point-by-point list of problems with the current Supplement, we will. If BLM feels that it would be helpful for NCAP to provide studies from its files that have not been included in the current Supplement, we will.

NCAP believes it has sufficiently established basic patterns of deficiencies that the BLM can easily continue the same analysis on the second half of this Supplement.

Sincerely,

Mary H. O'Brien

Mary H. O'Brien, Ph.D.
NCAP Information Coordinator

Attachment A: Excerpts from Appendix A (Summaries of Individual Pesticide Registration Standards by Patrick Hoge and Lawrie Mott In Lawrie Mott. 1986. Pesticide Reregistration: An Evaluation of EPA's Progress. San Francisco: Natural Resources Defense Council.

Attachment B: Narrative Statement by Ruth Shearer in NCAP v. Block (1983): Toxicity of Herbicides Used by Region 6 Forest Service and Oregon BLM.

Attachment C: Moses, Marion. 1986. Epidemiologic Studies of Cancer in Humans Related to Farming, Agricultural Work, or Pesticide Application or Manufacturing Abstracts. Unpublished list of epidemiological studies distributed by National Farm Workers Health Group, Keene, California.

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Additional Comments on Supplement to the Western Oregon Program- Management of Competing Vegetation Draft Environmental Impact Statement

Background

The following comments are offered on behalf of the Northwest Coalition for Alternatives to Pesticides (NCAP). Earlier comments sent by NCAP (May 11, 1986) noted some of the Supplement's deficiencies through L-38; these note some on later pages. In addition, five EPA documents referenced in the EIS had been requested by NCAP on March 5, 1986; they were not mailed from EPA until May 20, 1986. Since those unpublished references arrived two and a half months after the Supplement was issued, the BLM will surely not consider these comments "late" in terms of the official closing period for comments on the Supplement. NCAP requests responses to each of its comments.

Specific Comments

Mutagenicity of the 10 Herbicides

Note: Comments 1-77 are found in the May 11, 1986 comments of of NCAP on this Supplement.

BLM 78: "Amitrole does not present potential for heritable genetic effects (EPA, 1985a)."

NCAP 78: 67-89 This statement is lifted verbatim from an EPA summary of test results that cite five positive results in mutagenicity assays. Moreover, the report cites five studies in which amitrole induced transformation of cells into malignant states. The EPA concludes these transformation assays "do not necessarily show that a transformation inducer is genotoxic. These results support oncogenicity potential but not necessarily mutagenicity potential." (Emphasis added.)

Five positive mutagenicity tests and five positive transformation tests do not allow EPA or anyone else to flatly state that amitrole does not present a potential for heritable genetic effects.

BLM 79: "Based upon the inconsistent genotoxic responses...2,4-DP represents a negligible mutagenic risk for humans." (L-38)

NCAP 79: 67-90 It is not toxicologically sound to state that three positive and four negative genotoxicity results are "inconsistent" given that the tests measure different processes (Ames mutagenicity, unscheduled DNA synthesis, mitotic crossing over, mitotic gene conversion, and reverse mutation) and under different conditions (activated, non-activated).

The BLM will not be able to defend its conclusion that 2,4-DP "represents a negligible mutagenic risk for humans." Remove the entire statement.

BLM 80: "Dalapon is probably not a mutagen because a 2-year cancer study resulted in no oncogenic effects." (L-38)

NCAP 80: 67-91 The "2-year cancer study" was a 1960 two-year feeding study, not a cancer study; tumors were not even discussed (USDA 1984). By 1982, the EPA had no valid cancer studies on file for dalapon. (EPA, 1984g)

The BLM's statement is fraudulent. It is an absolute waste of the public's time to find out that the BLM is lying.

BLM 81: Although the BLM notes that dicamba was mutagenic in two assays (Table 3-4, L-37), the BLM concludes by the next page that "dicamba is nonmutagenic." On L-106, the BLM again discusses the two positive mutagenic responses for primary DNA damage and states that "these tests are not useful in determining human mutagenic potential."

NCAP 81: 67-92 Cite your scientific source (other than a personal communication with some individual who will say that for you) for deciding that primary DNA damage tests are not useful in determining human mutagenic potential.

Remove the statement that dicamba is nonmutagenic. The worst case assumption with two positive results in standard mutagenicity assays that are done precisely

to determine whether a compound has mutagenic potential is that dicamba appears to hold mutagenic potential.

BLM 82: "Chromosome damage was induced by fosamine in an in vitro chromosome assay with rodent cells...Overall, fosamine is considered nonmutagenic and presents no mutagenic hazard to humans." (L-36)

NCAP 82: This is ridiculous. Fosamine is positive in a test that Table 3-3 (L-36) indicates is of "greater applicability to humans" and the BLM concludes that overall, fosamine presents no mutagenic hazard to humans (L-38). What is this "overall?" What shred of toxicological integrity is contained in such a statement?

67-93

Simply state that fosamine presents a potential mutagenic hazard to humans. It's the only defensible conclusion.

BLM 83: "Hexazinone was positive for inducing chromosome damage in an in vitro cytogenetic assay with rodent cells.....Based on these results, hexazinone is determined not to present mutagenic hazard to humans." (L-38)

67-94

NCAP 83: See NCAP 82.

BLM 84: The positive mutagenic result for hexazinone "was observed only at very high levels and could be caused by a secondary effect, such as high iodine concentrations or pH." (L-39)

67-95

NCAP 84: Cite your source for this judgment.

BLM 85: Picloram is cited as being positive in a particular mutagenicity assay. "EPA has determined that the positive study was insensitive and not capable of determining mutagenicity in the test system." (L-39)

67-96

NCAP 85: (a) Cite your source for this "EPA" conclusion.

(b) If the test is so insensitive as to be incapable of determining mutagenicity, how did it detect picloram mutagenicity?

BLM 86: Simazine: "A weakly mutagenic response and an increase in dominant lethals resulted from two studies with the fruit fly....This indicates that simazine may be mutagenic in some test systems, but there is no evidence to suggest that it is a mutagenic hazard to humans." (L-39)

67-97

NCAP 86: Of course there's evidence that simazine presents a mutagenic hazard to humans. You've just cited the evidence and you've described those two positive tests as being in the category of "greater applicability" in "determining human mutagenicity" in Table 3-3.

The only defensible statement given the data you've cited is "Simazine is a mutagenic hazard to humans."

BLM 87: In one of two mutagenicity tests, tebuthiuron was positive. "Tebuthiuron was nononcogenic in long-term laboratory studies and therefore is probably not a human mutagen."

The BLM cites (EPA 1984o) as its reference that tebuthiuron was "Nononcogenic in 1 study" (Table 3-4, L-37).

67-98

NCAP 87: (a) No oncogenic study is cited in EPA 1984o.

(b) Here we have an herbicide almost totally lacking in mutagenicity studies. Two studies, one of them positive, no oncogenicity study, and the BLM concludes that tebuthiuron is "probably not a human mutagen." Eliminate the statement. It is not supportable in terms of standard toxicological thought.

BLM 88: Triclopyr: "A dominant lethal assay with rats was weakly mutagenic....Triclopyr may be mutagenic in some test systems, but there is no data to suggest that it is a human mutagen." (L-39)

NCAP 88: You've just cited the data that suggest triclopyr is a human mutagen. The dominant lethal assay with rats is a relatively insensitive test and it is a test that yields evidence that a compound reaches the gonads. The BLM has labeled that particular assay as of "greater applicability" in "determining human mutagenicity (Table 3-3).

67-99

Your powers of denial that a hazard exists are of immense proportions.

Carcinogenicity of the 16 Herbicides

Table 3-4: Summary of...Carcinogenicity of Pesticides

BLM 89: Atrazine: "Nononcogenic in 2 studies (EPA, 1984b)."

NCAP 89: The EPA 1984b reference cites two studies by IBT, both regarded as supplementary, meaning that they are inadequate to base registration decisions on. The reference does not indicate whether the studies were positive or negative.

67-100

Cite a reference that supports your statement of nononcogenicity in two studies or eliminate the statement.

BLM 90: 2,4-DP: "Oncogenic in 1/3 studies (EPA, 1984f)."

NCAP 90: The EPA 1984f reference lists only two oncogenicity studies, 2,4-DP being positive in one.

The BLM indicates on L-108 that three 2,4-DP oncogenicity studies have been submitted to EPA and cites EPA (1982) as a reference. The EPA 1982 reference cites two studies, the same two listed in EPA 1984f.

67-101

The BLM proceeds to describe three studies on L-108, but the two 2-year feeding studies, one referenced to EPA, 1984f and the other to EPA, 1982 are the same study according to their accession numbers.

Indicate where you got the 1/3 oncogenicity or change it to 1/2. Why is the public having to do such elementary checking on the BLM's Supplement?

BLM 91: Dalapon: "Nononcogenic in 2 studies (USDA, 1984)."

NCAP 91: The USDA 1984 reference cites a 1960 study that wasn't a cancer study and didn't discuss the presence or absence of tumors.

The only other study mentioned by the BLM as being in USDA, 1984, is a 1960 52-week dog feeding study. This is not long enough to be a cancer study and there is no indication tumors were sought.

67-102

By 1982 (EPA, 1984g), the EPA had zero chronic toxicity or carcinogenicity studies on file. Apparently the two 1960 studies do not even qualify as adequate chronic toxicity studies.

The BLM cannot cite the two feeding studies as indicating no carcinogenicity and must admit that it has no valid carcinogenicity data.

BLM 92: Dicamba: "Nononcogenic in 2 studies (EPA, 1984h); Studies not adequate according to EPA (EPA, 1985d)."

NCAP 92: If the studies aren't adequate, they don't show anything. They're both 1962 studies done prior to modern cancer guidelines and the EPA has found that they are inadequate.

Eliminate references to them and state that you have no adequate data to make a determination of oncogenicity or nononcogenicity.

67-103

The BLM needs to mention that dicamba is contaminated with 2,7-dichlorodibenzo-p-dioxin[38] and needs to determine whether that particular dioxin has been tested for carcinogenicity or other health damage effects.

The BLM needs to note that dicamba is contamined with nitrosamines,[38] most of which have been found to be carcinogenic.[29]

BLM 93: Diuron: "Nononcogenic in 2 studies (EPA, 1984i); Studies not adequate according to EPA (EPA, 1985d)."

67-104

NCAP 93: Don't cite inadequate data. It violates 40 CFR 1502.24.

BLM 94: Fosamine: "Nononcogenic in 3 subchronic studies (EPA, 1984j; USDA, 1984)."

NCAP 94: Now we're citing subchronic toxicity studies for our evaluations of oncogenicity? You are in violation of 40 CFR 1502.24. Eliminate all references to them and indicate the fact that there are no data available for carcinogenicity and no data available for chronic toxicity.

67-105

BLM 95: Glyphosate: "Possibility of weak oncogenic effect in mouse study (EPA, 1985b)."

NCAP 95: Eliminate the phrase "possibility of." An oncogenic effect was observed in the mouse study: "Therefore, the Agency considers the study to be positive for oncogenicity at this time." (EPA 1985b).

67-106

If the BLM has some reference to support its phrase "Possibility of," cite it. The reference cited doesn't support it.

BLM 96: Picloram: "Nononcogenic in 3/5 studies (EPA, 1984m; Mullison, 1985)."

NCAP 96: The EPA 1984m reference cites two valid oncology studies: one positive and one negative. The Mullison, 1985 reference refers to the same two valid studies, an invalid IBT study and the results after 6 and 12 months of a two-year feeding study, with no evidence that it is an oncogenicity study. Aside from being inappropriate to cite a DOW Chemical Worker's review of studies, the BLM is not citing any additional valid oncogenicity data beyond that cited by the EPA.

67-107

The BLM's counting procedure for oncogenicity studies is fraudulent.

BLM 97: Simazine: "Nononcogenic in 1 study (EPA, 1984n)."

NCAP 97: The only oncogenicity study cited in EPA 1984n is an invalid IBT study. In its 1985 review of this Supplement for the BLM, the EPA told the BLM that data gaps exist for oncogenicity in two species (EPA 1985d). There is no valid oncogenicity study for simazine on file, so the BLM must eliminate reference to it.

67-108

BLM 98: "The limited chronic studies conducted on simazine do not indicate that simazine is carcinogenic." (L-41)

NCAP 98: what "chronic studies?" Cite your specific references.

EPA 1984n cites one two-year feeding study and writes "Chronic toxicity and oncogenic potential could not be determined (too few animals used)..." Another 2-year feeding study has not been given a core grade and does not indicate carcinogenicity was studied. That's it.

67-109

The EPA simply states the following in EPA 1985d:

"Data gaps exist for the following:

a. 90-day subchronic oral (rodent)
b. Teratogenicity (rat; rabbit pending upgrading)
c. Chronic oral (rodent and non-rodent)
d. Oncogenicity (two species)"

Why can't the BLM state data gaps so simply? There are no valid chronic tests on file. There are no oncogenicity tests on file. There are no teratology tests on file.

BLM 99: Tebuthiuron: "Nononcogenic in 1 study (EPA, 1984o)."

On L-41, the BLM writes "No carcinogenic effects were observed in a chronic feeding study in which rats and mice were fed from 0 to 1,600 ppm tebuthiuron in their diets for 2 years (USDA, 1984)."

NCAP 99: The EPA 1984o reference cites zero oncogenic studies.

67-110

The USDA reference cites a 2-year feeding study with no evidence that it was performed as an oncogenicity study. Apparently the study has not been submitted to the EPA: the EPA 1984o reference indicates zero two year feeding studies for tebuthiuron.

Remove the statement that tebuthiuron is nononcogenic in 1 study and indicate that there are no oncogenicity tests for tebuthiuron.

BLM 100: Triclopyr: "Nononcogenic in 3 studies (USDA, 1984)."

On L-41, the BLM writes, "For both rat and mouse 2-year feeding studies (Dow Chemical Company, 1983b, in USDA 1984) and a 228-day dog feeding study no oncogenic effects occurred in test animals exposed to triclopyr."

NCAP 100: By 1984, the EPA had zero oncogenicity studies and zero chronic toxicity studies listed for triclopyr (EPA 1984p).

The EPA warned BLM in its review of the BLM's draft Supplement that "the studies used to establish rat oncogenic potential and an ADI were found inadequate (IBT data)..... The oncogenic potential of Triclopyr, at present, remains unknown." (EPA 1985d).

67-111

(a) Since the USDA cites the Dow Chemical Company (1983b) for its "three studies," why doesn't the EPA list any of the three studies in its 1984p or 1985d reviews?

(b) Is the rat study cited in USDA 1984 the invalid IBT rat study noted in the EPA 1985d reference?

(c) Why is the BLM claiming nononcogenicity when the EPA indicates that the oncogenic potential of triclopyr is unknown?

NCAP 101: The sum total for carcinogenicity of the 16 herbicides in Table 3-4 is:

67-112

1 Nononcogenic:	Hexazinone (2x)
1 Uncertain:	2,4-D
6 Oncogenic (in at least one study):	Amitrole Asulam Bromacil 2,4-DP Glyphosate Picloram
8 No valid oncogenicity studies:	Atrazine Dalapon Dicamba Diuron Fosamine Simazine Tebuthiuron Triclopyr

67-112 CONT.

Any worst case analysis needs to deal with the eight herbicides for which there are zero valid oncogenicity studies, not just the six for which oncogenicity has been shown. Ignorance is not bliss.

Carcinogenicity Discussions

NCAP 102: The BLM does not discuss the fact that four 2,4-D amine salts have been found to contain 120 - 500 ppb of one or both of two N-nitroso compounds: N-nitrosodimethylamine and N-nitrosodiethylamine.[28]

Diethylnitrosoamine has been tested in 20 species including primates and has been a potent carcinogen in all of them.[29]

67-113

N-nitroso-dimethylamine and N-nitroso-diethylamine are believed to generate alkylating intermediates believed to be responsible for the mutagenic, toxic, and carcinogenic effects of the parent compounds in vivo and in vitro.[30]

There is no safe dose for a carcinogen and any discussion of the carcinogenicity of 2,4-D must discuss its potential contamination with carcinogenic nitrosamines.

BLM 103: The BLM describes the study of the carcinogenicity of a mixture of atrazine and simazine on L-40, L-41, L-90, L-107, and L-111.

67-114

(a) On L-40, reference is made to many flaws in this study and since the mixture caused carcinogenicity, the BLM claims that this is not considered substantive evidence for carcinogenicity in atrazine.

(b) On L-41, the BLM says the study isn't considered substantive evidence of the carcinogenicity of either constituent.

(c) No consideration is given to cancer of either simazine or atrazine in the human health risk analysis (Section 5).

(d) On L-90 and L-107, the statement is made that the tumor formation may be a result of "other chemicals in the formulation."

(e) On L-40, L-41, L-107, and L-111 references are made to putative chronic feeding study evidence that atrazine and simazine are not oncogenic.

(f) On L-90, the possibility that atrazine and simazine are synergistic for carcinogenicity is raised, but dismissed because "atrazine and simazine are not generally used in the Region for combination treatments."

NCAP 103: The following comments correspond by letter to the BLM considerations above:

(a) What flaws?

67-114 CONT.

(b) Why is the possibility that either atrazine or simazine is an initiator of cancer and either atrazine or simazine a promotor of cancer not considered? If a mixture of the two pesticides causes cancer, isn't there a carcinogen or carcinogens somewhere in the formulation?

(c) and (f) Because humans may encounter the mixture of simazine and atrazine in the environment as a result of spraying by BLM, consideration must be given to the possibility that either or both of the pesticides are carcinogens. Atrazine has been found in the groundwater in numerous states, has a demonstrated half life in water that varies from 10 to 106 weeks, a half-life in soil of less than 4 to 57 weeks[31] and is not removed from drinking water by normal water treatment procedures (e.g., distillation).[32]

Simazine has been found in groundwater, has a half-life in water of 8-30 weeks, and a half-life in soil of less than 4 to 16 weeks.[31]

67-114 CONT.

Residues of simazine and atrazine have been reported to be present in fish and invertebrates for periods as long as a year after application.[33,34]

(d) If other chemicals in the formulation of Fogard-S could have caused the rapid tumor formation, then other chemicals in either atrazine or simazine formulations could do so also. A person getting cancer from applications of atrazine and/or simazine does not really care whether it was due to "other chemicals in the formulation."

This illustrates the need to consider in the human risk health analysis that "other chemicals" in any of the formulations for any of the 16 herbicides may cause cancer, alone or in combination with the intended "active ingredient(s)."

(e) Chronic toxicity studies are not adequate to determine carcinogenicity unless so designed. There are no valid oncogenicity studies on file for either simazine or atrazine.

Moreover, the EPA regards both atrazine chronic toxicity studies as unacceptable for registration and considers them to be "data gaps."[35] The EPA review of this Supplement indicates that both simazine chronic toxicity tests are data gaps because they are inadequate (EPA, 1985c; see NCAP comment #98). Aside from chronic toxicity studies being irrelevant to the question of whether atrazine or simazine are oncogenic, the chronic toxicity studies the BLM is citing are not even sound.

Cancer Potency

BLM 104: 67-115 "EPA recommends using a threshold approach to analyze amitrole's carcinogenicity..." (L-41).

NCAP 104: Cite documentation or a reference for this recommendation.

BLM 105: "Several aspects of this analysis make the cancer potency estimates very high (pessimistic). First, it is assumed that any dose, no matter how small, has some probability of causing cancer.... Amitrole, for example, has been shown to cause cancer in test animals only at relatively high doses." (L-41)

NCAP 105: 67-116 How does the standard scientific judgment that any dose of a carcinogen has some probability of causing cancer make a cancer potency estimate "very high?" I fail to follow your reasoning.

67-116 CONT.

The amitrole example is entirely inappropriate. High doses are used because very few animals are tested. If cancer does not turn up in the few animals at some lower doses it does not mean that it would not turn up in a much larger population of animals. Your example of amitrole is toxicologically unsound.

BLM 106: 67-117 "The details of the cancer potency derivation for all of the chemicals based on the one-hit model are given in Attachment C." (L-42)

NCAP 106: No details of any cancer potency derivations are given in Attachment C or anywhere else.

BLM 107: 67-118 In determining 2,4-D cancer potency, "All tumors were considered, although many of them were benign." (L-43) In determining 2,4-DP cancer potency, "Only malignant tumors were considered in this case." (L-43).

NCAP 107: Why were benign tumors considered for 2,4-D, but only malignant tumors for 2,4-DP?

BLM 108: 67-119 Asulam cancer potency is based on a 107-week feeding study. The cancer potency is 0.02 per (mg/kg/day). (L-43)

NCAP 108: (a) The EPA has judged this study invalid (EPA, 1983; EPA 1984b).

(b) How did BLM derive the potency figure? I cannot find a cancer potency in the EPA, 1983 reference.

BLM 109: 67-120 Glyphosate cancer potency is .000034 per (mg/kg/day). (L-43)

NCAP 109: How did the BLM derive the potency figure?

BLM 110: Cancer potency figures are given for the seven herbicides for which oncogenicity studies have been performed and for which positive evidence of carcinogenicity has been noted. (L-41 - L-43)

NCAP 110: 67-121 The BLM has not given formulas into which these cancer potencies have been plugged, so whether or how they were used to derive the figures in Tables C-161 - C-166 (Lifetime Cancer Risk) is unknown. Knowing the cancer potencies BLM claims to be using is useless if the public cannot see whether in fact those cancer potencies are used and, if used, used in an appropriate manner.

67-121 CONT.

The formulas must be printed in the EIS so that the derivation of cancer risk can be followed by the public.

NCAP 111: 67-122 None of the cancer tests (except for the atrazine-simazine mixture) have been performed on the full formulation of the pesticide. Given that the EPA has indicated that inert ingredients of pesticides include benzene, formaldehyde, asbestos, carbon tetrachloride, methylene chloride, petroleum hydrocarbons, etc., all known carcinogens,[3] the BLM must discuss their lack of knowledge of the inert ingredients and the lack of cancer testing of the full formulation. The importance of this is the results on the Fogard S mixture of atrazine and simazine. The BLM must discuss the relevance of this missing information for the accuracy of their risk estimates (40 CFR 1502.22, April 25, 1986 version).

Section 4: Exposure Analysis

BLM 112: 67-123 "...with inert ingredients forming the remaining portion." (L-45)

NCAP 112: Define inert ingredients so that the public understands that inert ingredients are not inert.[1-3]

BLM 113: Table 4-1 footnote: "Inhalation is negligible based on field study data." (L-47)

67-124 "...a variety of studies have shown that inhalation exposure is very small compared with dermal exposure." (L-48)

"Field studies of workers have consistently shown that inhalation exposure represents only a small part of the total exposure..." (L-48)

NCAP 113: Cite the data.

BLM 114: 67-125 Table 4-2, Dietary Exposures Estimated in This Risk Analysis: Food items, realistic: Meat from a deer feeding offsite. worst case: food items closer to treatment unit. (L-47)

67-125 CONT.

"Game animals may have fed on plants from the drift area." (L-48)

NCAP 114: It is realistic to expect a deer (and other game) to feed onsite.[37] Calculate on that basis.

BLM 115: "...worker doses are based on actual dose levels found in field exposure studies in which no protective clothing or equipment was worn." (L-49)

NCAP 115: (a) The public is not told which worker doses are plugged in to which formulas to get the dose numbers in Tables B-1 - B-8 (which are carried to the fifth place right of the decimal point) or the dose levels (incorrectly called "doses") in Tables 4-11 and 4-12.

(b) Many of the worker studies cited by the BLM do not tell whether the workers were or were not wearing protective clothing or equipment. The Libich, et al. (1984) study indicates that the 1980 portion of the study involved workers wearing protective clothing. Were figures from that study used in the BLM formulas? The Nigg and Stamper study (1983) does not describe the clothing worn. The Kolmodin-Hedman, et al. (1983) study indicates a variety of clothing: some had rubber gloves, some high boots and a visor, etc. The Taskar, et al. (1982) study does not describe the clothing worn. The Kolmodin-Hedman and Erne (1980) study does not describe the clothing worn.

67-126

The BLM must indicate which studies they are referring to and how they know no protective clothing or equipment was worn.

It is not currently possible to figure out which worker numbers were used from which studies to get which doses.

BLM 116: "The dermal penetration rates used in the analysis were 6 percent for 2,4-D (Maibach, 1974)..." (L-50).

NCAP 116: Maibach indicates (personal communication) that the dermal penetration rate must be doubled to 12% because the studies were done on the forearm, the least vulnerable portion of the entire body. Maibach indicated that this required doubling has been published since 1974. The BLM should contact Dr. Maibach. The 6% rate is not defensible.

67-127

BLM 117: 67-128 "Doses for each worker catgegory found in the studies are listed in Table 4-5." (L-51)

NCAP 117: 67-128 CONT. Doses are listed for only three of the 10 studies described on L-51 - L-53. Which doses were used from the other 7 studies? What formulas were used for any of the doses?

BLM 118: 67-129 "The realistic dose estimates are higher than those that would occur...[e.g.] during the field exposure studies, many of the less severe types of accidents occurred.... Nevertheless, their doses were used in deriving the average worker doses for that field study." (L-54)

NCAP 118: If the "less severe types of accidents occurred" in the studies, why would that make the realistic dose estimates higher than those that would occur with the BLM? Somehow the BLM workers don't experience minor accidents? Their hoses or pumps don't ever break down?

BLM 119: The BLM estimates public exposures "by modeling the transport and fate of the applied herbicides. Details of the transport and fate modeling are in the next subsection." (L-55)

NCAP 119: 67-130 The modeling subsection describes considerations the BLM purportedly took into account in estimating public exposure. Nowhere does the BLM write out the formulas and indicate which numbers were actually plugged in. For instance, in Table 4-7, 0.0090 mg/sq. ft is estimated to drift onto berries and animals, 0.0049 mg/sq. ft onto the public and crops, 0.0264 onto water. Where did these numbers come from? What's the difference between berries and crops? Humans and nonhuman animals?

This entire exposure section is not able to be reviewed by the public until formulas are described and specific numbers cited, referenced, publicly derived, etc.

BLM 120: "Herbicide doses to individuals were calculated assuming that they drink 1 liter of the maximally contaminated water." (L-60)

67-131 NCAP 120: Once? Ten times? Aside from calculating lifetime doses for cancer, the BLM needs to consider cumulative effects of drinking contaminated water more than one day.

BLM 121: 67-132 Residues in Game Animals: "This is similar to the method used in the exposure analysis of USDA (1984)." (L-61)

Dermal Exposure (L-61)

NCAP 121: What are the actual residues calculated? What are the formulas?

BLM 122: "Lifetime exposures to the public for the five [do you mean seven?] herbicides [in the cancer risk analysis] were derived by assuming a realistic estimate would be a single exposure per lifetime..." (L-63)

NCAP 122: 67-133 When a watershed is sprayed, exposure is not for one day, whether in water, soil, etc. (See, for instance, the comments of Carol Van Strum and Paul Merrell regarding the continuing contamination of the Coast Range environment by TCDD years after 2,4,5-T spraying.)

Cite evidence that water will be pure the second day, berries will be uncontaminated, game will have residues for one day, etc. Why is a one day scenario considered realistic?

BLM 123: Vegetation contact: "In most casesm [sic] measurements of the total plant residues oveer [sic] time were available, so this data has been used to calculate degradation rates in those cases where surface measurements were unavailable." (L-63)

67-134 Table 4-10 (L-64) lists doses due to vegetation contact on day 1, day 30, and day 90.

NCAP 123: (a) Cite your references for each of the degradation rates.

(b) Why is vegetation contact dose 0.0 for picloram on the first day?

BLM 124: Effect of Body Size on Exposure: "All doses estimated in the exposure analysis were calculated for a representative 50-kg person.... [A] 20-kg child will receive a dose that is 3o percent greater in terms of mg/kg than it would be for a 50-kg person." (L-63)

NCAP 124: (a) What is the reference for this calculation? An estimate of infant and adult exposure to carbon tetrachloride near a hazardous waste disposal site indicated a 5-fold difference.[39]

67-135 Cite your evidence for your calculation of only a 36% increase.

(b) The only accounting for children appears in this statement and Table 4-9 (L-63) where the 2,4-D aerial routine-worst case scenario dose is figured for a 44-pound child and a 110-pound adult. Where are estimates of margins-of-safety for children? What is the meaning of a 36% greater exposure (which is an unreasonably conservative estimate)?

(c) Where is consideration of the particular vulnerabilities of children because of their immature immune system, rapidly dividing cells, undeveloped nerve system, etc.?

BLM 125: Lifetime doses are listed in Tables B-24 - B-32. (L-68, L-123 - L-130)

NCAP 125: 67-136 What numbers went into what formulas for these doses? What estimates of persistence in water, on food, on the vegetation? How can those tables possibly mean anything to the public if the formulas and numbers are not spelled out? (See 40 CFR 1502.24, 1502.1)

Section 5: Human Health Risk Analysis

BLM 126: Reproductive effects are described as "fetotoxic and maternal toxic" effects. (L-69)

67-137 NCAP 126: The BLM is failing to consider paternal reproductive toxicity.

BLM 127: "The ratio between the animal NOEL and the estimated human dose, referred to in this analysis as the margin of safety (MOS), is used to account for the uncertainty inherent in relating doses and effects seen in animals to doses and effects seen in humans." (L-69)

67-138 NCAP 127: There is no "margin of safety" immediately below the NOEL (see NCAP comments #6 and #9).

BLM 128: "For convenience in this analysis, the ratio between the herbicide's LD_{50} and the estimated human dose also is expressed as an MOS [margin of safety]; however, it should not be interpreted in the same way as the MOS based on a NOEL in terms of the expectation of no effects in humans." (L-69)

67-139 NCAP 128: CONT. (a) Cite a standard toxicological reference for this bizarre use of the term "margin of safety." If you can't, eliminate the whole concept or be in violation of 40 CFR 1502.24.

(b) What is the BLM's interpretation of an MOS based on an LD_{50}? If the margin of safety is 100, is a population within 100 dose levels of having 50% of them die?

BLM 129: "A negative ratio infers that the estimated dose (given all the assumptions of the scenario) represents a clear risk of possible acute effects if the ratio is based on the LD_{50} or of possible chronic effects if the ratio is based on the systemic or reproductive NOEL." (L-69)

67-140 NCAP 129: A negative ratio based on the LD_{50} infers that more than half of the population would be dead; a negative ratio based on a systemic or reproductive NOEL could mean acute and/or chronic effects. The sentence has no toxicological soundness to it.

BLM 130: "Comparing one-time or once-a-year doses (such as those experienced by the public) to NOEL's derived from lifetime studies tends to greatly overestimate the risk from those rare events." (L-69)

NCAP 130: 67-141 It is impossible to claim this. Effects aren't looked for after a single low dose. Some of the effects noted at the end of a chronic study could have occurred quite early. In the absence of looking for effects after a single dose, no one can say whether risk of damage from a single exposure is underestimated or overestimated by a NOEL. That is simple logic.

BLM 131: "A worst case analysis of cancer risk is conducted ...for herbicides for which there is scientific controversy about the their ability to cause cancer, such as...glyphosate." (L-69)

NCAP 131: Where is the controversy about glyphosate? The EPA has reviewed the study in which tumors of a type not seen in unexposed animals was seen in the test animals and concludes that a carcinogenic effect was recorded. Given the fact that after 14 years of selling Roundup, Monsanto still has only produced one valid cancer test

67-142

67-142 CONT.

and it indicates carcinogenicity, the controversy should center on why the 1972 Federal Insecticide, Fungicide and Rodenticide Act has not been fulfilled and enforced.

Cite references for the controversy about which the BLM is concerned.

BLM 132: "...lifetime dose over a 70-year period (computed in Section 4) with cancer potency estimates derived in the Hazard Analysis section." (L-69)

NCAP 132: 67-143 General components of lifetime dose were described in Section 4; no doses were computed. Cancer potency estimates were presented in the Hazard Analysis section; none were derived.

Lifetime doses must be computed in a public manner; cancer potency estimates must be derived in a public manner.

BLM 133: The probable risk of the herbicides causing mutations is "based on the available evidence of mutagenicity and carcinogenicity." (L-70)

NCAP 133: 67-144 There is not enough mutagenicity data to estimate probable risk; it is toxicologically unsupportable to base it on carcinogenicity. Cite your references from standard toxicological methodology to attempt to do so.

BLM 134: 2,4-D systemic NOEL: 1 mg/kg/day. (Table 5-1; L-70)

NCAP 134: 67-145 In a 90-day range finding study (rat), kidney effects were observed at 1 mg/kg/day. (EPA, 1985c) How can the BLM claim that no effects are observed at 1 mg/kg/day?

BLM 135: "The large ratios compared to the LD_{50} indicate very little chance of acute effects." (L-70).

NCAP 135: 67-146 This is ridiculous. The LD_{50} is a measure of death. A compound could cause a nonlethal acute effect at a very low dose and still have a very high LD_{50}. If I am wrong, cite your reference. If you can't cite a reference for your statement, eliminate it.

BLM 136: 67-147 Table 5-2: Lowest Margins of Safety for the General Public Under the Routine Scenarios. (L-71)

NCAP 136: 67-147 CONT. The table is meaningless unless the entire pesticide formulation has been tested. If the BLM intends to spray only the active ingredient, the margin of safety tables may have some integrity, depending on the adequacy of the test on which they are based and the accuracy of the exposure estimates (which is currently unknown, given that the BLM has not indicated the formulas and numbers used to estimate exposure or the references supporting the use of those numbers).

If the BLM intends to use the margin of safety tables, it must: (a) explain that their only utility is to describe a nonexistent case of only the active ingredient being sprayed; (c) present formulas used to derive the margins of safety; (d) indicate numbers that were plugged into the formulas; (e) guarantee the professional integrity of the numbers with references using standard toxicological methodology.

BLM 137: Triclopyr margins of safety are described in Table 5-2. (L-71)

NCAP 137: 67-148 The EPA's comment on Table 5-2: "[A] margin of safety cannot be established for Triclopyr - the studies used to establish rat oncogenic potential and an ADI were found inadequate (IBT data)." (EPA, 1985d) The BLM is violating 40 CFR 1502.24.

BLM 138: "The levels predicted on berries are also higher than those found in similar forest plants (USDA, 1984)." (L-72)

67-149

NCAP 138: What levels? The drift estimates in Table 4-7? How do those correspond to the 4 ppm found on raspberries after aerial application of 2,4-D in a Minnesota monitoring study?[40]

BLM 139: "[T]he levels predicted for deer in the routine-realistic scenario are similar to the highest levels found by Newton and Norris...who did not find levels greater than 0.08 parts per million in edible deer tissues." (L-72)

NCAP 139: What levels did the BLM use? I don't even know where they are indicated in the Supplement. The section on "Residues in Game Animals" (L-60) talks about how the levels were derived, but it doesn't tell what the levels were or the precise formulas used or numbers. So how is the public supposed to be able to judge the accuracy of the above sentence?

67-150

67-150 CONT. Note: Rather than harp on this again and again, the general point is this: none of the dose numbers, exposure numbers, margin of safety numbers, lifetime exposure numbers - none of them - can be traced or judged for their accuracy by the public.

The Supplement is going to have to be reissued as a draft Supplement once it is readable by the public.

Risk to the Public from Herbicides Used in Brown and Burn Operations

NCAP 140: 67-151 (a) What are the references for the half-lives of 2,4-D, glyphosate and triclopyr? (L-74)

BLM 141: "The health risk from potentially toxic pyrolysis products is negligible because the amount of the available parent compound for burning is insignificant after 5 months." (L-75) (Emphasis added)

NCAP 141: 67-152 (a) Much of the concern over slash burn smoke has to do with the total amount of chlorine present to produce such compounds as HCl (hydrochloric acid), Cl_2 (chlorine), $COCl_2$ (phosgene), and ClO_2 (chlorine dioxide).[41] Some of these compounds are as much as 800 times as toxic than the parent herbicides from which they are constituted.[41] Moreover, these chlorine compounds cause respiratory problems ranging from coughing to chronic bronchitis, pulmonary edema, to pneumonia.

What compounds do 2,4-D, glyphosate, or triclopyr degrade to and how long are they present on the wood?

67-153 (b) Cite references for the assumption that the herbicide spraying occurs no sooner than five months before spraying.

67-154 (c) The BLM does not mention that polynuclear aromatic hydrocarbons (PNAHs) have been detected in slash burn smoke, ash, and litter.[41,48] As PNAHs are carcinogenic and may be absorbed into the charcoal particles people inhale through slashburn smoke, the Supplement must address this problem.

67-155 (d) The BLM does not mention the problem of aerosols generated in slash burning.[47]

BLM 142: 67-156 Assumptions #1-#7. (L-74).

CONT.

NCAP 142: Cite references for these assumptions.

BLM 143: "Temperatures during the burning of vegetation are expected to reach at least 1,000 degrees Celsius..."

67-157

NCAP 143: (a) Cite your reference for this in terms of the conditions that prevail in western Oregon slashburns.

67-158 (b) More relevant than the temperature that is reached is the temperatures that prevail throughout slash burning. What are those temperatures?

BLM 144: "No information on the combustion of triclopyr is available." (L-75)

67-159

NCAP 144: What significance does that incomplete information hold for BLM research or risk concerns?

BLM 145: Pyrolysis of glyphosate produces alkylpyridines, acetonitrile, alkylpyrazines, benzene, and toluene. (L-75)

67-160

NCAP 145: The BLM needs to discuss the possibility of damage if humans breathe such products.

Cancer Risk

BLM 146: Cancer risk is discussed only for those active ingredients for which valid oncogenicity tests exist indicating positive results. (L-80)

NCAP 146: (a) The public is concerned about the potential cancer risk of those herbicides for which no cancer test has been performed. Since only an oncogenicity test can detect cancer, the BLM needs to state that the potentiality exists that atrazine, dalapon, dicamba, diuron, fosamine, simazine, tebuthiuron, and triclopyr may cause cancer.

67-161

For each of these herbicides, the BLM merely says that available data (i.e., data in tests that are not oncogenicity tests, often data that are in chronic effects tests judged inadequate by EPA, some even in subchronic effects tests) do not indicate carcinogenicity. The BLM apparently feels it can then spray these herbicides without telling the public that cancer may result.

67-161 CONT.

An example of this is glyphosate: until 1985, there was no valid oncogenicity test for glyphosate. "Available data" did not indicate carcinogenicity. Yet when a valid test was completed, it indicated glyphosate causes a type of tumor not found in unexposed mice. In other words, an herbicide the BLM would have pretended had no potentiality for cancer, does.

(b) Numerous inert ingredients are listed by the EPA as carcinogens.[3] What do you do about these carcinogens in a cancer risk analysis when they may be the precise inert ingredients that BLM is spraying?

67-162

BLM 147: "N is the number of days during which the dose D occurs during an individual's lifetime [for calculation of cancer risk]." (L-81)

NCAP 147: What is N for each of the eight herbicides being considered carcinogenic? What are the references for the N?

67-163

BLM 148: Herbicide applicators working for 5 years are estimated to be exposed to herbicides 30 to 70 times. A person working 30 years totals 288 to 480 exposures.

NCAP 148: Cite references for these estimates, based on field data.

Risk of Heritable Mutations

67-164

BLM 149: "No human studies are available that associate any of the herbicides with heritable mutations." (L-87)

NCAP 149: Add or substitute the following sentence: "No human studies are available that indicate the herbicides will not cause heritable mutations."

67-165

BLM 150: "...[M]utagenicity and carcinogenicity both follow similar mechanistic steps..." (L-88)

NCAP 150: Cite a reference other than a gypsy moth EIS. The two processes are different. Mutation is a change in DNA structure. Cancer is a change in DNA function. Function can be disrupted without disrupting structure and vice versa.

67-166

BLM 151: "Asulam and glyphosate tested negative for mutagenicity in all assays conducted, and thus can be considered to pose no mutagenic risk." (L-88)

NCAP 151: (a) Asulam has one valid mutagenic assay (see NCAP comment #67). A battery of mutagenicity tests must be conducted to test for any of numerous potential types of mutagenic potential.

(b) The BLM just got finished saying "the increased risk of cancer can be used to approximate the quantitative risk of heritable mutations" (L-88). Glyphosate has been shown to be carcinogenic, and now the BLM claims it has "no mutagenic risk." ????

67-167

BLM 152: "Fosamine, hexazinone, simazine, and triclopyr were nonmutagenic in the great majority of assays and were nononcogenic in all of the carcinogenicity tests performed; therefore, it can be assumed that their mutagenic risk is slight to negligible." (L-88)

NCAP 152: Eliminate this statement: see NCAP comments #24, 94, 97, 100.

67-168

BLM 153: "The lack of positive results in mutagenic or oncogenic tests with diuron suggests that diuron would present a very low risk to humans as a mutagen." (L-88)

NCAP 153: The BLM states on L-37 that there are zero mutagenicity tests reported for diuron and no adequate oncogenic tests. We pay tax money to have the BLM write fraudulent sentences like the one above?

67-169

BLM 154: "Atrazine tested positive for mutagenicity in 15 of 33 assays. However, many of the positive results were achieved through tests that may not be relevant to evaluating mutagenic risk in humans...[etc.]" (L-88)

NCAP 154: See NCAP comment #27.

Synergistic Effects

67-170

BLM 155: Kociba and Mullison (1985) are the only source cited for the discussion of synergistic effects. (L-89)

BLM 155: Mullison is a Dow employee. The reference is to a trade magazine, the Farm Supplier. The BLM is going to have to cite something besides a Dow worker's article in the Farm Supplier to guarantee the professional integrity of their disucssion.

67-170 CONT.

67-171

BLM 156: "[S]hort term toxicity studies are always done prior to the selling of a pesticide mixture. Should synergism unexpectedly be present in a proposed commercial mixture of two pesticides, it would be identified in such cases and would then be dealt with accordingly." (L-89)

NCAP 156: (a) Synergism for delayed effects or from chronic exposure would not be identified.

(b) Many combinations of pesticides are encountered that were never sold as a mixture and were not even tested for acute toxicity.

67-172

BLM 157: Kociba and Mullison say the LD_{50}s of 2,4-D and picloram separately bracket the LD_{50} of the mixture, indicating the lack of a synergistic effect. (L-89)

NCAP 157: Since only LD_{50}, dermal sensitization, and eye irritation tests are required of full formulations (e.g., products that include both 2,4-D and picloram), the chance of detecting synergism is low. Picloram and 2,4-D have shown just this synergism in skin sensitization studies. (EPA 1984a).

It would seem wise to test 2,4-D and picloram for other synergistic effects. At the very least, it must be stated that there is evidence that 2,4-D and picloram are synergistic.

67-173

BLM 158: "Based on a review of acute LD_{50}'s for mixtures of 2 or more of the 16 herbicides used in this analysis that have been submitted to EPA, no synergistic effects were found." (L-89)

NCAP 158: Cite references for this statement or eliminate it.

BLM 159: "Silvicultural and range applications are not annual; there are typically many years between applications." (L-89)

NCAP 159: Cite field evidence for this on sites where slashburning, site preparation, and crop tree release programs are in effect.

67-174

BLM 160: "...[A] number of acres are treated with mixtures of herbicides." (L-89)

NCAP 160: What acreages and what mixtures?

Attachment A1 Details of Mutagenicity and Carcinogenicity Testing

67-175

BLM 161: Atrazine: "Because plant metabolism is not generally considered important in developing a human hazard assessment, the relevance of the [positive mutagenicity] 'plant-activated' tests in a risk analysis is doubtful."

NCAP 161: If plants metabolize atrazine to a mutagen, and humans eat plants or eat animals that ate plants, how is it not relevant? Cite a toxicology reference that states that plant-activated mutagens are not relevant to human risk. Or eliminate the statement.

67-176

BLM 162: Amitrole: Laboratory cancer studies are discussed.

NCAP 162: Discuss the Swedish study showing a significantly elevated tumor incidence among Swedish railroad workers exposed to amitrole.[44]

67-177

BLM 163: 2,4-D: Laboratory cancer studies are mentioned.

NCAP 163: Discuss the various Swedish epidemiological studies indicating association between phenoxy herbicides and cancer.[42]

In particular, a study of human exposure to phenoxy herbicides that are less prone to contain dioxins and furans (MCPA, 2,4-D, and analagous phenoxypropionic acids, mecoprop and dichlorprop) carry a relative risk of 6.8 for the rare cancer, soft-tissue sarcoma.[43]

Discuss the Danish human exposure study that found workers in a pesticide factory exposed predominantly to MCPA (a phenoxy herbicide which, like 2,4-D, is unlikely to be contaminated with TCDD) to experience five cases of soft-tissue sarcoma in contrast to 1.64 expected cases. The author writes, "This result supports the Swedish observation of an increased risk of STS following exposure to phenoxy herbicides unlikely to be contaminated with 2,3,7,8-TCDD."[46]

*BLM 164: Picloram: Laboratory cancer studies are mentioned.

NCAP 164: 67-178 Discuss the study that found exposure to phenoxy, picolinic acid herbicides (e.g., picloram), or both was associated with significant increases in small-intestinal adenocarcinoma among sheep grazing in New Zealand.[45] This has potential relevance not only for grazers and browsers, but for humans: the New Zealand rates of human colon cancer are among the highest in the world.[45]

Conclusion

A summary of problems endemic to this Supplement and requiring a major rewrite and issuance of a new DEIS was given in the section, "Sudden Finish" (pp. 30-31) of NCAP's May 11, 1986 comments on this Supplement. They will not be repeated here.

These additional comments are offered as additional evidence that the inaccuracies, unsupported statements, uncited studies, and lack of professional standards are too numerous for a mere patching-up to become a Final EIS. Moreover, the calculations for exposure, dose, cancer risk, and margins of "safety" must all be spelled out and made publicly accountable.

Sincerely,

Mary H. O'Brien

Mary H. O'Brien
NCAP Information Coordinator

References

(References 1-27 are to be found in the May 11, 1986 comments of NCAP on this Supplement.)

28. PBI/Gordon. Analysis for N-nitrosocompounds. Results on four 2,4-D amines. Formal report submitted to EPA November 3, 1982 as summarized in personal communication with Diane Baxter, toxicologist at National Coalition Against the Misuse of Pesticides (Washington, DC), June 10, 1986.

29. Lijinsky, William. 1976. Health problems associated with nitrites and nitrosamines. AMBIO 5(2): 67-72.

68

Southern Oregon Northwest Coalition for Alternatives to Pesticides

P.O. Box 402, Grants Pass, Oregon, 97526
503-474-6034

April 29, 1986

RE: Comment on Supplement to Western Oregon Competing Vegetation DEIS

TO: Gregg Simmons, Environmental Coordinator
Bureau of Land Management Oregon
PO Box 2965
Portland, Oregon 97208

Dear Mr. Simmons,

SONCAP wishes to offer the following comments on your Supplement to the Western Oregon Competing Vegetation Draft EIS. We are also including comments on the 1983 Draft EIS itself, and urge you to update this draft before proceeding with the Final, since so much new information has evolved since it was published.

COMMENTS ON THE SUPPLEMENT

These comments are in two parts:
A. Is this an adequate Worst Case Analysis?
B. Specific questions about specific text and tables.

A. IS THIS AN ADEQUATE WORST CASE ANALYSIS? No.

1. The worst case analyses of 6 specific data gaps (identified on page L-17) are encompassed within the large body of quantitative data in the Section 5 Risk Analysis. Given the admitted uncertainty of the data, these statistics are not appropriate tools for a worst case analysis. The document proposes that we accept massive tables of data (of tiny tiny numbers), based on unproven studies and methodology.

2. Your WCA's cover cancer, mutagenic effects, synergistic effects, and cumulative effects. You admit that tests have proven positive in all of these categories for particular herbicides. Yet the tone of your conclusions in all cases, is that there is negligible risk.

Speaking to each category:

CANCER: There is a very fancy formula on page L-81 that is used to compute the risk the the public, the workers, under routine situations, and under accidental situations. This formula uses variables from the Hazard Analysis tables in Section 3. Therefore, this quantitative analysis, by its very nature, denies and covers up the uncertainty in the data.

As an example, in table 5-13, you have quantified that 1 in 1000 Exposed workers (worst case) of 2,4-DP will contract cancer. To the members of SONCAP, this level indicates a highly toxic substance. We oppose use of this substance,

2

because we feel the risk is too great. As documented, we have no confidence in the data or your assurances.

68-1 MUTAGENICITY: At the top of page 88, you state that certain "herbicides have the potential to cause mutations in humans", because there are "no adequate studies." Then you make the following unsubstantiated statements about particular herbicides:
a. "Fosamine, hexazinone, simazine, and triclopyr were nonmutagenic in the great majority of assays...it can be assumed that mutagenic risk is slight to negligible".
b. "The probability of dalapon or diuron causing heritable mutations is low because they have not been shown to cause cancer in any longerm studes."
c. "...studies for diuron were classified by EPA (1985d) as inadequate to determine carcinogenic potential to mammalian organisms. The lack of positive results in mutagenic tests ... suggests that diuron would present a very low risk as a mutagen."
d. "Mutagenic tests with 2,4-DP have shown mixed results. Based on the limited test data presented in Section 3, one cannot presume mutagenic hazard because no in vivo or mammalian assays have been conducted."

SYNERGISTIC AND CUMULATIVE EFFECTS: On page L-89 and L-90, your analysis and conclusions are, again, optimistic, although methods and data are uncertain.

3. I believe these worst case analyses reveal a tendency to understate and minimize hazards, in effect making them Best Case Analyses!

4. A suggestion: In respect to all of these WCA's, I would propose that you assess the expense and suffering which could be caused by these herbicides. What will the doctor bills be for the patients? How much disruption will be caused in their families? How many people will be taken out of the workforce and put in financial straits due to illness in the family? How much does it cost to have cancer? What would a small community's water system be worth to the residents? How much would organic growers suffer if their groundwater were contaminated? How long will it be until we really know what the total effects have been of every acre sprayed already? Then you will have something to compare to the benefits of your vegetation management program.

B. Specific questions about specific text and tables:

68-2 1. The Supplement does not include adequate HUMAN STUDIES, such as:
a. medical reports from exposed workers and the public
b. worker complaints and illness reports
c. medical statistics on incidents (see MEDLINE)
d. California pesticide incident study
e. 2,4-D incident studies
f. reports from chemically sensitive people

Why weren't reports such as these included?

68-3 2. On page 6, you contend that an accurate "margin of safety" may be computed by dividing the animal NOEL by the estimated human dose. This methodology is undocumented and therefore the entire Risk Assessment is unsubstantiated. There is no documented basis for calculating human margin of safety based on an animal LD_{50}.

Where is the documentation for this methodology?

3

68-4 3. On page 8, you state that "there are no residents, hikers, fishermen, or berrypickers in the vicinity of the vast majority of treatment units." This is not true in Southern Oregon where more and more rural areas are being populated next to BLM land, which lies in a checkerboard pattern. Therefore, many more people are at risk, and your conclusion that few people would be exposed is unfounded. We grow our food next to the forests where the children play.

Where are the population density maps that portray the actual number of people living adjacent to commercial forest land?

68-5 4. In table 3-3 on Mutagenicity Testing, the Group3 Tests on DNA damage are incorrectly classified as "NA" (not applicable).

Why did you classify the Group3 tests as NA?

5. In Table 4-5, which describes the 2,4-D Exposure Studies, it is impossible to determine the studies that the values come from. (In general, the reliability of the data comes even more into question, because the documentation of your methodology is so obscure.)

68-6 6. In the summary data starting on page L-32, the secondary references in the Hazard Analysis do not give adequate information for a researcher to locate the relevant studies. The reference citations given in the Supplement lead one to brief abstracts of studies in EPA documents, but not to the studies themselves. Many studies are not available to citizens from corporate laboratories because of chemical patenting stipulaions. This situation also arises with the citations given in Table 3-4.

How do you expect citizens to access these studies?

68-7 7. In the Cumulative Effects Section, you assume that there are no toxic background levels in the Western Oregon environment. This is a false assumption, because toxics from other sources (Wah Chang plant, Columbia River radioactivity, agrochemical contamination of Willamette Valley, etc.) are indeed in the soil, air, and water. The accumulative buildup of introduced toxins and their persistence in combinations with one another is not addressed. For example, consider dioxin buildup, toxicity and long-term persistence. See "Overview of National Dioxin Situation" (1985), by Carol Van Strum.

Do your conclusions assume that we are living in a toxic-free environment?

68-8 8. On page L-39, your assessment of Simazine's mutagenicity is unfounded. The facts presented do not document the issue.

What other facts did you use to draw your conclusions?

68-9 9. On page L-74, you state that the health risks from spray and burn operations are "negligible" and "pose no risk to health", yet you admit that benzene, toluene, and acetic acid are formed by this practice. Benzene is one of many forms of polynuclear aromatic hydrocarbons (PNAH's), which is known to cause leukemia and cancer. Dioxin is also released when sprayed slash is burned.

See the secondary references in "Slash Burn Pollution and Degradation of Resource Values" (1985) by Roger Hart of Oregon State Univ. and the EPA 2,4,5-T Cancellation Hearings.

68-10 What are your findings in relation to the chemical breakdown resulting from herbicide incineration, and how do they measure up against current air quality requirements?

68-11 10. On page L-89, in the analysis of synergistic effects, you rely on research done by Mr. Mullison, an ex-Dow Chemical employee. This one study on 2,4-D and picloram becomes the basis of your proposed model for measuring synergistic effects. I feel that this method is unproven and biased, and that your statement, "synergistic effects are unlikely to occur", is unfounded.

Do you have any other studies on synergistic effects?

68-12 11. The number of spills reported in Table 5-10 does not cover BLM spills.
What is the record of BLM accidents? Is it possible or probable to have a spill of more than 100 gallons? Is a single 100 gallon spill acceptable?

68-13 12. Tables C-1 through C-60 cite NOEL levels that have not been reduced to account for (1) human bodyweight differences and (2) human vulnerability. In similar analyses by the EPA, NOEL levels for rats were reduced 100x to account for the increased potency to humans. See USDA 1985a (your reference), Gypsy Moth EIS.
Why weren't these NOEL levels reduced for this study?

Good luck,
Julie Norman
for SONCAP
JULIE NORMAN

Southern Oregon Northwest Coalition for Alternatives to Pesticides
P.O. Box 402, Grants Pass, Oregon, 97526
503-474-6034

COMMENTS ON THE WESTERN OREGON PROGRAM-MANAGEMENT OF COMPETING VEGETATION DEIS:
Spring 86

1. In the following tables, the indicated information is OUT OF DATE.

68-14

Table 1-2	Comparative "Program Cost" by alternative
Table 1-4	Economic Conditions (earnings, employment, revenue)
Table 2-6	Statistics on Labor Force, Employment and Earnings 72-81
Table 2-7	Changes in Employment 79-81
Table 2-8	Private Sector Foresttry Employment 79-81
Table 3-4	Impacts on Employment and Earnings 79-81
Table 3-6	Impacts on the Allowable Cut, Cost of Vegetation, Stocking (very important to reassess)
Table 3-7	Impacts on Western Oregon Work Force (also very important, and has had much change)

- -

2. In Table 1-4, the Summary of Impacts for the Preferred Alternative lists several items that are unsubstantiated and/or incomplete. Some of them have been discussed in the Supplement.

68-15 a. Air quality: You state that "EPA air quality standards would not be exceeded". However, EPA standards have changed since this writing, and urban areas such as Medford and Grants Pass, Oregon now have increased DEQ restrictions which are causing a shortfall in burning (up to 50% for the past couple years, according to Al Larsen, Environmental Coordinator of the Medford BLM).
What is the new total projection for smoke intrusion, and how does it measure up to new DEQ air quality requirements?

68-16 b. Burning: You state that "Productivity [losses] would be affected on 54% more acres burned each year."
How many actual acres need burning each year (as of 1986), and what formulas do you use to come up with the 54% figure?

68-17 c. Big Game: You state that "Moderate reductions in existing big game population levels would occur."
How do you analyze the effects of your vegetation management program (chemical and non-chemical) on big game, and what is your definition of "moderate"?

68-18 d. Cavity Nesters, Song Birds, and Small Mammals: You state that "reductions in habitat diversity, snags, and downed material would moderately reduce..populations from existing levels."
Again, what data supports this statement, and what is your definition of "moderate"?
Do you have mortality statistics? (This year timber cruisers in the Southern

Oregon area have been finding burnt fawn skeletons in burn areas.)

- - - - -VERY IMPORTANT COMMENT BELOW - - - - - - - - - - - - - - - - - -

e. IMPACTS TO HUMAN HEALTH: You state that there is a:
"NEGLIGIBLE probability of impact".

I feel that this one assertion, written in 1983, essentially says:
"Go ahead with POTENTIALLY HARMFUL PROGRAMS without sufficient data."

This expresses a willingness to harm.

The court has since mandated that you try to describe the existing data gaps. In 1983, you were talking out of your hat and more than willing to go ahead and experiment on forest workers and the public, based on your subjective, unsupported opinion. (Your attitude is arrogant and dangerous, is my subjective opinion.)

Do you see what I am talking about?

I can't help but quote you. From the Conclusions of the IMPACTS Chapter:

> All herbicides proposed for use by BLM in vegetation management have a low order of mammalian toxicity. In general, basic biochemical and physiological differences between plants and animals account for the relatively low toxicity of herbicides to humans. Herbicides are designed to interfere with vital plant processes which are not duplicated in humans.
>
> Extensive studies of the absorption, distribution, metabolism and excretion of herbicides in most animals have shown that herbicides and their metabolites are rapidly eliminated from animals and thus do not accumulate to harmful levels in animal tissues. This reduces the possibility that exposure would result in harmful consequences. All herbicides proposed for use by BLM have a high margin of safety when handled according to label instructions.
>
> Because of the limited toxicity the of herbicides proposed for use and the low potential for exposure, the likelihood of an adverse impact on human health is negligible.

My final note: Please see this radical tendency to risk too much in your actions. Realize that you are working within a system which supports this type of bias. Then you can begin to take it into account when you make decisions.

- end of comments on DEIS -

Julie Norman
SOCAP
JULIE NORMAN

Dear Mr Simmons:
I'm writing about the supplement to Western Oregon Competing Vegetation EIS.
I'm not feeling at all good about this, what happens when an accident causes a spill in our nearby creek spring march or ponds
69-1 Accidents are very much a possibility with any ongoing project and I don't think it has been addressed adequately or in depth at all. Also the study doesn't address Worker complaints or illness. What worst case is this? - It doesn't fit - It certainly doesn't go in our community here in Williams
My wife is preg: with our third child - we live backed by several clearcuts - prime spray locations - These herbicides represent a life and death threat to our family
Can such a questionable gain in tree-vegetation ~~[illegible]~~ growth - control compensate the public
This is your job and you do it the best you can, I'm sure, but what about us folks on the front line with our families and health at stake - It drains our spirit, pocketbook, time and energy -
69-2 You state on page 5 that "there are no residents, hikers, firewood or berry pickers, in the vicinity of the cut within [illegible] treatment limits" - How can

this be true? we are only one small family and our direct water shed that my kids swim in and water used for everything comes directly out of miles of BLM management area - many acres that would be prime spray areas - how can honestly feel we have no right to clean water? I would like your view on this. If you spray, be prepared to pay for your liability for deaths and injuries that result. This is a highly emotional issue that will not go away - We have discussed this at town meetings and the feeling I get is people are afraid. I intend to bring it up to the calender at the next meeting.

Thank you

Marion Turley
4015 Eastfork Rd
Williams Oregon
97544

70

P.O. Box 241
9600 Thompson Crk. Rd.
Applegate, Or. 97530
May 9, 1986

Concerning: Comments on Supplement to Western Oregon Competing Vegetation DEIS

TO: Gregg Simmon , Environmental Coordinator
Bureau of Land Management Oregon
PO Box 2965
Portland, Or. 97208

Dear Mr. Simmons,

My name is Louise Nicholson and I live in the Applegate Valley on property adjoining both BLM and Forest Service Lands. I have been following with interest the events leading up to this supplement EIS since before the spraying was enjoined on BLM lands in this district, this prompts me to inter these comments which I hope you will take into consideration.

70-1 I was greatly dissappointed to find that this supplement does not offer any substantial data or important new findings that stand out or differ from the draft EIS. The new information that is offered appears to be incomplete, unreliable or obscure, such as the 2,4-D studies of exposure in Tables 4-5. From what studies do these figures originate?

Another misconception on which you are basing your conclusion is that there are no residents (or hunters, hikers, fishermen) in the vicinity of most of these units to be treated. Not only am I an avid hiker that lives next door to BLM land, but my drinking water is drawn off of these slopes and we fish from the stream that runs from these hillsides.

70-2 I am also concerned with your statement that only negligible health risks are at stake with the burning of slash. What about the byproducts of these burns? Benzene and Dioxin are seriously hazardous carcinogens and are released into the air with slash burning to be breathed by the human and non-human population in the surrounding area. This is inconsistent with your claim that it poses "no risk to health", as expressed on page 74. Especially at risk are those persons who are chemically sensitive.

Please address these ssues and those of other concerned citizens before making your decision.

Sincerely,
Louise Nicholson
Louise Nicholson

71

May 7, 1986

Gregg Simmons
Env. Coord.
BLM Oregon
P.O. Box 2965
Portland, Or. 97208

Dear Mr. Simmons,

This letter is in response to the supplement to the Competing Vegetation DEIS. I am opposed to the use of poisons with all their potential dangers on [illegible] amounts of the public domain. When this BLM land is in direct proximity to the inhabited areas, such as we have here in Williams, I find the idea of toxic techniques a deplorable approach. We operate a certified organic food and seed farm and will do everything within our rights to prevent the general and blatant use of herbicides around us.

1) Your report was written to serve your own ends. Your agency wants the use of herbicides, and your reports create a fictional, statistical situation that says, "It's alright".

2) I got the impression from "LD50" and "NOEL" figures that as long as not more than half the rats died, the risk was tolerable. I find such logic intolerable and do not want such poisons used on public land making all of us involuntary guinea pigs. As citizens, these are the lands we can have some say about.

71-1 3) You give us odds and a bunch of gobbeldygook but you don't really address the long term genetic and biological effects of what you do. What about the binders and glues that are used to hold herbicides on the plants and what about all of these taken together over the years?

4) I understand that these binders and glues are industrial patents, so you can't address them even if you wanted to. Is that true? How do they fit into the potential dangers of a chemical forestry program?

We do not want our county to become an experiment while you all try and hold up economic failure for a few more years. Just look at the great agricultural heart land of America. The petro-chemical/greening of America has led to poisoned water at the aquifer level. The lands treated in chemical fashion are being destroyed by salts, ammonia and the effects of working with dead soil that is pumped up with fertilizers. With all these chemicals the farmers are going broke. Now the BLM wants to do this to our mountains and water sources. This is a national travesty and should not be allowed to go on. What do you say about this?

Develop jobs and a diverse, people-intensive forest management program or you will have done the dirty work of the robber-barons again. Don't spray it, grow it!!

Sincerely,
Alan Venet

Alan Venet
1130 Tetherow Rd.

72

May 7 1986

Mr Gregg Simmons-Environmental Coordinator
BLM Oregon
PO Box 2965
Portland, Oregon 97208

RE: Comments on Suppliment to Western Oregon Competing Vegitation DEIS

Dear Mr Simmons:

An overview of the document in question reveals a very complex summary which was hard to read and understand. The following are noted items of interest.

72-1 1) The overall perspective of the DEIS does not project a "worst case analysis" from the point of view of those of us who live within drift range of past and proposed spray areas. There are many more people living close to(within ¼ mile) of) proposed and past spray areas than BLM realizes. There is also greater usage of BLM land by the public than is acknowledged. The statement concerning limited public exposure on Pg 8 and pgs 1-72-73 is not true. If repeated spraying on a site takes place- ie for site prep and then release we are exposed more than once. Often the spraying is not effective and so it must be repeated. If there are several contiguous sites with different operations happening at the same and different times we are exposed repeatedly to drift and water contamination.

72-2 2) The study does not include anticdotal evidence such as worker complaints and illnesses and complaints from sensitive allergic people. The NOEL(no observed effect level) is misleading. This refers to short term accute effects derived from animal data and extrapolated to determine human MOS(margins of safety). Studies on long term effects on humans who have been exposed have not been included if they exist. The validity of the MOS figures are suspect because of the questionable NOEL and because of the difficulty of extrapolating animal data to human.

3) The section on Cumulative Effects does not take into account toxics from other sources- ie air, water, and soil that could combine with herbicides to cause problems. The idea that exposures of forest communities are less than that of agricultural ones should have no bearing on the safety of either. Agricultural

chemicals are known causes of serious health hazzards in workers and surrounding communities. The fact that forest uses cause less hazzard does not mean they are safe.

4) On pg 61-62, assumptions were made for contamination of water, game animals and fish. It is interesting that no studies have been done on actual contamination of these resources
72-3 when that contamination has occured. Fish, for instance, have been killed by spills and water has been contaminated by drift and runoff residues. This has supposedly been monitered. The fact that studies of this type have not been done indicates the lack of real concern for public and environment by BLM-(pg 60-61).

5) I was unable to find any references to effects of herbicide spraying on domestic animals of down stream land owners and residents. Yet I know anecdotal evidence is available. I could not find a "worst case projection" on this issue.

6) I believe table 3-1(Pg L-27) to be misleading. In this table Amitol along with Asulum, bromacil, Atrizine, 24-DP, and Triclopyr) is classified as slightly toxic. Table salt receives the same classification. When discussing MOS for people drinking contaminated water (table 5-9-pg 1-79) and in the discussion concerning cancer risks (pg 1-85) also table 5-13, Amitrole is referred to as the greatest carcinogenic risk. Accurate interpretation of table 3-1 might only prove that rats (not humans) may be more or as sensitive to substances such as nicotine and caffine than they are to other substances listed

7) Studies quoted from EPA and other government sources are generally studies done by chemical manufacturers. This is unclear in the document. Also many of the so called independent studies used were those of people who work for, or are supported in some way by chemical manufacurers. There are very few actual independent studies used.

This concludes my comments.

Thankyou sincerely,

Susan Delles

Susan Delles
2801 Sykes Creek Rd
Rogue River, Or 97537

① 73

May 8, 1986
11001 Takilma Rd.
Cave Junction, Oregon
97523

Oregon State Director
Bureau of Land Management (935)
% R. Greg Simmons
P.O. Box 2965
Portland, Oregon 97208

Dear Mr. Simmons,

Having given extensive comments to the B.L.M. Draft E.I.S. on Vegetation Management, I expected to be sent a copy of the current Supplement. This was not the case,
73-1 but you didn't bother to answer any of the information questions I posed either of the Draft.

As noted in the Supplement, dermal contact is the most prevalent exposure route to herbicides compared to inhalation. There seemed to be no discussion
73-2 of nurseryworker or treeplanter exposure via this method of exposure. As a reforestation contractor for many years, I can assure you that most workers can not do their job effectively wearing rubber gloves. Light cloth ~~gloves~~ gloves pass any residual herbicide easily to the skin. Then in remote planting areas hands can not be easily washed and many planters eat without washing.

② 74

This exposure route should be considered in a worst case analysis. Testing mice and predicting likely exposure to people does not cover the practical working world of many forest workers.

Sincerely,

Jim E. Dunn

P.S. - There have been many recent vegetation management reviews and articles since the 1983, June Draft E.I.S. on Vegetation Management. The March, 1984 article "Vegetation Control for Douglas-Fir Regeneration on the Siuslaw National Forest: A Decision Analysis" by Knapp, Turpin, and Bentley in the Journal of Forestry is representative. Their work, derived from early stage greenhouse work where treatment "windows" were ill-defined show only a 6% decrease in present net worth without the use of herbicides. The Draft E.I.S. is in need of updating.

4-28-85

RE: comments on supplement
to Western Oregon
competing vegetation

Dear Mr. Simmons,

I am writing to add my comments
#1 - on this document. First of all, I would say I found (and have found in the past) that these type of documents are extremly hard for the general lay person to read & understand. I'm sure that this prevents many people from attempting to respond to such data.

#2 - comment is that on page 8 you mention that "there are no residents, hikers, fishermen or berry-pickers in the vast Majority of treatment areas. Since I have lived twice on home steads (the first for 13 years) that have been completely surrounded by BLM & 3 times within 1-2 miles of spray units in the past, I feel I have totally felt the fright & horror of feeling powerless in the face of herbicides. Twice being pregnant & living so close to spray units was very frighthing.

I have felt alot of sympathy for the women in the Alsea area of the oregon coast range. In an area such as southern oregon, private land & BLM - Forest service land is a ~~[illegible]~~ patch work of interconnected parcels. The idea that people would not be affected does not seem very reasonable.

#3 - comment — On page L-74 you write that risks from "spay & burn" operations are negligible and that there is no risk to health. But as I understand, you go on to say that benzene, toluene & acetic acid is formed. Living here in the Williams Valley, the smoke from the logged areas when their burned lies thick & heavy down in the valley. It would seem that if this smoke was also polluted with these cemicals the smoke would be very toxic.

74-1

#4 - comment - on page 6, I feel your method of computing the "margin of safety" is not very solid and makes the entire "Risk Assessment" seem unsubstantiated. There is no basis for calculating human margin of safety using an animal LD 50

I have felt for a number of years that Herbicides ~~of~~ are being used before their safety have been fully proven. I dont appreciate the feeling that I and my family are the "testing cases" in the BLM - Forest service large scale experiments

Thank you
Lynda Turley

75

Southern Oregon Post & Pole, Inc.

688 Crooks Creek • Selma, Oregon 97538
(503) 597-2835

May 5, 1986

Oregon State Director
Bureau of Land Management (935)
c/o R. Gregg Simmons
P.O. Box 2965
Portland, Or. 97208

Comment on the "Supplement to the Western Oregon Program-Management of Competing Vegetation":

I speak as owner/operator of Southern Oregon Post & Pole, Inc., for the past 15 years and as a member of the Josephine County Forest Farm Association.

75-1 The vegetation management program as described treats hardwood species as troublesome weeds and speaks primarily to the eradication of these species as 'competing' vegetation. There is no discussion or analysis of managing hardwood as a crop tree.

At this time, in southern Oregon, hardwood is, in fact, a crop tree of major importance to the local economy. Vegetation 'management' as described in the Draft EIS destroys the long-term potential of hardwood as a crop tree by creating brush rather than nursing hardwood as a crop tree.

Economic questions are critical here: BLM's C&C mandate to sustain the local economy must include all facets of the local economy which produce jobs, not just the softwood industry.

As a member of the Forest Farm Association and as owner/operator of Southern Oregon Post & Pole, I earn my living utilizing the products that you treat as unwanted vegetation; your Draft EIS does not plan for the continued sustained availability of products that I use.

The focus of BLM's management policies on even-age single species must be broadened. In 1986 and the future no Environmental Statement will be adequate until it analyzes the all-age all-species management alternative.

Thank you.

Art Downing

76

HENRY W. KUNZ
BONDED AUCTIONEER & APPRAISER
~~P.O. Box 561~~
~~Newport, Rhode Island 02840~~
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P.O. Box #190
Williams, Oregon
97544

Citizen Comment on Supplement to Western Oregon Competing VegetationDEIS

Gregg Simmons, Environmental Coordinator
Bureau of Land Management Oregon
P.O. Box 2965
Portland, Oregon 97208

Dear Mr. Simmons,

I am living with my wife and two children in Williams and building a house here on property which borders BLM land. I am appalled at the conclusions reached in this report. Making all the calculations on the assumption that persons exposed to these herbicides would be fully normal medically and without existing health problems is absurd. Williams, Oregon is surrounded by BLM land, and of all the people I know in this town fully half of them have chronic medical conditions of various gravity for which they are receiving either treatment or medication. Nowhere in this study is the pre-existing sensitivity of persons or their long-term medical situation considered. I'm sure all the rats used in the NOEL and LD50 studies were young, vigorous, and carefully protected from other chemicals, toxins, pollutants and medications. This is not the case in Williams, and, I'm sure, not the case in any ordinary community. Until tests are done to determine what effects these 16 herbicides would have on people on medication or on people of fragile health, I feel the situation has not even begun to be considered.

76-1

76-2 1. NOEL does not take into account what effects might be seen if (a) the rats were 40-50 years old and had already been fighting the effects of the environment all their lives, (b) the rats were to live 40-50 years after exposure and be re-examined at far later dates. I reject the idea that NOEL on young, short-lived rats can be applied

to the community of humans.

2. Throughout the report, the word "remote" is applied to the areas where spraying is proposed. I am only familiar with my community, but there are over 5000 people living within a mile or two of BLM lands which have been or are scheduled for clear-cutting and, I presume, future spraying. This term "remote" does not apply here, or to any area I'm familiar with in Jackson or Josephine Counties. There are homes and farms in all the valleys, surrounded by BLM land. I can only conclude that the word "remote" was only applicable to the persons living 3000 miles from Oregon who prepared the report. 76-3

3. I did not see any mention of the effects of possible contaminants such as petroleum distillates, dioxin, other hydrocarbons. I presume the rat subjects were tested for NOEL and LD50 on pure samples of the herbicides. In past applications of these herbicides, it is known that there have been contamination problems. Has there been, or will there be attention given to this question? 76-4

4. The scientific comaunity today recognizes that human sensitivity to toxins is greater than that of rats. These studies don't take that into account in calculating comparison between rat NOEL and supposed human NOEL. 76-5

5. Will there be follow-up studies on the rat subjects of this report on 2, 4, 6 year periods to determine if, in fact, the supposed NOEL dose had delayed effects? 76-6

6. I didn't see any results for tests on rat subjects for NOEL of the 16 herbicides when rat subjects were also administered daily doses of: antibiotics; hypertension medication; asthma and allergy medication; nicotine; caffeine; etc. Interactions of such substances are noted even on the counter-indications packaged with the medications. Have there been such studies? Will there be? 76-7

In light of the questions which this report raises, such as those of the actual carcinogenicity or toxicity of some of the herbicides, as admitted in the report's introduction, as well as those questions which I have asked, I believe this analysis is totally unrealistic, and deals only with a limited laboratory situation and simplistic mathematics, and does not address the questions of an actual worst-case scenario.

I feel that citizens with no scientific experience would either not understand this report at all, or would be lulled by its official tone into believing the basic question had been answered. That question: What is the conceivable risk to humans of a worst-case situation using these herbicides? It is a disservice to the American people to pretend that this report answers that question, even in small part.

Sincerely,

Henry Kunz

Headwaters
For the protection of critical watershed

May 10, 1986

Oregon State Director

Bureau of Land Management

c/o R. Gregg Simmons

P.O. Box 2965

Portland, OR. 97208

Re: "Supplement to the Western Oregon Program-Management of Competing Vegetation"

I. The Vegetation Management Environmental Statement for which this Supplement was written is obsolete and inapplicable to the Medford District BLM for the following reasons:

A. A recent Inspector General Report has revealed that Medford BLM has violated the National Environmental Policy Act (NEPA) consistently for the past several years when it failed to publically review and evaluate changes implemented in management practices.

The Supplemental Timber Management Environmental Statement, which was written only as a result of public pressure applied by Headwaters, evaluates only one facet of that change--clear cutting. There are other important issues including the question of sustained yield that will be evaluated in the new 10 year planning process which has already begun.

A valid EIS for Vegetation Management must evaluate the new plan, not an obsolete, outdated one. 77-1

B. The recently published supplement to the timber management plans in Medford disclosed that 55,000 acres of 'failed shelterwood' exists on the District. These acres are stocked with hardwood and regenerated softwood. The exact stocking has not been revealed.

A valid EIS for Vegetation Management must evaluate alternatives to clearcutting on these acres, and alternatives to destruction of hardwood by herbicides or burning, and the trade-off that is being made by the destruction of this second growth, including the effect on the allowable cut of this destruction of second growth for which BLM has taken allowable cut credit. 77-2 77-3

Post Office Box 1075, Grants Pass, Oregon 97526 Telephone (503) 474-6034

C. The long-term economic impact of the destruction of hardwood with herbicides or burning must be evaluated. BLM is required by the O&C Act to sustain the local economy. This mandate has historically applied only to the softwood economy, but the O&C mandate does not limit BLM's responsibility only to softwood economics. 77-3

Since the Vegetation Management EIS was prepared in 1983 the firewood market in Southern Oregon has thrived, while the softwood market continues to decline. In Grants Pass, for example, there are two firewood wholesalers who ship $200,000-$250,000 in firewood to California annually, and expect to grow this year. This figure does not include the thousands of cords of firewood which are sold

Considering this development of the hardwood market, and the place it is beginning to play in the local economy, no EIS will be adequate which does not evaluate alternatives to spray and burn technology which sustain hardwood as well as softwood for the future: all-age all-species management.

D. Medford BLM has been operating a vegetation management program without the use of herbicides for the past several years. Since the allowable cut reduction taken by the District is minimal, and since Medford BLM maintains that vegetation management is essential to achieve intensive management goals, the public can only assume that these goals have been achieved with some other vegetation management tools. What are these tools? 77-4

A valid EIS must evaluate these alternatives to herbicide use.

II. The Worst Case Supplement is troubled by erroneous and unreal assumptions and therefore erroneous and unreal conclusions.

A. There is no discussion of risk involved as a result of the clearcuts that take place in live streams. Medford BLM routinely clearcuts within the minor stream classes. These streams run water from approximately October until April or May. Many people use these streams for domestic or irrigation water. 77-5

There must be an evaluation of the risk involved in using water that has been sprayed in this manner.

B. The Supplement assumes that spray areas are posted. BLM Medford has not committed to posting--their regulations allow discretion. To our knowledge BLM has very rarely posted. In fact, it was only after enormous public pressure that Medford BLM agreed to inform nearby landowners that they would be at risk--During the last spray season BLM agreed to phone nearby landowners ½ hour before spray, only if we called and put our names on a list. 77-6

Given the attitude of the Medford BLM, the worst case analysis cannot assume that people have adequate knowledge of sprayed units, and must be reevaluated to assume that we do not.

C. So many of the assumptions in the Worst Case Supplement are glib and erroneous. For example, under the section Risk to the Public under Accidental Scenarios on page L.73, the Statement says:

> Using this value as an extremely conservative estimate of the probability of an application directly hitting

a human being, there might be three accidents over a period of 8 years if a spraying operation occurred every day for 6 months during each of those years.

The record established in the two years that Medford sprayed proves otherwise. Two children were sprayed while waiting for the school bus one morning. By your calculations, that leaves 6 years for one more direct hit to occur.

In conclusion, in 1986 and the future, the most important question to ask pertains to the value of hardwood in our local economy. Secondly, the assumptions in the Worst Case Analysis are unrealistic. For these reasons BLM must prepare new Environmental Statements.

Sincerely,

Paula Downing

Paula Downing
Board of Directors, Headwaters

78

A.C.O.T.S.

Applegate Citizens Opposed to Toxic Sprays
P.O.Box 291 Applegate, OR. 97530

May 12, 1986

Oregon State Director
Bureau of Land Management (935)
c/o R. Gregg Simmons
P.O. Box 2965
Portland, Oregon 97208

Dear Gregg Simmons:

The Applegate Citizens Opposed to Toxic Sprays,(ACOTS), originally commented on the Draft Environmental Impact Statement for the Western Oregon Program-Management of Competing Vegetation, (EIS), in August of 1983. In those comments we gave many reasons why we considered the EIS to be inadequate. We now submit additional comments to show that the EIS is even more inadequate, three years after it was drafted, and that the February 1986 Supplement to this EIS is inadequate as well.

I. Additional comments on the Draft EIS (June 1983).

78-1 1. The EIS was drafted to update the 1978 EIS-Vegetation Management with Herbicides because "an updated EIS is needed to address the increasing emphasis on non chemical vegetation management treatments." During the past three years of non chemical treatment of vegetation on all public lands, many different types of alternative management techniques have been used. These alternative treatments must be analyzed and discussed in a new, updated, EIS or new supplement. It makes absolutely no sense to write an EIS to update nonchemical treatments and then dismiss,or not incorporate, three years of valuable site specific data on the subject.

78-2 2. Additional scoping meetings are now needed in order to allow the public to consider additional alternatives. The proposed alternatives cannot be considered appropriate for full analysis in light of BLM's experience with non chemical treatment during the past three years and socio economic changes.

78-3 3. The cumulative impacts of herbicide use are not adequately analyzed. There is new data available regarding accumulation of pesticides in water, food, soils, fish, air and humans. The EIS assumes a pristine environment, but the proposed herbicide use is an additive problem of chemicals into the environment.

78-4 4. The indirect effects of herbicide use are not considered or discussed. Effects such as increased clearcutting, poor quality fiber, reduced crop rotation, loss of nutrients over several rotations, damage to crop trees, ground water contamination, etc. are impacts that are significant and require inclusion.

II. Comments on the Supplemental Environmental Impact Statement (SEIS).

78-5 1. Cumulative synergistic effects.
BLM seems to be considering the cumulative and synergistic effects of exposure to only the herbicides considered in the SEIS analysis. The significant cumulative impacts and synergistic effects resulting from the accumulation of pesticides in normal life are not discussed. The recent increased radioactivity in our water, food, soils and air from the nuclear accident in the Soviet Union is a good example of a likely adverse cumulative and synergistic effect.

2. The SEIS wrongly assumes that no other herbicide spray program or additional chemical use is taking place in areas where these proposed herbicides will be used.

78-6 3. There is no adequate discussion or analysis of the questionable "inert ingredients" used in the proposed herbicides.

78-7 4. A cost-benefit analysis which would assess all the costs including administrative, protest and toxic tort litigation, spill clean up, future medical, and other indirect effects is needed to evaluate the benefits of using these chemicals.

5. The SEIS is difficult for the lay person to read. Many sections are too technical, requiring a chemistry or toxological background.

78-8 6. All the data presented seems to average the effects rather than giving a range of the risks assessed.

78-9 7. The SEIS does not have adequate discussion of the risks of exposure to chemically sensitive people or non-humans.

III. Proposed Alternative.

78-10 BLM has already started planning for its new 10 year Resource Management Plans (RMP's) in Western Oregon to be completed in 1990. New management directions, increased public participation and examination of new data will be evaluated during this planning process. Therefore, we propose that the BLM consider a new Proposed Action Alternative to the one already selected in the Draft EIS. This alternative would continue using all the available non-chemical methods of vegetation management until the new RMPs are in place. When the RMPs are approved, BLM would then go about drafting a new EIS for managing competing vegetation.
Adoption of this alternative would provide BLM with the opportunity of truly evaluating non chemical treatment of vegetation over an approximate five year period. Further, the adoption of this alternative would prevent the possibility of additional extensive supplementation once the RMPs are in place.

IV. ACOTS hereby incorporates the comments of the Northwest Coalition For Alternatives To Pesticides (NCAP) as part of its comments on the proposed Supplement and Draft EIS.

Sincerely,

Christopher Bratt

Christopher Bratt
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Oregon State Director
Bureau of Land Management (935)
c/o R. Gregg Simmons
P. O. Box 2965
Portland, Oregon 97208

Dear Sir:

We are cognizant of the fact that it is beyond the comment period for the Supplement to the Western Oregon Program-Management of Competing Vegetation DEIS. The document has only just come to our attention, however, and we should like to comment on its treatment of sensitive populations. We hope that our comments can be taken into account at this late date. As the parents of chemically sensitive children, we have some experience and concern in this area. Our children have been made seriously ill on occasion by minimal accidental exposure to herbicides applied in a supposedly safe manner.

79-1 On page 6, the DEIS states that since margins of safety are at least 150 in all categories, no one (including sensitive individuals) should suffer adverse effects. The factor of 150 represents wishful thinking for sensitive individuals; research in this area is sketchy at best, but clinical ecologists suggest that sensitive persons may be hundreds, even thousands of times more sensitive to a given chemical than the general population. Clearly the routine realistic scenerios in table 5 are inadequate to insure safe margins for all sensitive individuals. The worst case analyses suggest that indeed "sensitive individuals could suffer some acute toxic effects" (p.8), effects that could be very serious indeed. The question is, "what effects, and how serious?" The DEIS is silent on that point.

On page 13, the DEIS suggests that "some individuals who are particularly sensitive to triclopyr could experience ill effects, but, again, this should occur only in the unusual circumstances of repeated doses." Clearly with very sensitive individuals, the "unusual" circumstances of repeated doses would not be necessary to produce toxic effects. And again, the question also is "what effects, and how serious?"

On page L-70, the same error occurs as on pages 6 and 13. Again the margin of 150 utilized earlier is equated with safety for sensitive individuals.

Page L-72 admits that "sensitive individuals could become ill and possibly experience stomach problems." In cases we know of, including our own children, exposure to toxic chemicals for sensitive individuals may lead to irreversible

damage to the immune system, to the body's ability to produce T or B cell lymphocytes, with the result that a sensitive individual becomes hypersensitized, now no longer able to tolerate even minimal exposures. A permanent handicap of staggering proportions is the result--an individual unable to eat normal food, drink treated water, live with paints and plastics--in short an individual no longer able to tolerate the modern world. There is evidence of central nervous system damage in such cases as well; whether it is reversible or not is difficult to say.

79-1 As a side note, I wonder what induced the writers of this DEIS to note the LD 50 dose in this context as if it were a comforting comparison. What connection can possibly be made between an LD 50 dose and thresholds for sensitive individuals?

Finally, page L-90 suggests that "some individuals who may be particularly sensitive to amitrole or triclopyr may experience ill effects but, again, this should occur only in the unusual circumstances of repeated doses." Once again, repeated doses will not be necessary to trigger ill effects in the very sensitive. And the key again is "what effects, and how serious?" The DEIS doesn't remotely approach the problem by suggesting a few "stomach problems" as the extent of such difficulty.

Sincerely,

Kenneth S. Nolley

Kenneth S. Nolley

Janet Nolley

Janet G. Nolley

Responses to Public Comments

3-1 No attempt is made in the EIS to analyze the economic efficiency of individual practices. The efficiency of each practice would vary with the condition of the site on which the practice would be applied. The diversity of site conditions in the five BLM districts makes enumeration of all possibilities impractical. Instead, the EIS evaluates alternative packages of practices, where each alternative or package is guided by an overall theme or policy direction, e.g., no prescribed burning or no aerial application of herbicides. In estimating acres that would be treated by the various practices under each alternative, silviculturists in each district selected cost-effective treatments for the site conditions each faced. In short, when fully funded, each alternative would be the least expensive means of achieving the highest level of conifer stocking for the treatments available. Site preparation and stand maintenance practices were selected first in each alternative followed by release and precommercial thinning.

The costs of EIS preparation, litigation, accidents and training were excluded from the display of costs because selective assignment to individual alternatives would have been arbitrary. Conversely, equal assignment to all alternatives would have increased the accounting detail without highlighting the differences among alternatives. Total cost of the DEIS was approximately $130,000.00 and the supplement was an additional $52,000. That total cost, allocated to the 92,000 treated acres per year (Alternative 1) over a 5-year program calculates to be $.40/ac/yr.

3-2 Under all alternatives, emphasis was placed upon providing an acceptable number of well-spaced planting spots through adequate site preparation and upon insuring survival through stand maintenance. If funding were not adequate to support the entire vegetation management program, these two goals would be given preference over growth-enhancing programs such as precommercial thinning and release treatments. This approach is taken due to BLM policies and because funding levels are subject to annual fluctuations.

3-3 The intent of placing a limit on the number of treatments was to provide a common ground for analysis across the range of alternatives. The limit was based in part on actual field experience. Although it is not an absolute value, it represents a reasonable approximation of what would happen in practice.

3-4 The annual treatment acres listed in Table 1-2 are based upon the professional knowledge and experience of BLM personnel most familiar with the vegetation management program in each district. These acres are presented in order to provide a basis for impact analysis, but adjustments in these program levels can be made. If significant adjustments, which fall outside the range of alternatives already analyzed, are necessary, the EIS will be supplemented. Following the treatment of competing vegetation, regardless of methods used, post-treatment surveys will be conducted.

8-1 Spill scenarios were included in the worst-case analysis (Appendix L).

9-1 BLM's decision on the alternatives and the rationale for that decision will be set forth in the Record of Decision to be prepared at least 60-days after the final EIS is distributed.

10-1 Current inventories indicate that there are approximately 53,100 BLM-administered acres of hardwood-typed lands in the EIS area. Of this total, 8,300 acres (16 percent) are planned for conversion to conifers during the 1984-1993 decade.

10-2 See response to comment 3-1.

10-3 See Table 1-2. The anticipated level of sheep grazing that would be used for vegetation control is shown under Maintenance and Release - Biological (Animals).

10-4 See response to comment 9-1.

10-5 Short-term is defined as 1 to 5 years. Short-term benefits to some terrestrial animals are discussed in Chapter 3, Impacts on Animals.

10-6 See text revision for Chapter 3, Impacts on Animals. Adoption of this mitigating measure as a requirement on all projects will be considered in developing the final decision on the vegetation management program. The Record of Decision for this program, to be prepared after the final EIS is distributed, will state whether this measure will be adopted.

10-7 The buffer strip widths shown in Appendix D would be minimum widths for all herbicide applications adjacent to streams, lakes or ponds without designated withdrawn riparian zones. Many streams in western Oregon BLM districts have had riparian zones identified for their protection. Since these zones are withdrawn from timber harvest, no vegetation management activities would occur within them. Spray buffer widths would be either those shown in Appendix D or the width of the withdrawn riparian zone, whichever is greater. In either case, the streams would be protected. Vehicle and hand applications of herbicides are more easily controlled, so smaller buffers can be utilized without affecting the aquatic environment.

10-8 The 1978 EIS identified several mitigating measures as project design features which would protect important wildlife habitats. These mitigating measures concerned wildlife winter range, wildlife mating and nesting, snags, seasonal restrictions and critical habitat protection. Appropriate mitigating measures would be considered in site-specific environmental analyses accomplished annually by each BLM district on proposed Vegetation Management plans or addressed in the Record of Decision for this proposed Vegetation Management Program.

11-1 There will be no timber management activity, and thus no vegetation management activity, in any of the coastal shorelands identified under Goal 17. BLM activities conducted outside the coastal shorelands will have no effect on them. For these reasons, Goal 17 is not applicable to this EIS.

11-2 A more detailed determination of consistency between the Vegetation Management EIS and Oregon's Coastal Management Program has been sent to the Department of Land Conservation and Development.

13-1 Some information in this section was obtained from Dost (1983), which was also used in preparation of the original BLM worst-case analysis. This section has been completely rewritten by Labat-Anderson, Incorporated. More detailed information, including sources, has been included in the FEIS (see Appendix L).

13-2 The calculations and extrapolations were made by Dr. Frank Dost, a qualified toxicologist who provided expertise and reviewed the DEIS prior to publication. See response to comment 13-1.

16-1 See text revision for Chapter 2, Climate and Air Quality.

16-2 The BLM recognizes that particulate standards could be exceeded if prescribed burning smoke were added to an already highly impacted airshed. The conclusion in the DEIS was based on the fact that all BLM burning is conducted in accordance with the Oregon Smoke Management Plan. Since this plan is designed to restrict burning at times when air quality problems exist, particulate concentrations in the nonattainment areas would not be expected to exceed the secondary or primary standards. Weather conditions required for prescribed burning are normally such that smoke will move away from areas of concern, so increases in particulates in these areas would likely be insignificant. In addition to restricting burning days to ideal weather conditions, BLM extinguishes burns quickly to reduce residual smoke.

17-1 The EPA has registered all of the herbicides proposed for use under this EIS. One of the criteria for EPA registration is that the herbicide will perform its intended function without unreasonable adverse effects on the

environment (or would not cause a significant increase in the risk of any unreasonable adverse effect) when used in accordance with widespread and commonly recognized practice (40 CFR 162.7 and 162.18-2).

17-2 The acreages presented in the EIS are estimated annual averages for all of western Oregon. They are not requirements. For example, if the need does not exist for certain practices during a particular year, those practices would not be applied. Likewise, acres treated by individual districts would be expected to fluctuate from year to year due to variations in budget, timber harvesting and environmental conditions. For purposes of evaluating impacts under this EIS, BLM assumed that treatment levels would remain constant for the next 5 to 10 years.

18-1 Aquatic biota respond when exposed to a given concentration of chemical for a given length of time. The size of an organism is not associated with its responsiveness to a certain toxicant (an example of this is the difficulty of killing pathologic bacteria).

18-2 Many variables govern the persistence of herbicides in the aquatic environment. Beschta and Jackson (1979) estimate that the general transport of bed material (sand size and larger) occurs on an average of 20 days each year during peak flows. Therefore, relatively few portions of streams retain bottom materials for any length of time. The large number of branch streams in western Oregon provides a major dilution factor. For these reasons, herbicidal persistence in stream systems would be insignificant, particularly since BLM spray operations are not expected to cause stream contamination that would exceed EPA-recommended criteria.

18-3 Several of the design features identified in this EIS are contained in the Field Guide to Policies and Procedures Required for Vegetation Management Using Integrated Pest Management Practices in Western Oregon, which has been incorporated by reference (see page 5 of the DEIS). This Field Guide prescribes the steps to be taken in the case of a chemical spill. Following is an excerpt detailing these requirements:

Spills

a. In the event of a spill of more than five gallons of mixture or one gallon of concentrate, the project inspector or crew foreman will immediately implement measures to contain the herbicide. The following individuals will be notified as soon as possible: (1) the Area Manager, (2) the District Manager, (3) the State Office Pesticide-Use Coordinator and, if the spill cannot be contained or advice is needed, (4) the Oregon Accident Response System, (Emergency Services). Emergency Services will contact the various agencies involved. Contact the State Police if radio but no phone is available or if there is no answer at the Oregon Accident Response System (spill occurs on a weekend or early morning).

b. Contain herbicides by diking and collecting pools. Know the availability of earth moving equipment close to the project.

c. The Environmental Protection Agency will be notified immediately for advice if a major spill occurs. For additional assistance, call the Pesticide Safety Team Network. Major spill examples include those that involve domestic or fish hatchery water supplies, people, livestock and crops.

d. Inspect surrounding areas for possible contamination.

e. Implement containment procedures by the contractor if required in the application contract.

18-4 In addition to water, diesel oil is added to the herbicide in some applications (see Table 1-3). The impact of this additive on vegetation and terrestrial vertebrates is discussed in Chapter 3.

19-1 The NCAP information packet was reviewed by Labat-Anderson, Incorporated during preparation of the Supplement to the Draft.

19-2 This proposal was made at the July 28, 1983, Eugene public meeting concerning the adequacy of the DEIS. No such program has been developed or found to be practical. Analysis of this proposal revealed that establishment and maintenance of desirable native roadside vegetation as an adjunct to current practices that maintain certain vegetation in some circumstances would not be cost effective. Consequently, the decision was made not to consider this proposed new treatment for analysis in the FEIS.

19-3 Opposing viewpoints such as those of Newton and Horowitz were considered in evaluating impacts of the alternatives. Viewpoints which were based upon solid research relevant to the analysis were cited in the document. Individual studies conducted by Groundwork, Inc. and Horowitz have shown that alternatives to the use of herbicides do reduce the growth of some competing species under some circumstances. The findings of Newton and Horowitz, however, do not negate the considerable volume of research which shows that herbicides are effective in the control of competing vegetation.

19-4 Not all negative impacts are considered significant and appropriate for analysis in an EIS. According to NEPA, EIS's must focus on significant environmental issues. Energy, wilderness, wetlands and aquatic vegetation were not identified as significant issues during the scoping process, and after review by the EIS team were determined not to be significantly impacted.

19-5 Impacts of aerial drift and volatilization of herbicides on air quality were not discussed because the chemical presence of herbicides in the atmosphere would be so brief that it would be insignificant. The report by Cameron and Anderson (1977) contains a citation from Norris (1967) stating that 60 to 75 percent of 2,4,5-T applied as low volatile esters in diesel oil in one study never reached the ground. The BLM staff has read the Norris (1967) study and personally discussed it with Dr. Norris. Two points are important to note. First, the inference that 60 to 75 percent of the spray was lost is incorrect. In addition to the 25 to 40 percent which reached the ground, Dr. Norris estimated that an additional 50 percent was intercepted by the vegetation. Subsequent studies conducted by Norris (1976 and 1981) indicated that from 70 to 85 percent of a helicopter-applied spray was intercepted at the brush level. Secondly, in the 1967 study a fixed-wing aircraft, not a helicopter, was used. Fixed-wing applications of herbicides are not typical in forests. Helicopter applications conducted in accordance with the design features discussed in Appendix D of the DEIS will hold drift and volatilization to a minimum. The study by Robinson and Fox (1978) is not applicable to this EIS analysis because it involved fixed-wing aircraft and different nozzle systems than those used by the BLM.

19-6 Discussion of the presence of herbicides in smoke was included in the EIS Risk Analysis and has been expanded in Chapter 3 and Appendix O. Units are normally burned 4 to 6 weeks after spraying, so herbicides are often absorbed into the soil or broken down into various by-products prior to burning. Levels of herbicides sprayed onto treatment units are not considered hazardous, and much smaller amounts would be involved in smoke. See responses to comments 16-2, 19-4, 46-6 and 46-12.

19-7 The BLM recognizes the primary National Ambient Air Quality standard as the threshold for determining the potential for particulate levels to significantly impact human health. However, a more comprehensive analysis of the effects of smoke on human health has been included in Chapter 3 and Appendix O of the FEIS. See response to comment 16-2.

19-8 See response to comment 19-4.

19-9 The effects of brush control would be insignificant on the water balance of a watershed because the brush is rarely killed and other plants quickly occupy the site.

19-10 The environmental consequences of these increases are discussed in Chapter 3, Impacts on Water Resources, where they are related to established water quality criteria.

19-11 No significant increase in soil erosion or nutrient influx into streams would be expected to result from herbicide treatments. While some defoliation occurs from contact with herbicides, it is rarely complete. In addition, many nontarget plants remain alive following spraying, due to their resistance to the herbicides. Thus, bare soil is not usually exposed as a result of herbicide treatments except in those areas where grass is significantly reduced or eliminated. Availability of nutrients to remaining plants would increase as a result of decomposition of foliage dropped from treated vegetation, but influx of nutrients into streams would be negligible.

19-12 Based on a review of Zemansky (1978) and the HALTS report (1980), BLM finds insufficient information to justify altering conclusions based upon the extensive literature review presented in Ghassemi et al. (1981) and USDA, FS (1984). See response to comment 18-2.

19-13 The data by Norris and others are the results of work carried out a decade or so earlier. Modern application techniques incorporating such features as buffer zones and controls over spray particle size were designed in response to those early observations. Current BLM data on water analyses (see Table 3-2) fail to demonstrate the "high concentrations" of herbicides. The BLM's use of herbicides in forestry applications would not sustain even low concentrations of herbicides in water over the long periods of time necessary for chronic exposure. See responses to comments 18-2 and 19-23.

19-14 Factors affecting aerial drift are recognized by BLM, and approximate project design features would be incorporated into contract requirements (see Appendix D).

19-15 Cameron and Anderson's findings were considered when compiling the data for Table 3-2. The records of BLM operational programs show that accidents are rare and minor.

19-16 See response to comment 19-12.

19-17 At the present time, there is no published data relating these impacts to measured losses in productivity. As Table 1-4 indicates, soil productivity losses from burning cannot be quantified but would be proportional to the number of acres burned under each alternative.

19-18 Since 1981, in response to a U.S. General Accounting Office report, more elaborate pretreatment surveys have been conducted for each unit scheduled for a vegetation control treatment. These surveys provide supporting data for annual environmental assessments. Post-treatment surveys are done within 2 years of treatment. Information gathered during these surveys includes the condition of the existing vegetation, projected impacts on target species of various control methods, recommendations and supporting rationale, and quantitative analysis of treatment effects on both target vegetation and conifers. For a more detailed discussion of the information documented in pretreatment surveys, see Appendix D.

19-19 Gratkowski and Lauterback (1974) were not cited to support aerial application of herbicides, but to provide evidence for the effectiveness of chemical release applications. Some variation in results would be expected between experimental and operational applications. See text revision for Chapter 3, Impacts on Vegetation.

19-20 In the first full paragraph on page 49 of the DEIS, a statement is made regarding damage to conifers which begin bud break early. This damage is attributed to the absorption of herbicides as well as diesel oil carriers. Other potential adverse effects were not discussed because they were not considered significant. See response to comment 19-4.

19-21 See response to comment 19-4. Plant mutagenicity is not considered to be a significant impact. Plant mutagenicity is a common phenomenon in agriculture, and

seldom are these mutants found to exhibit adverse characteristics.

19-22 BLM agrees with Dr. Horowitz that sprouting following manual cutting of some species such as red alder and greenleaf manzanita can, in some instances, be reduced by the timing of the treatments. However, if the timing for manual cutting is as critical as it is for herbicide spraying, the narrow time frame for optimum treatment would require a large labor force working within a short time period to treat the large number of acres required. Manual cutting would be used in all alternatives where it is biologically and cost effective.

The conclusion that cutting brush at the right stage in the development of a stand will allow conifers to achieve dominance despite resprouting is applicable to a few species such as red alder but is not true for many other species. Salmonberry and bigleaf maple, for example, have been shown to send up sprouts in excess of 3½ feet and 5 feet, respectively, by the end of the first growing season following cutting. Madrone and tan oak show similar responses. Unchecked, these sprouts can overtake and suppress conifer seedlings after two growing seasons.

With respect to the Roberts study, the work force involved either worked for or was contracted by one of the individual forest industry cooperators. All workers had a knowledge of chain saw use, and the average worker had 4½ years experience in the woods.

19-23 To create a chronic exposure, it would be necessary to respray the vegetation at frequent intervals, thereby maintaining a given herbicide concentration in the field. This would not occur under BLM's vegetation management program. In fact, herbicide concentrations would decay from time of application, with a half-life varying anywhere from a few weeks to a few months depending on the chemical used. In the absence of chronic herbicidal exposure, long-term effects on wildlife are not anticipated.

A total of 7,352 acres (24 percent) of the 30,472 sprayed acres which were analyzed received more than one application of herbicides. Most of the multiple applications were in Salem and Coos Bay Districts due to severe coastal brush competition. Percent of multiple applications by district were: Coos Bay, 42 percent; Salem, 24 percent; Eugene, 12 percent; Medford, 9 percent; and Roseburg, 6 percent. See response to comment 19-24 for further discussion of chronic exposure.

19-24 Livestock have been exposed to herbicides for many years under both laboratory and field conditions with minimal or no effect. Erne (1966) determined that phenoxy herbicides were excreted rapidly in feeding studies with various animals, and with the administration of repeated doses, retention or accumulation of herbicides was not noted. Leng (1972) fed domestic animals fodder treated with 2,4-D or Silvex at the 300 ppm level and detected no residues of herbicides in milk or cream after a 3-week exposure. Slight residues were detected in milk and cream from cows fed higher concentrations of herbicides. When cows were removed from the experiment for 1 week, residues were no longer detected. Assuming a similar response in large game animals, it might be possible for suckling offspring to obtain traces of herbicides, but these traces would be excreted without accumulation in the body. Therefore, although the herbicides are rapidly excreted, damage to tissues and organs in the body was considered in the FEIS.

19-25 The size of an animal is not associated with its responsiveness to a certain toxicant. A large variety of animal types has been used during testing (Ghassemi et al. 1981), and none have been acutely poisoned at levels of BLM's proposed application rates.

19-26 See responses to comments 19-23 and 19-24.

19-27 Since herbicides would not bioaccumulate to any appreciable degree (see response to comment 19-24), they would not be transferred through the food chain. Detailed discussions of bioaccumulation

are presented in Ghassemi et al. (1981) and USDA, FS (1984). Appropriate food chain analysis was considered for wildlife in Appendix P.

19-28 The quantities of herbicide contaminants and additives are so small that they are insignificant. Additional discussion on inerts and toxicity of herbicides to wildlife have been included in the FEIS. Breakdown products were considered in analyzing the impacts of the parent herbicides. See response to comment 19-23.

19-29 Maintaining withdrawn riparian zones and spray buffers along fish bearing streams will minimize suspended sediments. Sediments would increase in some localized stream reaches, but in relation to entire drainages the impacts on fish populations would be insignificant.

19-30 Withdrawn riparian zones along fish bearing streams would protect fish-food organisms. See responses to comments 18-1 and 19-4.

19-31 Cameron and Anderson did not observe any results of herbicide toxicity. Their report was merely an operational summary of a spray project done by their organization and contained no original research on toxicity which could be utilized in this analysis. See responses to comments 18-1, 18-2 and 19-23.

19-32 The discussion of habitat and raptor nesting sites in Chapter 3, Impacts on Animals, does not refer to threatened or endangered animals.

19-33 The greatest proportion of total annual recreation visits to forested lands under BLM jurisdiction occurs during the period mid-June through the Labor Day weekend. Visitation during the remainder of the year is relatively low. Smoke resulting from prescribed burning operations carried out before mid-June or after Labor Day would not significantly affect recreation visitation. Although smoke would affect a substantially greater number of people during the primary recreation use season, overall impacts would be insignificant. Prescribed burning would be done according to the Oregon Smoke Management Plan when atmospheric conditions would normally carry smoke up and away from principal recreation use areas, burn units would be scattered throughout a large forested environment, and smoke from burning operations would be short-lived.

With the exception of hunting, and to some extent berry picking activities, recreation opportunities on lands under BLM jurisdiction are normally not associated with large harvested areas where herbicide spray projects would be undertaken. Since people are not attracted to these cut-over areas to participate in most forest-related recreation activities, the effects of herbicide spraying on recreation use would not be significant.

19-34 See response to comment 19-7.

19-35 The SRI report did not find a significant increase in miscarriages. The appropriate excerpt from the report reads as follows:

"The data on 134 miscarriages and 311 live births did not indicate a positive association between phenoxy herbicide exposure in males and subsequent spontaneous abortions in their wives. Stratifying the data for farm workers and forest/commercial workers also did not show an association. Although the overall comparisons did not support an association between paternal exposures and reproductive problems, in an isolated subgroup of wives of young forest/commercial workers (21 cases and 54 controls) there was a suggestive association with overall 2,4-D exposure, statistically significant at a low confidence level. No association was observed for the same age group in farmers."

Further investigation would be necessary to determine whether this latter finding is due to:

- A cluster, not unusual when multiple comparisons of variously grouped data are made.

- Undetected bias in the selection of the cases and controls of that subgroup.
- Association with a confounding variable that was inadequately controlled.
- A real association detected because of high fertility and high exposure in this subgroup.
- Some other cause.

In summary, the results of the study do not indicate any evident relationship between the use of 2,4-D and spontaneous abortion. The finding in young forest/commercial workers deserves further study, but does not in itself argue for restrictions on 2,4-D use pending such study. Reproductive effects such as miscarriages were considered in the Human Health Risk Analysis, Appendix L.

19-36 On the basis of the discord surrounding the interpretation of study results (Hansen study, 1971) and EPA's decision to undertake additional study, the courts have concluded that scientific uncertainty exists about 2,4-D's carcinogenic effect. See Save Our Ecosystems v. Clark, F.2d (9th Cir. 1984); Southern Oregon Citizens Against Toxic Sprays v. Clark, 720 F.8d 1475 (9th Cir. 1983); cert. denied, 469 U.S. 1028, 105 s.ct. 446, 83 L Ed. 2d 372 (1984). The disagreement among experts about picloram's carcinogenic effect is essentially the same as that surrounding 2,4-D. Hence, given existing judicial opinion, BLM is constrained to find that there is scientific uncertainty about asulam's and glyphosate's carcinogenic effects. Resolution of the scientific uncertainty of the carcinogenicity of 2,4-D, picloram, asulam, and glyphosate would require obtaining additional information at exorbitant costs (Appendix L). Accordingly, the BLM prepared a worst-case analysis as input to the decision making process regarding the use of 2,4-D, picloram, asulam, and glyphosate.

19-37 The risk of genetic injuries was considered in the Human Health Risk Analysis, Appendix L.

19-38 The EIS acknowledges that acute effects do not necessarily predict chronic effects. The Human Health Risk Analysis uses both acute toxicity testing such as LD_{50}s and chronic two-year studies that give NOEL's to characterize the toxicity of each herbicide.

19-39 The referenced discussion has been revised in the FEIS. The latest mutagenic and cancer studies on 2,4-D were considered in the FEIS.

19-40 See response to comment 19-36.

19-41 BLM stands by EPA interpretations of these studies. In addition, more recent cancer studies were considered in the Risk Analysis.

19-42 Preparation of the FEIS included review of the most recent 2,4-D epidemiological studies. Other studies are discussed in USDA, FS (1984).

19-43 Unlike growth enhancing treatments such as planting genetically improved seedlings, fertilization and precommercial thinning, no increase in future timber yields or ACE is attributed to the treatment of competing vegetation. Control treatments are, however, necessary to maintain acceptable stocking levels. Under some alternatives, curtailment of treatments would result in reduced stocking levels and, in extreme cases, loss of acres from the forest land base. These reductions would, in turn, decrease timber yields.

19-44 See response to comment 3-1.

19-45 The number of successive treatments likely to be needed was estimated by those foresters most experienced and familiar with the individual areas to be treated. The BLM considers these estimates to be reasonably accurate. The total program costs used to compare the alternatives are estimates based on actual experience.

19-46 The DEIS does not conclude that 2,3,7,8-T4CDD is the only dioxin of toxicological significance but merely acknowledges that it is the only dioxin known to be significantly toxic at this time.

20-1 See revised text in Chapter 3, Impacts on Human Health, Cost of Additional Research.

20-2 Mixed herbicides are sometimes applied to control a wider selection of plant species. There is no scientific evidence which demonstrates an increased potentiation or synergistic effect on animals.

20-3 See response to comment 19-37.

20-4 A general monitoring plan will be presented in the Record of Decision for the vegetation management program following public review of the final EIS. Specific indicator species may be selected for monitoring on a site-by-site basis.

21-1 Under the 1978-1987 plan, approximately 63,000 acres were proposed for aerial spraying each year. From 1979 through 1982, an average of 16,835 acres were actually sprayed each year. For comparison, the acreages proposed for aerial herbicide application (site preparation and maintenance and release) under each alternative are listed in Table 1-2. Analysis of impacts indicates opportunities for herbicides to enter streams would increase because the acreages proposed for spraying are greater than the acreages currently being sprayed.

21-2 See text revision for Chapter 3, Impacts on Water Resources.

22-1 Based upon such factors as wind speed, temperature, humidity, helicopter air speed, spray pressure and droplet size, the extent of aerial herbicide drift can be predicted with reasonable certainty. This predictive ability, coupled with the use of buffers, enables applicators to effectively control herbicide drift. In some instances, spray could drift beyond unit boundaries, but quantities would be so small that they would be insignificant. The criteria governing the application of herbicides is shown in Appendix D.

22-2 See response to comment 20-2.

23-1 See response to comment 22-1.

23-2 Monitoring is discussed on page 11 of the DEIS. A listing of vegetation control treatments, a description of what will be monitored and the frequency of that monitoring will be presented in the Record of Decision to be prepared following distribution of the FEIS.

23-3 The monitoring considered necessary to help insure compliance with the goals and mitigation measures identified in the DEIS is not expected to be significantly affected by budget constraints. Budget cuts could result in reduced treatment levels. In such cases, less monitoring would be done because less would be needed. However, monitoring of remaining, funded treatments would continue.

23-4 See response to comment 20-2.

24-1 According to the western Oregon BLM timber management EIS's, 33,900 acres are scheduled for planting annually during the timber management plans' effective period. Of this total, 27,400 acres (81 percent) will be initial plantings and 6,500 acres (19 percent) will be replants.

The stocking level at which the decision is made to replant a unit is primarily dependent on the site class of the unit and the number of years since the unit was harvested. Following are the stocking levels at which replanting is considered:

Site Class	Units Harvested Less Than 6 Years Ago (trees/acre)	Units Harvested 6 Years Ago or More (trees/acre)
I & II	249	149
III	219	149
IV	199	149
V	99	99

24-2 This EIS analyzes the environmental impacts of managing competing vegetation, not of timber harvest. The impacts of timber harvest on BLM-managed lands in western Oregon were analyzed in a series of timber management EIS's prepared in the late 1970's and early 1980's.

24-3 Since allowable harvest had already been calculated for the western Oregon BLM

timber management EIS's, estimates were extrapolated from those harvest levels. Information on credits for various practices varies by sustained yield unit and can be found in the timber management EIS's. For this vegetation management EIS, allowable harvest levels were adjusted only for expected variations in stocking levels.

24-4 All analyses, including those involving program costs, were based upon the correct acreage figures shown in Table 1-2. Table 1-4 did contain some errors which have been corrected.

24-5 As described in the response to comment 3-1, the treatment acreages reported in Table 1-2 represent the least-cost combination under each alternative for the site conditions expected. Any other treatment combination would increase cost. Manual clearing/scalping is not an effective substitute for gross yarding as a site preparation treatment. Gross yarding is designed to remove large woody material from harvested units using heavy equipment (tractors or cable yarders). It is sometimes considered a viable alternative to burning, BLM's preferred site preparation treatment, under special conditions such as on steep, south slopes with shallow soils or on units close to population centers where smoke could cause problems. On areas with heavy slash and brush accumulations, hand clearing/scalping is viewed as a last resort since it does little more than provide planting spots, and it concentrates slash accumulations, obstructing access for planting crews.

Additionally, hand clearing/scalping provides no control of competing vegetation outside the cleared area which may measure as little as 2 feet by 2 feet, and unless seedlings are tubed (an additional expense of approximately $200/acre), rodent damage may destroy the plantation. The allowable harvest level projected for each alternative depends most directly upon the anticipated level of stocking achieved, not the amount of site preparation accomplished.

24-6 All site preparation methods are used because they are effective at preparing planting sites and reducing competing vegetation during the initial growing years. Each site preparation method has its specific advantages and disadvantages. Late reforestation may require a different site preparation prescription, but it may involve any of the available treatment methods.

24-7 See response to comment 3-1.

24-8 As noted in the response to comment 3-1, the focus of the document is on comparing alternatives as packages of land treatments guided by a policy direction. The annual treatments would have a total cost and would allow an expected volume of timber for sale.

24-9 See response to comment 19-22.

24-10 Regardless of how the Douglas-fir seedlings became established under the ceanothus, this study by Gratkowski and Lauterback shows that chemical release is effective.

Timely planting does not guarantee plantation success. Numerous plantations have been overtopped by invading or resprouting species and have required release. Often, mere survival of the conifers is of more concern than growth increases.

24-11 In this same FIR report, Dr. Newton suggests that in the case of the two chemical treatments, exposure of conifer canopies without reducing or eliminating root competition could have caused stress which led to reduced tree growth. Another hypothesis offered in this report is that the broadcast spraying of herbicides may have caused enough chemical trauma in the conifers to offset the early tendency to accelerate in growth. The report contained the results of a study conducted by Peterson (1980) on the release of Douglas-fir from snowbrush ceanothus near McKenzie Pass. FIR reported a fourfold increase in Douglas-fir volume growth, relative to control trees, 3 years after treatment of 5-year-old plots. Additionally, both studies showed that Douglas-fir growth on sprayed plots (picloram

excepted) was greater than growth on hand released plots.

24-12 Current reforestation practices in western Oregon, particularly improved site preparation, have enabled BLM to achieve the minimum acceptable number of trees per acre on most units planted within 3 years of harvest. In many areas, timely planting is not enough to achieve adequate stocking, and stand maintenance and/or release operations are required to assure survival and maintain growth before serious overtopping occurs. Although the Lauterback study evaluated release of conifers that were seriously overtopped and generally larger than those encountered in current operational situations, the study does show that trees released with herbicides exhibit increased diameter and height growth compared to unreleased trees.

24-13 The cost of gross yarding (see Appendix B) is included in the program costs displayed for all alternatives in Table 1-2. Although gross yarding is usually performed by the logging contractor concurrently with the yarding of merchantable material, it is still a cost borne by the Government. This cost is reflected in reduced stumpage values.

An examination of data prepared by the Oregon Department of Worker's Compensation (Adelman et al. 1987) and discussions with that department's personnel revealed that information on injuries and fatalities specifically associated with gross yarding is not available. Available statistics, however, indicate that in Oregon during 1986, 8 of the 27 (30 percent) logging fatalities and 822 cases (45 percent) of logging injuries were apparently the result of yarding operations in general.

25-1 See response to comment 19-36.

25-2 Neither this EIS nor the EPA assumes a lack of human exposure to chemicals used in forestry. Both recognize the low levels of exposure and the lack of significant toxicological responses at these levels. Exposures which have occurred are the basis for the research cited in Chapter 3, Impacts on Human Health.

25-3 The application of the standard will meet or exceed Oregon Forest Practice Rules.

25-4 The sign developed by BLM is intended to inform the public that an area has been sprayed with chemicals approved by the EPA for forestry use. We recognize that use of the term "safe" has different interpretations. When the current supply of signs is exhausted, the BLM will reevaluate the current design and make appropriate changes.

25-5 See response to comment 10-6. Design features identified in Chapter 1 and Appendix D are committed unless modified by the Record of Decision.

25-6 Preventive treatments are included as design features under all alternatives (see Appendix A). The term "preventive" was not used in describing the treatments because all treatments would be preventive under certain conditions.

25-7 Integrated Pest Management (IPM) is a system which uses several techniques to gain control of unwanted plants and animals. This does not imply that chemicals would only be used as a last resort. Chemicals would be applied where they would provide the most effective control for the least cost. This IPM concept is the basis of Alternative 1.

25-8 The goal of Alternative 4 is to replace mechanical and aerial methods of vegetation control with manual methods where they would be effective. In estimating treatment acres, hand-applied chemicals were selected over slashing in many instances because chemicals were considered more effective and less costly. The elimination of all chemical treatments (hand-applied and aerial) is analyzed in Alternative 7.

25-9 If Alternative 4 were selected, the BLM would use less labor-intensive practices where field experience indicated that treatment objectives could not be met by manual methods. Without this flexibility,

the alternative would not have provided a realistic basis for achieving program goals.

25-10 Appendix A, Item R, states that the BLM will evaluate all costs to the agency, direct and indirect, short- or long-term, of each alternative. The summation of program costs for each alternative is displayed in Table 1-2. The cost for each alternative is derived by multiplying the cost per treatment in each BLM district by the average number of acres expected to be treated. The sum of treatment costs for all districts combined is reported in Table 1-2. The range of treatment costs experienced by the districts is reported in Appendix B.

25-11 The relative efficacies of herbicides and other vegetation management methods have been substantiated in the scientific research cited in the EIS.

25-12 See text revision for Chapter 1, Plantation Maintenance and Release, which provides more information on the practice of hand pulling.

25-13 The program costs which were analyzed to provide a monetary basis for comparing alternatives (see Appendix B) include administration costs.

25-14 See response to comment 23-2.

25-15 Table 1-4 is intended only to provide a summary listing of the major impacts to assist the reader. The basis for this data is presented in the appropriate text sections in Chapter 3, Environmental Consequences.

25-16 For the years 1980 through 1982, BLM was unable to burn approximately 1,300 acres each year in western Oregon due to weather and/or smoke management restrictions. About 1,000 of these acres were not planted when scheduled. Tree planting was delayed for 1 year on 90 percent of these acres and for 2 years on the rest. For the years 1983 through 1985, the number of acres BLM was unable to burn increased from 1,498 acres (1983) to 4,727 acres (1984) and then to 6,633 acres (1985). These increases were primarily due to weather and/or smoke management restrictions. It is estimated that approximately the same proportion as 1980-82 were not planted until after a one- or two-year holdover.

25-17 Injuries associated with burning are discussed in Chapter 3, Impacts on Human Health. Specific reference was not made to hazards of drip-torch ignition because these hazards do not significantly differ from those associated with manual ignition. If anything, drip-torch ignition is safer because personnel are not exposed to lighting hazards, and greater control over the lighting operation is possible. Control of fire intensity and rate of spread are the crucial factors affecting safety, and good control is a major advantage of drip-torch ignition. Misapplication, pilot error and transportation spills are not probable occurrences and were therefore not analyzed. Gelled gasoline is the proper nomenclature for the material used in prescribed burning. See responses to comments 8-1, 19-4 and 19-6.

25-18 Spill scenarios were included in the worst-case analysis (Appendix L).

25-19 Alternative 7 was designed as the most practical, cost-effective alternative available without the use of herbicides. If the use of herbicides is prohibited, this is the alternative that would most likely be adopted.

25-20 Proprietary data is referred to in explaining the lack of available information on some chemicals, but the analyses and summaries in these documents are based on hundreds of research references which are not proprietary.

25-21 The referenced statement is based on the Squire study which had results that were inconclusive, meaning no scientific conclusion could be reached from the data obtained. See response to comment 19-41.

27-1 An intensive timber management program is part of all eight alternatives. Only the management of competing vegetation, which is one component of that program, is analyzed in this EIS. Impacts of other components of the intensive timber management program (i.e., allowable cut, land use allocations, logging practices) are

addressed in the western Oregon BLM timber management EIS's.

27-2 Under general assumption No. 2, each BLM district estimated the treatment acreages necessary to achieve the stocking and allowable harvest goals specified in its timber management EIS. In developing those estimates, the districts often found that eliminating some practices would have precluded them from reaching those goals, resulting in lower stocking levels and allowable harvests. The decision maker must consider these variations when evaluating the alternatives.

27-3 Compared to proposed treatment acres in the 1978 EIS, this updated EIS increases emphasis on nonchemical methods, as indicated by the following: an increase of 43 percent in burning, a decrease of 41 percent in herbicide application, a decrease of 80 percent in scalping/spot clearing, a decrease of 35 percent in mechanical site preparation, an increase of 92 percent in mulching, an increase of 25 percent in precommercial thinning, and an increase of 39 percent in manual cutting. Decreases in a few of the nonchemical methods are primarily due to poor results in the field. The 10,000-acre versus 13,000-acre comparison for the Medford District contrasts an actual budgeted program for 1982 with a proposed 1983 program based on need.

27-4 Nonchemical vegetation management treatments are addressed in Chapter 1, Vegetation Management Treatments and Design Features, and Chapter 3, Environmental Consequences (under each affected resource).

27-5 BLM could not determine the origin of the commenter's numbers. For site preparation under the proposed action, 32,382 acres would be treated with nonchemical methods versus 13,181 acres treated with chemical methods.

27-6 This statement by Wall pertains to the collective impact of all ownerships in the region. The dramatic decline referred to is expected to occur on private lands. No such decline is expected on BLM-administered lands.

27-7 The BLM initiated the Forestry Intensified Research (FIR) program and identifies areas of concern through the FIR advisory committee, but the FIR scientists are autonomous in deciding how research will be carried out. In order to evaluate the effectiveness of manual vegetation control treatments, FIR scientists have designed a study whereby several hand slashing treatments will be compared side-by-side on the same site. The study has been initiated by the Adaptive FIR staff in cooperation with BLM's Medford District.

27-8 See response to comment 3-1.

27-9 As stated in Appendix A, forest by-product utilization is not an environmental impact issue in comparison of vegetation management alternatives and is therefore not addressed in this EIS.

27-10 The Roberts study was cited only to illustrate that research has shown manual cutting to cause vigorous sprouting of some coastal brush and damage to conifer crop trees. The decision to cut all brush on the study plots was made for three reasons: 1) to provide a large quantity of cut brush for post-treatment vegetation samples, 2) to place all plots and study sites on common ground, thereby making comparisons easier, and 3) to ensure that all sample conifers would be subjected to treatment. Although the felling of all brush is not a requirement in all manual slashing contracts, the inclusion of this requirement in the Roberts study does not negate the result that slashing was ineffective for conifer release. Furthermore, due to the quality of the work force involved in the Roberts study (see response to comment 19-22), felling these additional stems did not likely result in a significant increase in crop tree damage.

27-11 The statement that extra costs would be incurred due to the use of less effective practices such as manual cutting is based upon projected needs for retreating some acres upon which these less biologically effective methods would be used. Projected needs for retreatment are based upon actual field experience in each BLM district. Additional costs resulting from retreatment are reflected in the total

program costs shown in Table 1-2, not in the individual treatment costs listed in Appendix B.

27-12 Results of the Mapleton District studies indicate that manual release (cutting) of Douglas-fir from red alder produces favorable results within acceptable economic limits if the alder is small. The extent of red alder sprouting is dependent upon the timing of the operation. For many species, however, the timing of cutting does not seem to significantly affect sprouting ability. The BLM has found that size, species and physiological response of target vegetation, and that size, vigor and species of crop trees to be released are basic factors which interact with timing to determine the success or failure of treatment. In the Mapleton District studies, aerial application of herbicides was considered most effective in controlling salmonberry and thimbleberry, the other two major competitors on the District.

27-13 There was no intent to exaggerate the hazards associated with manual treatments. The text acknowledges that the potential for physical injury exists, and it reports published frequency rates of different types of injuries.

27-14 This EIS describes and analyzes the environmental impacts of implementing a program for managing competing vegetation on all five BLM districts in western Oregon. References such as those to salmonberry and vine maple were included to provide district specificity. These two species are common to the northwest part of the EIS area which includes the Salem and Eugene Districts and portions of the Coos Bay District. The sentence following the reference to salmonberry and vine maple in the EIS describes impacts on species specific to the southern portion of the EIS area.

27-15 As stated in the response to comment 27-6, the level of harvest on forest industry lands in Oregon is expected to decline. In western Oregon, a 29-percent reduction in the present harvest level is projected for forest industry lands (OSDF 1980a). Thus, the net use of chemicals and prescribed burning on all forest lands in western Oregon is expected to decline in coming years.

27-16 See response to comment 19-36.

28-1 See response to comment 19-36.

28-2 More detailed discussions of the herbicides, including their persistence in the environment, are presented in Ghassemi et al. (1981), USDA, FS (1984), and USDE, BPA (1983), which were incorporated by reference.

28-3 All Councils of Government in the EIS area received the DEIS, providing local governments the opportunity to comment. In many of the watersheds, BLM may not treat any vegetation for many years. If treatments were actually scheduled, their impacts would be addressed in site-specific environmental analyses accomplished by each BLM district. Local governments would then have the opportunity to comment on specific projects affecting individual municipal watersheds.

28-4 See text revision for Chapter 3, Impacts on Human Health.

28-5 See text revision for Chapter 3, Impacts on Human Health.

28-6 See text revision for Chapter 3, Impacts on Human Health.

28-7 See responses to comments 19-37, 19-41 and 19-42 and text revisions for Chapter 3, Impacts on Human Health.

28-8 See text revision for Chapter 3, Impacts on Human Health.

28-9 See text revision for Chapter 3, Impacts on Human Health.

28-10 See text revision for Chapter 3, Impacts on Human Health.

28-11 See text revision for Chapter 3, Impacts on Human Health.

28-12 Quantitative values relating to mammalian toxicity are presented in USDE, BPA 1983, which has been incorporated by reference.

28-13 See text revision for Chapter 3, Impacts on Human Health.

28-14 See text revision for Chapter 3, Impacts on Human Health.

29-1 Impacts of all alternatives on fish, including anadromous and resident fish, are discussed in Chapter 3. The proposed action would not be expected to significantly impact fish.

29-2 The DEIS discusses impacts in sufficient detail to evaluate the differences among alternatives. More specific impacts on wildlife would be considered in site-specific environmental analyses accomplished annually by each BLM district on proposed vegetation management plans.

29-3 As noted in the introduction to Chapter 3, none of the alternatives, including the proposed action, would be expected to significantly impact wetlands and aquatic vegetation.

29-4 See response to comment 10-7.

29-5 The summary was intended to be brief. A more detailed discussion of impacts on animals is presented in Chapter 3.

29-6 All commercial hardwood lands under sustained yield management are located in the coastal mountains of the Salem District. These lands comprise about 25,000 acres of hardwoods in small patches interspersed over a 244,000-acre area.

29-7 Since wetlands and aquatic vegetation would not be significantly impacted under the proposed action or any other alternative, detailed discussion was not considered appropriate. See response to comment 29-3.

29-8 Unidentified plant populations are those which are not yet known. Environmental analysis accomplished prior to any site-specific action would document any threatened or endangered plant species found to be present on the site.

29-9 Impacts on terrestrial vertebrates are discussed in Chapter 3.

29-10 Potential impacts on aquatic habitat, specifically changes in food sources, water temperatures, water chemistry and bottom materials are discussed in Chapter 3. These are the critical habitat components that would be impacted by vegetation control treatments. Impacts on specific species would vary depending on the stream affected. Site-specific impacts will be analyzed in environmental documents prepared annually for each BLM district's proposed vegetation management plan.

29-11 As stated in Chapter 3, Threatened or Endangered Animals, no adverse impacts are expected to occur to known nest and roost sites of listed threatened or endangered species.

30-1 See response to comment 29-2.

30-2 Where 1985 data is available to update the economic analysis tables, they have been updated. Earlier data is not now considered to be a relevant baseline for prediction of effects on future conditions, due to the extreme fluctuations in economic conditions during most of the previous decade.

SEIS COMMENT RESPONSES

32-1 The conclusions of the EPA Science Advisory Panel have been reviewed, and the discussion of glyphosate oncogenicity has been modified accordingly.

33-1 A great deal of emphasis was placed on writing the Supplement to the DEIS in a manner which could be easily read. Due to the highly technical nature of the document, use of the glossary would be necessary for some readers, as well as cross references to other text. All information needed to understand the analysis was provided.

33-2 As noted on page L-1, the Risk Assessment was prepared for both the USDA Forest Service and the USDI Bureau of Land Management by Labat-Anderson Incorporated. The EIS Supplement, of which the Risk Assessment is a part, applies specifically to western Oregon BLM lands and the proposed vegetation management

programs on those lands. The same Risk Analysis is being used by USDA Forest Service, Northwest Region, in their vegetation management EIS. The Final EIS (BLM), which combines the Draft EIS (June 1983) and Supplement EIS (February 1986), should help clarify any confusion that may exist.

33-3 Sections on "Why the Worker Dose Estimates are Higher than Would Occur in Actual Operations" and "Why the Public Dose Estimates are Higher than Would Occur from Actual Operations" in Section 4 (Appendix L) relate worst-case analysis to the real world. Appendix L, Table 5-15 also presents real world risks of cancer and other fatalities for comparison with projected worst-case risks.

33-4 BLM's Draft EIS, issued in June 1983, proposed the use of 14 herbicides, including ammate, diquat and MSMA. During preparation of the worst-case analysis, these three chemicals were not included, so only the 11 remaining chemicals were shown on Tables 2 through 7 of the Supplement to the DEIS. These tables were specifically related to the proposed BLM program in western Oregon, as opposed to the tables in Appendix L which included the 16 chemicals proposed for use by both the BLM and USDA Forest Service. The omission of Diuron from Table 3-1 was an oversight and has been corrected.

33-5 Although Tables 3 and 4 in DEIS Supplement, Appendix L, (Tables 5-1 and 3-4 in FEIS, Appendix L) do not list risk values (margins-of-safety), appropriate explanatory footnotes have been entered in the tables with exponential values as appropriate.

34-1 The Triclopyr report submitted was reviewed and it is agreed that the effects seen in the dog study with a NOEL (see Glossary) of 2.5 mg/kg/day are not representative of effects expected in humans. However, because of the uncertainty associated with the chronic rat and mouse studies, we will continue to use the lowest NOEL to compute the MOS. This information is discussed in Section 5 of Appendix L under "Threshold Toxicity of the 16 Herbicides."

37-1 The benefits of herbicide use, as well as all other practices, are discussed in Chapter 1.

38-1 The relationship between 2,4-D and "related" peripheral neuropathy has been clarified at appropriate places in the text.

38-2 See revision to Appendix L, Table 3-4.

38-3 See response to comment 34-1.

38-4 See revisions to Chapter 3 and Appendix L, Table 5-11.

38-5 The teratology discussion has been included with the discussion on subchronic toxicity studies (Appendix L), and the description of the exposure period for a teratology study has been altered.

38-6 The reference has been added to the text in Appendix L, Section 3, Threshold Toxicity of the 16 Herbicides.

38-7 See text revision for Appendix L, Section 3, Mutagenicity of the 16 Herbicides.

38-8 BLM believes that the routine (realistic) application scenario best represents exposure and risks associated with applying these herbicides in BLM's vegetation management programs. A range of possible but improbable events has been analyzed to provide additional information to the public and the decisionmaker.

38-9 The text on page L-10 refers the reader to Section 5 for an explanation of the conservative assumptions used in the calculations of cancer risk. Footnotes have been added to Chapter 3, Table 3-10, and Appendix L, Table 5-11, to clarify this.

38-10 BLM agrees that the method used to estimate mutagenic potential is new and represents a number of worst-case assumptions. The text has been revised to show that there is no widely accepted scientific method for quantifying mutagenic risks; however, the method chosen represents the worst-case.

38-11 A worst-case assumption is, by definition, not a realistic assumption. In the absence of contradicting evidence, a worst-case assumption would be that the agent is a human mutagen.

38-12 The relationship between mutagenic and carcinogenic mechanisms at the molecular level is quite respectable and convincing. The fact that operationally, at the bioassay level, these two phenomena do not always agree is a matter related to how the bioassays are performed. If the bioassay is performed properly, not necessarily at maximum-tolerated dose levels, the qualitative agreement at the bioassay level is fairly good.

38-13 No quantitative estimates of mutagenic potency were inferred from animal cancer bioassays.

40-1 The Supplement to the DEIS was specifically prepared to address human health. Analysis of impacts on stream quality, fisheries, wildlife and other resources was included in the Draft EIS in June 1983. The Final EIS will include updated information on potential impacts on all resources.

40-2 Appendix F to the Draft EIS contained references to Common, Chemical and major trade names of the proposed chemicals. More detailed information, as noted in the EIS, is available in Ghassemi et al. (1981); USDA, FS (1984); USDE, BPA (1983) and Dost (1983), all of which are incorporated by reference.

41-1 With the exception of atrazine, none of the herbicide studies in this report have identified lung-function/breathing problems. An acute oral LD_{50} study established an LD_{50} of 1,869 mg/kg for atrazine and reported the occurrence of dyspnea or air hunger resulting in labored or difficult breathing. The toxicity endpoint that was being evaluated in this study was lethality at a very high dose level which is not representative of actual exposure levels to the public during spraying operations. The text has been changed to indicate the toxic symptoms that were reported during the acute oral LD_{50} study for atrazine. Sensitive individuals are discussed in Appendix L, Section 5, of the FEIS.

41-2 EPA maintains the Pesticide Incident Monitoring Systems (PIMS) that includes reports from hospitals and doctors. This information was examined during the preparation of the EIS.

43-1 Bromacil is not proposed for use by the BLM in this EIS. It was included in the Supplement because of proposed use by USDA Forest Service. However, Appendix L, Section 3, has been clarified to show that the two mutagenicity studies evaluated on the EPA tox one-liner were core graded as inadequate and not acceptable, and no other mutagenicity studies were listed (EPA, 1984c).

43-2 According to the Preliminary Risk Assessment for bromacil conducted by the Toxicology branch of the Office of Pesticides and Toxic Substances, the 18-month mouse feeding study resulted in a significant increase (P .05) in liver tumors at 5,000 ppm (750 mg/kg/day). The discussion of the oncogenic potential of bromacil presented on page L-40 of the Draft Supplement text represents an EPA summary which states "the data in the mouse study discussed below indicate that bromacil is a liver carcinogen in CD-1 mice" (EPA, 1985).

43-3 See text revision to Appendix L.

43-4 The errors in Table 3 of the DEIS have been corrected.

46-1 There are many ongoing research programs that provide information on these herbicides. BLM will continue to evaluate this information and take whatever appropriate action is necessary to comply with all applicable Federal and State laws including NEPA.

46-2 The risks from all of these possible exposure events are considered in the EIS.

46-3 The worst-case spill scenario has been revised to account for spills of 2,000 gallons. As stated in Chapter 5 (Appendix

L), spills of greater magnitude would have proportionally lower margins of safety.

46-4 The cancer risk assessment uses all available published data and acceptable scientific methods to estimate the probability of cancer.

46-5 Table 5-16 (Appendix L) and a revised discussion of possible synergistic effects have been added to the FEIS in response to concerns regarding synergism.

46-6 There are a few chemicals used to desiccate (dry) vegetation that are effective in 2 weeks, but none of these are used by the BLM. The chemicals proposed for use for "brown and burn" operations by the BLM, (2,4-D, triclopyr and glyphosate) to be effective, require sufficient time to cure vegetation. This varies by chemical, but in no case would it be less than 4-5 weeks. Recent experience has shown that fall spray, in preparation for spring burns 8-10 months later, may be more effective for overall vegetation control in many cases. Thus, the statement cited is a valid statement for the proposed program. The analysis of risk to the public from "brown and burn operations" has been revised to consider shorter time periods between herbicide application and prescribed burning.

46-7 Because cancer tests are conducted over a 2-year period, possible breakdown products in the body are accounted for in the cancer potency values. Other important breakdown products in the environment, such as N-nitrosoglyphosate, are considered in the EIS when there is evidence that they are mutagenic or carcinogenic.

46-8 The risk of effects from multiple exposures are considered in the EIS. The example people, as outlined in Appendix L, Table 4-6, were assumed to receive exposure by up to six routes. However, as described in Appendix L, Section 4, because these herbicides degrade rapidly and are extremely transient in water, it is unlikely that a member of the public will receive simultaneous herbicide doses through more than two of the exposure routes.

46-9 The referenced example refers to routine (realistic) circumstances. Direct spraying of an individual is analyzed under the Accidental Worst-Case Scenario in Appendix L.

46-10 Residues in water were calculated assuming that the streams were very shallow and directly sprayed with drift. Runoff from lands above stream units are not likely to cause significantly greater residues and would not increase this amount significantly. In addition, actual monitoring data discussed in Appendix L, Section 5, show that these estimates are much higher than observed in the real world. Bioaccumulation factors were taken from the scientific literature. All of the herbicides are known to degrade so that long-term accumulation in sediments will not occur.

46-11 The analysis for the exposures and margins of safety for spills has been expanded to include spills of larger magnitude. See response to comment 46-3.

46-12 The discussion of "brown and burn operations" has been revised. Average acreages presented in the EIS are based on actual experience. Policy restrictions limit clearcut size, with units over 60 acres being extremely uncommon. See response to comment 46-6.

46-13 Synergistic effects are dealt with at the end of Appendix L, Section 5. Amitrole cancer risk is estimated using a number of conservative assumptions that tend to overestimate risk.

46-14 All available validated laboratory data on heritable mutations are presented in Appendix L, Table 3-3. EPA has not determined that the weight of evidence indicates that any of these herbicides is mutagenic. Because it is impossible to directly express the risk of genetic disease as the probability of the expression of a recessive genotype, a conservative estimate or worst-case estimate was made and a cancer risk assessment was conducted. The rationale for using cancer risk assessments as a worst-case estimate

for mutagenicity was presented in Appendix L, Section 5.

46-15 The discussion of synergistic and cumulative effects has been expanded in the FEIS.

46-16 EPA has only recently begun to evaluate the inert pesticide ingredients. The Office of Pesticide Programs is presently attempting to find a practical means of assigning the responsibility of data generation among pesticide manufacturers, formulators, and suppliers. The current provisions of FIFRA protect trade secrets of pesticide formulations and hinder the efficient development of needed test data. Therefore, the authors of this text were not able to obtain specific data from EPA concerning the toxicological potential of inert ingredients; however, a table evaluating the acute toxicity of the pesticide formulations has been included in Appendix L, Table 5-16.

48-1 The risk assessment uses the accepted scientific practice of comparing animal NOEL's with a range of possible human exposures. Although no attempt is made to determine "an acceptable margin of safety," Appendix L, Section 5, discusses what the estimated margins-of-safety mean in terms of possible human health effects.

48-2 The discussion of synergistic and cumulative effects has been expanded in the FEIS.

50-1 Human consumption of food items with residues from offsite deposits of drift are considered under the routine (realistic) application scenarios. However, consumption of food items from onsite (that had been sprayed at the full application rate) is considered under the accidental worst-case scenario.

51-1 A section has been added to Appendix L that discusses inert ingredients. See response to comment 46-16.

51-2 Studies regarding dioxins are not relevant to analysis of the herbicides proposed for use. Other governmental herbicide programs and uses of pesticides in agriculture and industry should not overlap with the use of herbicides in the forests of Oregon and Washington, nor are background levels of these chemicals likely to be above negligible amounts in the remote areas likely to be sprayed, so there is little likelihood of any additive effects.

51-3 The section on synergistic and cumulative effects has been revised. It should be noted that the large margins of safety shown in Appendix L, Table 5-2 (except for Amitrole, which is not proposed for use in this EIS) are valid for lifetime exposures.

51-4 The analysis and discussion on the effects of smoke on human health have been expanded in Chapter 3 and Appendix O.

51-5 The section on synergistic and cumulative effects has been revised.

52-1 The greatest risk to members of the public from routine operations does occur to people who receive multiple exposures and to single exposures from berry picking and eating vegetables. However, as shown in Appendix L, Table 5-2, there are large margins of safety (except for Amitrole, which is not proposed for use in this EIS) for every category of exposure, indicating very little chance of adverse health effects.

53-1 The systemic NOEL's used in this risk analysis as well as cancer potency values take into account chronic 2-year studies. The mutagenicity testing conducted on these chemicals (see Appendix L, Table 3-3) was designed to uncover long-term genetic mutations.

53-2 All NOEL's used in this risk analysis consider studies reviewed and validated by the U.S. Environmental Protection Agency.

53-3 BLM procedures ensure that people will not be intentionally sprayed. However, it is acknowledged that there are nearby residents in some areas, as well as hikers, berry pickers, hunters, and fishermen. The risk to these individuals is examined in the EIS. See response to comment 68-4.

53-4 As explained in Section 5 of Appendix L, the ratio between LD_{50} and the estimated human dose should not be interpreted as

margin-of-safety. Footnotes have been added to the appropriate tables to clarify this point.

53-5 See responses to comments 46-6 and 46-12.

53-6 Since 2,4,5-T is not proposed for use under this EIS, analysis of dioxins as contaminants is not applicable.

54-1 For many years in toxicology and laboratory animal medicine, laboratory animals including rats have been used successfully as reliable indicators of the potential effects of chemical exposure in humans. For most chemicals, laboratory animals not only predict the type of effect observed in humans but also the amount of chemical necessary to produce the effect. To do this, methods have been developed using NOEL's (no observed effect levels), MOS (margins of safety), safety factors, and various mathematical extrapolation procedures. Many of these accepted procedures have been used in this report. A discussion of the use of margins of safety in the risk assessment has been added to Appendix L.

55-1 All of the drift predictions in the EIS were based on actual field studies.

55-2 Available epidemiological studies on these herbicides are evaluated in the background statements incorporated by reference in Appendix L, Section 3.

55-3 The range of events examined in this EIS is adequate to inform decisionmakers and the public of potential impacts of BLM's proposed program.

56-1 The amount of herbicide likely to enter streams is examined in the EIS. Except for the unlikely event of a spill, the amount would be extremely small.

57-1 BLM policy does not authorize the immediate removal of firewood from sprayed areas treated with herbicides; therefore, further analysis is not required under this EIS.

59-1 It is against both Federal and State law to apply 2,4-D to irrigation ditches. This practice would not be allowed under the proposed program.

60-1 See responses to comments 53-4 and 54-1.

60-2 See response to comment 53-3.

60-3 The risks from these events are examined in the EIS.

60-4 Appendix L, Tables C-1 through C-60 show exposures in mg/kg/day which specifically allow for differences in human body weight. The abbreviation stands for milligrams of herbicide per kilogram of body weight per day. Thus a pilot in Table C-1 who weighs 100 kg. would receive .0004 × 100 or .04 mg. per day. See response to comment 54-1.

63-1 See response to comment 54-1.

64-1 Studies to examine the potential of 2,4-D and picloram to cause cancer have been completed and are under review by EPA. EPA has stated that the most recent rat study should not yield a cancer potency higher than what is used in this EIS.

64-2 The footnote has been corrected to show the NOEL is the highest amount observed to have no effect (Chapter 3, Table 3-5 of FEIS).

64-3 Tables 5 and 6 were summary tables only. Exact figures, including those "less than 10" are included in Attachment C to the Risk Assessment (Appendix L). The meaning of margins-of-safety that are less than 10 is explained in the text in Appendix L, Section 5.

64-4 Grazing is restricted in accordance with herbicide labels. The numerous scenarios used in the Risk Analysis provided a sufficient variety of situations to provide an adequate and representative analysis.

65-1 The risk analysis in Appendix L, Section 5, discusses the effects on sensitive individuals. For example, see page L-72, second column, first full paragraph of the Draft Supplement. The discussion has

been expanded in the FEIS. See response to comment 41-1.

66-1 The analysis of risk to the public from "brown and burn operations" has been revised to consider shorter time periods between herbicide application and burning. See response to comment 46-6.

66-2 While temperatures during the burning of slash are highly variable, there seems to be no question in the literature that temperatures could reach 1000° C, a possibility that was so stated in the Risk Analysis, referencing Kennedy et al. 1969. While temperatures at the soil surface have been reported to be 200° C-500° C for moderate burns and greater than 500° C for severe burns in clearcuts (Boyer and Dell, 1980), temperatures above the soil surface have been reported to be 1100° C at 2.5 feet and 5 feet above the soil surface with temperature maximums gradually rising to 1260° C-1430° C at 20 feet (Countryman, 1964 as cited in Wright and Bailey, 1982). The temperatures (at the 2.5-foot level) remained above 820° C for at least 40 minutes. Considering these results, the laboratory studies were considered to be applicable to the analysis.

66-3 The exposure analysis correctly indicates that inhalation exposure is possible, but notes that when comparing inhalation and dermal exposure, inhalation exposure is relatively small. In the analysis of worker exposures, inhalation and dermal doses were represented in the total doses that were extrapolated from field studies because the doses were estimated by urine analysis. In the analysis of public exposures, inhalation exposures were not estimated since the worker field studies showed inhalation to be such a small fraction of total exposure. The text of the exposure analysis has been expanded with a discussion of the inhalation dose to total dose relationship.

67-1 The efficacy of various vegetation management practices, singly or in combination, is so dependent on site specific conditions that general discussions do not always fully describe the situation. This is particularly true when very different environmental conditions such as found in northwest and southwest Oregon are being discussed in a single document. However, the EIS was not intended to analyze the efficacy of the various practices. As noted in Appendix C, acreage inputs from the districts were based on treatments expected to be effective and reasonable. The acreages submitted by the districts for each practice reflect their professional assessment of the efficacy of those practices in their districts. Each district was aware of appropriate, recent research results when they updated their acreages for the FEIS. Chapter 1 descriptions of the various practices are purposely general in nature and intended primarily to help the reader understand the impact analysis in Chapter 3. Conclusions reached from the analysis of impacts are properly cited in Chapter 3. Some citations have been added in Chapter 1 as appropriate.

67-2 New information has been included in the FEIS updating process.

67-3 Costs of the various treatments are still in the same ranges as shown in Appendix B. Some specific costs were updated as appropriate by each District and are reflected in the changes in Total Program costs.

67-4 The FEIS has been updated using recent research and experience.

67-5 Use of clearing saws is not a practice in itself, but merely an alternate method of accomplishing manual cutting. The EIS does not evaluate the tools used to accomplish manual cutting. The information would be more specific than necessary for analysis purposes and not needed for the decision.

67-6 The EIS analyzes a full program, without budget constraints. If actual budgets do not permit a full program under the selected alternative, then potential impacts on most environmental values would be less.

67-7 The data on employment and payments to counties in both the affected environment and the environmental consequences chapters has been updated. The title in

the DEIS (Table 2-15 Table 2-13) in the FEIS has been footnoted to clarify the difference in fiscal years used.

67-8 It is not relevant to discuss all the factors that affect the economic health of the region.

67-9 Projections of changes in allowable cut under various alternatives were based on a 5-10 year program. Short term changes (e.g. judicial orders) would not have the same effect on allowable cut. Minor adjustments to programs over a few years can be made without adjusting allowable cut significantly. The EIS, on the other hand, identified permanent reductions in stocking levels under most alternatives, which would have an allowable cut effect. Further discussion is not relevant to the analysis.

67-10 While Eugene and Medford were singled out in the Air Quality discussion, the EIS analysis covers all of western Oregon. See responses to comments 68-15 and 68-16.

67-11 See response to comments 51-4 and 53-6.

67-12 The differences in the amount of discussion on individual practices were primarily a function of the amount of available information. Some of the points made in the comment letter are verified by recent research and have been addressed in the FEIS.

67-13 The evaluation of potential alternatives was done following scoping meetings (see Appendix A, Scoping Summary). Those alternatives selected provide analysis of a broad range of options and include all aspects of the environment. The primary objective of all alternatives except Alternative 8 (No Action) is to manage vegetation competing with preferred timber species on those lands allocated to the timber harvest base in BLM land-use plans. (See Chapter 1, Purpose of and Need for Action.)

67-14 All published and unpublished references (except as noted in the introduction to the References Cited section in the Supplement) have been available for review in the Oregon State Office in Portland since the day the Draft Supplement was released. Access to this information has never been denied. The primary objective of all alternatives except Alternative 8 (No Action) is to manage vegetation competing with preferred timber species on those lands allocated to the timber harvest base in BLM land-use plans. (See Chapter 1, Purpose of and Need for Action).

67-15 As described at the beginning of Appendix L, Section 5, the margins-of-safety were calculated by dividing the animal NOEL's presented in Section 3 by the estimated human dose calculated in Section 4. The logic or formulas used to arrive at the figures and doses are clearly explained in Section 4. However, in response to your comment, we have added an example to each of the sections to aid the reader.

67-16 Based on consultation with the U.S. Environmental Protection Agency, it was determined that a risk assessment based on active ingredients provides the best method of comparison. However, an additional section on inert ingredients has been added in response to your comment. See response to comment 46-16.

67-17 Detailed records of pesticide spills maintained by the Forest Service and BLM identified the spills shown in Appendix L, Table 5-10. See response to comment 68-12.

67-18 It was the courts, not the BLM, that triggered an analysis of impacts under 40 CFR 1502.22 due to uncertainty regarding cancer. This was clearly stated on page 1 of the EIS Supplement.

67-19 There is no evidence presently available to indicate that diuron is oncogenic. The laboratory studies that have been submitted to EPA for the registration of diuron did not result in the presence of benign or malignant tumors. Even though diuron is closely related to linuron, and speculation of contamination has been made, diuron is not considered to be a suspected carcinogen because there is no actual laboratory data revealing positive oncogenic effects.

67-20 Appendix L, Table 5-1, has been revised to remove cancer potency indicating zero. The atrazine cancer potency also has been revised based on new data received from EPA. Where no cancer potency is indicated, validated chronic animal studies have not indicated any evidence of cancer. Chemicals for which EPA has requested additional cancer studies are clearly identified in Chapter 3.

67-21 The secondary source cited in Table 4 (Reuber, 1979, as cited in BLM, 1985) is on file at the Oregon State Office and is available for public review. In accordance with 40 CFR 1506.6(f), BLM maintains files of documents relied upon during EIS analysis and/or listed in the references cited section of such documents. All information in these files is accessible to the public.

67-22 Table 1-2, Appendix L, has been added, indicating data gaps currently identified by EPA under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) registrations standards.

67-23 See response to comment 54-1.

67-24 Appendix L, Table 3-4 has been changed to indicate that there are no chronic studies available.

67-25 In most cases, toxic effects at low doses do not appear until after a longer period of time. An exception is amitrole where effects were seen after only two days.

67-26 If data were available pertaining to paternal toxicity, it would have been included. The absence of any mention of paternal toxic effects was due to the fact that no such effects were reported for any of the studies discussed.

67-27 A safety-factor of 100 is often used where adequate long-term toxicity studies are available to represent a level at which the vast majority of people should not be affected. EPA has sometimes used factors greater than 100 (such as 2,000 for dicamba and 1,000 for picloram) where chronic studies are not considered to be adequate or where there are questions regarding the study data. Most routine public exposures are below the ADI's set by EPA. The risk analysis has an expanded discussion of the risks to sensitive individuals. See response to comment 54-1.

67-28 See response to comments 53-3 and 68-4.

67-29 The occurrence of peripheral nerve damage upon exposure to 2,4-D often appears to be idiosyncratic, because the dosage levels of exposure usually cannot be determined in human poisoning incidents and sensitivity can vary among different individuals. Peripheral nerve damage is usually diagnosed due to the occurrence of numbness in the extremities of affected individuals. 2,4-D has been reported to produce peripheral neuropathy with incomplete recovery. However, no effects to the nervous system have been noted in a number of laboratory animal studies including a recent rat dermal study.

67-30 The discussion of the risks to sensitive individuals has been expanded in the Risk Analysis.

67-31 As indicated in the text, this low margin-of-safety does indicate some risk of toxic effects. See response to comment 54-1.

67-32 Appendix L clearly states that the margins-of-safety are based on unprotected workers.

67-33 Description of possible toxic effects to unprotected workers has been added to the FEIS.

67-34 Doses that approach the acute oral LD_{50} are based on studies of rats; therefore, a lethal dose administered to a rat would not induce the same degree of toxicity in man. The possibility of severe toxic effects when a spill (on worker's skin) approaches the LD_{50} is discussed in the text. See text revision which includes the possibility of fatal effects.

67-35 Cancer risks are computed according to the possible scenarios that may be involved. Acres, years and herbicides are all summarized in this analysis.

67-36 The margin of safety calculated for dicamba in Appendix L, Table 7, was based on the systemic NOEL. Margins of safety based on reproductive effects are clearly labeled and presented in Section 5.

67-37 The discussion refers to epidemiological studies documenting evidence of heritable mutations. The sentence has been revised for clarification.

67-38 All glyphosate mutagenicity studies validated by EPA were negative.

67-39 Appendix L, Table 3-3 and associated text indicate that it is not the number but the type of mutagenic test that is relevant for determining the mutagenic potential of these herbicides.

67-40 See response to comment 38-10.

67-41 Most mutagenicity test results are important in defining the mutagenic properties of chemicals, but all mutagenicity results are not necessarily relevant to human risk considerations. Human genetic disease is derived from very specific alterations in the DNA which are (a) stable and (b) transmissible. Many tests for genotoxicity are unable to measure DNA damage which meets these two criteria and thus do not directly predict relevant genetic hazard. In addition, most of the tests are *in vitro* and do not attempt to relate dose levels or routes of exposure to use conditions. Consequently, tests could be conducted at dose levels which would be lethal to intact mammals.

67-42 Another review of the mutagenic potential of 2,4-D can be found in World Health organization. 1984. *Environmental Health Criteria 29: 2,4-Dichlorophenoxyacetic Acid (2,4-D)*. Geneva, Switzerland.

67-43 See response to comment 38-10.

67-44 This section has been revised and expanded in the FEIS.

67-45 EPA considers the synergistic effects of formulations using two herbicides such as Tordon containing 2,4-D and picloram.

67-46 As pointed out in the EIS, a given treatment unit is generally sprayed only once in a given year and usually not treated again until a number of years later. See response to comment 51-2.

67-47 These studies were reviewed and determined not to be appropriate for this analysis.

67-48 All exposures were compared to chronic animal studies, which indicate margins-of-safety for lifetime exposures.

67-49 The numbers of exposures assumed for workers were based on the advice of BLM and Forest Service pest management specialists and were intended to represent the practices of application of personnel working on Federal lands in the Northwest.

67-50 See response to comment 67-10.

67-51 These costs do not represent a single measurement of residues, but rather the cost of a study to show the residues under a variety of conditions and changes over time to show the effects of degradation and transport.

67-52 See response to comment 38-10.

67-53 The risk analysis discusses the risk of synergistic effects.

67-54 This information was taken from EPA. This study is not referred to as a cancer study.

67-55 The text has been revised.

67-56 The results from the second-feeding cancer study were negative.

67-57 The text has been changed to indicate that 2,4-DP was negative in one oncogenicity study.

67-58 Early in 1987, EPA released hundreds of pages of additional background documentation on herbicide registration.

67-59 The discussions have been revised to insure no invalidated studies were used in the FEIS.

67-60 See revised discussion at the beginning of Appendix L, Section 5, and the discussion

on synergistic and cumulative effects.

67-61 The text description of subchronic studies correctly reflects the definition according to NAS(1977) as ranging from a few days to 6 months. However, most subchronic studies are understood to be 90-day studies.

67-62 Chen et al. and Stevens and Gallo *in* Hayes (1984) and Klaassen and Doull *in* Doull et al. (1980) all use the term "chronic study". Klaassen and Doull *in* Doull et al. (1980) include cancer studies as chronic studies, and the current EPA guidelines combine cancer and chronic toxicity studies under a single testing protocol. However, tests for chronic toxicity, cancer tests (oncogenicity studies), and multigeneration reproductive toxicity studies are understood to have been designed to elicit separate and distinct toxic endpoints.

67-63 Chen et al. *in* Hayes (1984) in their discussion of the observations taken in acute toxicity studies include any changes in the skin, fur, eyes, mucous membranes, circulatory system, autonomic and central nervous systems, somatomotor activities, and behavior. Their discussion lists no less than 51 observed signs in 12 major categories that would indicate to the observer what organs, tissues, or systems are likely to be involved in the toxic effect of the tested chemical.

67-64 An LD_{50} is often used as a measure of acute toxicity.

67-65 This classification system is used by EPA.

67-66 This terminology is commonly used by EPA.

67-67 See text revision for clarification.

67-68 Both benign and malignant tumors are considered in oncogenicity risk assessment according to EPA's *Guidelines for Carcinogen Risk Assessment* (Fed. Reg. 51:185 Wed. Sept. 24, 1986). However, the two types of tumors are not given the same weight in all instances. Benign tumors in the absence of malignant tumors are considered to be only limited evidence of carcinogenicity. In most instances in the risk assessment in this EIS, where a higher cancer potency would result, both benign and malignant tumors are used in the calculation of potency.

67-69 EPA "tox one-liners" summarize the results of dozens of toxicity studies. Available epidemiological data was examined during the preparation of this EIS (see USDA, 1984) in addition to EPA's Pesticide Incident Monitoring System. An examination of the acute toxicities of formulations as compared with the technical products has been added to the FEIS.

67-70 Simazine is not proposed for use.

67-71 In an EPA memorandum (EPA 1983i) the EPA describes pharamacokinetic data submitted to EPA on the rate of triclopyr excretion in lab species with half-lives for urinary excretion of .7 hr, 1.5 hr, 3.1 hr, and 96 hr in rabbits, rats, monkeys, and dogs, respectively. DOW had contended that the dog kidney had a much reduced capacity for anion transport as compared to other species, including humans. EPA stated that it agreed with DOW's contention that the NOEL should not be based on PSP excretion impairment in dogs and thereafter set a PADI of .025 mg/kg/day based on the NOEL of 2.5 mg/kg/day (HDT) found in the 6-month dog study.

67-72 It has been acknowledged in the EIS that EPA does not consider these studies adequate to meet current guidelines. However, these studies have not been invalidated by EPA. Therefore, the *lowest* NOEL of 2.5 mg/kg/day found in the literature has been used.

67-73 Information on the effects observed in the diuron dog-feeding study has been added to the text.

67-74 The last sentence of this paragraph states that EPA has initiated a data call-in for dalapon.

67-75 The rationale for this column in Appendix L, Table 3-3 can be found in Brusick,

David. 1980 *Principles of Genetic Toxicology*. Plenum Press, New York.

67-76 See revision to text.

67-77 The table has been corrected to include all tasks in USDA, 1984, not just those using technical grade material.

67-78 A review of USDA (1984) and a recount of 2,4-D mutagenicity studies showed 10 positive and 28 negative studies excluding studies on plant systems. The latter are not considered important indicators of mammalian system mutagenicity. See also the response to 67-41, 67-42, and 67-89 indicating that a simple enumeration of positive versus negative mutagenicity assays is not alone sufficient to characterize a chemical's mutagenic potential.

67-79 See revision to Appendix L, Table 3-4.

67-80 See revision to Appendix L, Table 3-4.

67-81 Haxazinone was nonmutagenic in 4 out of 5 test systems.

67-82 EPA normally only has data submitted by the registrants.

67-83 See response to comment 67-86.

67-84 See response to comment 67-68.

67-85 This was the judgment of Dr. David Brusick. See Appendix L, Section 6, list of preparers.

67-86 The risk assessment does discuss potential systemic symptoms and reproductive effects in addition to its comparisons based on margins-of-safety, for example, amitrole effects on the thyroid, 2,4-D effects on the nervous system, and triclopyr's effects on the kidneys.

67-87 Clinical records, including reports such as the California state pesticide incident reporting system, are insufficient and unreliable in determination of effects/risk. They are doctors' opinions, not established research.

67-88 Available literature cited by Shearer was used by Labat-Anderson Incorporated for the Risk Analysis.

67-89 Mutagenic risk for humans infers the demonstration that an agent has been active in producing transmissible effects (gene mutations or chromosome abnormalities) in a suitable animal model or that the agent is active in a mammalian somatic cell assay with additional evidence establishing that the agent reached developing or mature gametes. Evidence less than that cited above is not sufficient to establish risk. Consequently, statements concluding that one or more positive microbial (bacteria, yeast, etc.) assays do not demonstrate a concern for human risk are correct and consistent with the data.

We agree that adding the number of tests is meaningless; however, the number of + and − studies for a given type of test do establish a weight-of-evidence for the response. For example, amitrole Ames tests 56(−) and 2(+) establish that amitrole is not mutagenic in the Ames assay. The 2(+) studies are discounted as spurious.

It is important to emphasize that not all tests included in the lists of assays measure mutation; thus, results from these tests should not be used to define a chemical as mutagenic. Examples of such tests are bacteria and yeast DNA repair assays (agents other than mutagens are capable of interfering with DNA repair), yeast mitotic recombination assays, and sister chromatid exchange assays. These tests may define genotoxicity but according to the International Commission for Protection Against Environmental Mutagens and Carcinogens (ICPEMC) (Mutation Res., 114: 117-177, 1982) defining an agent as genotoxic does not infer human hazard. Only positive results from appropriate mutation assays *in vivo* can be used for risk assessment.

67-90 The reason that 2,4-DP is assumed to be of negligible risk has more to do with the type of responses obtained than with the number of responses. None of the assays conducted were of sufficient relevance to establish much more than possible

microbial genotoxicity. Genotoxicity does not prove hazard (see International Commission for Protection Against Environmental Mutagens and Carcinogens (ICPEMC) citation).

67-91 Even acknowledging the reality of false positive and negative responses in mutagenicity studies, it is true that most noncarcinogens are not effective mutagens. Thus, the statement is consistent with the current mutagenicity/carcinogenicity data base.

The 2-year dog feeding study is not described as a cancer study in the changed text. However, the use of the two chronic feeding studies to provide evidence of the oncogenic potential of dalapon was not inappropriate. In both studies, test animals were examined for histopathological evidence of tumor formation and none was reported (USDA, 1984).

67-92 See International Commission for Protection Against Environmental Mutagens and Carcinogens (ICPEMC) (Mutation Res., 114: 117-177, 1982) for a discussion of the performance of DNA repair tests as predictions of genetic risk. The EPA GenTox working group on bacteria DNA repair tests conclude that positive results only in the bacteria DNA repair assay is not sufficient for evaluations of hazard (Mutation Res., 87: 211-297, 1981).

67-93 The reason for discounting the *in vitro* positive results is that fosamine was negative in an *in vivo* test for chromosome aberrations. *In vivo* studies usually take precedence over *in vitro* results as indications of hazard. This is especially true for cytogenetic analyses. All other genotox. data were in support of no effect.

67-94 See response to comment 67-93.

67-95 The "high iodine" phrase should be "high ionic." This error has been corrected. A manuscript in press by Brusick (Environmental Mutagenesis, 1986) will describe the problems of pH and ion levels in *in vitro* assays.

67-96 Sensitivity is probably not the correct word to use. Specificity is the determining factor in test ability. The test must be proven to discriminate between true positive and negative agents. This test had not been properly evaluated prior to its use on picloram and thus the results are of no value.

67-97 The Drosophila data does carry more weight than indicated in the supplement. The conclusion has been changed to include possible hazard.

67-98 The conclusion is based on weight-of-evidence including chronic animal data. However, there is probably not enough evidence for that conclusion to be stated absolutely. Thus, the worst-case conclusion of mutagenicity was made.

67-99 The evidence for germ cell effects is not consistent. A worst-case analysis would call for an assumption that the one positive study is the correct indicator of hazard. Triclopyr is presumed to be a genetic hazard pending other data.

67-100 A discussion of a recently completed 2-year chronic feeding/oncogenicity study of rats has been included in the text. Before the findings of the 2-year study were available, it was necessary to consider existing data from chronic studies.

67-101 The text has been revised to describe two oncogenic studies.

67-102 The tissue of test animals from both the 2-year and 52-week (1-year) feeding studies revealed no evidence of pathology or tumor formation (USDA, 1984). Whenever data obtained from validated oncogenicity studies is not available, any existing evidence of oncogenic potential was examined to assess the potential hazards. The description of the 2-year feeding study as an oncogenic study has been deleted from the text.

67-103 When chronic studies were reported, the data was examined to determine oncogenic potential of dioxin and nitrosoamine contamination. EPA has stated in the Guidance for the

Reregistration of Pesticide Products Containing Dicamba as the Active Ingredient, "The more toxic dioxin isomer 2,3,7,8-tetrachlorodibenzo- p-dioxin has not been found at the limit of detection (2 ppb) of the method and is not expected as an impurity in dicamba. Dicamba products formulated with dimethylamine have the potential of adding a dimethylnitrosoamine (DMNA) contaminant. Nitrosoamine levels in the dimethylamine formulations are expected to be less than 1 ppm. The risk levels for the dicamba products with the nitrosoamine contaminant are in the 1×10^{-7} to 1×10^{-8} range.

67-104 There is no reason to question the scientific integrity or accuracy of the two chronic studies cited for diuron. The studies were not listed as invalidated studies by EPA.

67-105 Appendix L, Table 3-4, has been changed to indicate that there are no chronic studies available for fosamine.

67-106 The U.S. EPA Science Advisory Panel has reviewed all relevant data and concluded there is not sufficient evidence to conclude that glyphosate is oncogenic in the mouse. (EPA, 1986e).

67-107 Appendix L, Table 3-4, has been changed to indicate that picloram was nononcogenic in one of two studies.

67-108 The results of the 2-year rat feeding study are the only available data to evaluate the effects of chronic exposure to simazine.

67-109 The text has been changed to indicate that a single chronic feeding study did not result in any reported oncogenic effect for simazine.

67-110 The study was cited incorrectly. The citation has been changed to (Elanco Products Co. as cited in USDA, 1984b).

67-111 The studies discussed in the text were not listed as invalidated studies on the EPA Tox One-Liner (1984). EPA (1985) concluded in a memorandum concerning Garlon 4A herbicides that a subchronic dietary NOEL for beagle dogs could be tentatively established at 2.5 mg/kg/day.

67-112 A worst-case analysis was only conducted for the herbicides for which there was positive evidence of carcinogenicity or where there has been a published allegation of cancer, as in the case of 2,4-D.

67-113 EPA generally considers contamination of nitroso compounds of less than 1 ppb of negligible risk to human health. EPA has data on a number of 2,4-D amine salts although some of the older formulations have not been tested. Estron 99, for example, is not an amine and therefore would not be expected to form N-nitroso compounds.

67-114 The risk assessment has been revised to include an analysis of the carcinogenic risk of atrazine based on new information supplied by EPA. See response to comment 67-122.

67-115 EPA's recommendation of a threshold approach for oncogenic risk assessment was referenced on page L-107 of the Supplement to the Draft EIS.

67-116 There is no generally accepted standard scientific judgment on what the cancer risk is at low doses. The example of EPA's amitrole risk assessment (EPA 1985a) shows how widely some of the commonly used models diverge in their estimates of risk at low dose. We have chosen a method that is one of the most conservative (i.e., predicts the highest risk).

67-117 Details of carcinogenicity testing are given in Attachment A rather than C of the Supplement to the DEIS. The specific sources of data used for cancer potency estimates are given in Section 3 under the heading "Cancer Potency". Some of the potency estimates were made using the Global 82 computer program. The estimates used were given by EPA or Crump (1983). The others were calculated from the referenced data using a least-squares linear regression procedure. Details have been added to the text.

67-118 For the analysis of 2,4-D cancer risk, the value for cancer potency was that computed by K. Crump using the Global

82 model. For the analysis of 2,4-DP cancer risk, the cancer potency computed was based on the tumor data that would give the highest cancer potency value.

67-119 The referenced study has not been invalidated by EPA. The discussion of asulam carcinogenicity has been expanded in the Hazard Analysis of the Supplement to the DEIS.

67-120 The cancer potency estimate for glyphosate was derived from data on the rate of kidney tumor formation in male mice as indicated on page L-43 of the Supplement to the draft EIS. The method used was the same as that outlined in the reply to 67-106. Following a worst-case approach, this estimate has continued to be used even though the FIFRA Scientific Advisory Panel has determined that no statistically significant difference existed between dosed mice and concurrent controls.

Following the advice of the Scientific Advisory Panel, EPA has classified glyphosate as a Class D carcinogen, for "inadequate evidence of oncogenicity" pending the collection of additional data (Guidance for the Reregistration of Pesticide Products Containing Glyphosate as the Active Ingredient, EPA, June 1986).

67-121 The formula was given on page L-81 of the Supplement to the Draft EIS.

67-122 The inert ingredients mentioned in the comment are not all carcinogens. However, as the comment implies, the ingredients also are not all "inert" but may exhibit some toxic effects. For this reason, most of the ingredients indicated in the comment are no longer used in pesticide formulations. None of the ingredients shown to be carcinogenic currently are used in the pesticide formulations considered in this EIS so no changes in the cancer risk assessments are necessary. The discussion of inert ingredients has been expanded in the FEIS. See response to comment 46-16.

67-123 See response to comment 67-122.

67-124 The exposure discussion has been expanded to include a description of studies showing the low percentage of total exposure that inhalation exposure represents.

67-125 Accidental exposures to the public include exposures by ingestion of deer meat from deer that have fed in a treated site.

67-126 a). The discussion of worker exposure has been expanded to indicate what exposures each field study showed.

b). All of the doses extrapolated from the worker field studies were based on work crews wearing ordinary work clothes and taking no special precautions against exposure.

67-127 The forearm is the most typical site for occupational exposure, therefore dermal penetration rates for the forearm are appropriate.

67-128 Doses from only four worker studies were used in the analysis. These are included in Table 4-4 and specific doses are described in the revised text. See response to comment 67-115.

67-129 Accidental doses to workers are examined separately from routine doses so that the range of possible worker doses can be described. The distribution of doses used to set the average worker dose was not a normal (bell-shaped curve) distribution but is skewed to the left because of the much higher doses from minor accidents. Therefore, the doses from the less severe accidents seen in the field studies tended to inflate the estimates of the doses an average worker would get. In routine operations the average worker would get a much lower dose.

67-130 The derivation of the drift values in Table 4-6 is explained in the subsections on "Spray Drift" and "Residues on Plants". Relative residues on berries and crops were estimated from separate tables of data in Hoerger and Kenaga (1972). "Crops" included a variety of vegetables and were considered to have different surface-to-mass ratios than berries. Dermal exposure to herbicide drift is discussed for game animals under "Residues in Game

Animals" and for humans under "Dermal Exposure". For wildlife the entire body surface area of the animal was assumed to be exposed to drift. For humans, 2 ft^2 of skin was assumed to be exposed to drift. Sample calculations for determining exposures are included in the FEIS.

67-131 Risks were judged by comparing estimated doses with NOEL's found in studies of laboratory animals that were dosed every day over their lifetime (unless a subchronic study showed a lower NOEL); therefore, the analysis implicitly assumes the liter of contaminated water is drank every day after spraying. The long-term lab studies would show any cumulative effects of a pesticide that may build up in any body tissue. None of the 12 herbicides has been shown to bioaccumulate to any significant degree.

67-132 The exposure analysis discussion has been revised to include example exposure calculations.

67-133 See response to comment 67-120.

67-134 The text has been expanded to indicate the sources of the herbicide degradation rates. The values for picloram appear in Table 4-9 as 0.0 because they are rounded to one decimal place.

67-135 In Section 4, the subsection on "Effect of Body Size on Exposure" is intended to show the effect of body size on exposures in all of the scenarios. Table 4-9 gives specific example exposures for one scenario. The formula (given in the text) that was used is based on a surface area scaling factor. Carbon tetrachloride exposure is not likely to be similar to herbicide exposure. The risk assessment acknowledges that humans will have a range of sensitivity to chemical exposures. Small children may in some cases be among the more sensitive individuals.

67-136 The lifetime average daily doses are simply the daily doses averaged over a 70-year lifetime, which has 25,550 days. The formula was given in the supplement to the Draft EIS on page L-81. Lifetime doses and cancer risks were calculated for the public for a single exposure and for 30 exposures to show a range of exposures that is not likely to be exceeded. The realistic and worst-case numbers of exposures to workers were based on the best judgment of BLM personnel familiar with vegetation management operations. Ninety-five percent of the exposures were assumed to be as in the routine-realistic scenarios, and 5 percent of the exposures were assumed to be as in the routine worst-case scenario.

67-137 See response to comment 67-14.

67-138 The statement in the EIS is correct. The ratio between the NOEL and the estimated human exposure is correctly defined as the margin of safety (MOS). Any exposure below the NOEL provides an MOS even though the MOS may not be acceptable.

67-139 The risk assessment defines a margin-of-safety as the ratio between a toxicity reference level derived in an animal study and an estimated human dose. The use of margins-of-safety is discussed in EPA's recent "Guidelines for the Health Assessment of Suspect Developmental Toxicants" published in the Federal Register (Vol. 51 No. 185 Wed. Sept. 24, 1986).

The risk assessment does not attempt to set regulatory safe dose levels as is the case for agencies such as EPA and FDA. The context for the use of the margin-of-safety is different but remains appropriate. Ratios based on LD_{50}'s are used to examine the relative risks among the alternative herbicides of lethal or other acute toxic effects from specified exposures.

67-140 A negative ratio based on the LD_{50} represents a clear risk of *lethal* effects.

67-141 The statement in the EIS is correct. NOEL values from lifetime exposure studies usually are much lower than those exposures required to produce a toxic effect from a single dose. Therefore, the use of lifetime studies greatly overestimates the risks associated with single exposures.

67-142 The EPA Science Advisory Panel has revised the glyphosate mouse cancer study and determined that it presented insufficient evidence of carcinogenicity in mice. The discussion of glyphosate oncogenicity has been revised in the document and the references are cited in that discussion.

67-143 See response to comment 67-125.

67-144 See response to comment 38-10.

67-145 The systemic NOEL of 1 mg/kg/day included in Appendix L, Table 5-1 is based on a 1-year interim report of an onco/chronic feeding study of rats and not on the 90-day range finding study.

67-146 It is a common practice to make comparisons between acute toxicity data and longer-term studies. In many instances, the dose levels for longer-term studies are picked based on fractions of the acute toxic dose. For example, a 90-day subchronic study may be run beginning at 10 percent of the LD_{50} dose. In this report, it is possible to make the statement that where ratios are sufficiently large there is little likelihood of any acute toxic effect, especially where the ratios exceed 100.

67-147 See revised discussion in Appendix L which covers inert ingredients.

67-148 See response to comment 67-100.

67-149 The estimated 2,4-D residues for berries range from 0.169 ppm for the small aerial operation to 1.303 ppm for the large aerial operation. These values are reasonable when compared to the Minnesota study. The higher concentrations in that study may have been a result of such factors as higher application rates, larger treatment areas, or greater spray drift due to different application equipment and weather conditions.

67-150 The text has been expanded to include an example of the method used to derive dietary exposures.

67-151 The 2,4-D half-life of 16 days is from: Morton, H. L., E. D. Robinson, and R. E. Meyer. 1967. Persistence of 2,4-D, 2,4,5-T, and dicamba in range forage grasses. *Weeds* 15:268-271. The glyphosate half-life of 14 days is from: Newton, M., and F. N. Dost. 1981. *Environmental Effects of Vegetation Management Practices on DNR Forest Lands.* Prepared for State of Washington, Department of Natural Resources. pp. 116-131. Cited in U.S. Department of Energy, Bonneville Power Administration. 1983. *Transmission Facilities Vegetation Management Program: Final Environmental Impact Statement.* DOE/EIS-0097-F. U.S. Government Printing Office, Washington, D.C. The Triclopyr half-life of 18 days is from: Radosevich, S. R., and D. E. Bayer. Effect of temperature and photoperiod on Triclopyr, picloram, and 2,4,5-T translocation. *Weed Science* 27(1):22-27.

67-152 Glyphosate does not contain chlorine atoms; 2,4-D has 2 chlorine atoms per molecule and Triclopyr has 3 chlorine atoms per molecule. Formation of HCl, Cl_2, $COCl_2$, and $Cl0_2$ from pyrolysis of 2,4-D or Triclopyr has not been documented. In the worst-case, if these products did form and were 800 times more toxic than the parent compounds, there would still be a wide margin of safety between the NOEL and the estimated dose.

67-153 See response to comment 46-6.

67-154 PNAH's have been detected in soil and litter samples at clearcut sites that were prescribed burned; however, PNAH's in smoke were not studied at these sites. PNAH's can be released to the atmosphere during the burning of wood, but studies have not been conducted to determine the amounts or types released to the atmosphere from burning woody vegetation. Production of PNAH's is significantly reduced under conditions of more complete combustion as would be present in the "brown and burn" operations due to the dryness of the vegetation.

67-155 Aerosols could be produced from burning woody vegetation. However, all "brown and burn" operations must comply with the State smoke management guidelines.

67-156 Assumptions 1, 2, 3, 4, and 7 are based on: U.S. Forest Service, 1985, *Risk Analysis of the California Reforestation Program*, prepared by Peer Consultants Inc., Rockville, Maryland. Assumption 5 is based on field estimates by Region 6 Forest Service personnel. Assumption 6 is a conservative assumption made for use in this risk assessment to estimate the maximum exposure to herbicides during burning.

67-157 This assumption is from U.S. Forest Service, 1985, *Risk Analysis of the California Reforestation Program*.

67-158 Temperatures are expected to range from 1,000 °C to 1,200 °C throughout prescribed burning. See response to comment 66-2.

67-159 Worker and public exposure to Triclopyr from "brown and burn" operations is so extremely low that information on specific combustion products of Triclopyr is not needed to assess the health risk.

67-160 Worker doses of glyphosate from "brown and burn" operations in the extreme case (burning at 2 months after pesticide application) are approximately 136,000 times less than the NOEL. Pyrolysis by-products comprise only 5 to 6 percent of this dose and would be at insignificant concentrations.

67-161 The *lack* of one or more studies on a particular chemical designed specifically to determine whether the chemical causes cancer in a test animal is not sufficient evidence to conclude that the chemical *would* cause cancer to humans. It is important to differentiate in discussing the risk of cancer from the herbicides between the risks from known or suspected carcinogens that *may* cause cancer, with an estimated probability level based on test animal data, and chemicals for which no judgments about risk can be drawn because no tumor data is available. The analysis cannot eliminate the possibility that one or more of the herbicides without testing may cause cancer, and we have clearly stated this uncertainty in the Hazard Analysis. No quantitative assessment of the risk of cancer can be done unless tumor data are available.

67-162 The N's used were listed in Tables B-24 through B-32. Also see the response to comment 67-125.

67-163 See response to comment 67-125.

67-164 The text has been revised to read "No human studies are available indicating whether the 16 herbicides cause heritable mutations."

67-165 The quotation referred to by the question states that "... mutagenicity and carcinogenicity both follow similar mechanistic steps (at least those that involve genetic toxicity) ..." and that "mutagens and at least primary carcinogens react with DNA to form a mutation or DNA lesion affecting a particular gene or set of genes". For a discussion of the relationship between mutagenicity and carcinogenicity, see "Principles of Genetic Toxicology," by D. Brusick (1980, Plenum Press).

67-166 The most recent EPA Tox One-Liner lists three mutagenicity studies for asulam. One of these tests used five strains of Salmonella typhimurium, another was a cell transformation assay (C3H/10T 1/2), and the third was a mouse dominant lethal assay. There was no indication of mutagenicity in any of these tests.

67-167 See responses to comments 67-27 and 67-78.

67-168 The risk assessment states that the worst-case assumption is that diuron is mutagenic. The discussion of diuron mutagenicity in the text has been revised.

67-169 See responses to comments 67-27, 67-29, 67-78, and 67-80.

67-170 The discussion of the risk of synergistic effects has been expanded.

67-171 See response to comment 67-159.

67-172 See response to comment 67-33.

67-173 See response to comment 67-159.

67-174 See Table 1-3 for acres treated with mixtures of herbicides.

67-175 Atrazine is considered a potential mutagen in the risk assessment.

67-176 Amitrole is not proposed for use in the FEIS.

67-177 Several scientific organizations, such as WHO, have reviewed and discounted the Swedish reports that suggest an association between environmental herbicide exposure and soft-tissue sarcoma. These studies cannot show any clear association between phenoxy herbicide exposure and the reported tumors. Until better measurements of exposure are made, these studies will be discounted by creditable scientific organizations. In addition, a better description of the histological and clinical features of these particularly rare types of tumors is needed before the studies can be adequately assessed. The Danish study that was mentioned suffers from the same inherent problems as the Swedish studies. It also should be noted that MCPA is not being assessed in this EIS, and it is not known what the contaminants are in MCPA.

67-178 In the New Zealand study, it is not known what the sheep were actually exposed to. Grazing sheep consume a wide variety of natural substances, some of which are carcinogenic. For example, mycotoxins commonly are found in plants and could cause tumors in grazing animals. Any potential association would need to be investigated under controlled laboratory conditions before any conclusions could be reached. Current laboratory findings do not confirm these results.

68-1 The statements referred to in your comment letter were substantiated in Section 3 of the Supplement.

68-2 See response to comment 67-87.

68-3 See response to comment 54-1.

68-4 The vast majority of spray operations done by BLM in western Oregon are away from local residences and areas popular for other outdoor activities. It is true that some areas in western Oregon have local concentrations of residences near BLM lands that could be treated, and that some people use the BLM lands for recreation activities. The Risk Analysis included scenarios to cover those situations. In addition, site specific annual EA's would assess potential impacts to local areas. Public comments on those site specific proposals would be solicited and considered.

68-5 For a discussion of the value of primary DNA damage assays as indications of human genetic risk see International Commission for Protection Against Environmental Mutagens and Carcinogens (ICPEMC), (Mutation Res.,*114*: 117-177, 1982). These tests do not *per se* measure mutation and therefore cannot define an agent as mutagenic. Risk is derived only from mutagens and not from genotoxins. See response to comment 67-89.

68-6 All material used in the analysis, including abstracts (summaries) provided by EPA, is referenced in the text. As stated in the references cited section, all documents referenced are available at universities, at libraries, or from federal agencies. See response to comment 67-22.

68-7 See response to comment 51-2.

68-8 See response to comment 67-97.

68-9 See responses to comments 51-4 and 53-6.

68-10 Very few hazardous air pollutants have had standards set under the Clean Air Act.

68-11 The discussion on synergistic effects has been revised.

68-12 Appendix L, Table 5-10, reflects the number of BLM and USDA Forest Service spills over the period 1973 to 1983. Since BLM had no spills during the time period, the table is essentially a Forest Service table. The original risk analysis was based on a spill of 1,000 gallons and has been revised to 2,000 gallons.

68-13 See response to comment 54-1.

68-14 Due to the 3-year time lag between publication of the DEIS and preparation of the FEIS, all sections of the DEIS were reviewed for the need to update information. All aspects of the economic analysis have been brought up to date. Due to the methods used to determine stocking and allowable cut effects in the DEIS, update was not necessary.

68-15 The air quality sections have been expanded in the FEIS to better address the proposed program and compare it to the baseline period which is required by law. Close coordination with the Oregon Department of Environmental Quality has been maintained, and their concurrence with the methodology of our analysis has been received.

68-16 Proposed burning acres are shown in Table 1-2. Appendix N shows estimates of historical acreages burned. The 54% figure reflected the proportion of acres proposed to burn to the acres burned under the existing condition defined in the EIS. Under the FEIS, which compares proposed acres to baseline acres, there would be a 29% increase shown in Table 1-4. Due to smoke management restrictions, it is likely that actual acres burned during a given year would be less than the proposed number of acres shown in Table 1-2. The average rate of accomplishment from 1983-1985 was 74%.

68-17 The impacts of vegetation management practices on big game were primarily analyzed by estimating the increase and/or decrease in forage which in turn changes big game populations. In addition, health effects on animals has been more thoroughly analyzed in Appendix P.

The term "moderate" was used for those situations where a statistically measurable change would be expected if a population study was conducted.

68-18 This statement in Table 1-4 is based on the discussion in Chapter 3, which lists all sources used. Mortality statistics are not available but would not be used anyway. Population surveys would be used to measure changes in living populations. See response to comment 68-17.

69-1 Accidents are dealt with under the accidental worst-case scenarios, which analyzes direct spraying of people, as well as spills.

69-2 See responses to comments 53-3 and 68-4.

70-1 The references used in Appendix L, Table 4-5, are listed in column 1 of the table under "Investigator."

70-2 See responses to comments 51-4 and 53-6.

71-1 See response to comment 46-16.

72-1 Although repeated exposures are unlikely under BLM's program, we acknowledge that they are possible. Because the system NOEL's are derived from are chronic laboratory studies, the MOS's represent risk from lifetime exposures. See response to comment 53-3.

72-2 The section on cumulative effects has been revised.

72-3 Sufficient studies have been done on the impacts of herbicides on wildlife and fish to enable analysis of impacts under the proposed program as well as worst case scenarios. Table 3-3, Chapter 3, and Appendix P (wildlife risk analysis), which have been added to the FEIS, summarize the available acute toxicity data. Results of theoretical scenarios as well as known results from stream monitoring can be compared to this data to provide a basis for a credible and realistic evaluation of impacts.

73-1 All comments to the Draft EIS were reviewed and appropriate responses prepared, including 13 responses to your letter. Those letters and responses are included in Chapter 4 of this FEIS, as well as comments and responses to the Supplement to the Draft.

73-2 Nursery workers were not included because nurseries are outside the scope of the document. Tree planters were not discussed because applicators were evaluated on the assumption that their exposure would be greater.

74-1 See responses to comments 51-4 and 53-6.

75-1 Discussion of managing hardwoods as a resource is outside the scope of this document. See response to comment 67-13.

76-1 See response to comment 41-1.

76-2 The exposure of experimental animals to chemical substances in large doses is a scientifically valid method to discover hazards to man. Long-term or chronic studies are conducted to identify possible health hazards associated with pesticide use, based on the quantal-dose concept that the incidence of an effect in a population is greater as the dose or exposure increases. Chronic studies usually extend over the average lifetime of a species, and relatively large doses are administered to animals during the testing periods so that the possible toxic effects can occur more frequently.

76-3 See response to comments 53-3 and 68-4.

76-4 A review of the toxicology of petroleum distillates and a table evaluating the acute LD_{50}'s of various pesticide formulations containing inert ingredients has been added to the text. See response to comment 46-5.

76-5 See response to comment 54-1.

76-6 Chronic studies of rats are conducted for the lifetime of the animal, which is generally 2 years.

76-7 The discussion of risks to sensitive individuals has been expanded.

77-1 Preparation of new land-use plans has just begun and will not be completed until 1990. This EIS correctly evaluates the program in relation to current existing timber management plans.

77-2 Evaluation of timber harvest practices is outside the scope of this EIS.

77-3 Discussion of hardwood management and second-growth management are outside the scope of this EIS. See response to comments 67-13 and 75-1.

77-4 The assumption that goals were all achieved without herbicides is incorrect. Many areas have had alternative practices applied, with mixed results. Other areas have had maintenance and release practices deferred, awaiting approval of herbicide use. If it is not approved, many of these sites will sustain reduced stocking and goals will not be achieved. All practices used for the past several years are already discussed in the EIS.

77-5 All discussion and analysis of surface water quality relates to live streams. Appendix L includes discussion of public exposure from herbicides entering water.

77-6 The Supplement to the DEIS assumes that posting is done in accordance with BLM policy. As noted in Appendix D, posting is not required with nonrestricted chemicals where the local manager judges there is no likelihood of public exposure.

78-1 During the past few years, there was a shift in the balance of practices used, but all practices used were evaluated in the DEIS. Experience with those alternatives is reflected in some changes in proposed acreages in Table 1-2.

78-2 BLM's experience with alternative treatments does not affect which alternatives are selected for analysis, but has affected the design of those alternatives. The selection of alternatives was done following an extensive scoping process and is sufficient for the FEIS.

78-3 The discussion of the risks of cumulative impacts has been revised. See response to comment 51-2.

78-4 The indirect effects, where relevant, were addressed.

78-5 The discussion on cumulative and synergistic effects has been expanded in the FEIS. Also see response to comment 51-2.

78-6 See responses to comments 46-16 and 67-122.

78-7 See response to comment 3-1.

78-8 The analysis of various scenarios covering the public versus workers, routine versus accidental situations and realistic versus worst-case doses provided the range of risks deemed appropriate.

78-9 The risks of effects on sensitive individuals are discussed in the risk analysis section. See response to comments 41-1 and 65-1.

78-10 See response to comment 77-1.

79-1 The risks of effects on sensitive individuals are discussed in the risk analysis section. See response to comments 41-1 and 65-1.

List of Agencies, Organizations and Individuals to Whom Copies of the Statement are Sent

Public meetings were held in Grants Pass, Medford, Coos Bay, Roseburg, Eugene and Salem, Oregon at which issues and alternatives to be addressed in the EIS were discussed (see Appendix A). In addition, BLM consulted with the Oregon Department of Land Conservation and Development; Oregon State Department of Forestry; USDA-Forest Service, Region 6; and the USDI Regional Solicitor in developing the draft EIS. Comments on the draft EIS, supplemental EIS and FEIS were requested from the following:

Federal Agencies

Advisory Council on Historic Preservation
Department of Agriculture
  Forest Service
  Soil Conservation Service
Department of Commerce
  National Marine Fisheries Service
Department of Defense
  U.S. Army Corps of Engineers
Department of the Interior
  Fish and Wildlife Service
  Bureau of Indian Affairs
  Geological Survey
  Bureau of Mines
  National Park Service
Environmental Protection Agency
Small Business Administration

Boards of County Commissioners

Benton County
Clackamas County
Coos County
Columbia County
Curry County
Douglas County
Jackson County
Josephine County
Klamath County
Lane County
Lincoln County
Linn County
Marion County
Multnomah County
Polk County
Tillamook County
Washington County
Yamhill County

State and Local Government

Oregon State Clearinghouse
Oregon Areawide Clearinghouse
  (See Appendix G)
Lane Regional Pollution Authority
Oregon Department of Environmental Quality
Oregon Department of Fish & Wildlife
Oregon Department of Forestory
Oregon State Historic Preservation Officer

Interest Groups (partial listing)

Audubon Society
Bureau of Reclamation
Champion International Corp.
FIR
Georgia Pacific
Giustina Bros. Lumber & Plywood Co.
Hoedads
Industrial Forestry Association
International Paper Co.
Izaak Walton League
Klamath Indian Tribe Menasha Corp.
National Wildlife Federation
Northwest Coalition for Alternatives to Pesticides
Northwest Forest Workers
Northwest Timber Association
Oregon Economic Development Commission
Oregon Environmental Council
Oregon Forest Industries Council
Oregon State University
Oregon Wheat Growers League
Oregon Wilderness Coalition
Oregon Wildlife Federation
Oregon Women for Timber
Oregonians for Food and Shelter
Sierra Club
Siletx Indian Tribe
Southern Oregon Citizens Against Toxic Sprays
University of Oregon

Western Environmental Trade Association
Western Forest Industries Association
Weyerhaeuser Co.
Willamette Industries, Inc.

Copies of this FEIS will be available for public inspection at the following BLM offices:

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Washington, D.C. 20240
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Oregon State Public Affairs Office
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Portland, Oregon 97208
Phone (503) 231-6277

Coos Bay District Office
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Roseburg District Office
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Roseburg, Oregon 97470
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Salem District Office
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Salem, Oregon 97306
Phone (503) 399-5646

Klamath Falls Resource Area Office
1939 South 6th Street
Klamath Falls, Oregon 97601
Phone (503) 883-6916

Reading copies will be placed in the following libraries: Portland State University, Portland; Oregon State University, Corvallis; University of Oregon, Eugene; Lane Community College, Eugene; Umpqua Community College, Roseburg; Linn-Benton Community College, Albany; and public libraries in: Applegate, Bandon, Brookings, Canyonville, Coos Bay, Coquille, Cottage Grove, Drain, Eugene, Gold Beach, Grants Pass, Illinois Valley, Klamath Falls, Medford, Myrtle Creek, North Bend, Oakland, Port Orford, Reedsport, Riddle, Roseburg, Salem, Springfield, Sutherlin, Williams, Winston, and Wolf Creek.

Salmonberry

List of Preparers

While individuals have primary responsibility for preparing sections of an EIS, the document is an interdisciplinary team effort. In addition, internal review of the document occurs throughout preparation. Specialists at the District and State Office levels of the BLM both review the analysis and supply information. Contributions by individual preparers may be subject to revision by other BLM specialists and by management during the internal review process.

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Contractors Contributing Substantial Input

USDA, Cooperative Extension Service - Review of Literature on the effects of Slash Burning on Human Health

Labat-Anderson Incorporated - Preparation of Risk Assessments on the effects of Herbicides on Human Health (SEIS and FEIS) and Animals (FEIS) (See Appendix L for detailed list of preparers.)

Peer Review of the Worst-Case Analysis

Although the Bureau of Land Management performed the worst-case analysis with an in-house team, a contract was let for peer review by experts. Because BLM has little toxicological expertise and because the need to ensure the accuracy of this worst-case analysis, Labat-Anderson, Inc., a consultant firm with in-house toxicological expertise and experience in performing worst-case analysis was retained. The input from the peer reviewers was incorporated in this Final EIS.

The final EIS received a favorable peer review by the following individuals:

Dr. Edward Calabrese University of Massachusetts	Cancer Risk Analysis	B.S., Biological Chemistry M.S., Biological Chemistry Ph.D., Toxicology
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Appendix A
Results of Scoping

Scoping Meetings and Correspondence

Between July 7 and July 15, 1982, public meetings were held in Grants Pass, Medford, Coos Bay, Roseburg, Eugene and Salem to discuss important issues and alternatives that should be addressed in the Western Oregon Vegetation Management Environmental Impact Statement (EIS). Five written statements and letters were also received during or following these meetings.

Alternatives

During these meetings, 19 alternatives were proposed for consideration in the EIS. Following is a summary of these alternatives, designated A through S, and BLM's analysis of their usefulness and relevance to the EIS process.

A. Utilize "Competing" or "Unwanted" Vegetation

This would more correctly be classified as an issue than an alternative. It emphasizes use of the by-products of most treatments but does not in itself represent an alternative treatment. Under all alternatives, efforts will be made to use competing vegetation where markets for it exist.

B. Use Less Herbicides and Increase Development of Other Practices, Particularly Labor-Intensive.

This alternative would reduce herbicide use from present levels and provide opportunities to develop alternative methods. It addresses a relevant and important issue which can be evaluated in the EIS.

C. Emphasize Stewardship Contracts in Managing Competing Vegetation

This does not represent an alternative treatment or set of management practices which could be analyzed in the EIS. It refers to a contracting technique which could be considered for use under most alternatives. The viability of stewardship contracting is currently under study by BLM.

D. Emphasize Preventive Treatments

Discussion on this alternative favored the use of harvest and site preparation practices which would result in the fewest vegetation management problems. Such practices would be included as design features under all alternatives and used whenever feasible. They would not compose a separate alternative.

E. Use Integrated Pest Management

This was proposed several times and was often defined differently. All discussions supported a balance of different methods of vegetation control versus a dependence on herbicides. There was also some emphasis on insuring that vegetation is actually a pest (i.e., competing) before it is treated. This concept is consistent with Department of Interior policy.

F. No Aerial Spraying

This proposal would eliminate all aerial application of herbicides. It is a relevant alternative which can be evaluated.

G. Treat Vegetation Management as a Thinning Project

This alternative focused on manually cutting competing vegetation as one would selectively thin a stand during precommercial thinning. This "thinning" treatment would only be appropriate for a relatively brief period in the life of a stand and would not represent a viable alternative during a stand's early stages of growth. Manual cutting of competing vegetation is included under Alternative B listed in this appendix above.

H. Use Slash as an Alternative Energy Source

This proposal is an element of Alternative A.

I. Harvest Medicinal Plants

This proposal is an element of Alternative A.

J. Emphasize Labor-Intensive Practices (assume current budget)

The labor-intensive concept is included under Alternative B. Using our current budget as a constraint would prevent us from meeting allowable cut levels specified in existing and proposed BLM district timber management plans. In order to be consistent with those plans, funding levels will be allowed to fluctuate between alternatives.

K. Use Harvest Practices Which Reduce Future Problems

This concept is an element of Alternative D.

L. Use More Conservative Approach When Bordering Private Land

This represents a variation of Alternative F, excluding aerial spraying only within a given distance from private land. It addresses a relevant issue.

M. While Operating Within State/Federal Law, Operate to Maximize Return on Investment (With Regard to Final Crop)
The first part of this proposal calls for only the minimum environmental safeguards provided under State and Federal law. An example appropriate to this EIS would be the use of less restrictive Forest Practices Act stream buffers in lieu of current BLM standards. This concept will be analyzed in an alternative which provides for the maximum use of herbicides. The remainder of the proposal focuses on economic efficiency, which will be analyzed for each alternative.

N. Optimize Mix of Labor-Intensive vs. Other Methods to Maximize Jobs Through Life of Stand
This concept is an element of Alternative B.

O. Provide a Given Percentage of Available Budget for Vegetation Management
See discussion of Alternative J.

P. Do Not Use Herbicides
This alternative eliminates the use of all herbicides for vegetation management, relying totally on other methods. It is a relevant alternative.

Q. Use Full Resource Analysis
This is an issue rather than an alternative. The intent behind the proposal was to ensure that treatment needs would be fully analyzed. This would presumably reduce the need for brush control, reduce herbicide use and minimize risks to humans and the environment. A full analysis of treatment needs and resource impacts will be included as a design feature under all alternatives.

R. Use Full Economic Analysis
This proposal represents an effort to evaluate all costs to BLM; direct and indirect, short-term and long-term. An economic analysis will be part of each alternative but will not constitute a separate alternative.

S. Fully Mitigate Impacts
This proposal would select methods that would minimize disruptions to the environment. It corresponds to the "no action" alternative which will be analyzed in the EIS.

Alternatives Selected

The following alternatives were selected for analysis in the EIS as a result of the scoping process:

Alternative 1 (E): Proposed Action
Alternative 2 (M): Emphasis on Use of Herbicides
Alternative 3 (G,H): Use of All Vegetation Management Treatments Except Prescribed Burning
Alternative 4 (B, J and N combined): Emphasis on Use of Effective Labor-Intensive Methods
Alternative 5 (L): Restricted Aerial Application of Herbicides
Alternative 6 (F): Use of All Vegetation Management Treatments Except the Aerial Application of Herbicides
Alternative 7 (P): Use of All Vegetation Management Treatments Except the Application of Herbicides
Alternative 8 (S): No Management of Competing Vegetation

The use of 2,4,5-T or Silvex will not be incorporated into any alternative because the manufacturer has not retained forestry registration.

Issues and Concerns Addressed

Attendees at the public scoping meetings were asked to suggest issues and concerns that should be addressed in the EIS. Issues which were relevant to the scope of the EIS and were included in the analysis are listed below.

Air Quality
Burning slash may cause smoke intrusions.

Soils
Vegetation management practices may increase erosion, deplete soil nutrients and adversely affect beneficial microorganisms in soil.

Water
Herbicides may contaminate streams.
Sedimentation may increase.
Stream buffers should be maintained.
What are the long-term effects of chemicals on ground water?
Evaluate the persistence of herbicides in the environment.

Vegetation
Herbicide spray may drift over nontarget areas.
Effectiveness of herbicides should be monitored.
Maintenance of plant species diversity.
Will conifers be damaged by chemicals?

Fish/Wildlife
Maintenance of adequate habitat, forage and species diversity.

Social Conditions
Local residents should be notified of BLM operations.

2,4,5-T should not be evaluated.
Public should have opportunity to influence policy.
Past public input should be used.
Data gaps should be discussed in EIS.
Don't use aerial spray near residences or water sources.
Emphasize labor-intensive methods to develop a work force.
Do not use aerial spray.
Generate more employment opportunities.
Consider side effects on unemployment, welfare, etc.
Existing controversy should be disclosed.

Economic Conditions
How will vegetation management practices affect timber yield projections?
Examine conflict between forest as "money producer" and forest as "environment". Analyze total costs, including repeat treatments.
Economics of various alternatives should be analyzed.

Human Health
Should 2,4,5-T be used at all?
Consider effects of practices on health in general.
Do threshold levels really exist below which exposure to herbicides is safe?
Examine claims that dioxin can cause health problems.
Examine conflicting evidence concerning safety of herbicides.
Discuss comparative degrees of toxicity.
Woods workers are concerned about exposure when working in recently sprayed units.
Discuss synergistic effects of herbicides.

Ecological
Discuss ecosystem disruptions which might result from managing competing vegetation.

Other
Can toxicological documentation be made available as part of draft EIS?
How do we define vegetation management problems?
Evaluate effects of spray "carriers" (i.e., diesel oil).
BLM should define goals more precisely.

Issues to be considered in the decision process:

Streamside sediment should be monitored for chemicals.
Spray effects on wildlife should be monitored.
Will vegetation management practices affect adjacent agriculture?

Issues and Concerns not Addressed:

The following issues raised by the public were not addressed in the EIS for the reasons identified.

Issues not addressed because they represented opinions rather than environmental issues that could be analyzed:

Forest by-products should be utilized, not wasted.
It is not feasible to immediately use 100 percent labor-intensive methods. Phase them in gradually.
Some "benefits" of vegetation management practices are questionable.
Breadth of scientific expertise on the EIS team is limited.

Issues not addressed because they were not environmental issues that could be analyzed or were outside the scope of this EIS:

There should be better record keeping and notification by adjacent private landowners who spray.
How will differences of opinion be handled?
Can BLM do more research on alternatives?
How to get 2,4,5-T back for forest use.
Analyze where BLM expenditures go--to local economy or elsewhere.

Issues not addressed because there were no identified impacts:

What is the significance of bioaccumulation and unrepaired cellular damage?
Harvesting medicinal plants which are competitive instead of killing them.
Will BLM slash burning increase fire risk?

Issues not addressed because they represent preferences about the conduct of the program that are applicable to all alternatives:

The public should participate in site evaluations.
Collect more centralized information on herbicide use patterns on intermingled public and private lands.
Public should have more input to design of tests and checking of test results.
BLM should have flexibility to negotiate with residents.
Adjacent residents should be treated with respect and sensitivity.

Miscellaneous issues not addressed and the rationale for not addressing them:

Consider implications of serious economic decline on the vegetation management program: This was not analyzed because it would not vary by alternative, and therefore an analysis would not provide meaningful information to the decision maker.

Social opportunity costs, such as costs that would result from not employing people under some alternatives, could not be specifically identified for analysis.

Analyze hidden costs: Costs which were one-time fixed costs rather than direct costs of the annual program were not included because they were outside the scope of the economic analysis, which was limited to an annual program.

BLM should monitor local health conditions, allergy cases and effects of spray on mother's milk: BLM does not have the organization or the expertise to monitor such conditions, and the issue is outside the scope of the EIS.

Discuss status of pesticide registration, the registration process, reregistration and conditional registration: Discussion of EPA registration is outside the scope of an EIS.

Appendix B
Analysis of Program Costs

Program costs were analyzed to provide a monetary basis for comparing the alternatives. During calendar year 1982, in response to a report by the U.S. General Accounting Office (U.S. GAO 1981), each western Oregon BLM district recorded detailed project cost data on all vegetation management activities. The completed project cost data sheets were the primary sources of current BLM costs used in this EIS. They included direct contract costs and indirect costs of project layout, contract preparation, contract administration, public notification, water sampling and analysis of water samples. Costs associated with EIS preparation, litigation, accidents and training were not included.

The ranges of actual treatment costs per acre are summarized below. The ranges primarily reflect differences in costs between districts due to differences in terrain, chemicals, application rates, unit size, types of vegetation treated and other local factors. For example, average scarification costs vary from $116 in Roseburg District to $235 in Salem District.

Each district applied the appropriate costs to their treatment acres to determine total program costs. For the budget analysis, districts budgeted whatever was necessary to carry out their proposed programs.

Extra costs would be incurred under some alternatives due to the use of less effective practices such as manual cutting. These costs are reflected in terms of increased acres treated and are thus included in the total program costs.

Individual Treatment Costs Per Acre for Western Oregon BLM Districts

Site Preparation		Maintenance and Release	
Treatment	**Costs Per Acre($)**	**Treatment**	**Costs Per Acre($)**
Mechanical		Manual	
Scarification/Piling	116-235	Slashing	100-135
Gross Yarding	300-600	Mulching	220
		Pulling	46-105
Manual		Chemical	
Slashing	96-180	Aerial	40-95
Spot Clearing/Scalping/ Hand Piling	50-250	Ground	45-160
		PCT	77-80
Chemical		Biological	
Aerial	40-130	Seeding	25-150
Ground	36-165	Animals	10
Prescribed Burning	150-363	Roadside Maint.	
		Mechanical	114-155
		Manual	109-181
		Chemical	71-110

Appendix C
Assumptions and Guidelines Used to Estimate the Annual Vegetation Management Program Levels and Associated Allowable Harvests

The annual treatment acreages proposed under this program (See Table 1-2) were estimated separately by each western Oregon district utilizing the professional knowledge and experience of those most familiar with the vegetation management program. Each district also estimated the number of acres that could not be reforested within 5 years of harvest or that would only meet minimum stocking standards if certain treatments were not available for use. These estimates were used to determine allowable harvests under each alternative. The following guidelines were used in developing the estimates.

General

1. Assume unlimited funding. The dollars needed to carry out the program would be available under each alternative.

2. The levels of stocking and allowable harvest described in each district timber management EIS preferred alternative or decision documents would be the goal under each alternative in the vegetation management EIS.

3. Planting sites would be prepared, using the treatments available under specific alternatives, to as nearly the same degree as possible.

4. Treatments used should be effective and reasonable. They must be proven by research or field experience or must show promise of effectiveness based on current research efforts. Availability of manpower and equipment to carry out the program should be considered in determining whether a treatment is reasonable.

5. Treatments must achieve the Bureau's target or minimum stocking level within 5 years of harvest, or the allowable harvest must be adjusted to reflect the reduced land base.

6. When the number of retreatments required for effectiveness is unknown, each district should limit the number to the same number of herbicide treatments it has had to apply on difficult areas (i.e., 2 or 3 treatments).

7. The existing program is generally based on an annual average for the 1979-1982 period.

Specific Guidelines by Alternative.

1. Alternative 1 (Proposed Action):
The starting point for the vegetation management program would be based upon levels identified in the district timber management EIS preferred alternatives or in decision documents. These levels could be increased if district data supported change.

2. Alternative 2 (Emphasis on use of Herbicide):
Manual, mechanical and biological treatments would be reduced where herbicides would meet program objectives. Chemical PCT would be used where desired.

3. Alternative 3 (No Burn): An increase would be expected in one or more of the following treatments: gross yarding, hand piling, cutting holes in slash, herbicide application, scarification, machine piling, planting larger stock and protecting seedlings.

4. Alternative 4 (Labor-Intensive): Replace mechanical and aerial methods with manual methods (slashing, scalping, piling, spraying, etc.) where they would be effective. Don't strive to maximize labor if treatments would not be effective. Where there is more than one manual treatment that would work, use the least costly treatment.

5. Alternative 5 (Restricted Aerial): Treatments other than aerial spraying would be allowed within the one-quarter-mile corridor.

6. Alternative 6 (No Aerial): Increases would be expected in ground spraying, other manual treatments, mechanical treatments or biological treatments.

7. Alternative 7 (No Herbicide): Increases would be expected in manual, mechanical and biological treatments.

8. Alternative 8 (No action): Only use those site preparation practices necessary to provide access for planting and to prepare planting sites (i.e., prescribed burning, gross yarding, slashing).

Appendix D
Excerpts from Field Guide to Policies and Procedures Required for Vegetation Management using Integrated Past Management Practices in Western Oregon (USDI, BLM 198la)

Pre-Treatment Surveys

Documentation of the following information is required as a minimum when conducting pre-treatment vegetation management field surveys:

1. Management program/objective for the site.

2. Consideration of all feasible vegetation management alternatives including techniques to prevent vegetation management problems.

   a. Identification of environmental effects of each alternative - fish, wildlife, soil, water, air, threatened/endangered plants and animals.

   b. Human safety associated with each method.

   c. Effectiveness of each method (retreatment needs).

   d. Cost of each method (Ref. Inst. Memo 81-595).

   e. Specificity of each method—hazard to nontarget species.

   f. Map of survey unit(s).

3. Recommended treatment method(s) (combinations).

4. If chemical pesticides are recommended, the following additional information is required.

   a. Herbicide, application rate, carrier.

   b. Posting requirements found on the label.

   c. Positive placement techniques planned to minimize drift and effects on nontarget areas.

   d. Method of application.

   e. Special restrictions on the herbicide label with regard to handling, buffer strips, grazing, planting, wind speed, droplet size, etc.

   f. Monitoring needs (water).

Project Design Features

Buffer Strips

The following are minimum widths (measured horizontally) for protective buffer strips for all herbicides applied adjacent to Class I open waters, lakes or ponds. Wider buffers should be used if required on the labeling of the herbicide planned for use.

Method	Buffer Strip
Aerial Spraying	100 feet
Vehicle Spraying	25 feet
Hand Application	10 feet

Aerial applications require that a 100-foot unsprayed buffer strip will be left adjacent to inhabited dwellings unless waived, in writing, by the resident. A buffer strip of at least 100 feet will be left adjacent to land used for pasture, crop land, dwellings or barns.

Posting of Spray Areas

Install temporary project area signs at points of common public access that identify the herbicide used, date applied and purpose and telephone number of the local BLM office. These signs shall be in English and Spanish. Certain restricted use pesticides may require posting additional information described on the label as a condition of use.

Posting of areas treated with nonrestricted pesticides is not required where the local manager judges there is no likelihood of public exposure.

Application Contract Requirements

Most of the herbicides used in western Oregon are applied through contracts awarded to the lowest bidder. The contractor normally supplies and applies the herbicides.

1. Contracts for application will require that the water intake system for mixing shall be arranged so that an air gap or reservoir will be placed between the live water intake and the mixing tank to prevent any backflow of chemical into the water source.

2. Contracts for application will require that contractors will not wash out any spray tanks in or near any streams or dispose of any chemical

containers on the contract area. Chemical containers should be disposed of at Department of Environmental Quality approved sites.

3. During aerial spraying, spray will be turned off at the end of spray runs and during the time when a turn is being made to start another spray run. Initial spray swaths along buffer strips or areas to be protected will be made parallel to these areas and before spraying commences on the rest of the project.

4. Mixing and loading operations will take place in an area where an accidental spill will not flow into a stream or body of water.

5. Applications to asphalt or other types of paved roads will be avoided.

6. Aerial application equipment will be equipped with no drip nozzles that use a vacuum or siphon automatic shut off system that will draw the chemical back from the boom when not spraying. Spray nozzles on the boom will not be extended horizontally on the boom to more than 6/7 of the length of the helicopter rotor.

7. In aerial applications, the contractor shall provide at least one qualified individual for each mixing truck to handle fueling, mixing spray solutions and loading. This person shall be equipped and trained to take remedial action in the event of equipment malfunction or spills of herbicide or herbicide carrier mixes.

8. To minimize drift and volatilization, aerial spraying operations will usually be prohibited when any of the following conditions exist on the spray area: wind velocity exceeds 5 miles per hour; temperature exceeds 70° F; snow or ice covers vegetation; raining or rain expected that will reduce the effectiveness of the chemical being applied; foggy weather; relative humidity is less than 50 percent and temperature exceeds 70° F. (applies to water-based sprays only; air turbulence (thermal up drafts, etc.) is so great as to seriously affect the normal spray pattern; temperature inversions are present which could lead to off-site movement of the spray.

Label directions will be followed in lieu of the above if they prescribe different conditions of use. Low volatile formulations of phenoxy herbicides will be used to reduce the potential for off-site contamination.

9. Hourly measurements of weather conditions will be made by trained personnel at spray sites during application. Additional measurements will be made anytime it appears that a weather change may be taking place that could jeopardize safe placement of the spray on the target area.

10. Helicopters will normally be required to fly at an air speed of 40 to 50 mph at a safe distance above the vegetation. Spray pressure in the boom will normally be 20 to 35 pounds per square inch. Maximum drift reduction with normal spray formulations and application equipment will be used.

Specific herbicide labels may specify boom pressures, air speeds, aircraft heights and nozzle configurations that are considered desirable to reduce drift and increase effectiveness. In the event of a conflict, the label specifications will be followed in lieu of the aforementioned requirements.

11. During air operations a radio network will be maintained which links all parts of the project. Direct radio communications between spray aircraft and ground crews will be established.

12. Pre-spray reconnaissance flights will be made to orient pilots to project area boundaries and any sensitive areas such as agricultural lands, important streams, residences, and fish hatcheries that are near spray target areas.

13. On herbicide application projects conducted directly by Bureau personnel, a licensed (certified) employee will monitor and supervise the project. Contractors will be licensed according to State and Federal law. Compliance with contract requirements will be enforced by a BLM project inspector.

14. Buffer strips (or no spray areas) may be designated by the Contracting Officer's Authorized Representative (COAR) or the project inspector during operations as a means to protect heretofore undetected threatened/endangered plants, critical riparian zones and other sensitive areas.

Monitoring

A water monitoring program will be carried out by each district as part of the proposed action. The purpose is to determine the effectiveness of buffer strips, and administrative controls in minimizing impacts on water quality and the aquatic environment.

Deep well water monitoring will be done upon request if there is a reasonable expectation that there is potential for contamination from BLM spray operations. Expertise from EPA, Oregon Universities, and the State Department of Agriculture will be consulted if a monitoring request is received to ascertain whether such requests have any validity.

Each District will evaluate its monitoring needs. At the time the annual spray program is developed, the District should determine the location of Class I streams and those areas which might require special attention such as domestic water supplies and fish hatcheries.

This information will be used in establishing priority sampling areas. When reviewing the locations of planned herbicide treatments, the District person(s) responsible for water quality monitoring will select sample sites for water quality samples.

Monitoring schedules will be designed to sample during periods when any contamination will be most detectable. Contingency plans should be developed to permit sampling during any phase of the treatment program should a situation arise when quick reaction is needed. Control samples will be taken prior to treatment. Ideally, this should be within 24 hours of the treatment period. The sample should be taken from the same site as the other monitoring samples.

Selection of Monitoring Streams and Stations

Any stream may be considered for water quality sampling. However, it is neither possible nor necessary to sample all waters. To aid in selecting streams for monitoring, a priority system has been developed. Highest priority will be given to those streams with important fisheries, extensive human use, or where the potential exists for major environmental impacts. The following is a list of priorities for which monitoring is required:

1. Municipal Watershed

Sampling will be done on streams contributing a major portion of a municipal water supply if: a) the spray project is adjacent to a stream; and b) the diversion point for the municipal water supply is not more than 10 miles downstream from the treatment area. Sample sites will be established just below the treatment area and just above the municipal water diversion point.

2. Fish Hatchery Supply Watershed
Sampling will be done on streams providing water for fish hatcheries if the fish hatchery is less than 10 miles downstream from the treatment area. Sample sites will be established just below the treatment area and just above the hatchery diversion point.

3. Domestic and Agricultural Watershed
Agricultural uses include irrigation and livestock uses. Streams for domestic and agricultural water supplies will be sampled if the diversion point is one mile or less downstream from the treatment area. One sample site will be established below the boundary of the treatment area.

4. Major Fish-bearing Stream
Major fish-bearing streams are those identified by District Biologists as Class I streams. Sampling will be done on all Class I streams at sites located downstream from the treatment area.

5. Unique Situations
In addition to the above situations where monitoring is required, monitoring should also be considered on an individual basis in a number of other situations:

a. The stream is not classified as a Class I stream but contains an important population of resident fish.

b. The stream flows into a marsh or lake which is located within five miles downstream from the treatment area. Herbicide dissipates gradually in flowing water but will accumulate in quiet areas such as lakes or marshes. In the lakes or marshes, the herbicide can affect rooted or planktonic flora.

c. Thirty percent or more of a watershed is being treated in one year. This is especially important during the winter and spring months when many of the smaller ephemeral and intermittent streams are flowing. Any herbicide entering a smaller stream will be quickly diluted when the smaller stream merges with other streams. If several areas in a watershed are treated, the dilution effect may be lost. In watersheds with extensive herbicide treatment, where the dilution effect may be reduced, sampling should be considered, at least on

the larger streams downstream from the treatment area.

d. The watershed is considered to be socially sensitive. Public interest is often much greater in some areas than others. Those areas for which the public has expressed the most interest should be considered for water quality monitoring.

Appendix E
Excerpts from *Oregon Forest Practice Rules and Statute* (OSDF 1985)

General Rules

629-24-101 Definitions. As used in these rules, unless otherwise required by context:

(2)(a) "Class I waters" means any portions of streams, lakes, estuaries, significant wetlands, or other waters of the state which are significant for:

A. Domestic use, including drinking, culinary and other household human use;

B. Angling;

C. Water dependent recreation; or

D. Spawning, rearing or migration of anadromous or game fish.

(b) The following are included within the meaning of "Class I waters":

A. The water itself, including any vegetation, aquatic life, or habitats therein; or

B. Beds and banks below the normal high water level which may contain water, whether or not water is actually present.

(3) "Class II special protection waters" (Class IISP waters) means any Class II waters which have a significant summertime cooling influence on downstream Class I waters which are at or near a temperature at which production of anadromous or game fish is limited.

(4)(a) "Class II waters" means any waters of the state, not classified as Class I waters, which have a definite channel or bed.

(b) The following are included within the meaning of "Class II waters":

A. The water itself, including any vegetation therein; or

B. Beds and banks below the normal high water level, whether or not water is actually present.

(c) "Class II waters" do not include unchanneled overland flow, roadside ditches, puddles, or other surface waters which have no surface outlet.

(8) "Buffer strip" means a protective area adjacent to an area requiring special attention or protection.

(30) "Riparian area" means the ground area along a Class I water where the vegetation and microclimate are influenced by perennial or intermittent water, associated high water tables, and soils which exhibit some wetness characteristics.

(31) "Riparian area of influence" means the transition area, within the riparian management area, between the riparian area and upland vegetation. It forms the outer edge of the riparian management area. The "riparian area of influence" contains trees which may provide shade or contribute fine or large woody material or terrestrial insects to a stream. It also may contain trees that provide habitat for wildlife associated with the riparian management area. The area may be identified by such characteristics as change in plant composition and relative plant abundance.

(32) "Riparian management area" is determined under OAR 629-24-117 and means an area along each side of a Class I water in which special management practices are required for the protection of water quality, aquatic habitat, and wildlife habitat. It includes the riparian area and the riparian area of influence.

Application of Chemicals

629-24-203 Protection of Waterways, Areas of Open Water, and Dwellings when Spraying. The operator shall protect waterways and areas of open water such as swamps or impoundments from contamination when spraying chemicals by aircraft by leaving an unsprayed strip of at least one swath width untreated on each side of every Class I water or area of open water. When applying chemicals, the operator shall leave a 100-foot unsprayed strip around inhabited dwellings unless written permission is received from the resident. When applying chemical spray from the ground, the operator shall leave unsprayed a strip of at least ten (10) feet on each side of every waterway or area of open water. Chemical spray application in or adjacent to the riparian area of influence shall be made parallel to waterways, and must be made prior to application to the remainder of the area to be treated. No untreated strip is required to be left by the operator when applying fertilizers, except

that precautions shall be taken to avoid direct application of fertilizers to Class I waters or areas of open water.

Appendix F
Environmental Fates of Herbicides Proposed for Use

The information contained in Appendix F of the draft EIS has been incorporated into the body of this document, primarily in the Impacts to Water Resources section (Chapter 3). Accordingly, Appendix F has been deleted from this document.

Appendix G
Relationship of Areawide Clearinghouses to BLM Districts

BLM District	Areawide Clearinghouses	County
Salem:	Clatsop-Tillamook Intergovernmental Council	Clatsop Tillamook
	Metropolitan Service District	Clackamas Multnomah Washington
	Mid-Willamette Valley Council of Governments	Marion Polk Yamhill
	District 4 Council of Governments	Benton Lincoln Linn
	Lane Council of Governments	Lane
Eugene:	District 4 Council of Governments	Linn
	Lane Council of Governments	Lane
	Umpqua Regional Council of Governments	Douglas
Roseburg:	Lane Council of Governments	Lane
	Umpqua Regional Council of Governments	Douglas
Coos Bay:	Umpqua Regional Council of Governments	Douglas
	Coos-Curry Council of Governments	Coos Curry
Medford:	Umpqua Regional Council of Governments	Douglas
	Coos-Curry Council of Governments	Coos Curry
	Rogue Valley Council of Governments	Jackson Josephine
	Klamath Lake Planning and Coordinating Council	Klamath

Appendix H Descriptions of Major Soil Orders of Western Oregon

Xeric Soils of Moderate Rainfall Western Oregon Region

Mollisols, Alfisols, Vertisols and Ultisols of Valley

Soils of the Willamette Valley floodplain and terraces are dominantly deep, silty, moderately dark and somewhat acid. Poorly drained soils are common. Soils of the southwestern valleys are generally less silty, more variable in depth and lighter-colored, although dark clay Vertisols are common. Reddish, strongly leached Ultisols occur on older terraces and footslopes.

Alfisols, Ultisols, Inceptisols, Mollisols and Vertisols of Foothills and Mountains

These uplands have a pronounced dry period. The soils are highly variable but mostly dark at the surface, clayey and moderately acid in the north, becoming lighter-colored, less acid and less clayey in the south.

Udic Soils of High Rainfall Western Oregon Regions

Spodosols, Inceptisols and Entisols of Valleys and Coastal Lowlands

These soils are strongly acid, mainly dark and deep. Poorly drained, clayey soils are common in the stream valleys and estuaries. Gravelly soils predominate in western Cascade valleys. Sandy Spodosols, commonly with iron-cemented subsoils, occur on lower coastal terraces; Entisols on younger dunes.

Inceptisols and Ultisols of the Coast Range and Western Cascade Mountains

These areas are steep and heavily forested. The soils are mostly dark, loamy or clayey. Shallow, stony soils are common with deeper, reddish, clayey Ultisols on smoother, more stable slopes.

Inceptisols, Alfisols and Ultisols of the Western Klamath Mountains

These soils are dominantly light-colored, medium to slightly acid, loamy, and commonly stony and shallow. Granitic areas have sandy soils, and serpentine areas have mostly shallow, reddish, clayey soils.

Inceptisols, Spodosols and Entisols of High Mountains

Soils of the forested higher elevations are mostly dark, moderately to strongly acid, shallow and stony. Light-colored, coarse-textured Entisols and Spodosols occur on glacial deposits.

Xeric Soils of Moderate Rainfall Eastern Oregon Forested Regions

Mollisols and Inceptisols of the Mountains

Soils of the mountainous lava plateaus are mostly dark, moderately to slightly acid, loamy, moderately deep or shallow and stony. Tuffaceous bedrock areas have clayey soils. Light-colored, silty Inceptisols from volcanic ash occur on broad plateaus and northerly slopes.

Source: Loy et al. 1976

Appendix I
BLM-Administered Lands in Municipal Watersheds

Water District	Water Supply Source	BLM Acres In Watershed
Albany	South Santiam River	34,304
Alsea	North Fork Alsea River	17,984
Canby	Molalla River	40,320
Canyonville	O'Shea Creek	2,309
Canyonville	West Fork Canyon Creek	5,840
Carlton	Panther	1,000
Cave Junction	Illinois River	21,713
Central Point	Rogue River	160,211[1]
Cherry Grove	Tualatin River	1,198
Cherry Grove	Trask River	571
Clackamas	Clackamas River	14,080
Colton	Jackson Creek	530
Corbett	Gordon Creek	2,720
Corvallis	Chintimini Creek	40
Dallas	Rickreall Creek	2,816
Drain	Bear Creek	640
Drain	Allen Creek	280
Eagle Point	Rogue River	160,211[1]
Estacada	Clackamas River	5,312
Eugene/Springfield	McKenzie River	14,760
Falls City	Teal Creek	480
Forest Grove	Tualatin River	1,198
Forest Grove	Trask River	571
Gates	North Santiam River	2,752
Glendale	Section Creek	280
Gleneden Beach	Drift Creek	2,048
Gold Hill	Rogue River	188,852
Grants Pass	Rogue River	279,911
Hillsboro	Tualatin River	1,198
Hillsboro	Trask River	571
Jacksonville	Rogue River	160,211[1]
Kernville	Drift Creek	2,048
Lake Oswego	Tualatin River	1,198
Lake Oswego	Trask River	571
Laurelwood	Tualatin River	1,198
Laurelwood	Trask River	571
Leaburg	Middle Fork Willamette River	600[2]
Lebanon	South Santiam River	34,304
Lincoln Beach	Drift Creek	2,048
Lyons	North Santiam River	18,944
McMinnville	Nestucca River	920
McMinnville	Haskins Creek	not calculated
Medford	Rogue River	160,211[1]
Mill City	North Santiam River	3,592
Milwaukie	Clackamas River	14,080
Molalla	Molalla River	36,570
Monmouth	Teal Creek	480
Myrtle Creek	North Myrtle or Bilger Creek	190

Water District	Water Supply Source	BLM Acres In Watershed
Northwood Acres	Unnamed Creek	10
Oregon City	Clackamas River	14,080
Panther Creek	Panther Creek	40
Philomath	Chintimini Creek	40
Phoenix	Rogue River	160,211
Portland	Bull Run River	70
Riddle	Russell Creek	1,999
Salem	North Santiam River	18,944
Sandy	Alder Creek	480
Scappoose	Gourley Creek	600
Scappoose	Lazy Creek	384
Scappoose	South Scappoose Creek	1,632
Seal Rock	Tangeman Creek	10
Seal Rock	Siletz River	17,004
Sheridan	East Fork Willamina Creek	50
Siletz	Tangeman Creek	10
Siletz	Siletz River	17,004
Silverton	Abiqua Creek	1,792
Silverton	Silver Creek	200
Stayton	North Santiam River	18,944
Sweet Home	South Santiam River	29,584
Talent	Wagner Creek	2,800
Toledo	Tangeman Creek	10
Toledo	Siletz River	17,004
Valsetz	Fanno - Handy Creeks	240
Waldport	West - Eckman Creeks	80
Willamina	Willamina Creek	16,192
Yamhill	Turner Creek	56

[1]Supplemental source used in the summer.

[2]Development of this water supply is planned for the near future.

Appendix J
Herbicide Analyses of Streamflow Samples

The following table presents the only available water quality data on background levels of herbicides in western Oregon streams. The data was obtained from the U.S. Geological Survey's computer file for water data storage and retrieval (WATSTORE). It represents herbicide concentrations in streamflow samples collected randomly in time, not in conjunction with specific activities in the watersheds.

	Total 2,4-D (micrograms/1)[1]	Total 2,4,5-T[2] (micrograms/1)
Station No. 14191000 - Willamette River at Salem, Oregon		
Mar 22, 72	ND[3]	ND
Jan 17, 73	ND	ND
Mar 1, 73	ND	.01
Jun 26, 73	.02	.01
Sep 19, 73	ND	ND
Station No. 14207500 - Tualatin River at West Linn, Oregon		
May 27, 76	ND	ND
Aug 20, 76	ND	ND
Nov 23, 76	ND	ND
Feb 16, 77	ND	ND
Jun 1, 77	ND	ND
Sep 6, 77	ND	ND
Dec 2, 77	ND	ND
Feb 17, 78	ND	ND
May 16, 78	ND	ND
Nov 8, 78	ND	ND
Station No. 14301000 - Nehalem River near Foss, Oregon		
May 26, 76	ND	ND
Aug 19, 76	ND	ND
Nov 22, 76	ND	ND
Feb 24, 77	ND	ND
Jun 2, 77	ND	ND
Sep 9, 77	ND	ND
Dec 1, 77	ND	ND
Feb 16, 78	ND	ND
May 15, 78	ND	ND
Aug 2, 78	ND	ND
Nov 7, 79	ND	ND
Station No. 14372300 - Rogue River near Agness, Oregon		
May 20, 76	ND	ND
Aug 18, 76	ND	ND
Nov 17, 76	ND	ND
Feb 24, 77	ND	ND
May 17, 77	ND	ND
Aug 24, 77	ND	ND
Nov 29, 77	ND	ND
May 17, 78	ND	ND
Aug 16, 78	ND	ND
Nov 14, 79	ND	ND
Station No. 14312260 - South Umpqua River near Roseburg, Oregon		
Oct 7, 69	ND	ND
Aug 6, 70	ND	.02
Oct 6, 70	ND	ND
Apr 27, 71	ND	ND
Jun 22, 71	ND	ND
Nov 23, 71	ND	ND
Feb 23, 72	ND	ND
Jun 29, 72	ND	ND
Aug 29, 72	ND	ND
Sep 21, 72	ND	.01
Oct 18, 72	ND	ND
Dec 29, 72	ND	ND
Feb 22, 73	ND	ND
Apr 19, 73	ND	ND
Jun 29, 73	ND	ND
Aug 30, 73	.02	.01
Nov 12, 73	ND	ND
Jan 9, 74	ND	ND
Feb 19, 74	ND	ND
Apr 17, 74	ND	ND
Jun 25, 74	ND	ND
Sep 5, 74	ND	ND
Oct 23, 74	ND	ND
Jan 29, 75	ND	ND
Jul 22, 75	ND	ND
Oct 22, 75	ND	ND
Jan 22, 76	ND	ND
Apr 16, 76	ND	ND
Jul 22, 76	.01	ND
Oct 20, 76	ND	ND
Jan 6, 77	ND	.09
Apr 20, 77	ND	ND
Jul 26, 77	.05	.04
Oct 27, 77	ND	.03
Jan 25, 78	ND	ND
Apr 20, 78	ND	.01
Aug 14, 78	.04	ND
Oct 23, 78	ND	ND
Jan 23, 79	ND	ND
Apr 23, 79	.02	.01
Aug 30, 79	.05	.01
Jan 15, 80	ND	ND
Apr 14, 80	ND	ND
Aug 12, 80	ND	ND
Oct 14, 80	ND	.01
Feb 3, 81	.02	ND
Apr 20, 81	ND	ND
Oct 6, 81	.03	.02
Feb 4, 82	ND	ND

[1]A microgram is one millionth of a gram.
[2]2,4,5-T is not being evaluated under this EIS. 2,4-D and 2,4,5-T sampling data are presented here because data on other herbicides are not available.
[3]ND signifies specifically looked for but not detected.

Appendix K
Toxicity of Dioxins in Herbicides Proposed for Use

The information contained in this appendix which occurred in the draft EIS was thoroughly discussed in Appendix L, beginning on Page 3-48; therefore, Appendix K has been deleted from this document.

Appendix L

NOTE TO READER

Appendix L, Human Health Risk Assessment, was prepared under contract for use in both the Bureau of Land Management and U.S. Forest Service Vegetation Management EISs for Oregon. The Forest Service equivalent is identified as Appendix D in that document. Because most readers have access to both EISs, Appendix L will not be printed and distributed as a separate BLM volume. This approach will substantially reduce expenses for typesetting, printing and postage. Those who do not have the Forest Service EIS and want a copy of BLM Appendix L (USFS Appendix D) may obtain a copy through Oregon BLM offices in Portland, Salem, Tillamook, Eugene, Roseburg, Medford, Klamath Falls and Coos Bay.

Appendix M
Toxicity Research Costs

The information included in Appendix M of the draft EIS is provided in greater detail in Appendix L of this document and, therefore, Appendix M has been deleted.

Appendix N Prescribed Burning Background Information

Due to the complexity of the background information used to assess impacts on air quality, Appendix N includes extracts, summaries and explanations of methodology for reference purposes.

Baseline Period: The method of assessing impacts on air quality involves a comparison of current and projected emissions with those of a baseline period. After discussions with Oregon Department of Environmental Quality (John Core), it was agreed that a 1976-1979 baseline period would be acceptable for the analysis.

Methodology for Determining Baseline Acres Burned: During the baseline period, there was no reporting system or record-keeping system that consistently kept track of acres being burned according to ownership. Therefore, the Oregon Smoke Management Annual Reports for 1976-1985 were used. Since the annual reports did not begin reporting acres burned by owner until 1981, the 1981-85 five-year average of 13% was projected backward against the total acres burned each year during the baseline period to estimate acres burned by BLM each of those years (see Table N-1).

Biomass Consumption: To provide a reasonable analysis of emissions, it was necessary to have some reasonable and widely accepted estimates of biomass consumption. BLM and ODEQ have agreed that Sandberg's et al., 1985 (Tables 8, 10, 12 & 13) estimates are the best available at this time. An analysis using an average 2-inch duff depth was determined to provide a reasonable average for BLM lands in western Oregon. Biomass consumption data in Tables N2 and N3 are extracted from Sandberg et al. 1985 (Tables 8, 10, 12 & 13) and were used for calculations of emissions in Table 3-1. Since the Tables were based on 4-inch duff depth, the average consumption of duff was reduced by 50% (Sandberg, personal communication June 1986). Sandberg's mid-range consumption figures were used for Table 3-1 calculations. Emission factors used in the calculations were from Ward et al. (1988).

Adjustment for Baseline Burning Acres Based on Accomplishment: Evaluation of prescribed burning accomplishments for the years 1983-85 reveal a decreasing percentage of acres burned compared to the number of acres planned for burning (1983-88%, 1984-72%, 1985-68%, Average 74%). Since the differences may be annual variations and not necessarily a trend, the average accomplishment of 74% was used in Table 3-1 to project emissions.

Table N-1 Number of Acres Burned

Year	State Acres	%	BLM Acres	%	Private Acres	%	USFS Acres	%	Total Acres
1976	—		14769		—		—		113608
1977	—		12788		—		—		98367
1978	—		14835		—		—		114113
1979	—		13459		—		—		103531
1980	—		16678		—		—		128295
1981	4142	4%	12948	12%	34768	33%	52535	50%	104393
1982	2709	3%	12069	14%	38005	43%	35405	40%	88188
1983	5760	6%	10177	11%	41614	43%	38730	40%	96281
1984	5099	5%	10906	11%	44318	45%	38691	39%	99014
1985	6055	6%	16117	15%	42683	39%	43814	40%	108669
81-85 Total	23765		62217		201388		209175		496545
5 Yr. Ave.	4753	5%	12443	13%	40278	41%	41835	42%	99309

1976-79 Baseline Acres 13963

NOTE: BLM acres burned from 1976-80 were estimated by applying the 13% BLM proportion of total acres on a 5-yr. average to the known statewide totals for 1976-80

Source: Communication with Mike Ziolko (OSDF) for 1985

Table N-2 Biomass consumption estimates (Oregon)

Fuel Category	Calculated baseline (1976-79) Average Consumption High	Mid	Low	Fuel Category	Calculated (1984) Average Consumption High	Mid	Low
	(tons per acre)				(tons per acre)		
Duff	32.3	29.3	26.4	Duff	30.0	21.3	15.0
Woody 3"	12.3	12.3	12.3	Woody 3"	13.2	9.5	6.7
Woody 3"	16.3	16.0	15.7	Woody 3"	14.5	11.0	8.2
Rotten	2.7	2.7	2.6	Rotten	2.5	2.2	1.9
TOTAL	63.6	60.2	56.9	TOTAL	60.2	44.0	31.8

Source: Sandberg et al 1985

Table N-3 Prescribed Burn Emission Inventory (Oregon)

1976-1979 Average

State Burn Type	Biomass Consumed (tons)	(tons/acres)	Emission Factors TSP	PM10	PM2.5	CO	Emissions* TSP	PM10	PM2.5	CO
			(pounds/ton)				(tons/year)			
Oregon										
Broadcast	3,011,365	60.2	34	26	24	273	51,193	39,148	36,136	411,118
Piled	3,060,027	60.2	12	8	8	231	18,360	12,240	12,240	353,852
TOTAL	6,071,391	60.2	22.9	16.9	15.9	252	69,553	51,388	51,388	764,970

State Burn Type	Biomass Consumed (tons)	(tons/acres)	Emission Factors TSP	PM10	PM2.5	CO	Emissions* TSP	PM10	PM2.5	CO
			(pounds/ton)				(tons/year)			
Oregon										
Broadcast	3,052,756	44.0	34	26	24	268	51,897	39,686	36,633	408,880
Piled	1,246,355	44.0	12	8	8	230	7,478	4,985	4,985	143,144
TOTAL	4,299,111	44.0	27.6	20.8	19.4	257	59,375	44,671	41,618	552,024

Source: Sandberg et al 1985

* Totals may vary slightly due to rounding.

Appendix O
An Estimate of Carcinogenic Risk Associated with Polyaromatic Hydrocarbons in Smoke from Prescribed Burning in Forestry

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Introduction

The most important component of an assessment of smoke-derived risk is determination of exposure. Without dependable estimates or measurements of the amounts of combustion products reaching individuals, speculation about effects is pointless. However, some combustion products have minimal biological impact and it should be obvious that there is no point in measuring substances that make no contribution to hazard. It is necessary, therefore, to determine which classes of components must be considered according to either direct evidence of genetic or other activity, or similarity to structures that have known activity. Because many polyaromatic hydrocarbons are known to be carcinogenic, there is public concern about the contribution of prescribed burning to the environmental carcinogenic load. This report on a limited number of the PAH found in smoke is the first step in assessment of the potential environmental health risks associated with smoke from burning of forest residues.

At present, assessment of the risks that might be associated with emissions from slash burning can be only best estimates. Three general factors contribute to this imprecision. Because combustion is ubiquitous in nature and human activity, it is difficult to consider any particular burning activity in isolation. In the case of slash burning, however, there are some characteristics in space and time that make it possible to consider the effects of prescribed burning alone. The nature of combustion chemistry also presents formidable obstacles. Almost any hydrocarbon up to perhaps 30 or more carbons can imaginably be synthesized during the combustion of wood and foliage. There are also large amounts of nitrogen oxides and carbon dioxide, variable amounts of carbon monoxide, some sulfur oxides and possibly small amounts of complex compounds that may be chlorinated by reaction with biological chloride, induced and powered by the energy of the combustion. There is a variety of complex biological compounds already in wood and foliage that may emerge intact or altered according to their volatility and vulnerability to heat. The pattern of products may vary with oxygen availability and temperature, with species of wood, moisture content, fuel loading and presumably other factors. The third problem is that the biological data describing the various toxicological characteristics of smoke components is limited.

In spite of all these difficulties, there appear to be ways to estimate the impact of at least certain components of smoke on health.

The products of combustion can be categorized into several discrete groups, within which the members can be expected to have reasonably similar biological effects. There will be a great number of low molecular weight hydrocarbons, most of which are produced in small amounts and are relatively innocuous in the context of open combustion. Carbon monoxide from forest burning is unlikely to qualify as a disseminated environmental hazard, but may well be plentiful enough to affect firefighters or other workers at the fire site. Nitrogen oxides similarly have environmental effects, but may not represent a primary health hazard in the direct sense. Eventually attention should be paid to the contribution of slash-derived nitrogen oxides to the pattern of photochemical reactions with other molecules in the atmosphere.

The present analysis is intended to concentrate on the polyaromatic hydrocarbons (PAH) to provide some idea of the extent of risk, primarily cancer risk, that might be expected from movement of these combustion products into populated areas. Unfortunately, while a large number of PAH have been *identified* as combustion products, only a few have been *measured* in fires, in a limited spectrum of burning conditions. Enough data are available, however, that reasonable estimates of the amounts of PAH in a smoke plume may be made.

The PAH have been recognized for decades as potential health hazards. Many have been shown to have carcinogenic potential, some have been found to have no carcinogenic or mutagenic activity, and for many others the data is not sufficient to make a judgment. The most common sources of PAH are industrial and power generation burning, internal combustion exhaust, and tobacco smoking, if one considers the personal environment. These primary sources have resulted in finding the chemicals in food, water, organisms at various trophic levels, soil

and so on. Formation of PAH from wood combustion was known long ago but became a public concern only in recent times when the contribution of residential wood combustion and forest and agricultural burning to the total PAH burden became recognized.

Cancer is the most important of the irreversible diseases that we must be concerned about, and to judge the carcinogenic impact of the mix of PAH derived from slash burning, we intend to examine the few for which enough data is available on both the amounts produced and their biological effects. Reproduction and other health effects are not being considered at this time. It is expected, however, that reproductive effects at the levels of PAH encountered in even heavy smoke will be found to be highly unlikely, as a general case.

Among the few examples of PAH known to be in wood smoke and which are carcinogenic are benzo(c)phenanthrene, the benzofluoranthenes, 3-methyl-cholanthrene, dimethylbenzanthracene and benzo(a)pyrene. At least benzo(a)pyrene (BaP) is acknowledged as a human carcinogen. It has also been the most extensively studied of the airborne PAH, and because of the great body of data on its distribution in smoke and in the environment generally, as well as massive amounts of biological data, it serves here as a model compound. While it is not the only carcinogen in smoke, it may have the greatest overall potential for such effect. It is true that there are problems in using BaP as the surrogate for all PAH, and this question has been discussed in detail by Haemisegger et al., of EPA (1985). Nonetheless, it provides an approach that I would expect to lead to estimates of risk that are within an order of magnitude of any that will be developed on a more precise basis.

It is not necessary to review the body of research describing the chemical processes that form these substances; for the present purpose it is sufficient to know they are present, and in approximately what amounts. The multitude of works describing the biological behavior of BaP, particularly its genetic and other biological effects also needs not be reviewed in detail here. A general description of their biological interaction is set out in Attachment A.

The EPA Cancer Assessment Group, (CAG) has derived a potency figure for BaP which can be used in estimating human risk from the calculated exposures. In this report the risk has only been estimated in terms of individuals to whom some defined degree and period of exposure can be assigned. An estimate of increased risk on a regional population basis is not yet included, although EPA and others have carried out similar exercises for exposures to PAH in other kinds of areas.

There is a great deal of data available comparing concentrations of BaP and total PAH in various environments. For the present problem, these are of value primarily as comparisons; for example, BaP concentrations in and around wood-burning homes and communities are discussed later. Santodonata et al. (1980) have attempted to estimate the overall human exposure through all media to BaP, carcinogenic PAH and all PAH. The identified carcinogenic PAH noted in that paper did not include all known carcinogens of the class, but suggest that 10-20% of the total production in the group are carcinogenic to some degree. These are typical of studies directed toward regional or national considerations, and have only limited value when examining singular problems like emissions from slash burning. As yet, specific data on slash burning seems scarce, and hypothetical models are relied upon.

Environmental Behavior and Exposure Estimates

It is generally agreed that the PAH are not free in the atmosphere as vapor and that they are incorporated in fine particulates with diameters well within respirable limits. Ryan and McMahon (1976) indicate that 80-90% are of mass median diameter less than 1.0 um. Sandberg et al. (1975) found 69% at less than 0.3 um, and Oregon DEQ estimates that 75% of grass smoke particles are less than 0.5 um. Pierce and Katz (1975) found somewhat larger particles, but still estimated that up to 80% were below 3 um, which is small enough to move into the alveolae of the lung. In other words, we must assume that all of the PAH in the atmosphere may have maximal opportunity for contact and absorption.

There are two other reasons why particle entrainment of PAH is important. First, BaP in the pure form, administered by inhalation to experimental animals without the other carbonaceous matter of the particles appears not to be a particularly potent carcinogen, but when administered with carbon particles the potency rises sharply. (Laskin and Sellakumar, 1974; referenced in Friberg and (Cederlof) 1978). Second, while PAH

in solution photodegrade, the soot particle (which is partly PAH) apparently protects against photochemical degradation, and for the moment it is necessary to assume a long half-time for at least some atmospheric PAH. Field studies of PAH transport have shown such persistence. (Lunde, 1977) It is not yet clear that slash emissions fit that pattern, but an assumption of persistence must be made.

To judge BaP exposure, there must be some reasonably dependable index of atmospheric BaP concentration available to us. Several relationships are possible. If the output of material from a given amount of fuel is known, we have an estimate of the amount of material that has gone into the atmosphere. Presumably an estimate of fuel loading per acre would tell something about the absolute amount of product formed, but the difficulty is that there is no way of measuring the volume of distribution. Does that smoke occupy one cubic mile or twenty? The fuel and character of the fire are influential, and within that volume, the density will vary with altitude, with topography and with air movement. Technically, it is possible to make direct measurements of BaP or other PAH in the atmosphere. To obtain an accurate picture of regional distribution, however, requires great number of samples, a high level of staffing, and experiments with a variety of fire types. The unfavorable economics of such an effort is obvious, but alternative approaches may well be satisfactory.

Because there is some order in the relations between particulate concentration and PAH, between fuel consumed and PAH, and between fuel consumed and particulates produced, it would appear that some combination of those relationships could be used to estimate amounts of PAH in the atmosphere. Of these the most easily observed, either by instruments or by eye, is smoke density which is simply another term for particulate concentration. Smoke measurement is all the more favored because the property of smoke to obstruct or scatter light is reasonably constant. If we can assume that products of combustion follow smoke in a reasonably constant manner, optical observations should therefore be a usable index of the amount of other combustion products present.

A relationship between BaP and particulate matter can be measured directly, as has been done by White (1985), and Ward & Hardy (1984), or indirectly by using data on BaP produced/kg fuel (Table O-1). The latter must be coupled to smoke density by measurements of particulate production per kg fuel. Exposures calculated by both methods will be illustrated below.

In Table O-1, BaP emission factors for several fuels are shown, in some cases providing information on the effects of different modes of burning of the same fuel. It is evident from these and other data that the mode of burning has great influence on the BaP emission characteristics. A fast burn with little smoldering clearly results in less PAH production. As the amount of green vegetation in the fire increases, PAH increases. (Ward and Hardy, 1984) For the purpose of preparing a very simple risk model, we will use a BaP emission factor of 2500 ug/ kg, which is on the high end of the range shown, and a number that EPA apparently finds sufficiently conservative. (Elmore, 1984) This figure leads to a BaP/ particulate ratio that is about an order of magnitude higher than the highest ratio measured directly in the field. Forest managers are aware of factors that diminish emissions from prescribed burning, and more research into this problem is emerging. It is to be expected that outputs of BaP on the high end of the ranges shown in Table O-1 are unlikely.

Particulate emission measurements have ranged from a high of 40ugm/kg fuel to 8.5ugm/kg. (Imhoff, 1983; Dasch, 1982; Sandberg, 1975; Radke, 1978; Lim and Lips, 1981) Most of the ratios fall between 8.5 and 15ugm/kg fuel. If we are to use such numbers to draw a relation between smoke density and BaP concentration in the air in order to estimate human exposure, the lower particulate output per unit fuel implies a higher concentration of BaP in the atmosphere if the BaP output/kg fuel remained the same. In our estimates we will therefore use the low figure of 9.5 gm particulate /

Table 0-1 BaP EMMISSION FACTORS

Fuel & Condition	G BaP/KG Fuel	Reference
Pine	50	Dasch, 1982
Willow	700	Dasch, 1982
Willow	1900	Dasch, 1982
Ash	5	Dasch, 1982
Ash	17	Dasch, 1982
Pine slash, backing fire	238-3454	Ryan & McMahon, 1976
Pine slash, heading	38-97	Ryan & McMahon, 1976
Grass straw	500	Oregon DEQ, undated
Spruce wood, normal 02	50	Ramsdahl, 1982
Spruce wood, 02 starved	620	Ramsdahl, 1982
Charcoal, normal 02	0.3	Ramsdahl, 1982

kg fuel and the relatively high emission factor of 2500 ug BaP/ kg fuel. In other words, 8.5 gm of particulate is assumed to be accompanied by 2500 ug BaP. With this relationship, it is unnecessary to know the amount of fuel consumed; it is now only necessary to know the particulate loading in the atmosphere. The most easily used attribute of smoke is the visibility limit, because smoke has a relatively constant ability to obstruct or scatter light. The visibility truly becomes a limit during some intrusions of smoke from field burning, slash burning or even residential wood heating.

The light extinction for smoke is about 0.5 gm/square meter. A square column one meter on each side containing 0.5 gram of smoke would block all light, whether the column was very long or so short the particulates were spread in a layer. If the column is 100 meters long, or about the distance from goal post to goal post on a football field, the volume would be 100 cubic meters and the concentration of particles would be at a concentration of 0.005 gm or 5 mg/cubic meter. The amount of BaP would correspond to the fraction represented by 2500 ug BaP / 8.5 grams of particulate, which is 0.294 ug / mg. In our example of 5 mg particulate per cubic meter, this concentration would be about 1.5 ug BaP/ 5 mg smoke / cubic meter. If we use a larger particle emission factor, the BaP concentration estimate would be inversely lower.

Table O-2 shows how dosage may be estimated at various smoke densities or various visibility limits, using BaP as an example. Arbitrary respiratory ventilation rates and body weights are used in such calculations; differences in body weight and activity make only modest differences in estimates of low-dose effects.

The ratio 1.5 ug BaP / 5 mg particulate is used as noted above. The daily dose total in Table O-2 assumes 20 cubic meter respiratory ventilation per day, which may be as much as twice the normal daily rate. The dose per day assumes a 70 kg adult with complete trapping of all inhaled PAH by the lung.

The third column showing the concentration of BaP / cubic meter is the information we will use to estimate risk in this case. The EPA CAG has calculated a potency for BaP of 3.3×10^{-3}. This number represents the estimated added risk for continuous exposure to one microgram of BaP per cubic meter of atmosphere continuously over a 70-year lifetime. Assumptions of standard size and respiratory ventilation are used in the CAG calculations. It is customary to calculate cancer risk according to the lifetime dose, which means that the amount of chemical presumed to be taken in is averaged over the lifetime. This is consistent with present understanding of the biology of cancer initiation. If the relationships in Table O-2 are correct, lifetime continuous exposure to BaP only in smoke at 1000 meter visibility limit would carry a risk of $(3.3 \times 10^{-3}) \times$ (0.15 ug BaP per cubic meter/ 1 ug/cubic meter) $= 4.95 \times 10^{-4}$, or about 5 chances in 10,000. (The atmosphere in a typical wood burning home will contain on the order of 0.005 ug BaP / M^3.)

Exposure Relative to Risk

Because we do not at this time have direct data describing typical exposures to slash or grass smoke intrusions, a hypothetical situation will be set up in which there are 20 days of exposure per year for six hours each day, to smoke at two miles visibility. The relations are all linear and proportional; any adjustment of exposure upward or down can therefore be immediately reflected in the calculated exposure and risk. The remaining assumption is that the exposed individual resides ten years at the site, with the above exposure repeated each year.

Table 0-2 THE ESTIMATED RELATION BETWEEN VISIBILITY AND BaP CONCENTRATION AT VARIOUS SMOKE DENSITIES

Visibility	Partic/M^3	BaP/M^3	24 hr Dose	Dose/Kg
100 M (0.06 mi)	5.0 mg	1.5 ug	30.0 ug	0.43 ug
1000 M (0.62 mi)	0.5	0.15	3.0	0.43
1609 M (1 mi)	0.31	0.093	1.86	0.027
3218 M (2 mi)	0.155	0.046	0.93	0.013
8045 M (5 mi)	0.062	0.018	0.372	0.0053

The calculation can be quite simple. Twenty days times six hours times ten years is equivalent to fifty 24-hour exposure days at a concentration of 0.046 ug BaP / M^3. There are 25550 days in 70 years, so the average exposure/ day is 50 / 25550 × 0.046 ug BaP / M^3. (Ambient levels of BaP are usually expressed in nanograms / M3; 0.046 ug is 46 ng, 0.000091 ug is 0.091 ng.)

The risk factor for BaP is 3.3×10^{-3} (0.0033) or an added probability of 3.3 chances in 1000 of contracting cancer under an exposure of 1 ug / M^3 for 70 years. The risk factor, 0.0033, times the averaged concentration of 0.000091 equals 0.0000003 or a probability of 3 in 10,000,000 (3×10^7). If the particulate / fuel ratio doubled, without increasing the BaP / fuel ratio, the risk would be halved. If the BaP / fuel ratio decreased, the risk would decrease accordingly. Any discussion of risk in this context refers to that in addition to the background probability of cancer inherent in the population, which is on the order of 250,000 cases per million lifetimes. An additional risk of one in one million is considered in the regulatory sense to be the practical equivalent of zero. A risk of 3×10^{-7} is considerably less than the calculated additional cancer risk of living at 5000 feet altitude instead of sea level, living in a masonry house instead of wood, or taking a transcontinental air trip.

To illustrate the difference associated with a changed BaP / particulate ratio, the average ratios between BaP and particulate from slash burning have been estimated in laboratory study by White (1985) at 24 ug / gm, and in the field by Ward et al. (1984) at 15 ug / gm. This may be compared with the indirect relationship of approximately 300 ug / gm used in Table O-2 above, (2500 ug BaP / kg fuel and 8.5 g particulate / kg fuel = 294 ug BaP / gm particulate). It is immediately obvious that the exposures would be vastly less at the same smoke density if the measurements made by White (1985) or Ward et al. (1984) are used. The calculated risks for the hypothetical exposure above would be 12.5 and 20 fold less, respectively, or 1.5×10^{-8} and 2.4×10^{-8}.

Having examined a simple model for estimating added risk associated with BaP, some other PAH for which there are carcinogenicity data and combustion output data can be studied. The first question is how much of these compounds are produced and what factors influence their production. In Table O-3, the emissions of several PAH are described for test bed experiments with pine needles. The burns were conducted under backing and heading conditions, at fuel loadings of 0.1, 0.3 and 0.5 pounds per square foot (equivalent to 2.17, 4.36 and 10.89 tons per acre). The reported data is reasonably consistent with that describing emissions from pine slash, presumably whole limbs, et cetera, which produce 0.2-3.4 ug BaP/ gram fuel in a backing fire (Ryan and McMahon, 1976).

Aside from the measurements of each PAH, two important pieces of information stand out in the experiments with backing fires. As fuel loading increases, the ratio of PAH produced per unit of fuel decreases sharply. The ratio of PAH / Kg fuel at a loading of 0.3 lb/square foot was about 10-14% of the output at 0.1 lb/square foot, and at 0.5 lb the ratio was about 4-6%. Perhaps of greater importance, all of the PAH included in this analysis remained in nearly the same relation to one another at all fuel loadings. This may mean that once baseline information is established, relative concentrations of the various PAH may be predictable from assays of relatively few compounds, under relatively few sets of conditions. The lower PAH/fuel ratio at higher loadings may be a function of the increased heat generated by the additional fuel. It is well established that higher temperatures decrease PAH output. This may also be the reason for the low output with little difference between loadings in heading fires, which would tend to burn hotter.

The next step in the sample risk analysis is estimation of the relative concentration of the other PAH under consideration at this time. For this exercise the data of Ryan and McMahon arranged in Table O-3 is used as a basis for an estimate of the amount of each PAH to be expected in a plume, either related to BaP concentration or to smoke density (Table O-4).

Following that information, carcinogenic risks can be estimated for each of the PAH in the discussion, as shown in Table O-5. The approach is based on comparison of the limited data available for most PAH with the extensive information on BaP. It is one of the most studied of chemicals and is a classical model for carcinogenesis study. It is also the most extensively measured of the environmental PAH. For the other compounds discussed here, there is a more modest accumulation of environmental data, and at least some carcinogenesis data. Probably none of these substances is well enough documented to be

Table 0-3 RELATIVE AMOUNTS OF PAH PRODUCED UNDER VARIOUS COMBUSTION CONDITIONS AS uG PAH/ GRAM fuel burned, pine needles, 18-27% MOISTURE¢[a]

	Backing Fires			Heading Fires		
	Fuel Loading,		lb/ft²	Fuel Loading,		lb/ft²
Chemicals	0.1*[b]	0.3	0.5	0.1	0.3	0.5
benzo(a)pyrene	5.45	0.76	0.27	0.04	0.04	0.1
pyrene	31.7	3.2	1.4	1.12	0.98	1.13
benzo(c)phenanthrene	13.8	1.9	0.62	0.24	0.14	0.175
benzo fluoranthenes	19.2	2.33	1.14	0.16	0.13	0.24
fluoranthene	22.0	2.5	0.84	0.73	0.97	1.05
perylene	3.64	0.25	0.21	0.03	0.02	0.05
benzo(g,h,i)perylene	11.45	1.18	0.63	—	—	—

a Data from Ryan and McMahon, 1976

b equivalent to 2.17, 4.36, and 10.89 tons/acre

Table 0-4 CONCENTRATION OF PAH AT VARIOUS ATMOSPHERIC PARTICULATE (SMOKE) LOADINGS IN G/M3
Column A assumes 300 ug BaP/mg particulate, [a] Column B assumes 24 ug/mg[b]

Visibility Limit	100M (0.06m)		1000M (0.62 mi)		1609M (1 mi)		3218M (2.0 mi)		8045M (5.0 mi)	
Particulate/M3	5 mg		0.5 mg		0.31 mg		0.155 mg		0.062 mg	
	A	B	A	B	A	B	A	B	A	B
benzo(a)pyrene	1.5	0.12	0.15	0.012	0.093	0.007	0.046	0.004	0.018	0.001
pyrene	[c]8.69	0.69	0.87	0.08	0.54	0.043	0.27	0.021	0.108	0.009
benzo(c)phenanthrene	3.80	0.3	0.38	0.03	0.24	0.019	0.12	0.01	0.148	0.004
benzo fluoranthenes	0.52	0.042	0.052	0.0042	0.032	0.002	0.016	0.001	0.006	0.0003
fluoranthene	6.05	0.48	0.6	0.05	0.37	0.03	0.18	0.014	0.074	0.006
perylene	1.0	0.08	0.1	0.008	0.06	0.005	0.031	0.002	0.012	0.001
benzo(g,h,i)perylene	3.15	0.25	0.3	0.025	0.19	0.015	0.096	0.008	0.038	0.003

a 300 ug BaP/mg particulate based on assumption of 2500 ug BaP/kg fuel and 8.5g particulate/kg
b 24 ug/mg particulate based on direct measurement by White et al, (1985)
c Concentrations of all PAH calculated from relative concentrations at 0.1 lb./ft2 fuel loading in Table 3.

analyzed independently. Furthermore, few have been studied under inhalation exposure conditions, as BaP has.

Those that have been evaluated for carcinogenicity have been studied in the topical application skin tumor initiation-promotion model, which by itself is not necessarily helpful if we are concerned about lung cancer due to pulmonary contact. The estimates of risk for the various PAH in Table 0-5 are therefore based on an assumption that the pulmonary carcinogenic sensitivity to a given PAH relates to that of BaP in the same way as do their respective sensitivities to skin tumor initiation. The data for comparison can only be considered semi-quantitative, and they are categorized in relative orders of magnitude compared with BaP.

The EPA-CAG estimated potency of 3.3×10^{-3} for BaP is equaled by one compound, one is estimated to have 10% of the potency of BaP, two others are characterized by ambiguous data and are arbitrarily assigned a potency of 10% of that of BaP, and two others have no observable potency, according to IARC (1983). With that information, a series of risk estimates for the individual PAH at various smoke densities is listed, for two different ratios of BaP to particulate matter.

Table 0-5 RISK ASSOCIATED WITH VARIOUS PAH AT SMOKE DENSITY CHARACTERIZED BY TWO-MILE VISIBILITY, ASSUMING 20 SIX-HOUR EXPOSURE DAYS/YR OVER 10 YEARS OF RESIDENCE, NORMALIZED TO CONTINUOUS AVERAGE EXPOSURE OVER A 70-YR LIFETIME[a] [b]

Chemical	Potency[c]	Concentration ug/M³	Concentration norm to 70 yr ug/M³	Risk if[f] BaP-300 ug/mg Particulate	Risk if BaP-24 ug/mg Particulate
benzo(a)pyrene	3.3×10^{-3}	0.046	0.00009	3.0×10^{-7}	2.4×10^{-8}
pyrene	0	0.27	0.00053	—	—
benzo(c)phenanthrene	3.3×10^{-3} [d]	0.12	0.00023	7.6×10^{-7}	6.1×10^{8}
benzo fluoranthenes	3.3×10^{-4} [d]	0.016	0.000031	1.0×10^{8}	8.0×10^{-10}
fluoranthene	0	0.18	0.00035	—	—
perylene	3.3×10^{-4} [e]	0.031	0.000061	2.0×10^{-8}	5.0×10^{-9}
benzo(g,h,i)perylene	3.3×10^{-4} [e]	0.096	0.00019	6.27×10^{-8}	5.0×10^{-9}
			TOTAL RISK[g]	1.1×10^{-6}	8.8×10^{-8}

a Visibility is related to particulate density by use of extinction factor of 0.5g particulate/square meter. see text P. 10.

b A constant ratio of BaP to other PAH as indicated in Table 3 at 0.1 lb/ft² fuel loading is assumed.

c Potency is the estimated probability of cancer resulting from 70 years inhalation exposure to 1 ug/M³

d Potency is estimated by comparison of skin painting data for PAH in IARC monograph 32, 1983, with data from similar experiments with benzo(a)pyrene, and assuming that pulmonary carcinogenic potency will bear a similar relation to potency of 3.3×10^{-3} for BaP estimated by EPA-CAG.

e Where evidence is unsufficient to determine whether a compound is/is not carcinogenic, potency is assumed as 10% of BaP potency.

f 300 ug BaP/mg particulate based on assumption of 2500 ug BaP/kg fuel; 8.5g particulate based on direct measurement by White et al, 1985.

g Total risk is assumed to be sum of risks ascribed to individual PAH.

It is of interest to compare these estimates of projected exposure to slash smoke components with data on sources of wood smoke that has been obtained in other settings. The problem of PAH health effects has been known for many years, and the decade from 1966 to 1975 saw a major downturn in the amount of such material in the atmosphere, particularly in urban centers, which in some cases have reduced ambient levels to 0.2-0.4 ng BaP / M³. Many cities still range up to two ng / M³, however. Urban areas that derive a significant fraction of heating from wood have higher levels. Measurements have been made in several small U.S. communities that derive most of their heat from wood. Three villages in New Hampshire were found to have average concentrations of 0.4-0.5 ng / M³ (Hornig et al., 1981). In Mio, Michigan concentrations ranged between 1.1 and 13.8 ng /M 3 , with one very high value of 42.7 ng / M3 (Engel, 1985) and in Telluride, Colorado, Murphy et al. (1984) found a mean level of 7.2 ng / M³. In both cases the BaP was found to arise primarily from wood fuel. Other communities were less burdened, perhaps because of meteorological differences. In an upper middle class subdivision BaP levels were between 1.5 and 2.5 ng / M³ with higher surges on weekends, most of which was from wood (Imhoff et al., 1983). In Waterbury, Vermont, the mean concentrations were below one ng / M³. (Sexton et al., 1985) Air from northern Norway contained only 0.06 ng / M³ (Lunde, 1977).

Indoor concentrations in wood burning homes are sometimes very high, reaching as much as 8 ng / M³, according to Moschandreas, 1980, as quoted by the same author in a later 1981 paper.

The risks associated with residential wood combustion may be estimated in the same way we estimated risks associated with slash burning. It is fair to assume that in western Oregon a fire would be maintained during six months of the year, and if the fire is banked at night, PAH output would increase because of decreased oxygen supply. If a fire is allowed to go out there would be a six to eight hour period of decreased output. For this

analysis the concentration is assumed to remain constant through the burning months.

An environmental BaP concentration of one to four ng / cubic meter in the vicinity of a wood burning rural home is probably representative, recognizing that much higher levels often occur. It may be argued that as residential density decreases, the environmental air loading would decrease.

Interior levels would be relatively unaffected by residential density. Let us assume steady state loadings of one to four ng / M^3, representing the range to be found both outdoors and inside a wood burning residence for six months of the year. Unless a stove is very well made, levels may be much higher. The effective period of exposure for six months a year over 10 years of residence is 1825 days. 1825 days / 25550 days (days in 70 years) gives a factor of 0.0714 which normalizes to the average daily exposure over a lifetime. The ten-year by six-month exposures normalized to a lifetime for one ng BaP/ M^3 is 0.000071 ug / M^3.

The risk associated with this exposure or its multiples can be related to the added unit risk defined by the EPA Cancer Assessment Group of 3.3×10^{-3} for continuous intake of one microgram / cubic meter. Exposure to one nanogram is a thousand fold lower and would be 3.3×10^{-6} or three chances in one million. Ten ng / M^3 would carry a risk ten times higher.

Assuming the same pattern of PAH production, the total risk associated with firewood burning for the series of PAH we are considering at the moment, at concentrations of 1,2,3 and 4 ng BaP / M^3 would be 0.847, 1.7, 2.5, and 3.3×10^{-6}, respectively. The last factor would represent 3.3 chances in a million. If lifetime rather than 10 year exposure is to be considered, each of these factors would be raised by seven fold.

It appears that the relative risk of ordinary wood burning is at least as high as the risk calculated using the extremely conservative assumptions upon which the figures shown earlier are based. Given the very high concentrations found in some homes, some individuals are probably at risks on the order of one to ten chances / 100,000.

It is questionable whether the rather severe exposure sequence assumed for slash smoke would ever occur. However, it will be used until additional specific data on smoke intrusions is incorporated into the analysis. Also, there may be specific locations in which unusually high exposures might occur to a few individuals. In view of the known fuel consumption (10-30 tons/acre) in most slash burns, the assumed conversions of fuel to PAH are unrealistically high, and it is likely that the measurements of Ward & Hardy (1984) and White (1985) do reflect more correctly the BaP / particulate ratio in the field.

There seems to be a consensus that for the present BaP is an adequate surrogate for other PAH, since it is perhaps the most important factor. It is at least as potent as any of the other chemicals, and its chemistry and biological impact are known in great detail. In fact it serves as a positive reference in studies of other PAH.

There is a particular problem in dealing with some of the other potential carcinogens in the PAH fraction because there is far less data on either biological effects or physical presence than exists for BaP. At the same time, the estimates made for BaP incorporate exceedingly conservative assumptions of exposure, and it will not be surprising if the risk is overestimated by orders of magnitude. It is doubtful whether the other carcinogenic components of smoke will account for more than a doubling or tripling of the estimated risk from BaP to individuals under the circumstances described, and the population at risk will be found to be vastly less than that.

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Attachment A
A Sketch of the Mechanism by which PAH May Cause Cancer

It is useful to briefly review the biological interactions of the PAH. Like many complex molecules that are carcinogenic at some dose, the PAH are essentially nonreactive as they enter the body. Their activity is conferred by the same sequence of metabolic reactions that is intended to detoxify them, as will be seen below. This family of compounds is usually nonpolar and lacking any functional groups that can be ionized, and therefore is lipid soluble. Such a character allows ready movement across cell membranes, and results in distribution throughout a variety of tissues, including the fetus. The same characteristics cause the material to be resorbed from the kidney tubules into the circulation. The net result of all this is that the material would be very slowly excreted unless changed in some manner.

In all complex organisms systems have evolved to deal with this problem. In the liver particularly, and to lesser extent in most other tissues are enzyme systems that metabolize such compounds to polar, more water soluble products that can be excreted in the urine or bile. This evolutionary development was in response to natural compounds that must be dealt with by all organisms, and applies itself to the various synthetic materials that humans make as well. Certainly, the substances we are concerned with in this report must be considered natural materials, and have probably been in the environment long before complex organisms arrived.

The sequences of reactions are generally divided into "phase I" and "phase II" activities. In phase I, reactions of oxidation, reduction or hydrolysis either add or expose functional groups, usually oxygen or hydroxyls. These alone improve solubility and will result in some increased excretion. Phase II reactions are conjugative, adding soluble groups such as sulfate or glucuronic acid to the molecule and further expediting excretion.

There is, however, a problem in all this. The process of oxidation or hydrolysis involves several steps, and includes formation of highly reactive intermediate molecules with two adjacent carbons linked also to a single oxygen (epoxide). The

subsequent step is formation of diols, with hydroxyls on adjacent carbons. There has been an enormous body of research on this chemistry, and it is quite clear that the principal ultimate carcinogen is the diol intermediate. If these products are not passed forward through the remaining reactions which render them innocuous, they may "escape" within the cell or migrate to other cells. If they interact with DNA, they may cause damage that may result in initiation of cancer or mutation. Almost all carcinogens are activated in this fashion. Because cancer is a self-proliferating disease, it is at least possible that a single initiated cell could give rise to a cancer.

It is probable that escape from the intended reaction scheme is dependent on the concentration of intermediates in the cell, but it has by no means been established at what low concentration the reactions do *not* take place, or at which they are so efficient that no escape occurs. This in one among the many reasons why it is not yet possible to determine whether a threshold for cancer initiation exists.

The enzymes responsible for these activities are present at low levels at all times, and when an organism encounters significant amounts of such chemicals the amount of enzyme available increases, or is "induced." The greatest activity is usually in the liver, as is the greatest capacity for induction, but some activity is detectable in most tissues, including the skin. There is a large number of different enzymes that participate in the processes of metabolizing chemicals, but all are linked to perform a relatively few kinds of reactions. There is no need to devise a new enzyme for each new foreign chemical that arrives, because the actions of the enzymes are on a relatively limited number of chemical bonds that are common to all structures.

The metabolic process as it applies to the PAH is very well described in the IARC monograph 32 (1983), in the introductory general remarks.

Appendix P
BLM Western Oregon Wildlife Risk Analysis

A risk assessment was conducted to determine the potential wildlife impacts of 10 herbicides proposed for use in BLM's western Oregon vegetation management program. The risk assessment determined that, in general, wildlife risks in BLM's vegetation management program are low. A general description of the wildlife risk assessment is given here.

Wildlife risk from vegetation management with herbicides is a function of the inherent toxicity (hazard) of each of the herbicides to different animals and of the amount of each chemical (exposure) wildlife may take in during a control operation. In essence, the wildlife risk assessment compared estimated acute exposures of different animals with acute toxicity levels found in lab animals. Details of the wildlife hazard analysis and exposure analysis are given later in this appendix.

Wildlife Hazard Analysis

The toxicity of herbicides to wildlife varies among individuals of the same species (intraspecific), between different species (interspecific), and, often most markedly, between different classes of animals. Thus, a chemical may be more toxic to birds than to mammals, or more toxic to fish than to birds. However, toxicity testing has been conducted on relatively few wildlife species. Most laboratory testing has been done on rats and mice to estimate human toxicity. Thus, to determine the potential impacts of estimated doses on wildlife, it is necessary to compare those estimates with laboratory results on the few species that have been tested. Wildlife toxicity reference levels used to assess the risks of the 10 herbicides are given in Tables P-1 through P-10 in the discussion of wildlife risks.

Wildlife Exposure Analysis

An analysis of the 10 herbicides' risk to wildlife compared estimated acute doses for representative wildlife species with available hazard information on closely related species. Because the herbicides examined in this EIS show no tendency to bioaccumulate, long-term persistence in food chains and subsequent toxic effects, (such as those that result from the use of persistent organochlorides) were not considered a problem and were not examined in the risk analysis. Because the herbicides degrade relatively rapidly and sites are normally treated only once in a given year, no analysis of chronic wildlife dosing was done. Avian toxicity data were used as surrogates for assessing risks to terrestrial amphibians and reptiles because laboratory studies on those animal classes are not available.

Doses were estimated for a set of representative species that normally inhabit vegetation management areas and that, because of their relatively high population levels and broad habitat requirements, are most likely to be exposed. A number of domestic animal species were also included. The species were as follows:

Birds

Flicker Kingfisher
Mourning Dove Screech Owl
Jay

Mammals

Mouse Deer
Rabbit Fox

Amphibian

Reptile

Toad Snake

Domestic Animals

Cow Dog
Chicken

Herbicide doses for these representative species were calculated using a series of conservative, simplifying assumptions concerning routine spraying operations giving *realistic* dose estimates and worst-case dose estimates in which most animals are directly sprayed with herbicide. Exposures were based on the herbicide application rates for aerial application for the realistic case and for broadcast right-of-way applications in the worst case. These rates are listed in Table P-12. Where a rate of 0.0 is listed for the aerial applications the realistic right-of-way rate was used.

For realistic doses, dermal exposures were based on the levels likely to be found on vegetation leaf surfaces because the animals are assumed to seek cover during a spraying operation and would receive only a fraction of the direct application rate. Worst-case dose levels were estimated by assuming that animals do not seek cover and thus receive the

full herbicide application rate on their entire body surface. A dermal penetration rate of 10 percent was used for all 10 herbicides to determine what portion of their dermal exposure actually penetrated their skin. In both realistic and worst-case exposures, mammals and birds are assumed to receive an indirect dermal dose from grooming their fur or preening their feathers. This grooming dose is subtracted from the amount of herbicide on their body surface that is used to compute their dermal dose.

Realistic ingestion doses were assumed to come from animals eating a specified percentage of their daily food intake in contaminated items. The percentage was assumed to be proportional to their body size because larger animals generally have larger foraging areas and would tend to eat less in the sprayed area. All animals are assumed to feed entirely on contaminated food items in the worst-case.

Inhalation exposures were assumed to come from a hypothetical amount of herbicide droplets forming a cloud that moves slowly offsite. Analysis assumed animals are exposed for ten minutes. Inhalation exposure time was assumed to be the same in both the realistic and the worst case. As noted in the exposure details at the end of this appendix, inhalation exposure constitutes a negligible fraction of any animal's total herbicide dose.

The total systemic dose to each animal was calculated as the sum of the estimated doses received via dermal, ingestion, and inhalation routes. Tables P-1 through P-10 give the total realistic and worst-case dose estimates for the representative species.

Wildlife Risk Analysis

For wildlife risks, the criteria used by EPA in ecological risk assessment (EPA, 1986) are used here to judge the absolute risks to organisms and the relative risks among the 10 herbicides. The EPA criteria call for comparison of an estimated environmental concentration (EEC) with a laboratory-determined LD_{50} or LC_{50} (see Glossary) for the most closely related laboratory test species.

Where the EEC exceeds one-fifth the LD_{50} or LC_{50}, EPA deems it a significant risk that may be mitigated by restricting the use of the herbicide. EPA judges EEC's that exceed the LD_{50} or LC_{50} as unacceptable risk levels. In this risk assessment, an organism's total estimated dose (rather than an EEC) is compared with the laboratory toxicity level because the dose comes from all exposure routes, not just feeding.

The wildlife risk assessment tends to overstate the risks because many of the assumptions are quite conservative. For example, no degradation of the herbicides is assumed to occur; all herbicide sprayed is assumed to be biologically available. In the worst-case exposures, the entire diet of an animal is assumed to consist of contaminated items while in the realistic case a significant percentage (7 to 55 percent depending on body size) of the diet is assumed to be contaminated. Birds and mammals are assumed to receive dermal doses through their skin and from grooming. Dermal exposures are assumed to come both directly from herbicide spray and indirectly from brushing up against treated vegetation. This accumulation of doses from every conceivable route undoubtedly overestimates doses, even in the realistic case. Nevertheless, when these dose estimates do exceed the EPA risk criterion, and more so when they exceed the LD_{50} for the most closely related laboratory species, there is a clear risk of adverse effects on individual animals.

Wildlife Risk Overview

In general, risks to wildlife from the use of *herbicides are low to negligible in BLM's vegetation* management program. The realistic dose estimates are, in almost every instance, well below the EPA risk criterion of 1/5 LD_{50} and are far below the lab species LD_{50}. 2,4-D and triclopyr present the highest risks to wildlife. Fosamine, glyphosate, and dicamba present the lowest risks.

Local populations of small mammals, small birds, terrestrial amphibians, and reptiles may be adversely affected if large areas are treated; however, the reproductive capacity of these species is generally high enough to replace the few lost individuals within the next breeding cycle. Populations of larger mammals and birds and any domestic animals present should not be affected at all. Areas with sensitive species will be avoided.

Any direct toxic effects on individual animals should *be minimal compared to the indirect effects on* individual animals or local populations of the removal of most of the vegetative cover. These would be important particularly in the case of small

mammals and ground nesting birds. These indirect effects are discussed in detail in the text of the EIS.

The risks of the individual herbicides are discussed below. Literature references for the toxicity levels in laboratory species are given in the wildlife hazard analysis. First, it must be noted that there are very few toxicity studies on which to base these conclusions. This is particularly true of atrazine, diuron, glyphosate, and hexazinone. Avian data are relatively rare for most of the herbicides. However, the conservatism in estimating doses should compensate for some of the uncertainty in the toxicity data base.

Wildlife Risk from each of the 10 Herbicides

Asulam wildlife risks are very low. Even in the worst case applications, no wildlife doses exceed the EPA 1/5 LD_{50} risk levels (Table P-1). The realistic doses are far below the EPA levels so wildlife should not be directly affected by the use of asulam.

There is some degree of risk of wildlife effects from the use of atrazine. In many species the realistic dose represents a significant portion of the EPA 1/5 LD_{50} risk level (Table P-2) although no realistic dose exceeds it. Worst-case doses for 4 of the 5 bird species and for the toad and snake exceed the risk level so a number of individual birds, terrestrial amphibians, and reptiles may suffer acute toxic effects. Some of these individuals may die. Small mammals such as mice are also at risk but larger mammals should not be affected by atrazine.

Risks to wildlife from the use of 2,4-D are low to moderate for realistic exposures. Risks to small mammals appear to be relatively high—the realistic mouse dose exceeds the EPA 1/5 LD_{50} risk level (Table P-3). Risks to wildlife from worst-case 2,4-D doses are relatively high since doses exceed the EPA risk level for most birds, mammals, amphibians, and reptiles.

Dicamba does not present a risk to wildlife under realistic exposure assumptions. Dicamba presents a risk to wildlife only under the assumption of worst-case exposure. Where doses to birds, small mammals, terrestrial amphibians, and reptiles approach or exceed the EPA risk level (Table P-4) although none approach the LD_{50}. No species should be affected under the dicamba realistic application conditions.

Diuron, too, represents a wildlife risk only under worst-case exposures. Diuron worst-case wildlife doses (Table P-5) exceed the EPA risk level and in many cases represent a significant portion of the lab animal LD_{50}. Under realistic conditions, most animals should not be affected. Risk to chickens appears significant even under realistic doses. However, it is not likely that any domestic chickens would be exposed on the spray sites. Risks to other birds and all mammals however should be relatively low.

Fosamine presents a negligible risk of wildlife effects even under worst-case spraying conditions. The worst-case doses (Table P-6) are well below the EPA 1/5 LD_{50} risk levels.

Available data indicate that glyphosate poses very little risk to wildlife even under worst-case spraying conditions. Toxicity data on avian species (Table P-7) are not sufficient to accurately judge potential glyphosate effects on birds but the risk from glyphosate use appears to be relatively low even in worst-case applications.

Hexazinone presents a low degree of risk to wildlife. However, realistic doses are well below the EPA 1/5 LD_{50} levels. The worst-case dose to the mouse exceeds the EPA risk level (Table P-8)and the worst-case doses to birds, amphibians, and reptiles represent significant portions of the EPA risk level although none approaches the LD_{50}. Hexazinone risks to larger mammals appear to be very low.

Picloram wildlife risk is low based on worst-case doses (Table P-10) that are well below the EPA 1/5 LD_{50} risk level.

Risk to wildlife from the use of triclopyr is low to moderate. Except for the mouse, realistic doses are well below the EPA criterion level. However, the small mammal (mouse) worst-case dose (Table P-10) greatly exceeds the mouse LD_{50}. Worst-case doses to the flicker, jay, rabbit, toad, and snake exceed the EPA risk level. Small mammals and smaller birds appear to be at some risk from triclopyr use. Larger mammals and birds are at low to negligible risk from triclopyr use.

Table P-1. Asulam Wildlife and Domestic Animal Doses (mg/kg) Compared With Lab Acute Toxicity

Species	Realistic Dose Estimate	Worst-Case Dose Estimate	1/5 LD_{50}	LD_{50}	Laboratory Species
Flicker	41	256	520	2600	Partridge
Mourning Dove	27	182	800	4000	Pigeon
Jay	35	230	520	2600	Partridge
Kingfisher	8.0	53	520	2600	Partridge
Screech Owl	27	194	520	2600	Partridge
Mouse	94	550	800	4000	Rat
Rabbit	11	104	800	4000	Rabbit
Deer	1.9	35	800	4000	Rabbit
Fox	4.8	31	800	4000	Rat
Toad	58	311	520	2600	Partridge
Snake	42	271	520	2600	Partridge
Cow	0.9	25	800	4000	Rabbit
Chicken	15	146	520	2600	Partridge
Dog	0.5	5.1	800	4000	Rat

Table P-2. Atrazine Wildlife and Domestic Animal Doses (mg/kg) Compared with Lab Acute Toxicity

Species	Realistic Dose Estimate	Worst-Case Dose Estimate	1/5 LD_{50}	LD_{50}	Laboratory Species
Flicker	64	434	188	940	Bobwhite
Mourning Dove	42	309	188	940	Bobwhite
Jay	55	390	188	940	Bobwhite
Kingfisher	12	90	188	940	Bobwhite
Screech Owl	42	329	188	940	Bobwhite
Mouse	147	935	798	3992	Mouse
Rabbit	18	177	374	1869	Rat
Deer	3.0	60	374	1869	Rat
Fox	7.5	52	374	1869	Rat
Toad	91	528	188	940	Bobwhite
Snake	69	460	188	940	Bobwhite
Cow	1.5	42	374	1869	Rat
Chicken	24	247	188	940	Bobwhite
Dog	0.8	8.6	374	1869	Rat

Table P-3. 2,4-D Wildlife and Domestic Animal Doses (mg/kg) Compared With Lab Acute Toxicity

Species	Realistic Dose Estimate	Worst-Case Dose Estimate	1/5 LD_{50}	LD_{50}	Laboratory Species
Flicker	43	210	94	472	Pheasant
Mourning Dove	28	149	94	472	Pheasant
Jay	37	188	94	472	Pheasant
Kingfisher	8.3	44	94	472	Pheasant
Screech Owl	28	159	94	472	Pheasant
Mouse	98	451	76	380	Mouse
Rabbit	12	85	84	424	Rabbit
Deer	2.0	29	80	400	Deer
Fox	5.0	25	20	100	Dog
Toad	61	255	40	200	Toad
Snake	43	222	40	200	Toad
Cow	1.0	20	10	50	Cow
Chicken	16	119	76	380	Chicken
Dog	0.5	4.1	20	100	Dog

Table P-4. Dicamba Wildlife and Domestic Animal Doses (mg/kg) Compared With Lab Acute Toxicity

Species	Realistic Dose Estimate	Worst-Case Dose Estimate	1/5 LD_{50}	LD_{50}	Laboratory Species
Flicker	17	184	135	673	Pheasant
Mourning Dove	11	131	135	673	Pheasant
Jay	15	165	135	673	Pheasant
Kingfisher	3.3	38	135	673	Pheasant
Screech Owl	11	139	135	673	Pheasant
Mouse	39	396	238	1189	Mouse
Rabbit	4.8	75	400	2000	Rabbit
Deer	0.8	25	151	757	Rat
Fox	2.0	22	151	757	Rat
Toad	24	224	135	673	Pheasant
Snake	17	195	135	673	Pheasant
Cow	0.4	18	151	757	Rat
Chicken	6.3	105	135	673	Pheasant
Dog	0.2	3.6	151	757	Rat

Table P-5. Diuron Wildlife and Domestic Animal Doses (mg/kg) Compared With Lab Acute Toxicity

Species	Realistic Dose Estimate	Worst-Case Dose Estimate	1/5 LD_{50}	LD_{50}	Laboratory Species
Flicker	68	818	400	2000	Mallard
Mourning Dove	44	581	400	2000	Mallard
Jay	59	734	400	2000	Mallard
Kingfisher	13	170	400	2000	Mallard
Screech Owl	45	619	400	2000	Mallard
Mouse	157	1760	750	3750	Rat
Rabbit	19	333	750	3750	Rat
Deer	3	113	750	3750	Rat
Fox	8	98	750	3750	Rat
Toad	97	994	400	2000	Mallard
Snake	69	866	400	2000	Mallard
Cow	1.6	79	750	3750	Rat
Chicken	25	466	10[a]	250[b]	Chicken
Dog	0.8	16	750	3750	Rat

[a] Based on decreased weight loss in chickens
[b] LD_{100} for chickens at 9 successive doses (whole test group died)

Table P-6. Fosamine Wildlife and Domestic Animal Doses (mg/kg) Compared With Lab Acute Toxicity

Species	Realistic Dose Estimate	Worst-Case Dose Estimate	1/5 LD_{50}	LD_{50}	Laboratory Species
Flicker	51	547	1000	5000	Bobwhite
Mourning Dove	33	388	1000	5000	Bobwhite
Jay	44	491	1000	5000	Bobwhite
Kingfisher	10	113	1000	5000	Bobwhite
Screech Owl	34	414	1000	5000	Bobwhite
Mouse	118	1177	4880	24400	Rat
Rabbit	14	223	1476	7380	Guinea Pig
Deer	2.4	75	1476	7380	Guinea Pig
Fox	6	65	3000	15000	Dog
Toad	73	664	1000	5000	Bobwhite
Snake	52	579	1000	5000	Bobwhite
Cow	1.2	53	1476	7380	Guinea Pig
Chicken	19	311	1000	5000	Bobwhite
Dog	0.6	11	3000	15,000	Dog

Table P-7. Glyphosate Wildlife and Domestic Animal Doses (mg/kg) Compared With Lab Acute Toxicity

Species	Realistic Dose Estimate	Worst-Case Dose Estimate	1/5 LD_{50}	LD_{50}	Laboratory Species
Flicker	34	256	928	4640	Quail
Mourning Dove	22	182	928	4640	Quail
Jay	29	230	928	4640	Quail
Kingfisher	6.6	53	928	4640	Quail
Screech Owl	22	194	928	4640	Quail
Mouse	78	550	800	4000	Rat
Rabbit	9.6	104	760	3800	Rabbit
Deer	1.6	35	760	3800	Rabbit
Fox	4	31	760	3800	Rabbit
Toad	48	311	928	4640	Quail
Snake	35	271	928	4640	Quail
Cow	0.8	25	760	3800	Rabbit
Chicken	13	146	928	4640	Quail
Dog	0.4	5.0	760	3800	Rabbit

Table P-8. Hexazinone Wildlife and Domestic Animal Doses (mg/kg) Compared With Lab Acute Toxicity

Species	Realistic Dose Estimate	Worst-Case Dose Estimate	1/5 LD_{50}	LD_{50}	Laboratory Species
Flicker	43	307	452	2258	Bobwhite
Mourning Dove	28	218	452	2258	Bobwhite
Jay	37	275	452	2258	Bobwhite
Kingfisher	8.3	64	452	2258	Bobwhite
Screech Owl	28	232	452	2258	Bobwhite
Mouse	98	660	338	1690	Rat
Rabbit	12	125	172	860	Guinea Pig
Deer	2.0	42	172	860	Guinea Pig
Fox	5.0	37	172	860	Guinea Pig
Toad	61	373	452	2258	Bobwhite
Snake	43	325	452	2258	Bobwhite
Cow	1.0	30	172	860	Guinea Pig
Chicken	16	175	452	2258	Bobwhite
Dog	0.5	6.0	172	860	Guinea Pig

Table P-9. Picloram Wildlife and Domestic Animal Doses (mg/kg) Compared With Lab Acute Toxicity

Species	Realistic Dose Estimate	Worst-Case Dose Estimate	1/5 LD_{50}	LD_{50}	Laboratory Species
Flicker	17	102	400	2000	Pheasant
Mourning Dove	11	73	400	2000	Pheasant
Jay	15	92	400	2000	Pheasant
Kingfisher	3.3	21	400	2000	Pheasant
Screech Owl	11	77	400	2000	Pheasant
Mouse	39	220	400	2000	Mouse
Rabbit	4.8	42	400	2000	Rabbit
Deer	0.8	14	200	1000	Sheep
Fox	2.0	12	400	2000	Mouse
Toad	24	124	400	2000	Pheasant
Snake	17	108	400	2000	Pheasant
Cow	0.4	10	200	1000	Sheep
Chicken	6.3	58	400	2000	Pheasant
Dog	0.2	2.0	400	2000	Mouse

Table P-10. Triclopyr Wildlife and Domestic Animal Doses (mg/kg) Compared With Lab Acute Toxicity

Species	Realistic Dose Estimate	Worst-Case Dose Estimate	1/5 LD_{50}	LD_{50}	Laboratory Species
Flicker	34	409	340	1698	Mallard
Mourning Dove	22	290	340	1698	Mallard
Jay	29	367	340	1698	Mallard
Kingfisher	6.6	85	340	1698	Mallard
Screech Owl	22	310	340	1698	Mallard
Mouse	78	880	94	471	Mouse
Rabbit	9.6	166	110	550	Rabbit
Deer	1.6	56	62	310	Guinea Pig
Fox	4.0	49	62	310	Guinea Pig
Toad	48	497	340	1698	Mallard
Snake	35	433	340	1698	Mallard
Cow	0.8	40	62	310	Guinea Pig
Chicken	13	233	340	1698	Mallard
Dog	0.4	8.10	62	310	Guinea Pig

Details of the Wildlife Exposure Calculations

Wildlife exposures were calculated for a series of representative wildlife species typical of areas supporting forest vegetation in the Northwest and represent a range of phylogenetic classes, body sizes, and feeding niches. Table P-11 lists the representative wildlife species with various biological parameters used in the exposure analysis. References used in the species selection and in deriving the physical parameters of each species were Schmidt and Gilbert (1978), Scott et al. (1977), Burt and Grossenheider (1966) and Robbins et al. (1983).

Realistic and worst-case exposure estimates were made for each representative species for each of the three major exposure routes: inhalation, dermal, and ingestion. Exposures were based on the herbicide application rates shown in Table P-12.

Inhalation Exposures. Wildlife inhalation exposures were based on air sampling data from pesticide field applications, adjusted to give a dose at a breathing rate of 1 L/min for an exposure of 10 minutes. The dose was weighted by each animal's breathing rate based on the following equations:

Birds:

$$LPM = \frac{284 \times (BWT/1000)^{.77}}{1000}$$

Mammals:

$$LPM = \frac{379 \times (BWT/1000)^{.80}}{1000}$$

Reptiles:

$$LPM = .00334$$

Amphibians:

$$LPM = .007$$

where:

LPM is the animal's breathing rate in liters per minute

BWT is the animal's body weight in grams

The equations for birds and mammals were taken from Lasiewski and Calder (1971). The reptile value is from Gordon et al. (1968), who report a study on the collared lizard. The breathing rate for amphibians was from Hutchinson et al. (1968). As anticipated, the animal modeling results showed inhalation exposures to be only a small fraction of each specie's total dose.

Dermal Exposures. Dermal exposures were assumed to come from two sources: (1) directly from herbicide spray at the deposition rate that

Table P-11. Representative Wildlife and Domestic Species and Associated Biological Parameters

Representative Niche	Representative Species	Body Weight (Grams)	Daily Food Intake (Grams)	Percent of Food Contaminated in Realistic Case	Body Surface Area (cm2)	Body Surface Contacting Vegetation (Percent)	Percent of Body Groomed	Inhalation Volume (L/min)
Insectivorous Birds	Flicker	75	15	42	178	57	49	.038
Granivorous Birds	Dove	100	11	40	216	51	45	.048
Ominvorous Birds	Jay	70	14	43	170	58	50	.037
Piscivorous Birds	Kingfisher	250	50	33	398	36	35	.098
Carnivorous Birds	Owl	100	20	40	216	51	45	.048
Small Omnivorous Mammals	Mouse	20	6	55	74	93	72	.017
Medium Herbivorous Mammals	Rabbit	1,350	130	24	1,224	19	21	.480
Large Herbivorous Mammals	Deer	68,000	2,500	11	16,722	4	7	11.1
Carnivorous Mammals	Fox	5,670	475	18	3,189	11	14	1.52
Insectivorous Amphibians	Toad	22	5	54	79	90	0	.007
Carnivorous Reptiles	Snake	40	22	48	117	72	0	.00334
Domestic Animals	Cattle	453,590	12,000	7	59,292	2	4	50.6
	Chicken	2,000	300	22	1,591	16	19	.484
	Dog	13,000	NA	NA	5,715	8	11	3.06

NA = Not applicable or not available

should occur on vegetation leaf surfaces in the realistic case and at the herbicide application rate in the worst case and (2) indirectly by contact with contaminated vegetation. Fur, feathers, and scales afford varying degrees of protection against dermal exposure; by preventing the chemical from reaching the animal's skin, animal skin cover may instead allow the chemical to dry or to be rubbed off in their movements. For this reason, the dermal penetration value of 10 percent for mammals was adjusted for the three other classes. The dermal penetration factors that were multiplied by the

Table P-12. Application Rates Used for Routine-Realistic and Routine-Worst Case Scenarios (lb active ingredient/acre)

	Aerial		Backpack		Right-of-Way	
	Realistic	Worst Case	Realistic	Worst Case	Realistic	Worst Case
Asulam	2.40	3.34	1.20	3.34	2.40	5.00
Atrazine	3.75	4.00	3.00	4.00	3.00	8.50
2,4-D	2.50	4.00	2.00	4.00	2.50	4.10
Dicamba	1.00	4.00	0.50	4.00	1.00	3.60
Diuron	0.00	0.00	4.00	6.00	4.00	16.00
Fosamine	3.00	12.00	3.00	11.50	4.00	10.70
Glyphosate	2.00	5.00	1.50	5.00	2.00	5.00
Hexazinone	2.50	3.00	1.12	3.00	2.50	6.00
Picloram	1.00	5.00	1.00	4.00	1.00	2.00
Triclopyr	2.00	8.00	2.00	8.00	2.00	8.00

1. The average dose observed in the 2,4-D field study was expressed in terms of dose per pound of active ingredient applied.

2. The acreage figure was used to determine the number of pounds of active ingredient used in the scenario by multiplying by the herbicide's typical application rate (listed in Table 1-3).

3. The herbicide-specific dose was determined by multiplying the pounds of herbicide applied by the dose of 2,4-D per pound of 2,4-D applied for that worker category in the field studies and then adjusting for the herbicide's dermal penetration rate. The dermal penetration rates used in the analysis were 6 percent for 2,4-D (Feldman and Maibach, 1974), 0.48 percent for picloram (Lavy et al., 1984), 5 percent for dicamba (Draper and Street, 1982), and 10 percent for the other 7 herbicides (USDA, 1984).

mammalian penetration rate were as follows: (1) birds, 0.75; (2) reptiles, 0.15; and (3) amphibians, 5.0. The amphibian factor is high because the moist, glandular skin of the amphibian serves to a large extent as a respiratory organ and is many times more permeable than the other animal classes.

Wildlife may receive indirect dermal exposure in moving through contaminated vegetation by transferring herbicide from the vegetation to their body surface. The transfer would depend on (1) the density of the vegetation, (2) the animal's body size in relation to the height of the vegetation, and (3) the amount of movement of the animal.

To simplify the analysis, it was assumed that a certain percentage of the animal's total body surface received herbicide at the same level as in direct dermal exposure (either the level on leaf surfaces in the realistic case or at the application rate in the worst-case). That percentage was based on the animal's body size and a movement factor (MVF) to adjust for the taxonomic class. (Mammals, for example, are expected to move more than amphibians.) The animal's total body surface area was assumed to be a function of its weight according to the following formula (Kendeigh, 1970; Schmidt-Nielsen, 1972):

$$BSA = 10 \times (BWT)^{.667}$$

where:

BSA is the animal's body surface area in cm 2

BWT is the animal's body weight in grams

The animal's vegetation contact percent (VCP) is based on its body weight in grams (BWT) according to the following formula:

$$VCP = 2.89\ (BWT)^{-.3775}$$

The class adjustment factors (MVF's) for differing movement are as follows: (1) birds, 0.8; (2) mammals, 1; (3) reptiles, 0.3; and (4) amphibians, 0.4. The indirect dermal dose (IND) is then calculated using the direct dermal dose (DDD):

$$IND = DDD + (DDD \times VCP \times MVF)$$

Mammals and birds groom themselves regularly and may receive an ingestion dose if their fur or feathers are contaminated. The percent of their body surface groomed (PBG) was assumed to be a decreasing function of their body size according to the following formula:

$$PBG = 1.72\ (BWT)^{-.29}$$

No grooming was assumed for reptiles and amphibians. The oral dose for mammals and birds from grooming was subtracted from the amount of herbicide that would contribute to the animal's dermal dose.

Ingestion Doses. Each representative species was assumed to feed on contaminated food items according to a specified diet and to drink a specified amount of water. These dietary amounts are listed in Table P-13. The diet items—seeds, insects and berries—are assumed to have the following weights, surface areas and contamination level based on a 1 lb/acre application rate:

	weight(g)	surface area $(cm)^2$	contamination level in ppm based on a 1 lb/acre application
seeds	.002	.158	885
insects	.00322	.22	766
berries	.5	3.1416	70

These items are assumed to be contaminated over their entire surface area at the level on vegetation leaf surfaces in both realistic and worst cases. Grass was assumed to be contaminated at the level of 178.9 mg/kg per pound of herbicide applied per acre on site. Water is assumed to be drank from a stream 6 inches deep 100 feet offsite that reaches a concentration of 7.5 ppb per pound of herbicide applied per acre. Predators that feed on mice or toads are assumed to receive the total body burden each of these prey species has received through the three exposure routes described above as a result of the herbicide spraying operation. Predators that feed on fish are assumed to receive residue levels based on the concentration in the water. In the realistic exposures each species is assumed to consume a percentage of its daily intake in contaminated food items depending on its body size. The percentages are listed in Table P-11 and are based on the formula:

$$\% = 100 \times (1/(BWT)^{.2}$$

In the worst-case, each species entire daily food intake is assumed to consist of herbicide-contaminated items.

Table P-13. Representative wildlife species diet items[1]

Representative Species	Water	Vegetation	Seeds	Insects	Berries	Mouse	Toad	Fish
Birds								
Flicker	.02	0	0	15	0	0	0	0
Mourning Dove	.05	0	11	0	0	0	0	0
Jay	.05	0	5	5	4	0	0	0
Kingfisher	.08	0	0	0	0	0	0	50
Screech Owl	.05	0	0	0	0	20	0	0
Mammals								
Mouse	.05	1	2	3	0	0	0	0
Rabbit	.05	130	0	0	0	0	0	0
Deer	1.5	2500	0	0	0	0	0	0
Fox	.8	0	0	0	175	300	0	0
Amphibian								
Toad	.05	0	0	5	0	0	0	0
Reptile								
Snake	.01	0	0	0	0	0	22	0
Domestic Animals								
Cow	58	12000	0	0	0	0	0	0
Chicken	.10	0	300	0	0	0	0	0
Dog	.50	0	0	0	0	0	0	0

[1] Consumption in liters for water and in grams for all other items.

Wildlife Hazard Analysis

Asulam

Asulam is slightly toxic to birds and mammals based on acute oral LD_{50}'s ranging from greater than 2,600 mg/kg for the partridge to greater than 4,000 mg/kg for the rat, rabbit, guinea pig, mallard, pheasant, and pigeon (EPA, 1984b; WSSA, 1983). Technical asulam is not a primary skin and eye irritant or a dermal sensitizer in guinea pigs and rabbits (EPA, 1984b). Asulam was not teratogenic in rats or rabbits, but did cause reproductive effects (decreased mean number of live births per litter) in rats (EPA, 1984b). Bobwhite quail fed asulam at levels of 25 ppm in the diet for 28 days showed no changes in food consumption, growth rate, and mortality (Gallo et al., 1975). No reproductive or teratogenic effects were caused by treatment.

Atrazine

Atrazine is of low toxicity to birds and mammals based on acute oral LD_{50}'s ranging from 940 mg/kg in bobwhite quail to 4,237 mg/kg in Japanese quail (Table P-14) (EPA, 1983d; EPA, 1984c). Toxic effects in mammals include sedation, labored breathing, ruffled fur, and protruding eyeballs (EPA, 1984c). Atrazine did not cause irritation or sensitization of the skin in rabbits and guinea pigs, but was irritating to the eyes of rabbits (EPA, 1984c). In a 28-day feeding study, body weight loss was observed in sheep at the lowest dose tested of 50 mg/kg/day of the Atrazine 80W formulation (EPA, 1984c). In another study, no effects were observed in sheep given 25 mg/kg/day for 35 days (EPA, 1984c). No adverse effects were observed in ewes treated with 15 mg/kg/day throughout pregnancy (USDA, 1984), and no teratogenic or reproductive effects have been reported for mice and rats (EPA, 1984c).

Avian toxic effects from atrazine include weakness, hyperexcitability, muscle incoordination, tremors, and weight loss (Hudson et al., 1984). Eight-day dietary LC_{50}'s for the 99-percent active ingredient were all greater than 5,000 ppm in Japanese quail, bobwhite quail, pheasants, and mallards (EPA, 1983d). Pheasants given 15 weekly doses of AAtrex 80W (80 percent a.i.) showed no change in weight gain, number of eggs laid, eggshell thickness, survival, and weight of offspring (Melius, 1975, as cited in USDA, 1984). Injection of eggs with atrazine caused reduced hatching at 400 ppm (the highest dose tested) (Dunachie and Fletcher, 1970, as cited in USDA, 1984). No teratogenic effects were observed. The LC_{50} of eggs immersed in an aqueous emulsion of atrazine is greater than 400 lb/A, which is greater than the emulsifiable concentrate and is more than 60 times greater than the recommended application rate (Hoffman and Albers, 1984).

Atrazine has a low potential for bioaccumulation in animals and is readily metabolized to nontoxic metabolites and rapidly excreted via the kidneys (USDA, 1984).

2,4-D

2,4-D is recognized to be moderately toxic to vertebrate species. Many data exist on the toxicity of various formulations of 2,4-D to vertebrates; there appear to be significant differences among the forms of 2,4-D (amines, butyl esters, isooctyl esters, and propylene glycol butyl ether esters) in terms of toxicity (Ghassemi et al., 1981). In many instances, toxic response to 2,4-D formulations appears to be species-specific. The acute oral LD_{50}'s for a variety of birds and mammals are listed in Table P-15. Oral LD_{50}'s in mammals range from 100 mg/kg for dogs, cattle, and swine to 848 mg/kg for guinea pigs (USDA, 1984; Ghassemi et al., 1981). Toxic effects include gastrointestinal disturbances, weight loss, muscle weakness, and incoordination (USDA, 1984). Mild to moderate eye, skin, and respiratory irritation is caused by some formulations (USDA, 1984). No teratogenic or reproductive effects have been observed in rats (EPA, 1986d).

In birds, acute oral LD_{50}'s range from 472 mg/kg in young pheasants to greater than 2,000 mg/kg in mallards (Hudson et al., 1984). Avian toxic effects include excessive thirst and salivation, tremors, exhaustion, and imbalance (Hudson et al., 1984). Eight-day dietary studies with the dimethylamine salt of 2,4-D and the butoxyethanol ester of 2,4-D yielded LC_{50} values of greater than 5,000 ppm for Japanese quail, bobwhite quail, ring-necked pheasants, and mallard ducks (Hill et al., 1975, as cited in USDA, 1984). No reproductive or teratogenic effects were observed in the eggs of chickens and pheasants when treated with various forms of 2,4-D, even at dosage levels of up to 20 times the recommended field application rate (USDA, 1984). The LC_{50} of mallard eggs immersed in an aqueous emulsion of 2,4-D was 192 lb/A, which is 32 times the field application rate (Hoffman and Albers, 1984).

Table P-14. Acute oral toxicity of atrazine to birds and mammals

Species	LD_{50} (mg/kg)
Rat	1,869
Mouse	3,992
Japanese quail	4,237
Bobwhite quail	940
Mallard duck	>2,000
Pheasant	>2,000

Source: EPA, 1983d; EPA, 1984c; Hudson et al.. 1984

Table P-15. Acute oral toxicity of 2,4-D to mammals and birds

Species	Form of 2,4-D	LD_{50} (mg/kg)
Rat	Acid	375
	Butyl ester	620
Mouse	Acid	368
	Butyl ester	380
Guinea pig	Acid	469
	Butyl ester	848
Rabbit	Acid	800
	Butyl ester	424
Dog	Acid	100
Cat	Butyl ester	820
Cattle	Butyl ester	100
Swine	Butyl ester	100
Mule deer	Acid	400 to 800
Chicken	Acid	541
	Butyl ester	2,000
Mallard	Acid	>2,000
	Amine (4 lb a.e./gal)	>2,025
Pheasant	Acid	472
Pigeon	Acid	668
Japanese quail	Acid	668
Chukar	Acid	200 to 400

Source: USDA, 1984; Hudson et al., 1984; Ghassemi et al., 1981

Animals do not bioaccumulate 2,4-D to any great extent. The 2,4-D that is absorbed is usually eliminated very rapidly in unmetabolized form (Ghassemi et al., 1981). Very few monitoring data exist on 2,4-D levels found in wildlife. However, studies by Erne (1974 and 1975, as cited in DEA, 1986) in Sweden that sampled 2,4-D levels in liver and kidney tissue of 250 animals taken by hunters or found dead during the period from 1968 to 1972 showed residues that ranged from 0.05 to 6 mg/kg.

There is some indication in the literature that after treatment with 2,4-D there is increased palatability and possibly increased toxicity of normally unpalatable weeds. This was observed in ragwort (Senecio jacobaea), Britain's most serious poisonous weed to domestic livestock, after 2,4-D application (Irvine et al., 1977). Increased palatability was thought to be related to an increased water-soluble carbohydrate content. The authors reported that the total unsaturated pyrrolizidine alkaloid content may also be increased by 2,4-D, increasing the plant's toxicity. Based on the results of this study, it was suggested that cattle be withheld from pastures for about 3 weeks after application of 2,4-D. Effects on grazing wildlife have not been observed; however, increased toxicity may be possible.

Dicamba

Technical dicamba is slightly toxic to mammals based on oral LD_{50}'s of 757 mg/kg in rats and 1,189 mg/kg in mice (USDA, 1984). The oral LD_{50} for guinea pigs is 3,000 mg/kg and for rabbits is 2,000 mg/kg (HSDB, 1987a). Technical dicamba caused mild dermal irritation and mild to moderate eye irritation in rabbits (EPA, 1984a). The acute oral LD_{50} of the Banvel formulation is 1,707 mg/kg in rats (USDA, 1984). Banvel showed a moderate potential for causing dermal sensitization in guinea pigs (EPA, 1984h). Five doses of 250 mg/kg of the Banvel D formulation and 10 daily doses of 250 mg/kg caused no adverse effects in sheep (USDA, 1984). However, two doses of 500 mg/kg of Banvel D caused death in sheep, although 1 dose of 1,000 mg/kg caused no adverse effects (USDA, 1984). Dicamba has not been observed to be teratogenic in rats and rabbits (EPA, 1984h); however, reproductive effects may occur at levels above 2.5 mg/kg (EPA, 1985d).

The EPA (1983e) has characterized technical dicamba and formulated dicamba acid and its salts as practically nontoxic to avian wildlife in dietary

exposures. The avian 8-day dietary LC_{50} of technical dicamba acid is greater than 10,000 ppm in both bobwhite quail and the mallard duck (EPA, 1983e). An acute oral LD_{50} of 673 mg/kg was reported for technical dicamba in pheasants (USDA, 1984). The acute oral LD_{50}'s of the formulated products were all greater than 2,510 mg/kg in the mallard duck, and the 8-day dietary LC_{50}'s were all greater than 4,640 ppm in the mallard and the bobwhite quail (EPA, 1983e).

No teratogenic effects were observed in chicken eggs injected with dicamba; however, hatching success was reduced at the highest dose tested of 400 ppm (USDA, 1984). The LC_{50} of mallard eggs immersed in an aqueous solution of dicamba was greater than 200 lb/A which is more than 200 times the recommended field application level (Hoffman and Albers, 1984). However, eye malformations and stunted growth were observed at levels below the reported LC_{50}.

Diuron

Diuron is slightly toxic to mammals based on the acute oral LD_{50} of 3,750 mg/kg in rats (EPA, 1986a). Central Nervous System (CNS) depression was observed in mammals at high doses. Diuron was not irritating to the eyes and skin of rabbits in primary irritation studies (EPA, 1986a). Diuron did not cause teratogenic or reproductive effects in rats (EPA, 1986a). According to Palmer and Radeleff (1969), application rates of up to 9.6 lb/A would not be dangerous to sheep or cattle.

Diuron is very slightly toxic to birds based on the oral LD_{50} of greater than 2,000 mg/kg in mallard ducks (EPA, 1983f). Signs of toxicity included incoordination and frequent falling (Hudson et al., 1984). The subacute dietary LC_{50} is greater than 5,000 ppm in mallards and ring-necked pheasants, and is 1,730 ppm in bobwhite quail (EPA, 1983f). Diuron is toxic to chickens at relatively low doses (Palmer and Radeleff, 1969). Chickens experienced decreased weight gain at the lowest dose tested of 10 mg/kg for 10 days. All chickens died after 9 doses of 250 mg/kg. Application rates of greater than 1 lb/A were therefore considered hazardous to chickens.

Fosamine

Fosamine is very slightly toxic to mammals based on acute oral LD_{50} values of 24,400 mg/kg in rats, 7,380 mg/kg in guinea pigs, and greater than 15,000 mg/kg in dogs for the Krenite formulation (41.5 percent active ingredient) (DuPont, 1983; USDA, 1984). Krenite caused mild to moderate skin irritation and no eye irritation in rabbits (DuPont, 1983). The acute oral LD_{50} of the Krenite S formulation (Krenite with surfactant added) is greater than 5,000 mg/kg in rats (DuPont, 1983). Krenite S is not a dermal irritant and is a moderate to severe eye irritant in rabbits (DuPont, 1983). Sheep given Krenite in the diet for 90 days showed no adverse effects at doses of up to 2,500 ppm, the highest dose tested (Schneider and Kaplan, 1983, as cited in USDA, 1984). Unformulated fosamine and Krenite were not teratogenic in rats (USDA, 1984).

Unformulated fosamine is very slightly toxic to birds based on acute oral LD_{50}'s of greater than 5,000 mg/kg in mallard ducks and bobwhite quail (Schneider and Kaplan, 1983, as cited in USDA, 1984). The 8-day dietary LC_{50} of unformulated fosamine is greater than 10,000 ppm in mallards and bobwhite quail (Schneider and Kaplan, 1983, as cited in USDA, 1984). The acute oral LD_{50} of formulated fosamine is greater than 10,000 mg/kg in the bobwhite quail and the mallard duck (DuPont, 1983).

Glyphosate

Glyphosate is generally recognized to be of low toxicity in the environment. Acute oral LD_{50}'s are 4,320 mg/kg for the rat and 3,800 mg/kg for rabbit (EPA, 1984k; USDA, 1984). Based on these values glyphosate can be considered slightly toxic.

Oral LD_{50} values for the Roundup and Rodeo formulations in rats are 5,400 mg/kg and greater than 5,000 mg/kg, respectively (Monsanto, 1983 and 1985). The oral LD_{50} of Roundup in the goat is 4,860 mg/kg (Monsanto, 1985). Glyphosate, Roundup, and Rodeo are practically nontoxic or slightly toxic to the eyes and skin of rabbits (Monsanto, 1983 and 1985). No reproductive or teratogenic effects have been caused by glyphosate in rats or rabbits (EPA, 1984k).

Studies conducted on black-tailed deer and small mammal populations in the Pacific Northwest showed no obvious adverse effects caused by the use of glyphosate for vegetation management during the first year after treatment (Sullivan, 1985). However, in the following years, changes in the composition of small mammal communities occurred in close association with vegetative

succession caused by glyphosate application. No adverse effects on reproduction, growth, or survival were observed in populations of deer mice during the year following treatment.

Glyphosate is slightly toxic to birds based on the acute oral LD_{50} of greater than 2,000 mg/kg in bobwhite quail (EPA, 1986e). The 8-day dietary LC_{50} is greater than 4,000 ppm for both mallard ducks and bobwhite quail (EPA, 1986e). Avian reproduction studies yielded no reproductive effects at dietary exposure levels of up to 1,000 ppm (EPA, 1986e).

Through alteration of habitat, glyphosate caused changes in habitat use, density, and foraging behavior of at least four species of nesting birds (Sullivan, 1985). Most species returned to pre-spray foraging behavior within 2 years at which time vegetation conditions were comparable to those present before treatment.

Residue and metabolism studies have indicated that glyphosate is only slowly absorbed across the gastrointestinal membranes, and that, in the vertebrates tested, there is minimum tissue retention and rapid elimination of residues (Monsanto, 1982).

Hexazinone

Based on toxicity data for birds and mammals, hexazinone presents a low hazard to wildlife species (EPA, 1982e). The acute oral LD_{50} of technical hexazinone is 1,690 mg/kg in rats, 860 mg/kg in guinea pigs, and 2,258 mg/kg in bobwhite quail (EPA, 1984l; EPA, 1982e). The acute oral LD_{50} of a 25-percent hexazinone solution is 6,887 mg/kg in rats (DuPont, 1984). The 8-day dietary LC_{50}'s of greater than 10,000 ppm for mallards and greater than 5,000 ppm for bobwhite quail indicate that technical hexazinone is practically nontoxic to birds (EPA, 1982e). Formulated and unformulated hexazinone were irritating to the eyes but not to the skin of rabbits and guinea pigs (USDA, 1984; EPA, 1982e). Hexazinone has not been observed to cause teratogenic or reproductive effects in rats or rabbits (EPA, 1984l; USDA, 1984).

In a study to determine the effects of hexazinone pellets on wildlife, Gridball pellets (10 or 20 percent hexazinone) were placed in the feeding areas of wild or captive rodents, raccoons, skunks, opossums, white-tailed deer, songbirds, and gamebirds (Richmond, 1979, as cited in USDA, 1984). Only one captive prairie vole was observed nibbling and urine-marking pellets. No other animals appeared to be attracted to the Gridballs, and no mortality or unusual behavior was observed.

Picloram

Picloram is slightly toxic to mammals based on acute oral LD_{50}'s ranging from greater than 540 mg/kg in calves to 8,200 mg/kg in rats (Table 16) (Lynn, 1965; Jackson, 1965). Technical picloram caused mild eye and skin irritation in rabbits (EPA, 1984h). Picloram was not teratogenic in rats, rabbits, or mice; however, reduced fertility was observed in rats at 1,000 ppm (50 mg/kg)(EPA, 1984h). The Tordon 101 formulation caused no ill effects in sheep at single doses of 1,900 mg/kg, but caused death at levels of 2,200 mg/kg and above (Lynn, 1965). Temporary weight loss was the only adverse effect seen in calves given Tordon 101 in single doses of 1,900 to 3,163 mg/kg (Lynn, 1965). No toxic signs or adverse effects on growth were observed in sheep given 18 mg/kg/day of technical picloram in the diet for 33 days (Jackson, 1965). Stimulated growth and improved feed efficiency were observed in swine given 22 mg/kg of feed for an unspecified time (McCollister and Leng, 1969). Metabolic and residue studies in mammalian species indicate that picloram is rapidly eliminated unchanged in the urine following ingestion (USDA, 1984). No metabolites have been detected. In addition, picloram does not appear to accumulate to any significant extent in animal tissues (USDA, 1984).

Table P-16. Acute oral toxicity of picloram to mammals and birds

Species	LD_{50} (mg/kg)
Rat	8,200
Mouse	2,000 to 4,000
Rabbit	approx. 4,000
Guinea pig	approx. 3,000
Sheep	> 720
Calf	> 540
Chicken	approx. 6,000
Mallard duck	> 2,000
Pheasant	> 2,000

Sources: Hudson et al., 1984; Jackson, 1965; Lynn, 1965

Picloram is very slightly toxic to birds, based on LD_{50}'s ranging from greater than 2,000 mg/kg in mallards and pheasants to approximately 6,000 mg/kg in chickens (Table P-16) (Lynn, 1965; Hudson et al., 1984). Regurgitation occurred shortly after mallards were given treatment, and pheasants exhibited mild muscle incoordination and tremors after treatment (Hudson et al., 1984). Subacute dietary LC_{50}'s for bobwhite and Japanese quail, ring-necked pheasants, and mallard ducks were all greater than 5,000 ppm (HSDB, 1987b). The 8-day dietary LC_{50} of the Tordon 101 formulation is greater than 10,000 ppm for the bobwhite quail and mallard duck (EPA, 1984i).

Japanese quail given 100 ppm in a 2-week dietary study showed no effects on feathering, reproduction, mortality, and weight (Kenaga, 1969). In a similar test at 1,000 ppm, egg fertility and hatchability were reduced the first week but not the second (Kenaga, 1969). A 3-generation study with Japanese quail showed no effects on food consumption, reproduction, survival, and body weight when given 100, 500, or 1,000 ppm in the diet (Kenaga, 1969). In a 1-year study in which Japanese quail were given 100 ppm to 10,000 ppm in their diet, no effects on reproduction, feeding, or body weights were observed. Mortality rates of treated quail were lower than those of controls (Kenaga, 1969).

The LC_{50} of mallard eggs immersed in an aqueous emulsion of picloram was 100 lb/A, which is more than 10 times greater than the recommended field application level (Hoffman and Albers, 1984). Spray treatment of chicken eggs or ring-necked pheasant eggs with a dose equivalent to 2.8 kg/ha of Tordon 101 did not affect embryonic development or subsequent growth of hatched chicks (EPA, 1984i).

Triclopyr

Triclopyr is moderately toxic to mammals based on LD_{50}'s ranging from 310 mg/kg in guinea pigs to 729 mg/kg in male rats (Table P-17) (EPA, 1985j). Technical triclopyr is slightly irritating to the eyes and skin of rabbits (EPA, 1985j). The Garlon 3A and Garlon 4 formulations are slightly toxic with oral LD_{50}'s of 2,830 and 2,140 mg/kg in rats (males and females, respectively) (Dow Chemical Company, undated). Garlon 3A may cause slight to moderate eye and skin irritation, and Garlon 4 may cause slight skin irritation but no eye irritation (Dow Chemical Company, undated). Ponies exposed to 4 daily doses of 60 mg/kg of triclopyr exhibited no adverse effects; however, exposure to 4 daily doses of 300 mg/kg caused depression, decreased gastrointestinal activity, and respiratory and muscular distress (Osweiler, 1983).

No teratogenic or reproductive effects have been observed in rats and rabbits (EPA, 1985j). Triclopyr is rapidly excreted, primarily as the parent compound, through the kidneys in animals (USDA, 1984). Small quantities of two other compounds are also excreted. Triclopyr does not appear to bioaccumulate in animal tissues in any significant amount (Dow Chemical Company, 1987).

Based on acute oral and dietary studies, triclopyr, Garlon 3A, and Garlon 4 are very slightly toxic to birds (Table P-17). The acute oral LD_{50} of technical triclopyr is 1,698 mg/kg for mallard ducks, and the dietary LC_{50} ranges from 2,935 to greater than 5,000 ppm (Dow Chemical Company, undated; Kenaga, 1979). The dietary LC_{50}'s of Garlon 3A and Garlon 4 are all greater than 9,000 ppm (Dow Chemical Company, undated). A one-generation reproduction study showed no reproductive effects, symptoms of toxicity, or abnormal behavior when mallards were given up to 500 ppm in the diet for 10 weeks prior to egg laying and 10 weeks during egg laying (Dow Chemical Company, 1987). A similar study reported no reproductive or toxic effects in bobwhite quail exposed to dietary levels of up to 500 ppm for 11 weeks prior to egg laying and 8 weeks during egg laying (Dow Chemical Company, 1987).

Aquatic Risk Analysis

The risks of adverse effects from exposure to herbicides were estimated for a variety of aquatic organisms under the various application scenarios (including accidents) described in the human health risk analysis.

Representative acute toxicity reference values (LC_{50}'s or EC_{50}'s) and chronic toxicity reference values (MATC's or NOEL's, see Glossary) were derived from the summary tables presented in the aquatic hazard analysis for the following groups of organisms: warmwater fish (including bluegill, fathead minnow, and catfish), coldwater fish (e.g. rainbow trout), microcrustaceans (including water fleas, copepods, scuds, sowbugs, seed shrimp and fairy shrimp), insects (including stoneflies, mayflies, dragonflies, and midges), molluscs (claims and snails), crayfish, and amphibians (tadpoles).

Table P-17. Acute toxicity of triclopyr in birds and mammals

Species	Formulation	Test	Results
Rat	Technical	Oral LD_{50}	729 mg/kg (male) 630 mg/kg (female)
Mouse	Technical	Oral LD_{50}	471 mg/kg
Rabbit	Technical	Oral LD_{50}	550 mg/kg
Guinea pig	Technical	Oral LD_{50}	310 mg/kg
Rat	Garlon 3A	Oral LD_{50}	2,830 mg/kg (male) 2,140 mg/kg (female)
	Garlon 4	Oral LD_{50}	2,460 mg/kg (male) 2,140 mg/kg (female)
Mallard duck	Technical	Oral LD_{50} Dietary LC_{50}	1,698 mg/kg >5,000 ppm
	Garlon 3A	Dietary LC_{50}	>10,000 ppm
	Garlon 4	Dietary LC_{50}	>10,000 ppm
Japanese quail	Technical	Dietary LC_{50}	3,278 ppm
Bobwhite quail	Technical	Dietary LC_{50}	2,935 ppm
	Garlon 3A	Dietary LC_{50}	11,622 ppm
	Garlon 4	Dietary LC_{50}	9,026 ppm

Source: EPA, 1985j; Dow Chemical Company, undated; Kenaga, 1979

These toxicity reference values were compared to the estimated environmental concentrations (EEC's) for each chemical under each scenario. The ratio of the EEC to the LC_{50} (or EC_{50}) is the quotient value (Q-value).

The Q-values (EEC/LC_{50}) were compared to the risk criteria proposed by EPA (1986) where the risks of effects to fish or invertebrates are described as follows:

Q-value		Risk
EEC/LC_{50}	< 0.1	no acute risk
EEC/LC_{50}	≥ 0.1 and ≥ 0.5	Presumption of risk that may be mitigated
EEC/LC_{50}	< 0.5	Presumption of significant risk of acute effects
EEC < NOEL or MATC		No chronic risk

Results the Risk Analysis

The amount of herbicide reaching a body of water depends primarily on the application method and the application rate. In this analysis the lowest estimated concentrations were in the realistic right-of-way scenario and the highest values (not including accidents) were in the worst-case routine aerial application scenario. The range of estimated concentrations of the herbicides in water are in Table P-18.

For typical right-of-way operations the estimated herbicide concentrations in water are 1.9 to 7.4 ppb. There are no significant risks of acute or chronic effects to any fish or invertebrate from any of the herbicides under this scenario.

Table P-18. Range of herbicide concentrations (ppb) in water under the six routine scenarios.

Pesticide	Realistic R.O.W.	Realistic Backpack	Realistic Aerial	Worst-case R.O.W.	Worst-case Backpack	Worst-case Aerial
ASULAM	4.5	5.0	113.0	12.4	15.9	529.0
ATRAZINE	5.6	12.4	177.0	21.2	19.1	634.0
2,4-D	4.7	8.3	118.0	10.2	19.1	634.0
DICAMBA	1.9	2.1	47.1	9.0	19.1	634.0
DIURON	7.4	16.6	—	39.8	28.6	
FOSAMINE	7.4	12.4	141.0	26.6	54.9	1902.0
HEXAZINONE	4.7	4.6	118.0	14.9	14.3	476.0
PICLORAM	1.9	4.2	47.1	5.0	19.1	793.0
RODEO!	3.7	6.2	94.2	12.4	23.9	793.0
ROUNDUP!	3.7	6.2	94.2	23.9	23.9	793.0
TRICLOPYR	3.7	8.3	94.2	19.9	38.2	1268.0

Herbicide concentrations range from 2.1 to 16.6 ppb in the routine-realistic backpack spraying operations. In this scenario there is also no significant risk of acute or chronic effects to aquatic organisms from any of the herbicides. There is a very slight chance (Q-value = .104) of acute adverse effects from diuron to the scud *Gammarus fasciatus* which is highly sensitive to this herbicide. Sensitive trout species are at slight risk of reproductive effects from exposure to picloram.

Herbicide concentrations from worst-case right-of-way operations range from 5.0 to 39.8 ppb, and for worst-case backpack operations from 14.3 to 57.3 ppb. In both of these operations no significant adverse effects are expected based on the estimated Q-values. *Gammarus fasciatus* which, as mentioned previously, is highly sensitive to diuron, has a slight risk of acute effects in these scenarios. Again, sensitive trout are at slight risk of reproductive effects from picloram.

Aerial applications result in much higher estimates of herbicide concentrations in water than the right-of-way or backpack spraying operations. Estimated aquatic concentrations are 47.1 to 188.0 ppb for realistic aerial operations and 476 to 1,902 ppb for worst-case aerial operations.

Under aerial applications of atrazine, larvae of fish and amphibians are at significant risk of death and teratogenic effects. Under worst-case assumptions for large aerial applications, fish are also at significant risk of acute effects from 2,4-D, atrazine, Roundup, and triclopyr esters (see Table P-19). Trout are at significant risk of adverse effects to fry from exposure to picloram. Drift and run-off from a 400-acre 2,4-D aerial treatment area could produce adverse effects on microcrustaceans and molluscs. The estimated concentration of atrazine under the worst-case 400-acre site poses a significant risk to all aquatic animals. No other significant risks from aerial operations are expected based on the estimated Q-values.

Accidents

Herbicide concentrations in water due to the various types of accidents are given in Table P-20. Herbicide concentrations would be relatively low (0.72-3.45 ppm) from a helicopter accidentally dumping its pesticide load into a reservoir. No significant adverse effects would be expected to occur except in the cases of atrazine, where some fish species could experience adverse acute and reproductive effects, and picloram where adverse reproductive effects could occur in trout.

Accidents resulting from a truck spill into a reservoir, direct spraying of a water body, or a helicopter dump into a pond would result in moderately high concentrations of herbicides (0.8 - 11.7 ppm) in water. These concentrations would normally cause adverse effects in many aquatic organisms. Table P-21 summarizes the risks of acute and chronic effects due to a helicopter dumping its herbicide load into a pond; this scenario represents the highest expected concentrations of these three type of accidents.

An accidental spill of a truck's herbicide load into a pond is the worst-case accident and would result in the highest herbicide concentrations (27-110 ppm)

Table P-19. Risks to aquatic organisms from worst-case routine aerial operations.

SCENARIO	HERBICIDE[a]	LC_{50}[b] (PPB)	EEC (PPB)	Q-VALUE (EEC/LC_{50})	RISK[c]
	2,4-D				
WARMWATER FISH:		1,200	634	0.528	SIGNIFICANT
COLDWATER FISH:		1,420	634	0.446	SLIGHT
MICROCRUSTACEA:		440	634	1.441	SIGNIFICANT
INSECTS:		1,600	634	0.396	SLIGHT
MOLLUSCS:		3,750	634	0.169	SLIGHT
CRAYFISH:		100,000	634	0.006	NO RISK
AMPHIBIANS:		—	634	—	NO DATA
CHRONIC TOXICITY:		320	634	1.981	SIGNIFICANT
	PICLORAM				
WARMWATER FISH:		3,700	793	0.214	SLIGHT
COLDWATER FISH:		8,600	793	0.092	NO RISK
MICROCRUSTACEA:		380,000	793	0.002	NO RISK
INSECTS:		—	793	—	NO DATA
MOLLUSCS:		380,000	793	0.002	NO RISK
CRAYFISH:		—	793	—	NO DATA
AMPHIBIANS:		—	793	—	NO DATA
CHRONIC TOXICITY:		35	793	22.657	SIGNIFICANT
	ATRAZINE				
WARMWATER FISH:		220	634	2.882	SIGNIFICANT
COLDWATER FISH:		870	634	0.729	SIGNIFICANT
MICROCRUSTACEA:		1,000	634	0.634	SIGNIFICANT
INSECTS:		720	634	0.881	UNACCEPTABLE
MOLLUSCS:		500	634	1.268	SIGNIFICANT
CRAYFISH:		—	634	—	NO DATA
AMPHIBIANS:		310	634	2.045	SIGNIFICANT
CHRONIC TOX.:		50	634	12.680	SIGNIFICANT
	GLYPHOSATE (RODEO FORMULATION)				
WARMWATER FISH:		1,000,000	793	0.001	NO RISK
COLDWATER FISH:		1,000,000	793	0.001	NO RISK
MICROCRUSTACEA:		930,000	793	0.001	NO RISK
INSECTS:		—	793	—	NO DATA
MOLLUSCS:		—	793	—	NO DATA
CRAYFISH:		—	793	—	NO DATA
AMPHIBIANS:		—	793	—	NO DATA
CHRONIC TOXICITY:		—	793	—	NO DATA
	GLYPHOSATE (ROUNDUP FORMULATION)				
WARMWATER FISH:		1,300	793	0.610	SIGNIFICANT
COLDWATER FISH:		1,800	793	0.441	SLIGHT
MICROCRUSTACEA:		3,000	793	0.264	SLIGHT
INSECTS:		18,000	793	0.044	NO RISK
MOLLUSCS:		—	793	—	NO DATA

Table P-19. Risks to aquatic organisms from worst-case routine aerial operations. (continued)

SCENARIO	HERBICIDE[a]	LC_{50}[b] (PPB)	EEC (PPB)	Q-VALUE (EEC/LC_{50})	RISK[c]
CRAYFISH:		1,000,000	793	0.001	NO RISK
AMPHIBIANS:		—	793	—	NO DATA
CHRONIC TOXICITY:		—	793	—	NO DATA
	FOSAMINE				
WARMWATER FISH:		670,000	1,902	0.003	NO RISK
COLDWATER FISH:		367,000	1,902	0.005	NO RISK
MICROCRUSTACEA:		100,000	1,902	0.019	NO RISK
INSECTS:		—	1,902	—	NO DATA
MOLLUSCS:		—	1,902	—	NO DATA
CRAYFISH:		—	1,902	—	NO DATA
AMPHIBIANS:		—	1,902	—	NO DATA
CHRONIC TOXICITY:		—	1,902	—	NO DATA
	TRICLOPYR				
WARMWATER FISH:		870	1,268	1.457	SIGNIFICANT
COLDWATER FISH:		740	1,268	1.714	SIGNIFICANT
MICROCRUSTACEA:		1,170,000	1,268	0.001	NO RISK
INSECTS:		—	1,268	—	NO DATA
MOLLUSCS:		56,000	1,268	0.023	NO RISK
CRAYFISH:		1,000,000	1,268	0.001	NO RISK
AMPHIBIANS:		—	1,268	—	NO DATA
CHRONIC TOX.:		110,000	1,268	0.012	NO RISK
	HEXAZINONE				
WARMWATER FISH:		274,000	476	0.002	NO RISK
COLDWATER FISH:		100,000	476	0.005	NO RISK
MICROCRUSTACEA:		56,000	476	0.009	NO RISK
INSECTS:		—	476	—	NO DATA
MOLLUSCS:		320,000	476	0.001	NO RISK
CRAYFISH:		1,000,000	476	0.000	NO RISK
AMPHIBIANS:		—	476	—	NO DATA
CHRONIC TOX.:		10,000	476	0.048	NO RISK
	ASULAM				
WARMWATER FISH:		3,000,000	529	0.000	NO RISK
COLDWATER FISH:		5,000,000	529	0.000	NO RISK
MICROCRUSTACEA:		—	529	—	NO DATA
INSECTS:		—	529	—	NO DATA
MOLLUSCS:		—	529	—	NO DATA
CRAYFISH:		—	529	—	NO DATA
AMPHIBIANS:		—	529	—	NO DATA
CHRONIC TOXICITY:		—	529	—	NO DATA

Table P-19. Risks to aquatic organisms from worst-case routine aerial operations. (continued)

SCENARIO	HERBICIDE[a]	LC_{50}[b] (PPB)	EEC (PPB)	Q-VALUE (EEC/LC_{50})	RISK[c]
	DICAMBA				
WARMWATER FISH:		50,000	634	0.013	NO RISK
COLDWATER FISH:		28,000	634	0.023	NO RISK
MICROCRUSTACEA:		11,000	634	0.058	NO RISK
INSECTS:		—	634	—	NO DATA
MOLLUSCS:		—	634	—	NO DATA
CRAYFISH:		—	634	—	NO DATA
AMPHIBIANS:		106,000	634	0.006	NO RISK
CHRONIC TOXICITY:		—	634	—	NO DATA

[a] Diuron is not proposed for aerial use.

[b] For acute toxicity the 96-hr LC_{50} or EC_{50} was used. For chronic toxicity the lowest NOEL or maximum acceptable toxicant concentration (MATC) from a fish or invertebrate study was used as a reference value

[c] Slight risk indicates the Q-value is between 0.1 and 0.5 and the risk can be mitigated.

Table P-20. Herbicide concentrations (ppm) in water from accidents.

	Helicopter Dump into Reservoir	Truck Spill into Reservoir	Direct Spraying	Helicopter Dump into Pond	Truck Spill into Pond
ASULAM	0.0961	0.9699	3.67	3.0749	30.7493
ATRAZINE	0.1151	1.1508	6.24	3.6825	36.8255
2,4-D	0.1151	1.1508	3.01	3.6825	36.8255
DICAMBA	0.1151	1.1508	2.93	3.6825	36.8255
DIURON[a]	—	0.9206	11.74	—	29.4604
FOSAMINE	0.3452	3.4524	8.80	11.0476	110.4764
GLYPHOSATE	0.1438	1.4385	3.67	4.6032	46.0318
HEXAZINONE	0.0863	0.8631	4.40	2.7619	27.6191
PICLORAM	0.1438	1.4385	3.67	4.6032	46.0318
TRICLOPYR	0.2302	2.3016	5.87	7.3651	73.6509

[a] Not proposed for aerial use

in water of any of the scenarios. Adverse effects would likely occur in at least some groups of aquatic organisms from any of the herbicides. The risk of adverse effects is given in Table P-22. Direct fish kills would probably occur from any of the herbicides except glyphosate (Rodeo formulation), fosamine, and asulam.

Aquatic Hazard Analysis

Asulam

Asulam is only slightly toxic to fish*. All 96-hr LC_{50} values are greater than 1,700 ppm in the five species of fish tested (see Table P-23). No information is available on its toxicity to aquatic invertebrates or amphibians.

*The classifications for relative toxicity are based on Clark et al., 1970 where 96-hr LC_{50} values are described as follows: < 1 ppm, dangerous or highly toxic, 1-10 ppm, harmful or moderately toxic, and > 10 ppm, slightly toxic.

Table P-21. Risks of adverse effects to aquatic organisms from a helicopter spill of herbicide into a pond.

SCENARIO	HERBICIDE[a]	LC_{50}[b] (PPB)	EEC (PPB)	Q-VALUE (EEC/LC_{50})	RISK[c]
	2,4-D				
WARMWATER FISH:		1,200	3,682	3.068	SIGNIFICANT
COLDWATER FISH:		1,420	3,682	2.593	SIGNIFICANT
MICROCRUSTACEA:		440	3,682	8.368	SIGNIFICANT
INSECTS:		1,600	3,682	2.301	SIGNIFICANT
MOLLUSCS:		3,750	3,682	0.982	SIGNIFICANT
CRAYFISH:		100,000	3,682	0.037	NO RISK
AMPHIBIANS:		—	3,682	—	NO DATA
CHRONIC TOX.:		320	3,682	11.506	SIGNIFICANT
	PICLORAM				
WARMWATER FISH:		3,700	4,603	1.244	SIGNIFICANT
COLDWATER FISH:		8,600	4,603	0.535	SIGNIFICANT
MICROCRUSTACEA:		380,000	4,603	0.012	NO RISK
INSECTS:		—	4,603	—	NO DATA
MOLLUSCS:		380,000	4,603	0.012	NO RISK
CRAYFISH:		—	4,603	—	NO DATA
AMPHIBIANS:		—	4,603	—	NO DATA
CHRONIC TOX.:		35	4,603	131.514	SIGNIFICANT
	ATRAZINE				
WARMWATER FISH:		220	3,682	16.736	SIGNIFICANT
COLDWATER FISH:		870	3,682	4.232	SIGNIFICANT
MICROCRUSTACEA:		1,000	3,682	3.682	SIGNIFICANT
INSECTS:		720	3,682	5.114	SIGNIFICANT
MOLLUSCS:		500	3,682	7.364	SIGNIFICANT
CRAYFISH:		—	3,682		NO DATA
AMPHIBIANS:		310	3,682	11.877	SIGNIFICANT
CHRONIC TOX.:		50	3,682	73.640	SIGNIFICANT
	GLYPHOSATE (RODEO FORMULATION)				
WARMWATER FISH:		1,000,000	4,603	0.005	NO RISK
COLDWATER FISH:		1,000,000	4,603	0.005	NO RISK
MICROCRUSTACEA:		930,000	4,603	0.005	NO RISK
INSECTS:		—	4,603	—	NO DATA
MOLLUSCS:		—	4,603	—	NO DATA
CRAYFISH:		—	4,603	—	NO DATA
AMPHIBIANS:		—	4,603	—	NO DATA
CHRONIC TOX.:		—	4,603	—	NO DATA
	GLYPHOSATE (ROUNDUP FORMULATION)				
WARMWATER FISH:		1,300	4,603	3.541	SIGNIFICANT
COLDWATER FISH:		1,800	4,603	2.557	SIGNIFICANT
MICROCRUSTACEA:		3,000	4,603	1.534	SIGNIFICANT
INSECTS:		18,000	4,603	0.256	SLIGHT

Table P-21. Risks of adverse effects to aquatic organisms from a helicopter spill of herbicide into a pond. (continued)

SCENARIO	HERBICIDE[a]	LC_{50}[b] (PPB)	EEC (PPB)	Q-VALUE (EEC/LC_{50})	RISK[c]
MOLLUSCS:		—	4,603	—	NO DATA
CRAYFISH:		1,000,000	4,603	0.005	NO RISK
AMPHIBIANS:		—	4,603	—	NO DATA
CHRONIC TOX.:		—	4,603	—	NO DATA
	FOSAMINE				
WARMWATER FISH:		670,000	11,048	0.016	NO RISK
COLDWATER FISH:		367,000	11,048	0.030	NO RISK
MICROCRUSTACEA:		100,000	11,048	0.110	SLIGHT
INSECTS:		—	11,048	—	NO DATA
MOLLUSCS:		—	11,048	—	NO DATA
CRAYFISH:		—	11,048	—	NO DATA
AMPHIBIANS:		—	11,048	—	NO DATA
CHRONIC TOX.:		—	11,048	—	NO DATA
	TRICLOPYR				
WARMWATER FISH:		870	7,365	8.466	SIGNIFICANT
COLDWATER FISH:		740	7,365	9.953	SIGNIFICANT
MICROCRUSTACEA:		1,170,000	7,365	0.006	NO RISK
INSECTS:		—	7,365	—	NO DATA
MOLLUSCS:		56,000	7,365	0.132	SLIGHT
CRAYFISH:		1,000,000	7,365	0.007	NO RISK
AMPHIBIANS:		—	7,365	—	NO DATA
CHRONIC TOX.:		110,000	7,365	0.067	NO RISK
	HEXAZINONE				
WARMWATER FISH:		274,000	2,762	0.010	NO RISK
COLDWATER FISH:		100,000	2,762	0.028	NO RISK
MICROCRUSTACEA:		56,000	2,762	0.049	NO RISK
INSECTS:		—	2,762	—	NO DATA
MOLLUSCS:		320,000	2,762	0.009	NO RISK
CRAYFISH:		1,000,000	2,762	0.003	NO RISK
AMPHIBIANS:		—	2,762	—	NO DATA
CHRONIC TOX.:		10,000	2,762	0.276	NO RISK
	ASULAM				
WARMWATER FISH:		3,000,000	3,075	0.001	NO RISK
COLDWATER FISH:		5,000,000	3,075	0.001	NO RISK
MICROCRUSTACEANS:		—	3,075	—	NO DATA
INSECTS:		—	3,075	—	NO DATA
MOLLUSCS:		—	3,075	—	NO DATA
CRAYFISH:		—	3,075	—	NO DATA
AMPHIBIANS:		—	3,075	—	NO DATA
CHRONIC TOX.:		—	3,075	—	NO DATA

Table P-21. Risks of adverse effects to aquatic organisms from a helicopter spill of herbicide into a pond. (continued)

SCENARIO	HERBICIDE[a]	LC_{50}[b] (PPB)	EEC (PPB)	Q-VALUE (EEC/LC_{50})	RISK[c]
	DICAMBA				
WARMWATER FISH:		50,000	3,682	0.074	NO RISK
COLDWATER FISH:		28,000	3,682	0.132	SLIGHT
MICROCRUSTACEA:		11,000	3,682	0.335	SLIGHT
INSECTS:		—	3,682	—	NO DATA
MOLLUSCS:		—	3,682	—	NO DATA
CRAYFISH:		—	3,682	—	NO DATA
AMPHIBIANS:		106,000	3,682	0.035	NO RISK
CHRONIC TOX.:		—	3,682	—	NO DATA

[a] Diuron is not proposed for aerial application

Atrazine

Atrazine is moderately to highly toxic to fish and aquatic invertebrates (see Table P-24). Early life-stage studies with fish and amphibians have indicated that atrazine is highly acutely toxic and teratogenic. Atrazine also affects reproduction in a number of invertebrates at concentrations of 1 ppm or less.

2,4-D

The aquatic toxicity of the butoxyethanol ester of 2,4-D ranges from moderately to highly toxic. Acute LC_{50} values range from about 0.5 ppm to 10 ppm for most species (see Table P-25). Amphipods (*Gammarus*) and snails *Lymnea* are among the most sensitive groups. The acids, to which esters rapidly hydrolyze, are not nearly as toxic; they are typically 100 times less toxic than the esters (Ghassemi et al., 1981). The toxicity of 2,4-D to amphibians has not been reported.

Dicamba

Dicamba is only slightly toxic to most aquatic organisms. Dicamba salts and the free acid are considered toxicologically equivalent because the salt hydrolyzes to the free acid in an aqueous environment (EPA, 1983e).

Short-term LC_{50} values are greater than 10 ppm for fish, amphibia, and most invertebrates (see Table P-26). The amphipod *Gammarus lacustris* with a 96-hr LC_{50} of 3.9 ppm, has shown a greater sensitivity to dicamba than any other aquatic animal tested (Sanders, 1969, in Pimentel, 1977, as cited in USDA, 1984). A 48-hr EC_{50} of 11 ppm was determined for *Daphnia pulex* (Sanders and Cope, 1966, in Hulbert, 1975, as cited in USDA, 1984). *Daphnia magna*, with a 48-hr EC_{50} of greater than 100 ppm (Johnson and Finley, 1980) does not appear to be as sensitive as *D. pulex*. No long-term aquatic toxicity studies have been reported.

Diuron

Diuron is moderately toxic to fish (see Table P-27). Ninety-six hour LC_{50}'s for technical diuron range from 1.4 ppm for cutthroat trout to 8.2 ppm for bluegill. Aquatic invertebrates are more sensitive to diuron than fish; the lowest LC_{50} is 0.16 ppm for the scud, *Gammarus fasciatus*. Toxicity values for amphibians have not been reported.

Fosamine

Fosamine is considered slightly toxic to nontoxic to fish since all 96-hr LC_{50} values are greater than 100 ppm (see Table P-28). Yolk-sac fry, fingerlings, and eggs of salmonids are not acutely sensitive to fosamine. Ninety-six-hour EC_{50}'s based on avoidance behavior and white blood cell counts in coho salmon are also greater than 100 ppm. No toxicity information is available for amphibians.

Glyphosate

The aquatic toxicities of the glyphosate formulations Roundup and Rodeo are much different, the latter

Table P-22. Risks of adverse effects to aquatic organisms from a truck spill of herbicide into a pond.

SCENARIO	HERBICIDE[a]	LC_{50}[b] (PPB)	EEC (PPB)	Q-VALUE (EEC/LC_{50})	RISK[c]
	2,4-D				
WARMWATER FISH:		1,200	36,826	30.688	SIGNIFICANT
COLDWATER FISH:		1,420	36,826	25.934	SIGNIFICANT
MICROCRUSTACEA:		440	36,826	83.695	SIGNIFICANT
INSECTS:		1,600	36,826	23.016	SIGNIFICANT
MOLLUSCS:		3,750	36,826	9.820	SIGNIFICANT
CRAYFISH:		100,000	36,826	0.368	SLIGHT
AMPHIBIANS:		—	36,826	—	NO DATA
CHRONIC TOX.:		320	36,826	115.081	SIGNIFICANT
	PICLORAM				
WARMWATER FISH:		3,700	46,032	12.441	SIGNIFICANT
COLDWATER FISH:		8,600	46,032	5.353	SIGNIFICANT
MICROCRUSTACEA:		380,000	46,032	0.121	SLIGHT
INSECTS:		—	46,032	—	NO DATA
MOLLUSCS:		380,000	46,032	0.121	SLIGHT
CRAYFISH:		—	46,032	—	NO DATA
AMPHIBIANS:		—	46,032	—	NO DATA
CHRONIC TOX.:		35	46,032	1315.2	SIGNIFICANT
	ATRAZINE				
WARMWATER FISH:		220	36,826	167.391	SIGNIFICANT
COLDWATER FISH:		870	36,826	42.329	SIGNIFICANT
MICROCRUSTACEA:		1,000	36,826	36.826	SIGNIFICANT
INSECTS:		720	36,826	51.147	SIGNIFICANT
MOLLUSCS:		500	36,826	73.652	SIGNIFICANT
CRAYFISH:		—	36,826	—	NO DATA
AMPHIBIANS:		310	36,826	118.794	SIGNIFICANT
CHRONIC TOX.:		50	36,826	736.520	SIGNIFICANT
	GLYPHOSATE (RODEO FORMULATION)				
WARMWATER FISH:		1,000,000	46,032	0.046	NO RISK
COLDWATER FISH:		1,000,000	46,032	0.046	NO RISK
MICROCRUSTACEA:		930,000	46,032	0.049	NO RISK
INSECTS:		—	46,032	—	NO DATA
MOLLUSCS:		—	46,032	—	NO DATA
CRAYFISH:		—	46,032	—	NO DATA
AMPHIBIANS:		—	46,032	—	NO DATA
CHRONIC TOX.:		—	46,032	—	NO DATA
	GLYPHOSATE (ROUNDUP FORMULATION)				
WARMWATER FISH:		1,300	46,032	35.409	SIGNIFICANT
COLDWATER FISH:		1,800	46,032	25.573	SIGNIFICANT
MICROCRUSTACEA:		3,000	46,032	15.344	SIGNIFICANT
INSECTS:		18,000	46,032	2.557	SIGNIFICANT

Table P-22. Risks of adverse effects to aquatic organisms from a truck spill of herbicide into a pond. (continued)

SCENARIO	HERBICIDE[a]	LC_{50}[b] (PPB)	EEC (PPB)	Q-VALUE (EEC/LC_{50})	RISK[c]
MOLLUSCS:		—	46,032	—	NO DATA
CRAYFISH:		1,000,000	46,032	0.046	NO RISK
AMPHIBIANS:		—	46,032	—	NO DATA
CHRONIC TOX.:		—	46,032	—	NO DATA
	FOSAMINE				
WARMWATER FISH:		670,000	110,476	0.165	SLIGHT
COLDWATER FISH:		367,000	110,476	0.301	SLIGHT
MICROCRUSTACEA:		100,000	110,476	1.105	SIGNIFICANT
INSECTS:		—	110,476	—	NO DATA
MOLLUSCS:		—	110,476	—	NO DATA
CRAYFISH:		—	110,476	—	NO DATA
AMPHIBIANS:		—	110,476	—	NO DATA
CHRONIC TOX.:		—	110,476	—	NO DATA
	TRICLOPYR				
WARMWATER FISH:		870	73,651	84.656	SIGNIFICANT
COLDWATER FISH:		740	73,651	99.528	SIGNIFICANT
MICROCRUSTACEA:		1,170,000	73,651	0.063	NO RISK
INSECTS:		—	73,651	—	NO DATA
MOLLUSCS:		56,000	73,651	1.315	SIGNIFICANT
CRAYFISH:		1,000,000	73,651	0.074	NO RISK
AMPHIBIANS:		—	73,651	—	NO DATA
CHRONIC TOX.:		110,000	73,651	0.670	NO RISK
	HEXAZINONE				
WARMWATER FISH:		274,000	27,619	0.101	SLIGHT
COLDWATER FISH:		100,000	27,619	0.276	SLIGHT
MICROCRUSTACEA:		56,000	27,619	0.493	SLIGHT
INSECTS:		—	27,619	—	NO DATA
MOLLUSCS:		320,000	27,619	0.086	NO RISK
CRAYFISH:		1,000,000	27,619	0.028	NO RISK
AMPHIBIANS:		—	27,619	—	NO DATA
CHRONIC TOX.:		10,000	27,619	2.762	SIGNIFICANT
	ASULAM				
WARMWATER FISH:		3,000,000	30,749	0.010	NO RISK
COLDWATER FISH:		5,000,000	30,749	0.006	NO RISK
MICROCRUSTACEANS:		—	30,749	—	NO DATA
INSECTS:		—	30,749	—	NO DATA
MOLLUSCS:		—	30,749	—	NO DATA
CRAYFISH:		—	30,749	—	NO DATA
AMPHIBIANS:		—	30,749	—	NO DATA
CHRONIC TOX.:		—	30,749	—	NO DATA

Table P-22. Risks of adverse effects to aquatic organisms from a truck spill of herbicide into a pond. (continued)

SCENARIO	HERBICIDE[a]	LC_{50}[b] (PPB)	EEC (PPB)	Q-VALUE (EEC/LC_{50})	RISK[c]
	DIURON				
WARMWATER FISH:		8,200	29,460	3.593	SIGNIFICANT
COLDWATER FISH:		1,400	29,460	21.043	SIGNIFICANT
MICROCRUSTACEA:		160	29,460	184.125	SIGNIFICANT
INSECTS:		1,200	29,460	24.550	SIGNIFICANT
MOLLUSCS:		—	29,460	—	NO DATA
CRAYFISH:		—	29,460	—	NO DATA
AMPHIBIANS:		—	29,460	—	NO DATA
CHRONIC TOX.:		—	29,460	—	NO DATA
	DICAMBA				
WARMWATER FISH:		50,000	36,826	0.737	SIGNIFICANT
COLDWATER FISH:		28,000	36,826	1.315	SIGNIFICANT
MICROCRUSTACEA:		11,000	36,826	3.348	SIGNIFICANT
INSECTS:		—	36,826	—	NO DATA
MOLLUSCS:		—	36,826	—	NO DATA
CRAYFISH:		—	36,826	—	NO DATA
AMPHIBIANS:		106,000	36,826	0.347	SLIGHT
CHRONIC TOX.:		—	36,826	—	NO DATA

Table P-23. Toxicity of asulam to aquatic organisms

Species	Concentration (ppm)	Effect	Source
Rainbow trout	> 5,000	96-hr LC_{50}	WSSA, 1983
Bluegill	> 3,000	96-hr LC_{50}	WSSA, 1983
Channel catfish	> 5,000	96-hr LC_{50}	WSSA, 1983
Goldfish	> 5,000	96-hr LC_{50}	WSSA, 1983
Harlequin fish	> 1,700	96-hr LC_{50}	WSSA, 1983

Table P-24. Toxicity of atrazine to aquatic organisms

Species	Concentration (ppm)	Effect	Source
Rainbow trout	24 (18-32) (atrazine 4 L)	96-hr LC_{50} (95% C.L.)	Mayer and Ellersieck, 1986
	4.5 (3.5 – 5.7) (technical)	96-hr LC_{50}	Bathe et al., 1976 in USDA, 1984
- fry	0.87 (0.63-1.15)	96-hr LC_{50} Teratogenic effects in 3, 6, and 62% at 0.05, 0.54, and 5.02 ppm respectively. Exposure from spawning to 96 hours post hatching	Birge et al., 1979 and 1983 in USDA, 1984
Brook trout	6.3 (4.1-9.7)	96-hr LC_{50}	Macek et al., 1976 in USDA, 1984
- fry	0.24	Reduced survival and growth	Macek et al., 1976 in USDA, 1984
- adults	0.72	No effect on survival, egg production, or egg hatching	Macek et al., 1976 in USDA, 1984
Bluegill	42 (36 - 39) (atrazine 4 L)	96-hr LC_{50} (95% C.L.)	Mayer and Ellersieck, 1986
	0.5	Fish became lethargic, fed poorly, and had partial loss of equilibrium after 28 days	Macek et al., 1976 in USDA, 1984
	6 (approx.) (wettable powder)	96-hr LC_{50}	In USDA, 1984
- eggs & fry	0.095	No effects on hatching, survival, or growth after 18 months	Macek et al., 1976 in USDA, 1984
Fathead minnow	15 (11-20)	96-hr LC_{50}	Macek et al., 1976 in USDA, 1984

Table P-24. Toxicity of atrazine to aquatic organisms (continued)

Species	Concentration (ppm)	Effect	Source
- fry	0.52	25% mortality at 96 hours	
	0.213	No effect on survival, growth, or spawning after 43 weeks	
Catfish	7.6 (atrazine)	96-hr LC_{50}	In USDA, 1984
	35 (80% wettable powder)	96-hr LC_{50}	In USDA, 1984
	0.22 (0.15-0.32)	96-hr LC_{50} Teratogenic effects in 4, 13, 69, and 100% at 0.06, 0.43, 4.83, and 46.7 ppm respectively. Exposure from spawning to 96 hours post hatching	Birge et al., 1979 and 1983 in USDA, 1984
Brown shrimp	1.0	30% mortality or immobility at 48 hours	Butler, 1965 in USDA, 1984
Water fleas	3.6	48-hr LC_{50}	In USDA, 1984
Daphnia magna	1.15	Decreased fecundity, no effect on survival	Macek et al., 1976 in USDA, 1984
D. pulex	1.0	Decreased fecundity. Decreased survival at 20 ppm, not at 10. Synergistic effects with ethanol	Schaber and Lambert in USDA, 1984
Scud *Gammarus fasciatus*	5.7 (3.6-8.0)	48-hr LC_{50}	Macek et al., 1976 in USDA, 1984

Table P-24. Toxicity of atrazine to aquatic organisms (continued)

Species	Concentration (ppm)	Effect	Source
	0.14	Reproductive effects and reduced survival of offspring at exposures of 30 days to 17 weeks	
Clams and snails	0.5	87.5% mortality in clams; snails increased by approximately 400%	In USDA, 1984
Midge *Chironomus tentans* - larvae	0.72 (0.36 - 1.44)	48-hr LC_{50}	Macek et al., 1976 in USDA, 1984
	0.11	No adverse effect after 2 generations; reduced hatching success, increased larval mortality, and retarded development at 0.23 ppm	
Bullfrog -tadpoles	0.41	LC_{50} from spawning to 96 hours post hatching; Teratogenic effects of 3, 7, 22, 47, and 100% at 0.4, 6.33, 14.8, 26.4, and 45.8 ppm respectively	Birge et al., 1980 and 1983 in USDA, 1984
Leopard frog - tadpoles	0.31	Significant decrease in growth from 27-54 days. Significant increase in mortality at 0.31 to 12 ppm from 27 to 54 days of exposure;	Hine et al., 1981 in USDA, 1984

Table P-25. Toxicity of 2,4-D butoxyethanol ester to aquatic organisms

Species	Concentration (ppm)	Effect	Source
Rainbow trout			
-fingerlings	1.42 to 1.55	96-hr LC_{50}	Halter, 1980
-yearlings	9.0	96-hr LC_{50}	Dodson and Mayfield, 1979[a]
Bluegill	1.2	96-hr LC_{50}	Johnson and Finley, 1980
Fathead minnow	3.3	96-hr LC_{50}	Johnson and Finley, 1980
Black bullhead	7.1 to 7.7	96-hr LC_{50}	Halter, 1980
Crayfish			
Orconectes nais	> 100	48-hr LC_{50}	Sanders, 1970
Glass Shrimp			
Palaemonetes kadiakensis	1.4	48-hr LC_{50}	Sanders, 1970
Shrimp	1.0	48-hrs, no effect	Ghassemi et al., 1981
Water fleas			
Daphnia pulex	3.0	8 days, no effects	Sigmon, 1979[a]
D. magna	5.6	48-hr LC_{50}	Sanders, 1970
Copepod			
Nitocra spinipes	3.1	96-hr LC_{50}	Linden et al., 1979[a]
Scuds			
Gammarus lacustris	0.44	96-hr LC_{50}	Sanders, 1969[a]
Gammarus fasciatus	5.9	96-hr LC_{50}	Sanders, 1970
Sowbug-			
Asellus brevicaudis	2.6	96-hr LC_{50}	Johnson and Finley, 1980
Seed Shrimp			
Cypridopsis vidua	2.2	48-hr EC_{50}	Johnson and Finley, 1980
	1.8	48-hr LC_{50}	Sanders, 1970
Stonefly			
Pteronarcys californica			
-adult	> 1,000	96-hr LC_{50}	FWPCA, 1968[a]
-nymphs	1.6	96-hr LC_{50}	Sanders and Cope, 1968[a]
Eastern Oyster *Crassostrea virginica*	3.75	96-hr EC_{50}, decrease in shell growth	Butler, 1965, in USDA, 1984
Snail			
Lymnea sp.	0.32	6 wks LC42	Halter, 1980

[a] As cited in DEA, 1986

Table P-26. Toxicity of dicamba (88% technical) to aquatic organisms

Species	96-hour LC_{50} (ppm)	Source
Rainbow trout		
-fingerlings, 0.8g	28	Johnson and Finley, 1980
	135	Velsicol Chem. Corp. in Ghassemi et al., 1981
Cutthroat trout	> 50	Woodward, 1982, in USDA, 1984
Coho Salmon		Lorz et al., 1979, in
-juveniles	120[a]	USDA, 1984
Bluegill		
-fingerlings, 0.9g	> 50	Johnson and Finley, 1980
	135	Velsicol Chem. Corp. in Ghassemi et al., 1981
Glass Shrimp		
Palaemonetes kadiakensis	> 56	Johnson and Finley, 1980
Water flea		
Daphnia sp.	11[b]	Sanders and Cape, 1966, in Hurlbert, 1975, in USDA, 1984
Daphnia magna -lst instar	> 100[b]	Mayer and Ellersieck, 1986
Scud		
Gammarus fasciatus	> 100	Johnson and Finley, 1980
Sowbug		
Asellus brevicaudus	> 100	Johnson and Finley, 1980
Frog, tadpole		
-(1-2 wks old) *Adelotus brevis*	185	Johnson, 1976, in USDA, 1984
-(1-2 wks old) *Limnodynastes peroni*	106	Johnson, 1976, in USDA, 1984

[a] 48-hr LC_{50}

[b] 48-hr EC_{50}

Table P-27. Toxicity of diuron to aquatic organisms

Species	Concentration (ppm)	Effect	Source
Rainbow trout	4.9 4.1 - 5.9)[a]	6-hr LC_{50} 95% C.L.)	Johnson and Finley, 1980
	16 (11-23)[b]	96-hr LC_{50} (95% C.L.)	
Lake trout	2.7 (2.4 - 3.0)[a]	96-hr LC_{50} (95% C.L.)	Johnson and Finley, 1980
Cutthroat trout	1.4 (1.1 - 1.9)[a]	96-hr LC_{50} (95% C.L.)	Johnson and Finley, 1980
Bluegill	8.2 (7.4 - 9.1)[a]	96-hr LC_{50} (95% C.L.)	Johnson and Finley, 1980
Water fleas			
Daphnia pulex	1.4 (1.0 - 1.9)[a]	48-hr EC_{50} (95% C.L.)	Johnson and Finley, 1980
Simocephalus serrulatos	2.0 (1.4 - 2.8)[a]	48-hr EC_{50} (95% C.L.)	Johnson and Finley, 1980
Scud			
Gammarus fasciatus	0.16 (0.13 - 0.19)[a]	96-hr LC_{50} (95% C.L.)	Johnson and Finley, 1980
Sowbug			
Asellus brevicaudus	15.5 (7.2-33.4)[a]	96-hr LC_{50} (95% C.L.)	Johnson and Finley, 1980
Stonefly			
Pteronarcys californica	1.2 (0.9 - 1.7)[a]	96-hr LC_{50} (95% C.L.)	Johnson and Finley, 1980

[a] Technical material, 95%

[b] Wettable powder, 80%

Table P-28. Toxicity of fosamine to aquatic organisms

Species	Concentration (ppm)	Effect	Source
Rainbow trout -adult	>100	96-hr LC_{50}	Mayer and Ellersieck, 1986
-adult	>1,000[a]	96-hr LC_{50} (No effects at 1,000 ppm)	Schneider and Kaplan, 1983, in USDA, 1984
-yolk-sac fry (alevin)	367[b]	96-hr LC_{50}	USDA, 1984
-eggs	1,456[b]	lowest 96-hr LC_{50}	
Coho salmon	8,290[a]	96-hr LC_{50}	Schneider and Kaplan, 1983, in USDA, 1984
	295[a]	96-hr EC_{50}, based on avoidance behavior; threshold at 8.9 ppm	
	198[a]	96-hr EC_{50}, acute stress based on leucocrit values; threshold at 4 ppm	
-egg stages	25,377	lowest 96-hr LC_{50}	USDA, 1984
-yolk sac fry (alevin)	618[b]	96-hr LC_{50}	
-fingerlings	2,669	lowest 96-hr LC_{50}	
-yearling	3,295	lowest 96-hr LC_{50}	
Bluegill (378-1,190)[a]	670 (95% C.L.)	96-hr LC_{50} 1983, in USDA, 1984	Schneider and Kaplan,
Fathead minnow	> 1,000[a]	96-hr LC_{50} (No effects at 1,000 ppm)	Schneider and Kaplan, 1983, in USDA, 1984
Channel catfish	> 100	96-hr LC_{50}	Mayer and Ellersieck, 1986
Water flea *Daphnia magna*	1,524 (1,310-1,720)[a]	48-hr LC_{50} (95% C.L.)	Schneider and Kaplan, 1983, in USDA, 1984
Scud *Gammarus pseudolimnaeus*	> 100	96-hr LC_{50}	Mayer and Ellersieck, 1986
Midge *Chironomus plumosus*	> 100	48-hr LC_{50}	Mayer and Ellersieck, 1986

[a] ammonium salt

[b] Krenite!

being much less toxic; for this reason they are treated separately in this analysis.

Roundup

Table P-29 summarizes the toxicity of the Roundup formulation of glyphosate to aquatic organisms. Most 96-hr LC_{50} values range approximately from 2 to 18 ppm, classifying Roundup as moderately to slightly toxic. The acute toxicity of Roundup is greater at pH 6.5 than pH 7.5, and toxicity also increases with increasing temperature (Folmar et al., 1979). Rainbow trout did not exhibit avoidance behavior at concentrations up to 10 mg/L, whereas mayfly nymphs showed avoidance behavior at this level (Folmar et al., 1979).

Rainbow trout were exposed for 12 hours to 0.02, 0.2, and 2.0 mg/L of Roundup. No effects were observed on fecundity or maturation of gonads after being held in freshwater for 30 days (Folmar et al., 1979). Midge larvae were also exposed to 0.02, 0.2 and 2.0 mg/L of Roundup. Significant increases in stream drift of the larvae were observed at the highest concentration (Folmar et al., 1979).

Rodeo

The Rodeo formulation (53.5 percent isopropylamine salt of the active ingredient N-phosphonomethyl glycine) of glyphosate is practically nontoxic to aquatic organisms. The 96-hr LC_{50}'s for fish are all greater than 1,000 ppm, and the 48-hr LC_{50} for *Daphnia magna* is 930 ppm (see Table P-34) (Monsanto, 1983). No long-term aquatic toxicity studies have been reported.

No studies are available on the toxicity of glyphosate to amphibians.

Hexazinone

The aquatic toxicity of hexazinone is summarized in Table P-30. Hexazinone is only slightly toxic to fish; all 96-hr LC_{50}'s are greater than 100 ppm. EPA (1982 in USDA, 1984) described technical hexazinone as 'practically nontoxic' to fish. It is also only slightly toxic to aquatic invertebrates. No studies have been reported with amphibians.

Picloram

Tordon 101 is moderately to slightly toxic and picloram is generally only slightly toxic to aquatic organisms. All reported LC_{50}'s for picloram are greater than 10 ppm (see Table P-31).

Table P-29. Toxicity of glyphosate to aquatic organisms

Species	Concentration (ppm)	Effect	Source
Roundup:			
Rainbow trout			
-fingerlings, 1g	1.3	96-hr LC_{50}	Folmar, 1979
-fingerlings, 2g	7.4 to 14.	96-hr LC_{50}	
Bluegill	1.8 to 4.2	96-hr LC_{50}	Folmar, 1979
Fathead minnow	2.3	96-hr LC_{50}	Folmar, 1979
Channel Catfish			
-fingerlings	13.	96-hr LC_{50}	Folmar, 1979
-swim-up fry	3.3	96-hr LC_{50}	
-adult	16.	96-hr LC_{50}	Monsanto, 1982
Grass carp	15.	96-hr LC_{50}	Tooby et al., 1980
Carp	3.9	96-hr TL_{50}	Monsanto, 1982
Crayfish	> 1,000	96-hr LC_{50}	Monsanto, 1982
Water flea			
Daphnia magna	3.0	48-hr LC_{50}	Folmar, 1979
Copepod			
Nitocra spinipes	22.	96-hr LC_{50}	Linden et al.,1979
Scud			
Gammarus pseudolimnaeus	43.	96-hr LC_{50}	Folmar, 1979
Midge larvae	18.	48-hr EC_{50}	Folmar, 1979
Rodeo:			
Trout	> 1,000	96-hr LC_{50}	Monsanto, 1983
Bluegill	> 1,000	96-hr LC_{50}	Monsanto, 1983
Carp	> 10,000	96-hr LC_{50}	Monsanto, 1983
Water flea			
Daphnia magna	930	48-hr LC_{50}	Monsanto, 1983
Glyphosate[b]:			
Rainbow Trout	140 (120-170)	96-hr LC_{50}	Folmar et al., 1977[a]
	38	96-hr LC_{50}	USDA, 1981[c]
Bluegill	140 (110-160)	96-hr LC_{50} (static test)	Folmar et al., 1977[a]

Table P-29. Toxicity of glyphosate to aquatic organisms (continued)

Species	Concentration (ppm)	Effect	Source
	24	96-hr LC_{50} (flow through test)	USDA, 1981[c]
Fathead minnow	97 (79-120)	96-hr LC_{50}	Folmar et al., 1977[a]
Channel catfish	130 (110-160)	96-hr LC_{50}	Folmar et al., 1977[a]
Carp	115	96-hr LC_{50}	USDA, 1981[c]
Water flea *Daphnia sp.*	780	40-hr LC_{50}	Monsanto Company, 1982[c]
Midge *Chironomus plumosus*	55	48-hr EC_{50}	Folmar et al., 1979[c]

[a] In Ghassemi et al., 1981

[b] Technical glyphosate (95% or more of active ingredient) is assumed to be the formulation used.

[c] In USDA, 1984

Aquatic insects and crustaceans have 24-hr LC_{50}'s of 50 to 120 ppm for picloram. *Daphnia* showed no effect during a 24-hour exposure to 380 ppm (USDA, 1984). For lake trout and cutthroat trout Technical grade picloram (90 percent a.i.) is more toxic than the other formulations with 96-hr LC_{50}'s of 4.25 and 5.0 ppm, respectively.

Some aquatic invertebrates (*Gammarus fasciatus* and *Pteronarcys californica*) have also shown a high sensitivity to technical grade picloram (see Table P-31). Woodward (1979, in Ghassemi et al., 1981) reported increased fry mortality in cutthroat trout at concentrations of picloram (technical grade) greater than 1,300 ug/l and reduced fry growth above 610 ug/l (flow through tests). No adverse effects to fry occurred at below 290 ug/l. Similar findings have been reported by Scott et al. (1977, in Mullison, 1985). EPA (1985) has also reported chronic studies on lake trout, where low concentrations of picloram adversely affected the rate of yolk sac absorption and growth of fry. Johnson and Finley (1980) have reported a chronic NOEL for lake trout fry of less than 35 ug/l.

No adverse effects on growth were reported for algae, *Daphnia*, goldfish, and guppies exposed to 1 ppm picloram for 10 weeks. Guppies exhibited no adverse effects at this same concentration after 6 months of exposure (Lynn, 1965, in Ghassemi et al., 1981).

No studies with frog tadpoles or other amphibians have been reported.

Triclopyr

The toxicity of triclopyr to aquatic species is summarized in Table P-32. The butoxyethyl ester is highly toxic to fish, whereas the triethylamine salt is only slightly toxic; the 96-hr LC_{50}'s for rainbow trout are 0.74 ppm for the butoxyethyl ester and 552 ppm for the triethylamine salt. Unformulated triclopyr is also only slightly toxic. No studies on amphibians are available.

Table P-30. Toxicity of hexazinone to aquatic organisms

Species	Concentration (ppm)	Effect	Source
Rainbow trout	320-420[b]	96-hr LC_{50}	EPA, 1982[a]; Technical Data Sheet for Hexazinone, Du Pont
	>180[c]	96-hr LC_{50}	Mayer and Ellersieck, 1986
Brook trout	>100[b,c]	96-hr LC_{50}	Mayer and Ellersieck, 1986
Bluegill	505 (450-538)	96-hr LC_{50} (95% C.L.)	EPA, 1982[a]
	370-420	96-hr LC_{50}	EPA, 1982[a]
	925 (782-1,049)[d]	96-hr LC_{50} (95% C.L.)	Schneider and Kaplan, 1983[a]
Fathead minnow	274 (207-361)[b]	96-hr LC_{50} (95% C.L.)	EPA, 1982[a]; Technical Data Sheet for Hexazinone, Du Pont
Fiddler crab	>1,000[b]	96-hr LC_{50}	EPA, 1982[a]
Grass shrimp	56-100[b]	96-hr LC_{50}	EPA, 1982[a]
Water flea			
Daphnia magna	151.6 (125.2-172.8)[b]	48-hr LC_{50} (95% C.L.)	EPA, 1982[a]
Daphnia sp.	20-50[b] 10[b]	21-day LC_{50} 21-day NOEL	Mayack et al., 1982[a] and EPA, 1982[a]
Eastern oyster -larvae	320-560[b]	48-hr EC_{50}, based on reduction in number of normal embryos	EPA, 1982[a]

[a] As cited in USDA, 1984

[b] technical

[c] 90% wettable powder

[d] Velpar! L - 25% hexazinone liquid

Table P-31. Toxicity of picloram to aquatic organisms

Species	Concentration (ppm)	Effect	Source
Picloram (Tordon 101 formulation)*			
Rainbow trout	8.6 a.e. Tordon! 31.8 a.e. 2,4-D	96-hr LC_{50}	Lynn, 1965, and Winston, 1963, in Kenaga, 1969
Brook trout	13.7 a.e. Tordon! 50.9 a.e. 2,4-D	96-hr LC_{50}	Lynn, 1965, and Winston, 1963, in Kenaga, 1969
Brown trout	13.1 a.e. Tordon! 48.8 a.e. 2,4-D	96-hr LC_{50}	Lynn, 1965, and Winston, 1963, in Kenaga, 1969
Coho salmon	17.5	24-hr LC_{50}	Spehar et al., 1981[a]
Green sunfish	8.6 a.e. Tordon! 31.8 a.e. 2,4-D	96-hr LC_{50}	In Kenaga, 1969
Fathead minnow	3.7 a.e. Tordon! 13.7 a.e. 2,4-D	96-hr LC_{50}	Lynn, 1965, and Winston, 1963, in Kenaga, 1969
Pugnose minnow	7.6 a.e. Tordon! 28.2 a.e. 2,4-D	96-hr LC_{50}	In Kenaga, 1969
Goldfish	4.3 a.e. Tordon! 15.9 a.e. 2,4-D	24-hr LC_{50}	Hardy, 1963, in Kenaga, 1969
Water flea *Daphnia* sp.	530	95% mortality at 24 hrs; no mortality at 380 ppm	Lynn, 1965
Snail	530	100% mortality at 72 hrs.; no mortality at 380 ppm	Lynn, 1965
Picloram:			
Rainbow trout	24 - 34 (a.e.[b])	24 to 96 hr LC_{50}	U.S. DOI, 1965, in Kenaga, 1969
Coho salmon	21 - 29 (a.e.)	96-hr LC_{50}	Bond et al., 1967, in Kenaga, 1969

Table P-31. Toxicity of picloram to aquatic organisms (continued)

Species	Concentration (ppm)	Effect	Source
Bluegill	21 - 26.5 (a.e.)	96-hr LC_{50}	Bond et al., 1967, in Kenaga, 1969
Largemouth bass	13.1 - 19.7 (a.e.)	24 to 48-hr LC_{50}	U.S. DOI, 1964, in Kenaga, 1969
Goldfish	14 - 36	24 to 96-hr LC_{50}	U.S. DOI, 1964, in Kenaga 1969
Mosquito fish	120 - 133 (a.e.)	24 to 96-hr LC_{50}	Johnson, 1978[a]
Brown shrimp	1	48-hr NOEL	U.S. DOI, 1966[a]
Water flea *Daphnia sp.*	530	95 percent mortality at 24 hours, NOEL at 380 ppm	Lynn, 1965[a]
	1	No observed effect on growth and reproduction after 10 weeks	Hardy, 1966[a]
Scud *Gammarus lacustris*	50 48	24-hr LC_{50} 48-hr LC_{50}	Sanders, 1969[a] U.S. DOI, 1968, in Pimentel, 1971[a]
Stoneyfly nymphs, *Pteronarcys californica*	120	24-hr LC_{50}	Sanders and Cope, 1968[a]
Eastern oyster	1	No observed effect on shell growth after 48 hours	Butler, 1965[a]
Picloram (Technical Grade)**			
Rainbow trout	12.5	96-hr LC_{50}	Johnson and Finley, 1980
Lake trout	4.25	96-hr LC_{50}	Woodward, 1976[a] Johnson and
	0.035	Decreased rate of yolk sac absorption and growth in fry, chronic exposure	Finley, 1980

Table P-31. Toxicity of picloram to aquatic organisms (continued)

Species	Concentration (ppm)	Effect	Source
Cutthroat trout	5.0	96-hr LC_{50}	Woodward, 1976[a]
	> 1.3	After 22 days exposure increased fry mortality;	Woodward, 1979[a], in USDA, 1984 and in Ghassemi et al., 1981
	> 0.610	Reduced growth of fry;	
	< 0.29	no adverse effects	
Bluegill	23.0	96-hr LC_{50}	Johnson and Finley, 1980
Channel catfish	6.3 - 15.5	96-hr LC_{50}	Johnson and Finley, 1980
Scud			
Gammarus fasciatus	0.027	96-hr LC_{50}	Johnson and Finley, 1980
Stoneflies			
Pteronarcella badia	> 10.0	96-hr LC_{50}	Johnson and Finley, 1980
Pteronarcys californica	0.048	96-hr LC_{50}	Johnson and Finley, 1980

* Tordon 101 formulation = 10.2% picloram-TIPA[c], 5.7% a.e., and 21.2% a.e. 2.4-D TIPA:

** Technical grade = 90% a.i.

[a] As cited in USDA, 1984

[b] a.e. - acid equivalent

[c] TIPA-triisopropylamine salt

Table P-32. Toxicity of triclopyr to aquatic organisms

Species	Concentration (ppm)	Effect	Source
Rainbow trout	0.74[a]	96-hr LC_{50}	Dow Chemical Company, 1983, in USDA, 1984
	552[b]	96-hr LC_{50}	
	117	96-hr LC_{50}	
Bluegill	0.87[a]	96-hr LC_{50}	Dow Chemical Company, 1983, in USDA 1984
	891[b]	96-hr LC_{50}	
	148 (triclopyr)	96-hr LC_{50}	
Fathead minnow	120 to 245[b,c]	96-hr LC_{50} Toxicity increased with temperature between 17 to 26 °C)	Mayes et al. (in press), in USDA, 1984
	101 (88.5 - 116)[b,c]	8-Day LC_{50} 24,8 - 25.8 °C)	
-embryo-larval stages	114[b,c]	98% mortality at 28 days; 21% mortality in controls	
Crab	>1,000[d]	96-hr LC_{50}	Dow Chemical Company, 1983, in USDA, 1984
Shrimp	895[d]	96-hr LC_{50}	Dow Chemical Company 1983, in USDA, 1984
Water flea *Daphnia magna*	1,170 (1,030 - 1,340)[b]	48-hr LC_{50} (95% C.L.)	Gersich et al., 1984
	1,140 (950 - 1,590)[b]	21-day LC_{50}	
	110	MATC based on total young and brood size	
Oyster	56 - 87[d]	48-hr LC_{50}	Dow Chemical Company 1983, in USDA, 1984

[a] Garlon 3A butoxyethyl ester

[b] Garlon 3A-triethylamine salt (TEA) or other TEA formulation

[c] Flow-through tests

[d] Garlon 3A-type not specified

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Glossary of Terms

Adsorption - Adhesion of substances to the surfaces of solids or liquids. Technically, the attraction of ions of compounds to the surfaces of solids or liquids.

Air Contaminant - An unnatural component of air.

Air Pollutant - Either an air contaminant that represents a hazard to human health or a natural component of air present in sufficient quantity to create such a hazard.

Allowable Cut - The amount of timber that may be harvested annually or periodically from a specified area over a stated period in accordance with the objectives of management.

Allowable Cut Determination Process - The development and evaluation of alternative levels of timber production for the purpose of establishing an allowable cut.

Animal Unit Months (AUM) - The amount of forage (of any combination of vegetative species) necessary for the subsistence, in a healthy state, of one mature cow (and calf under six months) for a period of one months.

Archeological Resources - All evidences of past human occupations other than historical documents, which can be used to reconstruct the lifeways of past peoples. These include sites, artifacts, environmental data and all other relevant information. Archeological resources are also called cultural resources.

Area of Critical Environmental Concern (ACEC) - An area within the public lands where special management attention is required (when such areas are developed or used, or where no development is required) to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources or other natural systems or processes, or to protect life and safety from natural hazards (FLPMA Sec. 103(a)).

Average Employment - The sum of number of employees, reported monthly, divided by twelve; because employment is reported for all employees working during any one month, it is a modest overestimate of full-time equivalent employment.

Board Foot - A unit of solid wood, 1 foot square and 1 inch thick.

Broadcast Burning - Intentional burning in which fire is intended to spread over all of a specific area. It may or may not qualify as prescribed burning.

Brush-Seedling Stage - A successional stage in the development of a forest where vegetation is dominated by brush and/or tree seedlings.

Buffer Strip - A protective area adjacent to an area requiring special attention or protection. In contrast to riparian zones which are ecological units, buffer strips can be designed to meet varying management concerns.

Bureau Planning System - A process used in the BLM to establish land use allocations, constraints and objectives for various categories of public land use.

Carcinogenic - A substance producing or inciting cancer.

Characteristic Landscape - The existing visual character of an area of land. The term does not necessarily mean naturalistic landscape character. It can refer to farmlands, timberlands or another type of landscape.

Chemical Degradation - The breakdown of a chemical substance into simpler components through chemical reactions.

Clearcutting - A method of timber harvesting in which all trees (merchantable or unmerchantable) are cut from an area.

Commercial Forest Land - Forest land that is now producing or is capable of producing at least 20 cubic feet per acre per year of commercial coniferous tree species.

Coos Bay Wagon Road (CBWR) Lands - Public lands granted to the Southern Oregon Company and subsequently reconveyed to the United States.

Covered Employment (Payroll) - Employees and payroll covered by either the Oregon Unemployment Insurance Law or the program of Unemployment Compensation of Federal Employees.

Critical Habitat - (1) The specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the Endangered Species Act, on which are found those physical or biological features (a) essential to the conservation of the species and (b) which may require special management considerations or protection, and (2) specific areas outside the geographical area occupied by the species at the time it is listed upon the determination by the Secretary that such areas are essential for the conservation of the species.

Cryic Soil Temperature Zone - A soil temperature regime used in soil classification. Generally, these soils have mean annual temperatures between 32 F and 47 F.

Cultural Modifications - Man-caused alterations of the landscape.

Cultural Resources - Those fragile and nonrenewable remains of human activity, occupation, or endeavor, reflected in districts, sites, structures, buildings, objects, artifacts, ruins, works of art, architecture, and natural features, that were of importance in human events. These resources consist of (1) physical remains, (2) areas where significant human events occurred—even though evidence of the event no longer remains, and (3) the environment immediately surrounding the actual resource. Cultural resources, including both prehistoric and historic remains, represent a part of the continuum of events from the earliest evidences of man to the present day.

Decision Document - A document issued subsequent to environmental analysis identifying the decisions made concerning a proposed action, the rationale used in making the decisions and the environmental considerations used in the decisionmaking.

Defoliation - A reduction in the amount of leaves or needles due to the application of vegetation management treatments, specifically herbicides.

Demographic Analysis - A statistical evaluation of a human population with regard to size and density, distribution and vital statistics.

Designated Area - Principal population centers of western Oregon which have been established in consultation with the Oregon Department of Environmental Quality.

Dispersed Recreation - Pleasure-seeking activities which may occur over wide areas. Density of use is normally low, and facility developments are nonexistent.

Dissolved Solids - Material dissolved in water; usually refers to material in a water sample which passes through a 0.45 mm membrane filter.

Distance Zone - Distance (viewing) zones are subdivisions of public lands which specify the distances between observer and observed areas. In the VRM inventory process, there are three distance

zones: foreground-middleground, background and seldom-seen. Areas seen from highways, rivers, scenic overlooks or other viewing locations which are less than 5 miles away are in the foreground-middleground zone. Seen areas beyond the foreground-middleground but less than 15 miles away are in the background zone. Areas not seen as foreground-middleground or background are categorized seldom-seen.

DNA - Deoxyribonucleic acid. Any of various nucleic acids that are the molecular basis of heredity in many organisms.

Drip Torch - A container of slash-burning fuel equipped with a wick to ignite the fuel mixture as it drips from the container onto the slash. Hand-held torches have a 1½ gallon capacity, and ignition is accomplished using a fiber-filled, fuel-soaked wick. The torch used by a helicopter has a 30-55-gallon capacity and is equipped with an electrically activated fuel pump and ignition.

Droughty Soil - A soil that, due to its internal characteristics, provides limited plant food and moisture.

Dry Ravelling - The downslope movement of detached soil, debris or gravel.

Duff - Forest litter and other soil organic debris in various stages of decomposition located on top of the mineral soil.

Edge - The place where plant communities meet or where successional stages of vegetation conditions within plant communities come together.

Endangered Species - Plant or animal species that are in danger of extinction throughout all or a significant portion of their range (see Threatened Species).

Environmental Assessment (EA) - A systematic environmental analysis of site-specific BLM activities used to determine whether such activities have a significant effect on the quality of the human environment and whether a formal environmental impact statement is required.

Environmental Impact Statement (EIS) - A formal document to be filed with the Environmental Protection Agency that considers significant environmental impacts expected from implementation of a major Federal action.

Erosion (soil) - Removal of soil from its place of origin to a point of deposition other than a stream channel.

Escape Cover - Generally, any vegetation, rocks or logs used by fish for security or escape from danger.

Evapotranspiration - The process which returns soil moisture to the atmosphere, including evaporation and plant transpiration (uptake of soil water through roots and loss of water through leaves or needles).

Even Flow - Maintaining a relatively constant, undiminishing supply of timber from year to year for the planning cycle.

Fetotoxin - A substance that through its chemical action can kill or injure unborn human or animal offspring.

First Order Stream - A small, unbranched tributary.

Forbs - Herbaceous broadleafed plants; most often used pertaining to herbaceous plants eaten by wildlife.

Forest Land - Land that is now, or is capable of becoming, at least 10 percent stocked with forest trees and that has not been developed for nontimber use.

Frigid Soil Temperature Zone - A soil temperature regime used in soil classification. It is similar to the cryic temperature zone, but the mean summer temperature is warmer (see Cryic Soil Temperature Zone).

Gelled Gasoline - A slash-burning fuel mixture containing an aluminum soap of fatty acid (Alumagel) and gasoline. This gelling additive is mixed with gasoline at the rate of 7 pounds per 35 gallons.

Grass-Forb Stage - A successional stage in the development of a forest where vegetation is dominated by grass and forbs. Conifer and brush seedlings may also be present.

Gross Timber Volume - The total volume present in a stand without deduction for defects or anticipated logging damage.

Gross Yarding - Removal from a logging unit of most large tree materials (generally all logs greater

than 8 inches in diameter and at least 8 feet in length).

Groundwater - Subsurface water in the zone of saturation.

Habitat - The environment in which an organism occurs.

Hiding Cover - Vegetation capable of hiding 90 percent of a standing adult deer or elk from the view of a human at a distance equal to or less than 61 meters (200 ft.). Generally, any vegetation used by deer or elk for security or escape from danger.

Historic Resources - All evidences of human activity that date from historic (i.e., recorded history) periods. These resources include documentary data (i.e., written records, archival material, photographs, maps, etc.), sites, artifacts, environmental data, and all other relevant information. Also included are locations where documented historical events took place, even though no physical evidence of the events remains other than the setting. Historic resources are cultural resources and may be considered archeological resources when archeological work is involved in their identification and interpretation.

Hypothermia - A condition of subnormal body temperature caused by exposure to cold.

IMPLAN - An economic input-output model maintained by the U.S.D.A. Forest Service on the U.S. Department of Agriculture's Fort Collins Computer Center. An input-output table specific to the eighteen county region described in this EIS was built in June 1982. A copy of the output and the multipliers is available at the Eugene BLM District Office.

In-lieu Property Tax - Federal land is exempt from property taxes levied by local jurisdictions. To compensate, the Federal government shares revenue with State and sometimes local governments instead (in-lieu) of making property tax payments.

Instream Structure - Boulders and large stable woody debris which create pools and trap spawning gravel. Extensively used by fish for security or escape from danger.

Integrated Pest Management (IPM) - Use of several techniques (e.g. burning, grazing and mechanical, manual or chemical methods) as one system to gain control of animals or plants existing in areas where they are unwanted (see BLM Manual 9220).

LC_{50} - A lethal concentration rate at which 50 percent of the test animals will be killed. It is usually used in testing of fish or other aquatic animals.

LD_{50} - The dosage of toxicant, expressed in milligrams of toxicant per kilogram of animal body weight, required to kill 50 percent of the animals in a test population when given orally.

Leach - Usually refers to the movement of chemicals through soil by water; may also refer to movement of herbicides out of leaves, stems or roots into the soil.

Lumber and Wood Products, except Furniture - Defined by the Office of Management and Budget and the Standard Industrial Classification Manual as Major Group No. 24, which includes logging contractors engaged in cutting timber and pulpwoods; merchant sawmills, lath mills, shingle mills, planing mills, plywood mills, and veneer mills engaged in producing lumber and wood basic materials; and establishments engaged in manufacturing finished articles made entirely or mainly of wood or wood substitutes. Certain types of establishments producing wood products are classified elsewhere, e.g., furniture and office and store fixtures are classified in Major Group No. 25.

Management Framework Plan (MFP) - Land use plan for public lands which provides a set of goals, objectives and constraints for a specific planning area to guide the development of detailed plans for the management of each resource.

Maximum Acceptable Toxicant Concentration (MATC) - Hypothetical concentrations falling between no observable effect level (NOEL) and lowest observable effect level (LOEL), based on partial life cycle test.

Merchantable Volume - That portion of the gross timber volume (less deduction for defects and anticipated logging damage) which is suitable for marketing. Given the same gross timber volume, a stand consisting of many small trees will contain less merchantable volume than a stand consisting of fewer large trees.

Metabolism - The chemical changes in living cells by which energy is provided for vital processes and new material is assimilated.

Metabolite - A product of the chemical changes in living cells which provide energy and assimilate new material.

Microbial Degradation - The breakdown of a chemical substance into simpler components by bacteria, algae, fungi, and actinomyces.

Microclimate - The climatic condition of a small area modified from the general climatic conditions by local differences in elevation or exposure.

Microgram - One millionth of a gram.

Mineralizable Nitrogen - A soil nutrient used as an index of forest soil fertility and site productivity.

MOS - Margin of safety.

Mutagen - A substance that tends to increase the frequency or extent of genetic mutations (changes in hereditary material).

National Ambient Air Quality Standards (NAAQS) - Standards designed to assure protection of public health and safety, allowing an adequate margin of safety. The NAAQS for particulate matter less than 10 microns in size (PM_{10}) is 50 micrograms per cubic meter annual average and 150 micrograms per cubic meter, 24 hour average, not to be exceeded more than once per year. National standards and Oregon air quality standards for criteria pollutants (SO_2, CO, NO_2, O_3, Pb and particulate) are identical. NAAQS are established under Section 109 of the Clean Air Act and, in Oregon Administrative Rules as OAR 340, Division 31.

National Register of Historic Places - The official list, established by the Historic Preservation Act of 1966, of the nation's cultural resources worthy of preservation. The Register lists archeological, historic, and architectural properties (i.e., districts, sites, buildings, structures, and objects) nominated for their local, State, or national significance by State and/or Federal agencies and approved by the National Register staff. The Register is maintained by the National Park Service.

Natural Levels - Amount of pollutants present from natural sources without human disturbances, which have reached equilibrium.

NOEL - No observed effect level.

Nonattainment - Failure of a geographical area to attain or maintain compliance with ambient air quality standards.

Nonattainment Area - A geographical area that has failed to attain or maintain compliance with air quality standards. Nonattainment Area boundaries are commonly the same as city, standard metropolitan statistical area (SMSA) or county boundaries.

O&C Lands - Public lands granted to the Oregon and California Railroad Company and subsequently revested to the United States.

Outstanding Natural Areas - Areas of outstanding scenic splendor, natural wonder or scientific importance that merit preservation in their natural condition. The preservation of these resources in their natural condition is the primary management objective. Access roads, parking areas and public use facilities are normally located on the fringe of the area. The public is encouraged to walk, rather than drive, into the area for recreation purposes wherever feasible.

Paleontology - A science dealing with the life of past geological periods as known from fossil remains.

Particulates - Finely divided solid or liquid particles in the air or in an emission; includes dust, smoke fumes, mist, spray and fog.

Peak Flow - The highest amount of streamflow or riverflow occurring in a year or during a single storm event.

Personal Income - Income received by all individuals in the economy from all sources; made up of wage and salary disbursements, proprietors income, income of persons, dividends, personal interest income, and the difference between transfer payments and personal contributions for social insurance.

Photodecomposition - The breakdown of a substance, especially a chemical compound, into simpler components by the action of radiant energy.

Photosynthesis - Formation of carbohydrates in the tissues of plants exposed to light.

Plant Community - An association of plants of

various species found growing together in different areas with similar site characteristics.

Planning Area Analysis - Documentation of the existence and significance of economic, social, infrastructure, institutional and environmental values, the establishment of economic demand projections, within a planning area.

Plantation Maintenance - For purposes of this EIS, any vegetation management action taken after planting to promote the survival and establishment of trees. Treatments may include use of biological, mechanical, or manual weeding, mulching, herbicides or a combination of methods.

Precommercial Thinning - Cuttings made in immature stands (10-25 years) in order to stimulate the growth of trees by increasing available soil moisture and nutrients. Such cuttings decrease the time needed to reach merchantable size and increase total merchantable yields from the stand.

Prehistoric - Pertaining to that period of time before written history.

Prescribed Burning - Intentional application of fire to forest or rangeland in their natural or modified state to meet specific management objectives.

Prevention of Significant Deterioration (PSD) - Air quality regulations intended to prevent deterioration air quality in areas that are cleaner than the air quality standards; establish specific increments beyond which air quality cannot deteriorate; establish new source permitting requirements and set aside "pristine" (Class I) air quality areas for specific protection under the regulations. The regulations relate to the Clean Air Act (PL 95-95) as amended *and* the PSD provisions of pertinent State law (Oregon OAR 340, Chapter 20).

Public Lands - Any land and interest in land owned by the United States within the several States and administered by the Secretary of the Interior through the Bureau of Land Management. May include public domain, O&C or acquired lands in any combination.

Public Domain Lands - Original holdings of the United States never granted or conveyed to other jurisdictions.

Recreation Experience - the expected or desired psychological and physiological outcomes from engaging in a specific recreation activity within a specific setting.

Recreation Opportunity - The opportunity for a person to engage in a specific recreation activity within a specific setting to realize a predictable recreation experience.

Recreation Site - A recreational development on a relatively small, distinctively defined parcel of BLM-administered land. Sites have facilities (e.g., roads, parking space, litter cans, tables, restrooms, waste water sumps, barbecue pits) designed primarily to accommodate camping and/or picnicking.

Reforestation - Reestablishment of a tree crop on forest land.

Regeneration - The renewal of a commercial tree crop, whether by natural or artificial means; also, the young crop itself.

Release - Any action taken on an established commercial timber stand to control stand composition and promote dominance and/or growth of suitable tree species. Treatments may include mechanical or manual slashing of undesirable brush and tree species, herbicides, biological control or a combination of methods. Forest fertilization is not considered a release treatment.

Research Natural Areas - Areas established and maintained for research and education. The general public may be excluded or restricted where necessary to protect studies or preserve research natural areas. Lands may have: (1) Typical or unusual faunistic or floristic types, associations, or other biotic phenomena, or (2) characteristic or outstanding geologic, pedologic or aquatic features or processes.

Riparian Habitat - Those terrestrial areas where the vegetation complex and microclimate conditions are products of the combined presence and influence of perennial and/or intermittent water, associated high water tables and soils which exhibit some wetness characteristics. Includes riparian zones plus one-half the transition zone (or ecotone) between riparian zones and upland habitat (Instruction Memo OR-08-243).

Riparian Zone - An area identified by the presence of vegetation that requires free or unbound water or conditions more moist than normally found in the area (Instruction Memo OR-08-243).

Runoff - That part of precipitation, as well as any other flow contributions, which appears in surface streams, either perennial or intermittent.

Scalping - The removal of live vegetation, roots and/or slash to expose an area of mineral soil suitable for planting. This work is usually performed using a hand-held hoe or shovel-like tool.

Scarification - The dislodging of root systems of brush and/or hardwood species and removing surface vegetation. This work is usually accomplished using a tractor with a special blade. Scarification often includes piling or windrowing of slash, brush and unmerchantable trees.

Scenic Quality - A measure (A, B or C) of the aesthetic appeal of an area of land. Scenic quality is determined by an interdisciplinary team of evaluators using standard Bureau criteria (BLM Manual 8400).

Scribner - A log rule commonly accepted in the EIS area used to determine the board foot volume contained in a log.

Sclerophyllous Species - Evergreen shrub and tree species characterized by having thick, leathery leaves. These species are strong competitors with conifer seedlings on dryer sites of southwestern Oregon. Examples of these species include tanoak, madrone and ceanothus.

Scoping - The process by which significant issues relating to a proposal are identified for environmental analysis. Scoping includes eliciting public comment on the proposal, evaluating concerns and developing alternatives for consideration.

Second Order Stream - A stream formed by the joining of two small, unbranched tributaries.

Secondary Succession - An alteration of the natural plant succession of an area by fire, cultivation, logging, windthrow or any similar disturbance that destroys the principal species of an established community.

Sediment - Organic matter or soil that settles to the bottom of a liquid.

Sediment Yield - The quantity of sediment, measured in dry weight or by volume, transported in water flowing through a stream cross-section in a given time. Consists of both suspended sediment and bedload.

Sensitive Species - Species not yet officially listed but which are undergoing a status review or are proposed for listing according to Federal Register notices published by the Secretary of the Interior or Secretary of Commerce, or according to comparable State documents published by State officials. (Reference Instruction Memo W.0. 80-722).

Sensitivity Level(s) - Estimates of levels of public concern for scenic quality. Sensitivity levels (high, medium, or low; are based upon standard Bureau criteria (BLM Manual 8400).

Seral (Successional) Stage - The relatively transitory plant communities within an orderly process of plant community change.

Severance Tax - A tax paid when timber is harvested or severed from the stump.

Silviculture - The art of producing and tending a forest.

Site Preparation - For purposes of this EIS, any action taken prior to reforestation efforts (natural or artificial) to create an environment which is favorable for survival of suitable trees during the first growing season. This environment can be created by altering ground cover, soil or microsite conditions; using biological, mechanical, or manual clearing; prescribed burning; herbicides or a combination of methods.

Slash - The branches, bark, tops, cull logs, and broken or uprooted trees left on the ground after logging has been completed.

Smoke Management Program - A program designed to ensure that smoke impacts on air quality from agricultural or forestry burning operations are minimized; that impacts do not exceed or significantly contribute to violations of air quality standards or visibility protection guidelines and that necessary open burning can be accomplished to achieve land management goals.

Snag - A standing dead tree or partially dead tree from which some or all of the leaves and limbs have fallen. For management purposes, a snag is defined as any dead or partly dead tree at least 10.2 cm. (4 in.) dbh and at least 1.8 m. (6 ft.) tall.

Soil - The unconsolidated mineral and organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants.

Soil Order - The highest (most general) category in the U.S. soil classification system. All soils are differentiated into 1 of 10 soil orders.

Soil Productivity - The capacity of a soil in its normal environment to produce a specified plant or sequence of plants under a specified system of management.

Soil Series - The lowest (most detailed) category in the U.S. soil classification system.

State Historic Preservation Officer (SHPO) - The official within each State, authorized by the State at the request of the Secretary of the Interior, to act as a liaison for purposes of implementing the National Historic Preservation Act of 1966.

Stocking Surveys - Examination of planting sites either prior to first planting or following treatment. Survey is designed to determine whether target stocking or stocking standards have been achieved, and to identify any conditions which may limit the success of a reforestation project so corrective action can be taken.

Stocking Standards - A level of conifer seedling density which is to be achieved. In addition to achieving a desired number of trees per acre, these trees must be well-distributed throughout the plantable acreage.

Stratification - Arrangement of vertical layers of vegetation.

Stream Order - A system of stream classification. Each small unbranched tributary is a first order stream. Two first order streams join to make a second order stream. A third order stream has only first and second order tributaries, and so forth.

Stumpage - Price paid for standing trees.

Succession - The orderly process of plant community change. Process by which one plant community will succeed another over time given the same climatic conditions.

Suspended Sediment - Sediment suspended in a fluid by the upward components of turbulent currents or by colloidal suspension.

Sustained Yield - The yield that a forest can produce continuously at a given intensity of management.

Sustained Yield Unit - An administrative division of the EIS area for which an allowable cut is calculated.

Target Stocking - A specific stocking standard which is the goal of BLM reforestation efforts in western Oregon. This standard is designed to obtain the desired number of well-spaced trees per acre at the age of first commercial thinning. Target levels assure that intermediate cuts will be realized through commercial thinning. Minimum stocking standards represent a lower (but acceptable) number of well-spaced trees per acre, but no intermediate cuts are anticipated. Below minimum stocking represents an unacceptable number of trees per acre.

Teratogen - A substance tending to cause developmental malformations in unborn human or animal offspring.

Texture (soil) - The relative proportion of sand, silt and clay (expressed as percentages) in a soil; grouped into standard classes and subclasses in the USDA Soil Survey Manual.

Thermal Cover - Cover used by animals to ameliorate effects of weather. For elk, a stand of conifer trees which are at least 40 feet tall with an average crown closure of 70 percent or more. For deer, cover may include saplings, shrubs or trees at least 5 feet tall with 75 percent crown closure.

Threatened Species - Plant or animal species that are not presently in danger of extinction but are likely to become so within the foreseeable future throughout all or a significant portion of their range.

Timberlands - See Forest Land.

Timber Base - Acres included in the calculation of the allowable cut.

Timber Production Capability Classification (TPCC) - A classification system that identifies the commercial forest land base capable of producing timber on a sustained yield basis.

Topkill - The death of the above-ground portion of brush or trees.

Toxicity - A characteristic of a substance which makes it poisonous.

Translocation - The transfer of substances from one location to another in the plant body.

Transpiration - The process by which plants take up moisture from the soil through their root systems and give off moisture to the air through their leaves (needles).

True Fir - A member of the genus Abies, e.g., white fir (Abies concolor). Douglas-fir (Pseudotsuga menziesii) is not a true fir.

Udic Soils - Soils which are not dry for an extended period (greater than 45 days) at 4 to 12 inches deep during most years.

Understory Species - Shade-tolerant plant species which characteristically grow beneath the forest canopy; e.g., blackberry and rhododendron.

Unit Resource Analysis (URA) - A BLM planning document which contains a comprehensive inventory and analysis of the resources within a specified geographic area and an analysis of their potential for development.

Viable Population - The number of individuals, adequately distributed throughout their range, necessary to perpetuate the existence of natural, genetically stable, self-sustaining populations.

Visibility Protection Plan - A plan that implements the requirements of the Clean Air Act by establishing programs for visibility monitoring; short and long term control strategies and procedures for program review, coordination and consultation with the Federal Land Managers. The programs relate to Section 169A of the Clean Air Act as amended and, in Oregon, OAR 340-20-047 Section 5.2, Visibility Protection Plan for Class I Areas.

Visual Resources - The land, water, vegetation, animals and other natural or man-made features visible on public lands.

Visual Resource Management (VRM) - Planning, designing and implementing management activities on public lands in ways that will provide acceptable levels of visual impacts.

Visual Resource Management Classes - Categories (I, II, III, or IV) assigned to public lands based upon scenic quality, sensitivity level and distance zone criteria. Class I (preservation) provides the highest level of protection for scenic values, and Class IV the lowest level.

Volatilization - The vaporizing or evaporating of a chemical substance.

Water Quality - The combined physical, chemical and biological characteristics of water bodies.

Watershed - The area drained by a given stream.

Wetland or Wetland Habitat - Permanently wet or intermittently flooded areas where the water table (fresh, saline, or brackish) is at, near, or above the soil surface for extended intervals, where hydric wet soil conditions are normally exhibited, and where depths generally do not exceed 2 meters. Vegetation is generally comprised of emergent water-loving forms (hydeophytes)which require at least a periodically saturated soil condition for growth and reproduction. In certain instances, vegetation may be completely lacking.

Wildlife Habitat Area (WHA) - The area which encompasses the major biological habitat components of any wildlife species or groups of species in a biotic community (BLM Manual 6610.05A).

Xeric Soils - Soils which are dry for an extended period (greater than 45 days) at 4 to 12 inches deep during most years.

Yarding - The act or process of conveying logs to a landing.

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ABBREVIATIONS

ac:	acres
ai:	active ingredient
AQCR:	Air Quality Control Region
MAUM:	Animal Unit Month
BaP:	benzo(a)pyrene
BLM:	U.S. Department of the Interior, Bureau of Land Management
BPA:	U.S. Department of Energy, Bonneville Power Administration
CBWR:	Coos Bay Wagon Road
CDFA:	California Department of Food and Agriculture
CEQ:	Council on Environmental Quality
CFR:	Code of Federal Regulations
cm:	centimeter
CRAFTS:	Coordinated Research on Alternative Forestry Treatments and Systems
CZMA:	Coastal Zone Management Act
DEIS:	draft environmental impact statement
DOE:	U.S. Department of Energy
EIS:	environmental impact statement
EPA:	U.S. Environmental Protection Agency
FEIS:	final environmental impact statement
FIFRA:	Federal Insecticide, Fungicide, and Rodenticide Act
FIR:	Forestry Intensified Research
FLPMA:	Federal Land Policy and Management Act
FS:	U.S. Department of Agriculture, Forest Service
ha:	hectare
HDT:	highest dose tested
HI:	hazard index
ICPEMC:	International Commission for Protection Against Environmental Mutagens and Carcinogens
IPM:	Integrated Pest Management
kg:	kilogram
LCDC:	Land Conservation and Development Commission
LD:	lethal dose
LDT:	lowest dose tested
m:	meter
mg:	milligram
mg/kg:	milligrams per kilogram
mg/l:	milligrams per liter
MOS:	margin of safety
MOU:	Memorandum of Understanding
mph:	miles per hour
NAS:	National Academy of Sciences
NCI:	National Cancer Institute
NEPA:	National Environmental Policy Act
NOEL:	no observed effect level
NPS:	National Park Service
NRC:	National Resource Council
NRCC:	National Research Council of Canada
O&C:	Oregon and California Railroad
ODEQ:	Oregon Department of Environmental Quality
ODFW:	Oregon Department of Fish and Wildlife

OSDF:	Oregon State Department of Forestry
PAH:	polycuclic aromatic hydrocarbon
ppb:	parts per billion
ppm:	parts per milliom
RBC:	red blood cells
RPAR:	rebuttable presumption against registration
SCS:	E.S. Department of Agriculture, Soil Conservation Service
SEIS:	supplemental environmental impact statement
USDA:	U.S. Department of Agriculture
USDI:	U.S. Department of the Interior
USFS:	United States Department of Agriculture, Forest Service
WBC:	white blood cells
WHO:	World Health Organization
WSSA:	Weed Science Society of America
VRM:	visual resource management
WSA:	wilderness study area
$M	thousands of dollars
$MM:	millions of dollars

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