Appendix M
Fuels

TIMBERED ROCK FIRE,
Medford District BLM and Rogue River National Forest
August 2002

Emergency Stabilization and Rehabilitation (ESR) and
Burned Area Emergency Rehabilitation (BAER)
Burn Severity Mapping

Methods and Definitions

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Mapping Methods:

The Timbered Rock fire occurred primarily on Medford District BLM Lands during August 2002 and totaled approximately 27,000 acres. Burn severity for the Timbered Rock fire was mapped with the aid of Landsat 7 satellite imagery (30 meter multi-spectral) acquired August 7, 2002.

BAER support staff at the USDA Forest Service Remote Sensing Applications Center (RSAC) in Salt Lake City procured the imagery from USGS EROS Data Center in Sioux Falls, SD (Landsat). RSAC staff then processed the imagery in Salt Lake City before delivering it to the BAER team in Grants Pass, Oregon, via ftp. This pre-processing included several steps:

1. The images were imported to ERDAS Imagine and georeferenced to UTM Zone 10, NAD27 for use with Rogue River National Forest and Medford BLM spatial datasets (GIS).
2. A band ratio was created from both images using the mid-infrared and near-infrared channels, since these have been shown to be sensitive to post-fire conditions.
3. The band ratios were classified and interpreted by RSAC staff. The resulting classifications were grouped into four burn severity classes: Unburned-Very Low, Low, Moderate, and High.
4. Next, a spatial overlay of pre-fire vegetation was used to adjust the classes to account for likely pre-fire fuel conditions.

An aerial reconnaissance via helicopter was conducted, and was followed by ground visits to validate the preliminary map. Adjustments were made based on aerial and ground observations.

Table M-1. Acres and Percent by Burn Severity Class

Burn Severity	Acres	Percent
High	2,798	10.3
Moderate	7,859	29.0
Low	8,477	31.3
Very Low/Unburned	7,927	29.3
	27,061	100.0

Burn Severity Class Definitions:

The Interagency Emergency Stabilization and Rehabilitation Manual set forth guidelines for mapping and identifying classes of burn severity. The Forest Service BAER website (http://fsweb.gstc.fs.fed.us/baer) contains a link to this manual, as well as documents, lesson plans, and presentations explaining burn severity classes and mapping techniques. These guidelines are followed, but each fire and each ecosystem has its own unique qualities that make a "one-size fits all" absolute definition impossible, and burn severity class definitions may vary slightly. For this reason, the following paragraphs describe the burn severity classes as they occur in the Timbered Rock fire area. It is important to recognize that the definitions of burn severity for BAER/ESR assessments are tied to changes in soil hydrologic function (infiltration, erosion hazard) and ecosystem impacts (revegetation potential, changes in vegetation community composition), and are NOT a direct reflection of vegetation mortality. Black stems where green trees once grew do not necessarily indicate high burn severity if the density of pre-fire fuels was not enough to lead to high heat and long residence times, both of which are generally necessary for high burn severity. If timber stands were sparse, burn severity is most likely low or moderate. Even many shrub stands do not result in high burn severity since shrubs tend to be flashy fuels that burn quickly and have thin litter layers, thus short fire residence time.

Local landscape level differences in burn severity occurred in the burned area due to differences in soils, as well as vegetation type and density throughout the burned area. Another important factor was changing weather conditions during the period of burning.

Burn severity tends to be moderate or even low in those areas where soils are extremely rocky and pre-fire fuels were simply not heavy enough to support a severe fire for any length of time, such as grassland or light shrub stands. High burn severity tended to occur where there were denser stands of mixed conifer with thicker litter and duff layers. These generally occur in the Timbered Rock fire area on northerly slopes with deeper soils, and especially in the lower reaches of Flat Creek. Past fires from 1987 and other years burned in the area, and these former burns tended to result in low or moderate burn severity.

Based on field observations, aerial reconnaissance, and post-fire satellite imagery, the burn severity classes for the Timbered Rock fire can be generally described in the following paragraphs. Note: there are small unmapped inclusions of other burn severity classes in any given polygon, but the polygon should predominantly exhibit characteristics as described for its burn class. Minimum polygon size is approximately 5 acres.

Burn Severity Classes

Very Low/Unburned

These areas are a mosaic of unburned areas and very low severity ground fire. In these areas where pre-fire vegetation is forest or shrub, consumption of ground cover (litter and duff) and vegetation mortality is minimal. Overstory canopy remains vigorous and green. Mortality of trees and shrubs is slight. This includes large contiguous areas of rock outcrop or bare soils. Approximately 29% of burned area is Unburned-Very Low severity mosaic.

Low

Low burn severity is the dominant burn severity class in the Timbered Rock Fire, at approximately 31% of the burned area. Low burn severity dominates in areas where pre-fire fuels were sparse or light, such as grasslands, sparse trees or shrubs with thin litter and duff layers, and includes areas where smaller but common areas of rock outcrop or bare soil occur and contribute to the sparse nature of the vegetation. The fire probably spread rapidly but residence time was short due to paucity of ground and surface fuels. Amount of soil cover is not significantly reduced from pre-fire amount. Ample recognizable char is still evident in ash and char layers, as well as ample intact litter and duff, except in areas where none existed prior to the fire. Soil structure is not altered, fine and very fine roots still exist in surface soil, and surface 1mm or so of soil may or may not be weakly water repellant in places. Vegetation is lightly scorched, large trees are mostly not killed, and very small diameter fuels have been consumed. Forbs may be consumed or charred, but regrowth of vegetation will not be significantly inhibited. In most areas grass, forbs, and shrubs are already sprouting. Overall, adverse impacts to ecosystem and soil hydrologic function are slight to none. Ecosystems most likely benefited from the fire effects - thinning of fuels, release of nutrients, stimulation of fire-dependent vegetation species, creation of additional edge habitat and openings, and many other positive ecosystem benefits from low severity fire. Tree mortality may occur, but is slight.

Low severity can also occur in more densely forested areas if fire behavior was not extreme, such as night burns in forested areas, or areas at higher elevations where fire behavior conditions (wind, humidity) were not conducive to extreme behavior.

Post-fire runoff and erosion from areas of low burn severity are not expected to significantly increase over pre-fire rates.

Moderate

Moderate burn severity comprises about 29% of the Timbered Rock Fire. Moderate burn severity dominates in areas of moderately dense to dense shrub communities, in plantations, and in areas where hardwood or conifer tree species were moderately dense to dense, but brown needles remain on trees. In the case of shrub communities and plantations, the lack of thick pre-fire litter and duff layers resulted in rapid spread but relatively short residence time of fire. Shrub canopy may be all or partly consumed, shrub skeletons and root crowns remain, there is some identifiable char and litter beneath a thin ash layer, soil structure is intact, fine and very fine roots remain. Plantations may exhibit up to 100% mortality. The top

1mm or more of soil may or may not be water repellant in spots.

In areas where pre-fire vegetation consisted of hardwood or conifer trees, brown needles or leaves remain on trees, some identifiable char and litter may be present beneath the ash layer but much of the litter has been consumed. Soil structure is generally intact, fine and very fine roots remain, and water repellency may be significant or not. Fine fuels close to the ground may be all consumed and trees may exhibit 40 to 80 percent mortality or more. The importance of the potential for needlecast and leaf litter as brown needles and leaves fall to the forest floor and create natural mulch cannot be overstated.

Mulch is the single most effective post-fire treatment that can be done in areas of moderate or high burn severity to:

a) provide soil cover as protection from erosion by wind and water;
b) moderate surface soil temperature and moisture for seed and sprout regeneration (keeps soil surface cooler and more moist than areas lacking mulch),
c) slowing runoff rates and promoting infiltration, and;
d) re-introduction of organic matter for re-starting or continuing nutrient cycling vital to long-term soil productivity.

These areas where natural mulch potential exists are not likely to be treatment candidates, since natural processes will already provide the most effective treatment.

Post-fire runoff and erosion rates from forested areas with moderate burn severity will be increased from pre-fire levels. The amount of increase relates to the amount of needlecast (mulch) potential, amount of water repellant soils, soil type, amount of surface rock, and slope morphology.

Post-fire runoff and erosion rates from shrub ecosystems with moderate burn severity may be significantly increased over pre-fire rates, particularly the first storm season. In these areas, first-year runoff rates may approach those to be expected from high severity forest areas, but the recovery rate is much faster. By the second season following the fire, runoff and erosion from these moderate severity shrub areas will be significantly reduced due to vegetation recovery.

High

High burn severity is the least extensive class in the initial assessment area, at approximately 10%. It occurs in isolated small patches, and more extensively in a few watershed areas where pre-fire vegetation consisted of dense conifer or hardwood trees. Such areas include lower Flat Creek and along some east-facing slopes above Elk Creek at the southern end of the burned area. In these areas, pre-fire forest stands were denser, litter and duff were generally deeper, fire and heat residence time were longer, and nearly complete consumption of ground cover has occurred. The ash layer may be 1 to 2 inches deep. Some, but little recognizable char is evident beneath the ash layer. Soil structural stability may be reduced due to more complete consumption of soil organic matter. Fine and very fine roots may have been consumed in the surface few centimeters of soil. Water repellency is generally strong at the soil surface, and was observed in some places up to 1 to 2 inches below the surface. (It is important to note that even in unburned areas, soils may exhibit some water repellant characteristics due to the nature of the leaf and needle litter or abundance of fungal mycelia.) Complete consumption of tree crowns has occurred, few to no or leaves needles remain on trees, mortality can be assumed to be close to 100%.

Runoff and erosion are expected to be significantly increased over pre-fire levels for at least 3 to 5 years. Recovery of vegetative cover is expected to be slower in these areas of high burn severity.

FUEL MODEL DESCRIPTIONS
Grass Group

Fire Behavior Fuel Model 1

Fire spread is governed by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Fires are surface fires that move rapidly through the cured grass and associated material. Very little shrub or timber is present, generally less than one-third of the area.

Grasslands and savanna are represented along with stubble, grass-tundra, and grass-shrub combinations that met the above area constraint. Annual and perennial grasses are included in this fuel model. Refer to photographs 1, 2, and 3 for illustrations.

This fuel model correlates to 1978 NFDRS fuel models A, L, and S.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch dead and live, tons/acre	0.74
Dead fuel load, ¼-inch, tons/acre	.74
Live fuel load, foliage, tons/acre	0
Fuel bed depth, feet	1.0

Photo 1. Western annual grasses such as cheatgrass, medusahead ryegrass, and fescues.

Photo 2. Live oak savanna of the Southwest on the Coronado National Forest.

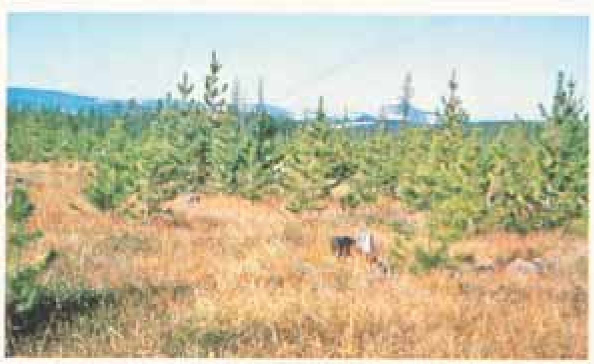

Photo 3: Open pine—grasslands on the Lewis and Clark National Forest

4

Shrub Group

Fire Behavior Fuel Model 4

Fire intensity and fast-spreading fires involve the foliage and live and dead fine woody material in the crowns of a nearly continuous secondary overstory. Stands of mature shrubs, 6 or more feet tall, such as California mixed chaparral, the high pocosin along the east coast, the pinebarrens of New Jersey, or the closed jack pine stands of the north-central States are typical candidates. Besides flammable foliage, dead woody material in the stands significantly contributes to the fire intensity. Height of stands qualifying for this model depends on local conditions. A deep litter layer may also hamper suppression efforts. Photographs 9, 10, 11, and 12 depict examples fitting this fuel model.

This fuel model represents 1978 NFDRS fuel models B and O; fire behavior estimates are more severe than obtained by models B or O.

Photo 9. Mixed chaparral of southern California; note dead fuel component in brenchwood.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch dead and live, tons/acre	13.0
Dead fuel load, ¼-inch, tons/acre	5.0
Live fuel load, foliage, tons/acre	5.0
Fuel bed depth, feet	6.0

Photo 10. Chaparral composed of manzanita and chamise near the Inaja Fire Memorial, Calif.

Photo 11. Pocosin shrub field composed of species like fetterbush, gallberry, and the bays.

Photo 12. High shrub southern rough with quantity of dead limbwood.

Fire Behavior Fuel Model 5

Fire is generally carried in the surface fuels that are made up of litter cast by the shrubs and the grasses or forbs in the understory. The fires are generally not very intense because surface fuel loads are light, the shrubs are young with little dead material, and the foliage contains little volatile material. Usually shrubs are short and almost totally cover the area. Young, green stands with no dead wood would qualify: laurel, vine maple, alder, or even chaparral, manzanita, or chamise.

No 1978 NFDRS fuel model is represented, but model 5 can be considered as a second choice for NFDRS model D or as a third choice for NFDRS model T. Photographs 13 and 14 show field examples of this type. Young green stands may be up to 6 feet (2 m) high but have poor burning properties because of live vegetation.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch dead and live, tons/acre	3.5
Dead fuel load, ¼-inch, tons/acre	1.0
Live fuel load, foliage, tons/acre	2.0
Fuel bed depth, feet	2.0

Photo 13. Green, low shrub fields within timber stands or without overstory are typical. Example is Douglas-fir–snowberry habitat type.

Photo 14. Regeneration shrublands after fire or other disturbances have a large green fuel component, Sundance Fire, Pack River Area, Idaho.

Fire Behavior Fuel Model 6

Fires carry through the shrub layer where the foliage is more flammable than fuel model 5, but this requires moderate winds, greater than 8 mi/h (13 km/h) at mid-flame height. Fire will drop to the ground at low wind speeds or at openings in the stand. The shrubs are older, but not as tall as shrub types of model 4, nor do they contain as much fuel as model 4. A broad range of shrub conditions is covered by this model. Fuel situations to be considered include intermediate stands of chamise, chaparral, oak brush, low pocosin, Alaskan spruce taiga, and shrub tundra. Even hardwood slash that has cured can be considered. Pinyon-juniper shrublands may be represented but may overpredict rate of spread except at high winds, like 20 mi/h (32 km/h) at the 20-foot level.

The 1978 NFDRS fuel models F and Q are represented by this fuel model. It can be considered a second choice for models T and D and a third choice for model S. Photographs 15, 16, 17, and 18 show situations encompassed by this fuel model.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch dead and live, tons/acre	6.0
Dead fuel load, ¼-inch, tons/acre	1.5
Live fuel load, foliage, tons/acre	0
Fuel bed depth, feet	2.5

Photo 15. Pinyon-juniper with sagebrush near Ely, Nev.; understory mainly sage with some grass intermixed.

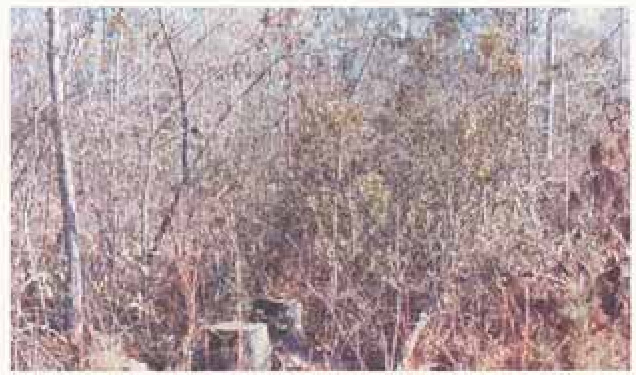

Photo 16. Southern hardwood shrub with pine slash residues.

Photo 17. Low pocosin shrub field in the south.

Photo 18. Frost-killed Gambel Oak foliage, less than 4 feet in height, in Colorado.

Timber Group

Fire Behavior Fuel Model 8

Slow-burning ground fires with low flame lengths are generally the case, although the fire may encounter an occasional "jackpot" or heavy fuel concentration that can flare up. Only under severe weather conditions involving high temperatures, low humidities, and high winds do the fuels pose fire hazards. Closed canopy stands of short-needle conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and occasionally twigs because little undergrowth is present in the stand. Representative conifer types are white pine, and lodgepole pine, spruce, fir, and larch.

This model can be used for 1978 NFDRS fuel models H and R. Photographs 22, 23, and 24 illustrate the situations representative of this fuel.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch, dead and live, tons/acre	5.0
Dead fuel load, ¼-inch, tons/acre	1.5
Live fuel load, foliage, tons/acre	0
Fuel bed depth, feet	0.2

Photo 22. Surface litter fuels in western hemlock stands of Oregon and Washington.

Photo 23. Understory of inland Douglas-fir has little fuel here to add to dead-down litter load.

Photo 24. Closed stand of birch-aspen with leaf litter compacted.

Fire Behavior Fuel Model 9

Fires run through the surface litter faster than model 8 and have longer flame height. Both long-needle conifer stands and hardwood stands, especially the oak-hickory types, are typical. Fall fires in hardwoods are predictable, but high winds will actually cause higher rates of spread than predicted because of spotting caused by rolling and blowing leaves. Closed stands of long-needled pine like ponderosa, Jeffrey, and red pines, or southern pine plantations are grouped in this model. Concentrations of dead-down woody material will contribute to possible torching out of trees, spotting, and crowning.

NFDRS fuel models E, P, and U are represented by this model. It is also a second choice for models C and S. Some of the possible field situations fitting this model are shown in photographs 25, 26, and 27.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch dead and live, tons/acre	3.5
Dead fuel load, ¼-inch, tons/acre	2.9
Live fuel load, foliage, tons/acre	0
Fuel bed depth, feet	0.2

Photo 25. Western Oregon white oak fall litter; wind tumbled leaves may cause short-range spotting that may increase ROS above the predicted value.

Photo 26. Loose hardwood litter under stands of oak, hickory, maple and other hardwood species of the East.

Photo 27. Long-needle forest floor litter in ponderosa pine stand near Alberton, Mont.

Fire Behavior Fuel Model 10

The fires burn in the surface and ground fuels with greater fire intensity than the other timber litter models. Dead-down fuels include greater quantities of 3-inch (7.6-cm) or larger limbwood resulting from overmaturity or natural events that create a large load of dead material on the forest floor. Crowning out, spotting, and torching of individual trees are more frequent in this fuel situation, leading to potential fire control difficulties. Any forest type may be considered if heavy down material is present; examples are insect- or disease-ridden stands, windthrown stands, overmature situations with deadfall, and aged light thinning or partial-cut slash.

The 1978 NFDRS fuel model G is represented and is depicted in photographs 28, 29, and 30.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch dead and live, tons/acre	12.0
Dead fuel load, ¼-inch, tons/acre	3.0
Live fuel load, foliage, tons/acre	2.0
Fuel bed depth, feet	1.0

The fire intensities and spread rates of these timber litter fuel models are indicated by the following values when the dead fuel moisture content is 8 percent, live fuel moisture is 100 percent, and the effective windspeed at midflame height is 5 mi/h (8 km/h):

Model	Rate of spread *Chains/hour*	Flame length *Feet*
8	1.6	1.0
9	7.5	2.6
10	7.9	4.8

Fires such as above in model 10 are at the upper limit of control by direct attack. More wind or drier conditions could lead to an escaped fire.

Photo 28. Old-growth Douglas-fir with heavy ground fuels.

Photo 29. Mixed conifer stand with dead-down woody fuels.

Photo 30. Spruce habitat type where succession or natural disturbance can produce a heavy downed fuel load.

Logging Slash Group

Fire Behavior Fuel Model 11

Fires are fairly active in the slash and herbaceous material intermixed with the slash. The spacing of the rather light fuel load, shading from overstory, or the aging of the fine fuels can contribute to limiting the fire potential. Light partial cuts or thinning operations in mixed conifer stands, hardwood stands, and southern pine harvests are considered. Clearcut operations generally produce more slash than represented here. The less-than-3-inch (7.6-cm) material load is less than 12 tons per acre (5.4 t/ha). The greater-than-3-inch (7.6-cm) is represented by not more than 10 pieces, 4 inches (10.2 cm) in diameter, along a 50-foot (15-m) transect.

The 1978 NFDRS fuel model K is represented by this model and field examples are shown in photographs 31, 32, and 33.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch dead and live, tons/acre	11.5
Dead fuel load, ¼-inch, tons/acre	1.5
Live fuel load, foliage, tons/acre	0
Fuel bed depth, feet	1.0

Photo 31. Slash residues left after skyline logging in western Montana.

Photo 32. Mixed conifer partial cut slash residues may be similar to closed timber with down woody fuels.

Photo 33. Light logging residues with patchy distribution seldom can develop high intensities.

14

SOIL TEMPERATURE MODELING SCENARIOS USING A VARIETY OF FUEL LOADS*

SCENARIO 1 **SALVAGE**
Stand age is 15-30 years post Timbered Rock Fire.
Loadings as follows:
Program defaults were used. See computer run for loadings
40% of dead and down is rotten (FOFEM program default)
9 tons/acre used in scenario 1

SCENARIO 2 **NO SALVAGE**
Stand age is 15-30 years post Timbered Rock Fire.
Fuel loadings as follows:

11" to 18" dbh material 26 tons/ acre	75% available for consumption = 20 tons/acre
19" to 30" dbh material 42 tons/acre	50% available for consumption = 21 tons/acre
31" + dbh material 26 tons/acre	25% available for consumption = 7 tons/acre

40% of dead and down is rotten (FOFEM program default)
48 tons/acre used in scenario 2

SCENARIO 3 **NO SALVAGE**
Stand age is 30-60 years post Timbered Rock Fire.
Fuel loadings as follows:

11" to 18" dbh material 26 tons/ acre	90% available for consumption = 23.4 tons/acre
19" to 30" dbh material 42 tons/acre	75% available for consumption = 31.5 tons/acre
31" + dbh material 26 tons/acre	50% available for consumption = 13 tons/acre

40%of dead and down is rotten (FOFEM program default)
68 tons/acre used in scenario 3

SCENARIO 4 **NO SALVAGE**
Stand age is 60 years + post Timbered Rock Fire.
Fuel loadings as follows:

11" to 18" diameter material 26 tons/ acre	100% available for consumption = 26 tons/acre
19" to 30" diameter material 42 tons/acre	75% available for consumption = 38 tons/acre
31" + diameter material 26 tons/acre	50% available for consumption = 21 tons/acre

65% of dead and down is rotten (decay increased over time to simulate natural decay processes)
85 tons/acre used in scenario 4

*Fuel loadings were determined using an average of size classes of standing snags derived from stand exam data collected within the Timbered Rock Fire perimeter in the fall of 2002. Percentage of rot was varied by age to simulate decay class changes. Fuels were modeled with no duff layer to show effects of large wood on soil heating. Fuel loadings are derived from 3 inch and larger wood using FOFEM 5. Ages for breakpoints were determined by using information from Maser et.al. (1988)

FUEL LOADING CALCULATIONS FOR TIMBERED ROCK SOIL HEATING SCENARIOS

Fuel loadings were determined using an average of size classes of standing snags derived from stand exam data collected within the Timbered Rock Fire perimeter in the fall of 2002. This data represents a composite of a variety of site conditions, which are not site specific, but represents the fire area well as a whole. Each tree was broken down into log lengths and weights were determined from log weight table included in this appendix.

11" to 18"dbh *45 trees / acre*
14"X 18' = 498lbs or .25 tons
18"X 14' = 684 lbs or .34 tons

498X 45 = 22,410	11 tons/acre estimated
684X45 = 30,780	15 tons/acre estimated
	26 tons/acre estimated total load for size class

19" to 30" dbh *19 trees / acre*
30"X 20' = 2757 lbs or 1.38 tons
20"X 20' = 1170 lbs or .59 tons
14" X 20' = 540 lbs or .27

2757 X 19 = 52,383 lbs	26 tons/acre
1170 X 19 = 22,230 lbs	11 tons/acre
540 X 19 = 10,260 lbs	5 tons/acre
	42 tons/acre

31"+ dbh *9 trees/acre*
14" X 20' = 540 lbs or .27 tons
20" X 20' = 1170 lbs or .59 tons
36" X 20' = 4029 lbs or 2.01 tons

540 X 9 = 4,680	3 tons/acre
1170 X 9 = 10,560	5 tons/acre
4029 X 9 = 36,261	18 tons/acre
	26 tons/acre

Stand age 20 to 30 years

11" to 18"- 26 X .75 =	20 tons/acre
19" to 30"- 42 X .5 =	21 tons/acre
31"+ 26 X 25 =	7 tons/acre

Stand age 31 to 60 years

11" to 18"- 26 X .90=	23 tons/acre
19" to 30"- 42 X .75 =	32 tons/acre
31"+ - 26 X .50 =	13 tons/acre

Stand age 61 + years

11" to 18" – 26 X .100=	26 tons/acre
19" to 30"- 42 X .90 =	38 tons/acre
31"+26 X .80 =	21 tons/acre

TITLE: Results of FOFEM model execution on date: 4/26/2003

FUEL CONSUMPTION CALCULATIONS

Region: Pacific_West
Cover Type: SAF/SRM - SAF 234 - Douglas-fir - Tanoak - Pacific Madrone
Fuel Type: Natural
Fuel Reference: FOFEM 241

FUEL CONSUMPTION TABLE

Fuel Component Name	Preburn Load (t/acre)	Consumed Load (t/acre)	Postburn Load (t/acre)	Percent Reduced (%)	Equation Reference Number	Moisture (%)
Litter	0.50 -	0.50	0.00	100.0	999	
Wood (0-1/4 inch)	0.35 -	0.35	0.00	100.0	999	
Wood (1/4-1 inch)	1.05 -	1.00	0.05	95.1	999	10.0
Wood (1-3 inch)	0.75 -	0.32	0.43	43.2	999	
Wood (3+ inch) Sound	5.40	0.14	5.26	2.7	999	10.0
Wood (3+ inch) Rotten	0.60	0.06	0.54	9.2	999	10.0
Duff	0.00 u	0.00	0.00	0.0	2	40.0
Herbaceous	0.20	0.20	0.00	100.0	22	
Shrubs	0.52 +	0.31	0.21	60.0	23	
Crown foliage	0.00 -	0.00	0.00	0.0	37	
Crown branchwood	0.00 -	0.00	0.00	0.0	38	
Total Fuels	9.37	2.88	6.49	30.8		

'u' Preburn Load is User adjusted
'+' Preburn Load is Heavy/Abundant
'-' Preburn Load is Light/Sparse

FIRE EFFECTS ON FOREST FLOOR COMPONENTS

Duff Depth Consumed (in) 0.0 Equation: 6
Mineral Soil Exposed (%) 50.8 Equation: 10

Soil Heat Report

Cover Type.....: SAF/SRM - SAF 234 - Douglas-fir - Tanoak - Pacific Madrone
Duff Depth.....: Pre-Fire: 0.00 cm., Post-Fire: 0.00 cm.

Soil Layer Maximum Temperature
(measurements are in centimeters and Celsius)

Depth	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Temp.	269	93	56	46	39	35	32	30	28	26	25	23	22	21
Time	10	18	21	28	39	53	67	83	96	106	113	118	120	1

Max Depth Having 60 degrees: 1
Max Depth Having 275 degrees: - None -

TITLE: Results of FOFEM model execution on date: 4/26/2003

FUEL CONSUMPTION CALCULATIONS

Region: Pacific_West
Cover Type: SAF/SRM - SAF 234 - Douglas-fir - Tanoak - Pacific Madrone
Fuel Type: Natural
Fuel Reference: FOFEM 241

FUEL CONSUMPTION TABLE

Fuel Component Name	Preburn Load (t/acre)	Consumed Load (t/acre)	Postburn Load (t/acre)	Percent Reduced (%)	Equation Reference Number	Moisture (%)
Litter	0.50 -	0.50	0.00	100.0	999	
Wood (0-1/4 inch)	0.35 -	0.35	0.00	100.0	999	
Wood (1/4-1 inch)	1.05 -	1.05	0.00	100.0	999	10.0
Wood (1-3 inch)	0.75 -	0.75	0.00	100.0	999	
Wood (3+ inch) Sound	28.80 u	11.23	17.57	39.0	999	10.0
Wood (3+ inch) Rotten	19.20 u	11.68	7.52	60.8	999	10.0
Duff	0.00 u	0.00	0.00	0.0	2	40.0
Herbaceous	0.20	0.20	0.00	100.0	22	
Shrubs	0.52 +	0.31	0.21	60.0	23	
Crown foliage	0.00 -	0.00	0.00	0.0	37	
Crown branchwood	0.00 -	0.00	0.00	0.0	38	
Total Fuels	51.37	26.07	25.30	50.7		

'u' Preburn Load is User adjusted
'+' Preburn Load is Heavy/Abundant
'-' Preburn Load is Light/Sparse

FIRE EFFECTS ON FOREST FLOOR COMPONENTS

Duff Depth Consumed (in)	0.0	Equation: 6
Mineral Soil Exposed (%)	50.8	Equation: 10

Soil Heat Report

Cover Type.....: SAF/SRM - SAF 234 - Douglas-fir - Tanoak - Pacific Madrone
Duff Depth.....: Pre-Fire: 0.00 cm., Post-Fire: 0.00 cm.

Soil Layer Maximum Temperature
(measurements are in centimeters and Celsius)

Depth	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Temp.	374	290	227	179	144	116	92	73	67	60	51	42	32	21
Time	72	82	104	130	147	184	196	152	157	166	174	180	187	1

Max Depth Having 60 degrees: 9
Max Depth Having 275 degrees: 1

TITLE: Results of FOFEM model execution on date: 4/26/2003

FUEL CONSUMPTION CALCULATIONS

Region: Pacific_West
Cover Type: SAF/SRM - SAF 234 - Douglas-fir - Tanoak - Pacific Madrone
Fuel Type: Natural
Fuel Reference: FOFEM 241

FUEL CONSUMPTION TABLE

Fuel Component Name	Preburn Load (t/acre)	Consumed Load (t/acre)	Postburn Load (t/acre)	Percent Reduced (%)	Equation Reference Number	Moisture (%)
Litter	0.50 -	0.50	0.00	100.0	999	
Wood (0-1/4 inch)	0.35 -	0.35	0.00	100.0	999	
Wood (1/4-1 inch)	1.05 -	1.05	0.00	100.0	999	10.0
Wood (1-3 inch)	0.75 -	0.75	0.00	100.0	999	
Wood (3+ inch) Sound	29.75 u	17.41	12.34	58.5	999	10.0
Wood (3+ inch) Rotten	55.25 u	44.66	10.59	80.8	999	10.0
Duff	0.00 u	0.00	0.00	0.0	2	40.0
Herbaceous	0.20	0.20	0.00	100.0	22	
Shrubs	0.52 +	0.31	0.21	60.0	23	
Crown foliage	0.00 -	0.00	0.00	0.0	37	
Crown branchwood	0.00 -	0.00	0.00	0.0	38	
Total Fuels	88.37	65.23	23.14	73.8		

'u' Preburn Load is User adjusted
'+' Preburn Load is Heavy/Abundant
'-' Preburn Load is Light/Sparse

FIRE EFFECTS ON FOREST FLOOR COMPONENTS

Duff Depth Consumed (in) 0.0 Equation: 6
Mineral Soil Exposed (%) 50.8 Equation: 10

Soil Heat Report

Cover Type.....: SAF/SRM - SAF 234 - Douglas-fir - Tanoak - Pacific Madrone
Duff Depth.....: Pre-Fire: 0.00 cm., Post-Fire: 0.00 cm.

Soil Layer Maximum Temperature
(measurements are in centimeters and Celsius)

Depth	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Temp.	478	402	337	284	240	201	167	134	101	72	63	52	38	21
Time	124	131	150	173	205	222	258	271	279	203	209	212	216	1

Max Depth Having 60 degrees: 10
Max Depth Having 275 degrees: 3

WEIGHTS IN POUNDS AND TONS FOR DOUGLAS-FIR WILDLIFE LOGS

LARGE END DIA "	LOG LENGH IN FEET 10		12		14		16		18		20	
	LBS	TONS	LBS	TONS	LBS	TONS	LBS	TONS	LBS	TONS	LBS	TONS
14	297	0.15	351	0.18	402	0.20	450	0.23	498	0.25	540	0.27
16	393	0.20	465	0.23	534	0.27	600	0.30	663	0.33	723	0.36
18	504	0.25	594	0.30	684	0.34	771	0.39	855	0.43	933	0.47
20	627	0.31	741	0.37	855	0.43	963	0.48	1068	0.53	1170	0.59
22	762	0.38	903	0.45	1041	0.52	1176	0.59	1308	0.65	1434	0.72
24	912	0.46	1083	0.54	1248	0.62	1410	0.71	1569	0.78	1725	0.86
26	1074	0.54	1275	0.64	1473	0.74	1668	0.83	1857	0.93	2043	1.02
28	1251	0.63	1488	0.74	1719	0.86	1944	0.97	2169	1.08	2385	1.19
30	1440	0.72	1713	0.86	1980	0.99	2244	1.12	2502	1.25	2757	1.38
32	1644	0.82	1956	0.98	2262	1.13	2565	1.28	2862	1.43	3153	1.58
34	1860	0.93	2214	1.11	2562	1.28	2907	1.45	3246	1.62	3576	1.79
36	2088	1.04	2487	1.24	2883	1.44	3270	1.64	3651	1.83	4029	2.01
38	2331	1.17	2778	1.39	3219	1.61	3654	1.83	4083	2.04	4506	2.25
40	2589	1.29	3084	1.54	3576	1.79	4062	2.03	4539	2.27	5010	2.51
42	2859	1.43	3408	1.70	3951	1.98	4488	2.24	5019	2.51	5541	2.77
44	3141	1.57	3747	1.87	4344	2.17	4938	2.47	5520	2.76	6099	3.05
46	2438	1.22	4101	2.05	4758	2.38	5406	2.70	6048	3.02	6681	3.34
48	3747	1.87	4473	2.24	5190	2.60	5898	2.95	6600	3.30	7293	3.65
50	4071	2.04	4860	2.43	5640	2.82	6411	3.21	7176	3.59	7932	3.97
52	4407	2.20	5262	2.63	6108	3.05	6945	3.47	7776	3.89	8595	4.30
54	4755	2.38	5679	2.84	6594	3.30	7500	3.75	8397	4.20	9285	4.64
56	5118	2.56	6114	3.06	7101	3.55	8079	4.04	9045	4.52	10005	5.00
58	5496	2.75	6567	3.28	7626	3.81	8676	4.34	9717	4.86	10749	5.37
60	5886	2.94	7032	3.52	8169	4.08	9297	4.65	10413	5.21	11520	5.76