VEGETATION

Characterization

Array and Landscape Pattern of Plant Communities and Seral Stages: The South Fork Coos Watershed is in the *Tsuga heterophylla* zone described by Franklin and Dyrness (1973, pg. 70-88). The common conifer trees are Douglas-fir, western hemlock and western redcedar. The Watershed's west end approaches the *Picea sitchensis* zone (Franklin and Dyrness 1973, pg. 58-63). Sitka spruce grows on the bottom lands, riparian zones, and lower north facing slopes in the extreme west end of the Watershed. The eastern extent of the Sitka spruce range is controlled by the drop in maritime influence with increased distance from the ocean and falls off rapidly inland from the first major ridge line. The most obvious limit to the Sitka spruce range is the tree species's increased susceptibility to tip weevil damage as marine influence decreases. Grand fir, blue blossom ceanothus, Oregon myrtle on upland locations, and to a lesser extent Port-Orford-cedar suggest there was a high fire frequency in those locations where they are found before Euro-American settlement. Based on 19th century survey notes, myrtle and bigleaf maple were the most common tree species on the better drained bottom lands now used as pasture, whereas the poorer drained sites supported crab apple and willow (Gordon 1858a,b,&c). Scattered incense cedars were found in sections 24 & 25, T.27S., R.9W. There are no known incense cedars more than a mile or two to the west of the crest of the Coast Range inside the Watershed. Incense cedar becomes common to the east of the Watershed. Vegetation on the valley bottom and valley side hills is highly modified by a long history of human use.

Myrtle and big leaf maple are generally found below 1,800 feet. Myrtle is found on droughty south to west facing slopes frequented by fire and on riparian sites where the soils are seasonally saturated. Big leaf maple is found on the well-drained benches and lower slopes. Both myrtle and big leaf maple are often components of low elevation stream side stands. Chinkapin and madrone are generally found above 1,800 feet and typically on warm south facing and ridge top locations. Both chinkapin and madrone are more often found in the warmer drier eastern parts of the Watershed, but may also be found on harsh microsites in the western part of the Watershed. Periodic disturbance may be necessary to maintain a component of either of these two species in a stand, and both are tolerant of extreme heat and drought. They differ in that chinkapin is tolerant of cold where as madrone with its broad leaves is sensitive to extreme cold and snow (Niemiec et al 1995). Red alder was only rarely found above 1,800 feet, in either an upland or riparian setting before the Watershed area was roaded. The general lack of red alder in the unmanaged forest can be attributed to two factors. First, the snow line is about 1,800 to 2,000 feet. Above that elevation early snows will break the brittle alder branches giving the conifers a competitive advantage. The other factor is red alder is short lived and shade intolerant, which means it will drop out as a component of the forest if stand replacement disturbances are not occurring at intervals less than about 100 years.

The following description of shrub distribution is based on observations on BLM lands. On the west end of the Watershed, where marine influence is the strongest, draws and midslope locations are occupied by salmonberry with evergreen huckleberry on ridge tops. Salmonberry is a very vigorous shrub species on all aspects at the extreme west end of the Watershed and on north facing low elevation low slope positions in the western half of the Watershed. Salmonberry becomes less common and less vigorous with increased elevation and increased distance from the ocean. On Blue Ridge where basalt replaces sedimentary parent material, salal is the dominant shrub. East of Blue Ridge, rhododendron is found on ridge tops generally above 1,800 feet. Evergreen huckleberry is found on ridge tops generally below 1,800 feet. Salal forms near pure stands in the understory on deep red clay soils on gentle to moderate slopes on warm upper slope locations. Vine maple joins salal on those sites in the draws. Oregon grape, either by itself or in association with rhododendron and/or salal, is found on well-drained soils with a high rock fragment content. Snowbrush ceanothus is occasionally found on south to west facing upper slopes and ridges in Susan Creek and Burnt Creek areas. Isolated areas of blue blossom ceanothus are found on southwest slopes in the Ren Smith area of Daniels Creek. Scattered rock outcrops and scree areas are found in the Watershed, which support specialized plant communities.

Above about 1,800 feet elevation, riparian vegetation is restricted to narrow bands and few hardwoods are found in the old growth riparian zones. At lower elevations in the Watershed, the riparian zone becomes wider where there are flood plains, larger order streams, and on streams with numerous steep tributaries. As a general trend, the riparian zones are wider on the western end of the Watershed and narrower on the eastern side.

Scattered small rock outcrops and scree areas are found in the Watershed that support specialized plant communities. Small patches of madrone are found on south west facing upper slopes in the south east portion of the Watershed.

Processes Affecting Landscape Patterns: The most prevalent stand replacement process occurring today is timber harvest and subsequent reforestation. Most of the vegetation has been altered through fire exclusion, agricultural practices, and logging. Most of the forest land has been cut and regenerated since 1940. Before Euro-American settlement, the dominant factor affecting overall landscape patterns was fire. Flood (peak flows) and debris flows were the major influences on riparian vegetation patch dynamics (Jones et al 2000).

Table Veg-1: Processes that Influence the Current Vegetation Patterns

Process	Influence on Upland Vegetation:		Influence on Riparian Vegetation:	
	Landscape Patterns (Stand Replacing)	Stand Structure (Stand Modifying)	Riparian (Stand Replacing)	Riparian Stand Structure (Stand Modifying)
Fire (Lightning & Human Caused)	X	X	X	X
Wind	X	X	X	X
Management (Timber Harvest & Agriculture)	X	X	X	X
Disease (Primarily Root Rot)		X		X
Landsliding/ Mass Wasting		X	X	X
Stream Bank Erosion				X
Plant Competition		X		X

Rockland associated dry balds are maintained by fires that reduce organic matter accumulations, retard forest vegetation encroachment temporarily expose these sites to erosion.

For general discussions on processes affecting stand structure and landscape patterns see:

- Franklin and Dyrness (1973), and Hemstrom and Logan (1986) for plant succession.
- Averill et al (1995) for an overview on disturbance.
- Oliver and Larson (1990) for vegetation competition and stand dynamics.
- Agee (1993) for fire as a disturbance process. Especially, fire effects on vegetation (pg. 113-150), fire effects on western hemlock forests (pg. 205-225).
- Agee (1993) pg. 9, Smith (1962) pg. 413-414, 422, & 499, and Oliver and Larson (1990) pg. 100-106 for wind as a disturbance process.
- Appendix: Vegetation and Disturbance Processes

Current Conditions

Array and Pattern of Vegetation: Current vegetation patterns are a result of past management actions, harvest practices and associated road building, land ownership, fires, human settlements, agriculture and farming. Landsat data displayed on Map Veg-2 and summarized on Table Veg-2 show the cover condition across the Watershed as of the summer of 1993. Early or mid-seral stands occupy most of the private forest land in the Watershed. Approximately 1,685 acres are agricultural and rural residential lands.

Table Veg-2: Forest Classes and Acres Based on Landsat Data from Summer 1993. (Four class reclassification of the data set. See Vegetation Appendix for breakdown by drainage)	no data	water, agr., new clearcut, young plantations, nonforest	conifer stands	hdwds stands	mixed stands	total
Panther Ck. Subwatershed	1	9,394	17,465	481	127	27,468
Cedar Ck. Subwatershed	1	10,125	23,024	1,258	356	34,764
Tioga Ck. Subwatershed	1	2,510	19,839	2,035	264	24,649
South Coos Subwatershed	5	17,129	49,020	6,102	1,211	73,467
Total Ac for the South Fork Coos Watershed	8	39,158	109,348	9,876	1,958	160,348
Percent of acres in the South Fork Coos Watershed	0.0%	24.4%	68.2%	6.2%	1.2%	100.0%

The GIS Forest Operations Inventory (FOI) data set contains stand specific information for all stands managed by the BLM. The FOI is designed to track past and prescribed land treatments, and contains other information that is helpful in setting land treatment priorities. The FOI layer in GIS was last updated in 1997. Map Veg-3 and in Table Veg-3 show FOI forest age class data, organized to match RMP Seral Stages and forest management age classes[1].

Table Veg-3: BLM FOI Acres by Stand Age (RMP & Timber Management Age Classes)

From GIS data updated to 1997	Early Seral	Mid Seral		Late Seral and Old Growth			NF	all BLM ac.	BLM ac. with 80 yrs.+	percent ac. with 80 yrs.+
	0-30 yrs.	31-60 yrs.	61-80 yrs.	81-160 yrs.	161-200 yrs.	201+ yrs.				
Panther Ck. Subwatershed	644	113	260	105	0	639	2	1,764	745	42.2%
Cedar Ck. Subwatershed	1,151	960	86	633	0	593	15	3,439	1,226	35.7%
Tioga Ck. Subwatershed	5,480	2,878	864	2,400	0	4,111	46	15,778	6,510	41.3%
South Coos Subwatershed	4,250	1,737	690	1,731	5	3,300	31	11,744	5,036	42.9%
Total BLM acs. in the So. Fk. Coos Watershed	11,525	5,688	1,901	4,869	5	8,644	94	32,726	13,517	41.3%
% of BLM acs. in each age class	35.2%	17.4%	5.8%	14.9%	0.0%	26.4%				

Array and Pattern of Riparian Vegetation: Riparian vegetation along fish bearing streams for most of this Watershed was evaluated following a method based on the Washington Department of Natural Resource (DNR) large woody debris recruitment potential module (Washington Forest Practice Board 1992). The DNR approach involved examining and classifying streamside stands using aerial photos. For this analysis we experimented with predicting large woody debris recruitment potential using reclassified Landsat satellite data. Table Veg-4 and Map Veg-4 display the results of this analysis. We used the DNR protocol for streamside vegetation classification as a basis for reclassifying the satellite

[1] The Vegetation Appendix contains an expanded version of these tables that show acres by drainage. The optimum window for commercial thinning/ density management, occurs around age 30. Culmination of mean annual increment for stands that were not commercial thinned occurs around age 60. The exact age for each individual stand depends on site quality, past management, initial stand density, and method used to measure tree volume.

data. The methods we used and the strengths and limits of using Landsat data on GIS are discussed in the Instream CWD Recruitment Potential section of the Vegetation Appendix.

Table Veg-4: Streamside CWD Recruitment Potential for All Ownerships and Based on Reclassed Landsat Data

	6th & 7th order streams		3rd, 4th, & 5th order streams	
Risk classification for nonattainment of CWD into the stream from the streamside stands (image data captured summer 1993)	Reclassed acres within 150 feet of the stream centerline	calculated lineal feet of affected streambank*	Reclassed acres within 100 feet of the stream centerline	calculated lineal feet of affected streambank**
High risk	186	54,014	1,198	521,849
Medium risk	313	90,895	1,578	687,377
Low risk	474	137,650	2,417	1,052,845
Nonforest, recent clearcuts, and young plantations***	1,171	340,058	1,945	847,242
water	181	N/A	9	N/A
total	2,325	622,618	7,147	3,109,313

* *((acres X sq. ft/ac.) ÷ 150 ft width of the reclass zone either side of stream)*
** *((acres X sq. ft/ac.) ÷ 100 ft width of the reclass zone either side of stream)*
*** mix of high risk (roads, nonforest, brush, young hardwoods) and medium risk (very young plantations)

We used the reclassed CWD recruitment potential Landsat data to look at the larger issue of CWD recruitment on all of BLM's Riparian Reserve land in the Watershed. The results are displayed on Table Veg-5 and Map Veg-5. Although Table Veg-5 shows 5,258 acres classed as "medium" or "high risk," Table Veg-6 shows more than half those acres are in patches smaller than 5 acres.

The reclassed Landsat data show more acres of hardwoods than does the FOI data base (1,908 acres vs. 1,105 acres). Part of the discrepancy is attributable to the 5-acre lower size limit on what is practical to track in FOI. When only those stands greater than 5 acres are counted, Landsat hardwood stands total 819 acres (Map Veg-6). Some of the difference is traceable to the Landsat data showing polygons broken strictly on the stand type, whereas the FOI map shows logical treatment units, which may have inclusions of other timber types. Of those FOI acres, "hardwood conversion" is recommended for 610 acres. The rest have a treatment recommendation showing them as hardwood stands not to be converted. A comparison between the reclassed Landsat data and a FOI map shows most the hardwood stands, recommended for conversion, are accurately mapped on the FOI theme. The locations of hardwood stands not to be converted, do not correspond well with the hardwood stands mapped using Landsat data. Instead, those FOI polygons mirror land use allocation decisions made in the 1980s, which are superceded by the Forest Plan. All riparian buffer land use allocation polygons had the same "no treatment" recommendation, and we drew those polygon boundaries based on a land use decision and not the stand type. We applied only one timber type classification, to all acres inside riparian buffer polygons found in each section. Now that we are required to do riparian restoration on suitable sites, the old FOI riparian buffer polygon boundaries, the associated timber type classification, and in some cases, the recommended treatment no longer fit our needs. Similarly, we did not map other hardwood stands when we first built the FOI maps in the 1980s because those stands were either contained inside areas managed for habitat, with a "no treatment" recommendation or were surrounded by forests stands with a recommended treatment of "high priority clearcut."

Table Veg-5: CWD Recruitment Potential for all BLM Acres Inside the Riparian Reserve Based on Reclassed Landsat Data (image data captured summer 1993)

Risk classification for nonattainment of CWD	established conifer all ac.	established hardwood all ac.	established mixed patches & stands all ac.	all other ac.	total by class
High risk	2,822	89	30	N/A	2,942
Medium risk	498	1,819	0	N/A	2,316
Low risk	11,392	0	454	N/A	11,846
NF, recent CC, and young plantations	N/A	N/A	N/A	2,353	2,353
water (non-forest)	N/A	N/A	N/A	13	13
total by stand type	14,712	1,908	485	2,365	19,470

Table Veg-6: CWD Recruitment Potential for Those BLM Stands Inside the Riparian Reserve that Are Greater than Five Acres, Based on Reclassed Landsat Data (image data captured summer 1993)

Risk classification for nonattainment of CWD	acres in established conifer stands that are >5 ac.	acres in established hdwd stands that are >5 ac.	acres in established mixed stands that are >5 ac.	all other acres	total by class
High risk	1,246	0	0	N/A	1,246
Medium risk	55	819	0	N/A	874
Low risk	10,362	0	12	N/A	10,373
NF, recent CC, and young plantations	N/A	N/A	N/A	1,668	1,668
water (non-forest)	N/A	N/A	N/A	0	0
total by stand type	11,662	819	12	1,668	14,161

The Vegetation and Disturbance Processes Appendix contains additional information on some tree species associated with riparian areas and processes that effect stream side vegetation. A small patch of Oregon ash grows near the Tioga Creek stream gauge (sect. 31, T.26S., R.9W.) Scattered willows[2] also grow along Tioga Creek and other streams.

Fifteen Percent Rule: As shown on Table Veg-3, 41.3% of Federal land in this 5th Field Watershed supports stand 80-years old and older, and therefore meets the 15% rule. This includes 8,648 acres of stands older than 200 years old, which equals 26.4% of Federal land in the Watershed. The combination of LSR land and land classified FGNW, in this Watershed, support 10,455 acres of stands that are 80-years old and older. That equals 31.9% of all the Federal lands in the Watershed.

Port-Orford-cedar: This Watershed is on the extreme northeastern end of the natural range of Port-Orford-cedar (POC). In this part of its range, POC is more typically found growing on upper slopes, ridge tops and south facing benches. However, second growth POC are growing next to Tioga Creek and Burnt Creek in sections 31 and 32, T.26S.,R9W. Timber cruise data from the 1960s through 1994 show 14 BLM timber sale units in this Watershed contained POC. The highest concentration of POC on BLM land was in section 34, T.25S., R.9W. where 5 timber sale units, containing 276 POC trees, were sold. A proposed but dropped unit in section 10, T.26S., R.9W. contained 68 POC. In the rest of the timber sale units, POC numbers were no higher than 22 and commonly much less. The only known mature POC trees on BLM land in this Watershed are in section 10, T.26S., R.9W. Those POC trees are inside the

[2] The following willow species were observed along Tioga Creek: Sitka willow (*Salix sitchensis*), Pacific willow (*S. lucida* ssp. *lasiandra*), and Scouler's willow (*S. scouleriana*). Other species may also be present in the Watershed.

LSR and the road accessing that area is blocked. Additional information can be found at the following Internet sites: http://www.fs.fed.us/r6/siskiyou/poc1.htm and http://www.fs.fed.us/database/feis/plants/tree/chalaw/.

POC is highly susceptible to a fatal fungal root disease caused by *Phytophthora lateralis*. The Port-Orford-Cedar Management Guidelines (Betlejewski 1994) includes methods for managing the root disease. This document provides a context for analyzing the site specific impacts and selecting disease management and mitigation measures that may be included in project proposals. The guide presents an array of management options, however, not all options are suitable on all sites. The best disease management approach will depend on the site specific conditions and will benefit from an adaptive management approach.

Swiss Needle Cast: Aerial surveys for Swiss needle cast indicate this fungal disease on Douglas-fir foliage occurs up to about 14 miles inland form the mouth of Coos River (Filip 1998). This suggests Swiss needle cast is either present or potentially can affect Douglas-fir stands in Daniels Creek, Morgan Ridge and parts of Blue Ridge at the extreme west end of the Watershed. At least one BLM plantation, in the Ren Smith area, appears to be infected but this has not been verified by examining the needles for the characteristic rows of tiny back fruiting bodies (pseudothecia) in the stomatal openings. Don Goheen, forest pathologist with the Southwest Oregon Forest Insect and Disease Service Center, provided the following information on Swiss needle cast. The disease is cause by *Phaeocryptopus gaeumannii*, an ascomycetous fungus. The disease causes yellowing and premature loss of infected needles. This can result in reduced height and diameter growth but rarely directly kills its host. The loss of foliage can affect the infected Douglas-fir trees competitiveness, which can alter stand dynamics and ultimately stand structure and species composition. *P. gaeumannii* is native to North America and was long thought to be of minor importance within the Douglas-fir range. Swiss needle cast causes severe damage to Douglas-fir planted outside the tree's range though out the world. In recent years, Swiss needle cast has become particularly damaging in Douglas-fir stands within 30 miles of the coast in Northwest Oregon. Most impacts are noted in stands 10 to 30 years old. However, cases of severe infection have been reported in older stands. The disease is showing up in Douglas-fir stands planted in or near the spruce zone on the south Oregon Coast. The cause of the current out break of Swiss needle cast does not have a single simple explanation and is a subject of ongoing research. However, one or more of the following factors may be responsible:

- Douglas-fir has been established in dense pure plantations in the coastal fog belt where the tree had been a minor component in wild stands.
- Some plantations were planted using off-site seed.
- As the disease progresses there is a greater inoculum load (more spores) increasing the probability and severity of infection.
- Recent climate shifts may have created conditions more favorable for the fungus.

The recommendations chapter lists the current strategies for managing the disease.

Reference Conditions

Map Veg-7[3], and Table Veg-7 show the 1900 vegetation distribution.

[3] The following is from the metadata for the 1900 vegetation map. Henry Gannet spent two years visiting almost all timbered areas in Oregon. He gathered the data township by township and provided an overall description of the timber status. The actual map was compiled by A. J. Johnson. The work began in 1898 and was finished 1902. The original map was hand drafted and so the scale is uncertain. The dimensions of the original map have changed due to medium shrinkage and expansion. This dimensional distortion is compounded by the photo-enlarging needed to increase the size of the map to make it suitable for digitizing. Some distortion was reduced by rubber-sheeting the map to correct latitude and longitude. The vegetation boundaries of the original map tend to follow township lines. This is likely a reflection of the data being compiled by township. These factors indicate the vegetation breaks shown on the map are approximations. The metadata does not cite the original source for the 1900 vegetation map, however it was likely part of a largeer document titled: *Annual Reports of the Department of Interior, for the Fical Year Ended June 30, 1900, Twenty-first Annual Report, U.S. Geological Service.*

Table Veg-7: 1900 Vegetation Distribution (From GIS Data)

Vegetation type	Acres
Timberless Area	11,899
Woodland	378
0 - 5,000 Board Measure* per Acre	54,825
10,000 - 25,000 Board Measure* per Acre	63,858
25,000 - 50,000 Board Measure* per Acre	18,976
cut timber, not restocking	7,672
Burnt	2,776
Total	160,385

* "Board Measure" is an old term approximately equivalent to a Board Foot.

Late 19th, early 20th century cadastral survey notes provide a means to interpret the 1900 vegetation classes. Timberless areas in the South Coos Subwatershed correspond to the bottom lands and adjacent uplands. Settlers cleared and converted the bottom lands to agricultural in the later half of the 19th century. The cadastral survey notes from 1857 for T.25S., R.11W. and T.25S., R.12W., and 1871/72 for T.26S., R.12W. document burnt timber on the uplands along Coos River (Gordon 1858c; Flint 1872a&c). Flint (1872a&c) commented that some burnt uplands were suited for grazing cattle. This suggests that some uplands next to Daniels Creek, and possibly along Coos River, were classified as "timberless" rather than "cut timber" or "burnt" because they were actively grazed in 1900. Bottom land vegetation in 1857 consisted of high salt marshes and crab apple thickets on the lower 3½ to 4 miles of Coos River. Crab apple appears to have been a dominant shrub cover on the flood plains around the junction of the Millicoma and Coos River. Gordon (1858c) documented a small prairie on the north flood plain just west of the junction of the Millicoma and Coos River. Crab apple, salmonberry, myrtle, [bigleaf] maple occupied the rest of the flood plains within about a mile of that junction. Gordon's notes show spruce and [Douglas-]fir were common enough to merit inclusion in the section line summaries in that area but do not distinguish between upland and bottomland sites. Myrtle and bigleaf maple were the dominant flood plain trees upstream from the junction. The survey notes show conifers present on many section lines that cross bottomlands. The notes also show that conifers were only rarely selected for scribing as bearing trees indicating that although conifers may have been present, they were not common on bottomland sites. The surveyors also found swampy areas dominated by either skunk cabbage or brush (mostly likely willow and/or crab apple) (Gordon 1858a,b&c). Map Veg-1 is a projection of the 19th century vegetation next to Coos River from Dellwood to the bay based on survey notes, and soil and geology maps. The Vegetation Appendix section "1857/1871/1872 Vegetation Communities on the Lower Coos River Flood Plains and Terraces," the Map Veg Apdx-1, and Map Veg Apdx-2 contain the data and assumptions used to develop Map Veg-1, along with additional information on the 19th century vegetation in the South Fork Coos Watershed.

The "cut, not restocking" area on the1900 vegetation map (Map Veg-7) shows where the early logging took place in the South Fork Coos River Watershed. The Simpson Lumber Company moved from logging around Coos Bay to logging in the South Fork during the 1880's. Simpson Lumber Company began construction on a railroad in 1898 so they could haul logs from the slopes beside Daniels Creek, and eventually Blue Ridge, to tide water. Ren Smith began logging in the "Smith Basin" at East and West Creeks in 1887. He used oxen to drag the logs from that area down to the McKnight place. See pages 77 to 80 in *Swift Flows the River* by Dow Beckham (1990) for additional logging history from the 1880's to the 1940's.

When surveying the part of T.26S., R.12W. that is inside the Watershed, Flint (1872c) recorded more observations of Oregon ash than alder in the section line summaries. Based on his notes, and considering that species typically grows on poorly drained soils, Oregon ash most likely grew on the Willanch soil[4] at the junction of Ren Smith[5] Creek and Daniels Creek, on Ren Smith Creek where it parallels the line between sections 11 and 14, and on the creek parallel to the line between sections 22 and 23. Flint also observed ash on lines across upland sites well away from wet bottom land. Given that Oregon ash will also grow on sandy, rocky and gravelly soils in riparian areas (Niemiec *et al* 1995), this suggests that Oregon ash may have once been an important streamside species on 1st and 2nd order draws. It is plausible that Oregon ash was shaded out by red alders, which invaded upland sites following road construction and ground lead logging, and/or by conifers that were finally able to survive and grow beyond the fire vulnerable seedling/ sapling/ pole stages, as the result of effective fire control.

The 1900 vegetation map shows most of the Cedar Creek and Panther Creek Subwatersheds supporting forests with 0 to 5,000 board measure per acre. The low timber volumes per acre are likely the result of a fire (or fires) that burned after Flint (1882) surveyed T.25S., R.8W. This fire destroyed all evidence for some corners[6]. Heydon (1897a&b) recorded in his survey notes that much of the timber had been burned in both T.26S., R.8W., and T.27S., R8W. The 1900 vegetation map also showed timberless areas in the Cedar Creek and Panther Creek Subwatersheds. What separates the timberless areas from the 0 to 5,000 BM/ ac areas is not apparent given the evidence in the survey notes other than possibly the severity of the burn[7]. Wygant (1913), wrote in his general description for the resurvey of T.25S., R.8W. that there was ". . . a heavy growth of poison ivy on the higher peaks." Heydon (1897a), also commented on the occurrence of "poison laurel" [poison oak] in the burned part of T.26S., R.8W. Poison oak is favored by frequent fires. The "Cadastral Survey Notes Excerpts for the Eastern Part of the South Fork Coos Watershed" section of the Vegetation Appendix contains selected survey line entries and general descriptions for T.25S.,R.8W.; T.26S.,R.8W.; T.27S.,R.7W.; T.27S.,R.8W.; T.28S.,R.8W.

The "burnt" polygon in the Tioga Creek Subwatershed is the Tioga Burn, an area subject to several reburns (Tioga Appendix: Fire History).

The survey notes covering the Cedar Creek and Panther Creek Subwatersheds suggest that red alder was uncommon there in the late 1800's. Willow does show in several line summaries suggesting it was an important riparian species along smaller streams. The willow abundance may be a function of the open conditions following the forest fires that the surveyors also documented in their notes. Heydon (1897b) found sufficient sugar pines in the southeast end of the Watershed on the lines between sections 34 and 35; 26 and 35, T.27S., R6W., to merit comment in the survey notes. Heydon (1897a) also noted "white

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4 Map 31 in the Coos County Soil Survey (Haagen 1989) shows the extent of Willanch soil at the junction of Ren Smith and Daniels Creeks.

5 The USGS Daniels Creek, OR. 1971 7.5' topographic map shows the creek name as "Wren Smith." However, the creek is named for Lorenso "Ren" Smith. Ren Smith was the first logger to push above the head of tidewater on the South Fork Coos (Beckham 1990).

6 From the 1911 retracement and resurvey of T.25S., R.8W. Will. Mer. (Wygant 1913):
North on retracement of West bdy. of Sec. 28.
. . . No further trace of old survey line.
40.00 Almost impassable jungle of small fir, hemlock and fallen burnt timber: no trace of 1/4 sec. cor. [*the survey note entry for this 1/4 corner, made by Flint (1882), reads: . . . Hemlock tree 6 ins. diam. For 1/4 sec. cor. wit. trees-*
A fir 24 ins. diam. bears N 85 W 20 lks dist.
Fir 30 ins. diam. bears N 70 E 25 lks dist.]

From the 1896 Subdivision survey of T.27S., R8W. by Heydon (1897b): . . . Line bet secs 4 and 5 . . .
Could find no trace of old cor. to secs. 4, 5, 32, 33 on north boundary of the Thp it having been destroyed by fire. . .
40.00 Found no trace of the 1/4 sec cor. . .

7 The southern timberless area is along the Coast Range crest just west of the Flournoy Valley and may be an artifact of "escaped" fires that were set to maintain the oak/ grass lands in the valley (Hathorn 1856a & b; Lewis 1990), however, this is speculative.

cedar" [POC] along section lines within about a mile of the junction of Cedar Creek and Arrow Creek[8].

Insect Kill and Blowdown - The most important windstorms in terms of damage to the forest, which occurred since the establishment of a District office in Coos Bay were in December 1951, October 1962 and November 1975 (USDI 1978). In addition, considerable timber was blown down in Coos County during the winter of 1949-1950 (Wright; Lauterback 1958). The effects of the 1949-1950 storms on BLM lands are not documented.

We have little information on mortality patterns on BLM lands in the South Fork Coos Watershed, due to natural agents other than fire, before 1949. However, an analysis of Weyerhaeuser's 1945-46 inventory data does indicate the pre-logging mortality patterns (Wright; Lauterback 1958) that may be applicable. In 1946, Douglas-fir with birth dates in the mid-1700s comprised 92% of the standing volume on the Millicoma Tree Farm. This is comparable to the stands on BLM land, in the South Fork Coos Watershed, west of Tioga Creek and east of the 1868 Coos Bay Fire. The Weyerhaeuser inventory showed the average gross growth to be 282 board feet per acre, average mortality of 244 board feet per acre giving a net growth of 38 board feet per acre per year. Analysis of the inventory data indicated that heavy mortality had been occurring for decades. Tabulation of the causes of mortality for the 50-years before the inventory indicated insects contributing to 70% of the total volume killed. Wind break caused 12% of the volume loss, fire killed 7% with suppression, drought, disease and unknown causes together killing 11%. Wright and Lauterbach considered their estimated times and causes of death for several decades old mortality to be little better than guesses but they believed estimates for more recent mortality to be reasonably good. Extensive killing by bark beetles continued until 1949. Insect caused mortality then declined to practically none by 1950. The 1949-1950 blow down provided conditions favoring the build up of tremendous bark beetle populations by spring 1951. Great numbers of bark beetle killed trees were evident by the end of the 1951. Lack of road access impeded sanitation and salvage efforts. The December 1951 blowdown provided new material for the bark beetles resulting in even greater populations in 1951 and 1952. The bark beetle populations began to decline in 1953 (Wright; Lauterback 1958). We do not have mortality figures for the BLM lands, however, the total mortality from wind and bark beetles on the near by Millicoma Tree Farm from 1950 to 1954 was 6,100 board feet per acre (Wright; Lauterback 1958). The 1961 type maps (drawn from 1959 aerial photography) show T.27S., R,10W. And T.26S.,R10W. peppered with bug kill patches. The bug kill patches generally ran 1.5 to 3 acres with a few larger and several smaller. T.26S.,R10W. had 7.4 bug kill patches per square mile, and T.27S.,R10W. had 1.8 per square mile. The bark beetle outbreak, following the 1962 blowdown, was not as extensive as the 1951-52 epidemic and the insect killed patches typically smaller than a dozen trees (USDI 1978; Lance Finnegan per. com.). This is attributed to rapid aggressive salvage efforts facilitated by good road access.

Riparian Vegetation in Tioga Creek Subwatershed: Examination of the 1943 and 1950 aerial photos showed the following in intact riparian zones next to the main stem and low gradient major tributaries below 1,800 feet in the Tioga Creek Subwatershed:

- Along 4th and 3rd order streams and flat gradient 2nd order streams, almost pure hardwoods occupy a zone that is up to 100 feet wide (approximately 50 feet either side of the creek[9]). The stands immediately adjacent to the pure hardwood strip have old growth Douglas-fir overstories and

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8 "White cedar" noted on the following lines common to: 8 & 9, 7 & 8, 6 &7, and 5 & 6. The following is from the summary for the line common to 6 and 7: "Timber - excellent fir hemlock white and red cedar. Considerable of the white cedar in secs. 6 and 7 is burned and dead."

9 Hardwood stand widths observed on the aerial photos for Tioga Creek Subwatershed should not be taken to represent the South Fork Coos Watershed as a whole. Less intensive examination of older aerial photos for other parts of the Watershed indicate that the occurrence, composition, and width of the hardwood streamside stands varies with elevation and distance from the ocean or from a fog influenced valley. However, trends in distribution of hardwoods with respect to disturbance processes and aspects can be extrapolated to other subwatersheds so long as elevation and distance from the ocean are considered.

hardwood dominated understories where there is a high density of 1st and 2nd order draws. The percent of the area occupied by hardwoods is relative to side draw density, side draw gradient and distance from channels. The percent hardwood cover goes up in proportion to the side draw density and side draw gradient suggesting debris torrents are responsible for at least some hardwood dominated riparian areas. The percent hardwood cover goes down with increased distance from a channel. Where side draw density is very high, conifers are largely confined to the ridges. See Shotgun and Susan Creeks on the 1950 aerial photos for examples.

- On 1st and 2nd order draws: hardwood riparian zones, when present, are 50 to 75 feet wide and reach farther up the north facing slopes than on the south slopes.
- Where the slope beside the stream is smooth (few or no tributaries) and south to west facing, a uniform closed canopy conifer stand may reach almost to the stream's edge. See the first 3rd order draw south of Shotgun Creek on the east site of Tioga Creek on the 1950 photos for an example.
- Where alders extend more than 100 feet away from the stream there are usually slope instability indicators: steep ground, high density of 1st order draws, sharp ridges, and usually the slope faces north. These sites often appear to be candidates for TPC classification of either FGR2 or FGNW.
- Rotational slumps are dominated by hardwoods, probably big leaf maple, with scattered old-growth conifer. See the west side of Tioga Creek between Coos River and Hatcher Creek on the 1950 photos for an example.

Myrtle and big leaf maple trees are components that help define the riparian zone at lower elevations. Based on observations in relatively intact riparian zones, and subject to site to site variation, myrtles are the more commonly found on the south facing side of the creek and big leaf maple to the north facing. High water tables favor myrtle over big leaf maple. Red alders are found directly next to the channel and on unstable moist steep usually north facing slopes.

Above 1,800 feet elevation, those hardwoods were a minor component and often absent from the riparian zone. At those higher elevations one must use changes in the shrub and herb layer to define the riparian zone. Typically those areas defined as riparian by vegetation are narrow. Western red cedar is most commonly found in but is not confined to the riparian zone.

Synthesis and Interpretation

The late 19th, early 20th century cadastral survey notes show the wide bottom lands occupied by myrtle-maple forests, swampy areas and brushy wetlands on the west end of this Watershed (Vegetation Appendix: 1857/1871 Vegetation Communities on the Lower Coos River Flood Plains and Terraces). The notes also show timber scatterings, and extensive areas with fire killed snags and fallen trees in this Watershed. All these habitats are now uncommon to almost nonexistent (see Figure 1 in this section, and also see the Images of the Landscape section of the Introduction Chapter).

Figure 1 Snags created by the 1936 Williams River Fire. The photo was taken September 27, 1950, in section 10, T.27S., R.9W., on the Tioga to Reston Road (now the Burnt Ridge Road). Large snag patches were a common habitat feature in the unmanaged landscape but are almost nonexistent in the managed landscape.

Based on timber sale cruise data and cadastral survey notes, POC grew in the following drainages: Lower Tioga Creek, Mink Creek, Burnt Creek, Bottom Creek, Lower Williams River, Lower Cedar Creek, Upper Cedar Creek, and possibly Arrow Creek.

Hardwood Stands: Crab apple, willow, myrtle and bigleaf maple were the most commonly noted bottom land/ riparian trees in the late 19th century survey notes.

Several land owners in this Watershed have told Coos Watershed Association employees that Oregon ash is currently not found in lower part of this Watershed (Ann Donnelly per. com.) This prompted a side bar investigation into the past and current range of Oregon ash in this Watershed. We found Oregon ash is present but not common in the Watershed today. Watershed team members found Oregon ash in both Daniels Creek and Tioga Creek Subwatersheds. However, Gordon, in his general description for T.25S, R.11W. noted ash among the tree species found along the rivers in 1857. Gordon did not list ash in any line summary for the sections in the South Fork Coos Watershed (we did not review the lines notes for those sections in the Millicoma Watershed). This suggests Gordon either only observed Oregon ash in the Millicoma, or he saw only small patches and individual ash trees along the South Fork Coos River. Flint's survey notes suggest that ash was at one time common the Daniels Creek Drainage (Flint 1872c). We do not know why the species is uncommon in the Watershed today. Our best guesses on why ash abundance has declined are:

- conversion of bottom land ash sites to agriculture,
- conifers out competed ash on the uplands following fire exclusion,
- land survey notes suggest red alders are far more common the landscape today than in the 1850. This larger red alder population may have out competed and replaced ash on wet sites.

Land survey notes suggest red alder was not wide spread in this Watershed at the end of the 19th century. At the same time, willow was commonly noted on bottom land sites and where there had been recent forest fires (Gordon 1858a,b&c; Flint 1872c; Heydon 1879a&c). Based on where alders were selected to be bearing trees and on the silvics of the species, red alders in the 19th century were most likely to grow on stream banks and on moist bottom land soils. These sites are subject to stream bank erosion, scouring by debris torrents, and alluvial and landslide deposition. Consequently, these streamside sites experienced a higher frequency of disturbance than the landscape as a whole. We suspect that management related exposure of bare mineral soil (ground lead logging, site scarification, and road construction) allowed establishment of a wide spread and abundant red alder seed source outside of riparian and slide track corridors. This in turn, allowed alder to replace willow as the most common hardwood on those moist sites in this Watershed outside the range of myrtles and maples.

Red Alder in the Riparian Zone: Alders are present on some sites not so much because they are riparian species but because they thrive where there is soil disturbance. The area occupied by red alder in the current landscape is greater than in the pre-management landscape. Niemiec and others (1995) reported the historical inventories indicate that the abundance of red alders has increased about 20-fold since the 1920s. The initial expansion of area occupied by red alder was in response to soil disturbances that favored alder. For example, cat trails, ground lead logging, road cuts and fills provide site conditions that approximate those found on natural landslides. Now with the aid of this well-established, expanded seed source along many road right-of-ways, alders are establishing in recently denuded sites in areas of the landscape where few alders occurred 20-years ago.

Based on examination of aerial photos for the Tioga Creek Subwatershed, many of the acres of streamside vegetation currently classified as poor condition, with respect to the current large woody debris recruitment potential, are sites where the streamside stands were naturally occupied by hardwoods in 1950. Some areas in poor condition are on rockland, or in landslide tracks, or steep north facing slopes where hardwoods had dominated the wild stand prior to cutting. The key to restoring riparian vegetation is not in removing all the alder. Rather it is in distinguishing those sites that are naturally subject to patch replacing disturbances (in this case slides and debris torrents) that recur on cycles of 100 years or less from those that would normally go a longer time between stand/patch replacing disturbances (for example stand replacement fire). Sites in the latter category are more logical candidates for restoration and will be the easier sites on which to reestablish conifer. The width of the naturally occurring stream side hardwood stands are most easily determined through a combination of viewing older aerial photos that show the pre-management condition of candidate sites for conversion, site visits to look for conifer stumps, assessment of potential for regeneration success, and assessment of the risk for landslides and debris torrents. Site visits are also necessary because some stream side areas shown by old aerial photos to support alders that regenerated following debris torrents may have supported conifer or mixed stands before the debris torrent. These former conifer or mixed stand sites are harder to detect since debris torrents sweep away nearly all evidence of an impacted draw's predisturbance condition. Under these conditions, identifying sites that are appropriate for reestablishing conifer or mixed stands depends on an assessment of the site's potential to support conifers and on an assessment of risk for debris torrents in the near future. The Vegetation and Disturbance Processes Appendix includes sections on the development of red alder stands, and on stand development following conversion of an red alder stand to conifer.

Fire: Fire as a natural or prehistoric aboriginal disturbance process is now restricted by fire control efforts. This has all but eliminated a major factor responsible for obtaining multistory multi-age stands, large snag and down log recruitment, and recruitment and maintenance of special habitats like timber scatterings and fire maintained gaps and prairies.

Land survey notes show that for at least the late 19th and early 20th centuries, forest fires resulted in considerable areas of dead and fallen trees. Currently, only individual and small patches of large diameter snags are recruited following small scale disturbances. Suppression mortality will recruit small diameter trees but that process works in young stands and recruits few large diameter trees. Without fire or active intervention, there is no longer a mechanism to recruit large well-stocked snag patches containing big diameter trees.

The exclusion of low to moderate severity fire eliminates the most important process on the Watershed for initiating understory conifer regeneration. Fire exclusion eliminates a mechanism that affects the species composition of each canopy strata. For example, underburns select against fire intolerant species in the overstory. Following a low to moderate severity fire, shade from the surviving overstory results in conditions favoring shade tolerant plants over shade intolerant species in the understory (Hofmann 1924). In the absence of fire, or of management activities designed to emulate the effects of fire, the long term change will be:

- Younger stands will carry higher stocking levels and take longer to grow to an average stand dbh of 20-inches compared with the growth trajectory for old-growth stands on the landscape (Tappeiner et al 1997).
- Lengthening of time before well stocked understory stands are recruited.
- Where gap formation results in understory tree recruitment, the understory will be uneven age. Fire history work in and near the Watershed suggests even-age understories were the norm in this landscape.
- Lack of fire may have insect and disease implications. For example fire can reduce the distribution the dwarf mistletoe that parasitizes hemlock. Bark beetle populations can explode in response the sudden availability of fire killed trees.
- Fire intolerant trees will occur in greater numbers in the overstory of older stands.

Fire exclusion may be contributing to the loss of what were once common habitats in the Coast Range:

ridge top fire prairies, and open stands or timber scatterings (see the Images of the Landscape section in the Introduction Chapter). Reburns on these fire prone areas provided a form of habitat stability that allowed the development of plant communities adapted to repeated fire. These communities were dependent on either high shade conditions in the case of timber scatterings, or full sun in the case of fire prairies. The elimination of reburns means the loss of those plant communities. Rapid regeneration following timber harvest does not provide the time necessary for these communities to develop. Since these communities have become rare in the Coast Range they are considered special habitats. The ROD allows activities to aid the recovery of a threaten or endangered species that are dependent on habitats other than late-successional/ old-growth. The ROD also allows activities necessary for managing special habitats not associated with old-growth forest (USDI 1995 pp 20 & 28). While watershed restoration is primarily seen to involve control and prevention of road run-off and sediment production, restoring riparian vegetation, and restoration of instream habitat complexity, it also includes meadow and wetland restoration (USDI 1995, pp 8). Restoration of nonforest habitats is part of meeting the first Aquatic Conservation objective of "Maintain and restore the distribution, diversity, and complexity of watershed and landscape features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted."

Fire and Landscape Patterns - The major valleys, valley side forests, and to a lesser extent the rest of the land inside the Watershed, were human influenced landscapes long before Euro-American settlement. Human impacts date back well before Euro-American settlement. The assemblage of plants that make up the Douglas-fir dominated forest, as we know it, came together for the first time about 6,000 years ago (Brubaker 1991). The earliest radiocarbon dates for human activity on the Oregon Coast are from before 8,000-years Before Present. Therefore, human use of this Watershed, and consequently influence over stand structural characteristics and landscape patterns may predate the arrival of the plant assemblage we know as the old-growth Douglas-fir forest. The Indians of the temperate forest on the Washington and Northwest California coast, and by extension on the Oregon Coast, burned the grass on small "prairies," ridge tops and along grass fringes of rivers so to maintain preferred plants and attract game. Lewis (1990) concluded that the timber was not intentionally underburned by the Coastal Indians and when the understory did burn, it was the result of either lightning fire or escape prescribed burn. However, LaLande and Pullen (1999) found ethnologic interviews indicating that both the Coquille and Coos Indians intentionally underburned some stands. Lightning is infrequent in the coastal forest and moist fuels limit lightning caused ignitions (Arno 1983). Barrett and Arno (1982) observed that the lower elevations, close to valleys where Indians resided, had higher fire frequencies than more remote mountainous areas where lightning was likely the primary ignition source. Fire history data indicates that fires, sufficiently intense so as to leave evidence of their occurrence, burned with return rates of 50-years or less in several drainages in this and in adjacent watersheds (Tioga Appendix: Fire History; North Fork Coquille Watershed Analysis in prep.; USDI 2000). Much of this data were collected on BLM lands close to Brewster Valley, the main valley in the North Fork Coquille and East Fork Coquille Watersheds, and upslope from the valley floors on Middle Creek, Cherry Creek and from the valley on Tioga Creek between the West Fork Tioga Creek and Burnt Creek. Drainages with substantially longer fire return rates are located some distance from broad valleys. These drainages are Little North Fork Coquille and Upper North Fork Coquille in the North Fork Coquille Watershed and the Upper Tioga Creek in the Tioga Creek Subwatershed.

The evidence for the purposeful use of fire by American Indians to manipulate ecosystems has been difficult to document. By the time ethnographers recorded information from native informants about their manipulation of Coast Range forests, many changes had already taken place. A decline of native populations was caused by a lack of resistance to diseases that were introduced from Europe. In addition, warfare (with old enemies and new immigrants), introduction of new technologies (firearms and iron), changes in economy (to fur trading, and sheep grazing), treaties (restricting and removing Indians from traditional lands), and in some cases extinction caused cultural disruption resulting in the cessation of cultural land use practices and loss of traditional knowledge about those practices (Williams 1994). LaLande and Pullen (1999) searched ethnologic interviews with elderly individuals, including informants from the Coos and Coquille, that recalled native traditions in southwest Oregon Indians. These interviews provided an informative, though incomplete, record of the methods and purposes of anthropogenic fire:

- *The Coquille used fire to drive deer into rope snares: "put [snare] on deer trail – put stick maybe two feet high – deer go – step there – rope goes over neck."*
- *The open, park-like forests that resulted from Indian-set fires were another long-term goal. Coquille men "burned brush out of the hunting places . . . every so often." Coos Hunters, who considered such areas "the loveliest of the country," set fire "in the mountains to clear away the brush and jungles and so make hunting easier." This created a "fine and beautiful open country . . . where deer [could] be seen at a distance"; the men set these favorite mountain locales afire annually, at the end of the fall hunt.*
- *The Coquille burned the hazel patches "every 5 years - in August"; this produced "a big slope of nice hazel nuts." . . . they "had lots of hazel nuts [, e]very year [men] burn it over . . . got baskets and baskets full."*
- The Coquille Indians used fire to burn the stickers off of "Indian oats," another name for tar weed, before harvesting the seed. They also used fire to improve berry patches. Although the informant was not specific as to what kind of berry, it was most likely huckleberry.

LaLande and Pullen (1999) and other authors cited in their paper surmised that Indians burning was not indiscriminate. The Indians knew how to use fire to obtain and maintain conditions on the landscape. Their practices included frequent light fires, set at different times of the year, to obtain a more diversified environment. This also lowered the risk of high intensity fire.

<u>Problems with defining "natural" conditions</u>: Sprugel (1991) suggests that the old-growth Douglas-fir forest of the Pacific Northwest may be a non-equilibrium ecosystem because the spatial scale of disturbance, specifically fire, in the region. Fire episodes in the region reset very large proportions of the landscape to early seral conditions. Between major fire episodes, the long climatic periods favoring stand development over stand replacement maintained a skewed distribution of successional stages. This precluded the attainment of a dynamic balance between disturbance and recovery that could lead to a roughly constant condition when averaged across the landscape or that could lead to a balance of opposing processes (e.g. gross primary production vs. total respiration, or nutrient input vs. nutrient loss). Sprugel also suggests that vegetation communities, which had evolved in the presence of a consistent pattern of aboriginal burning, were disrupted by the precipitous declines in American Indian populations following exposure to European diseases in the 16th and 17th centuries. Vegetation communities may still be in the process of organizing into new assemblages now that aboriginal burning is no longer a functioning process on the landscape. Aboriginal fire was, for a while in the 19th and early 20th century, replaced by fires set by settlers. However, this was a change in, rather than a continuation of, a disturbance process on the landscape. American Indians set fires to promote a diversity of habitats, especially by increasing edge effect. White settlers set fires to clear land for agriculture and maintain land in a condition suitable for grazing, and by that create more uniformity on the landscape (Williams 1994).

<u>Bark Beetles</u>: Fires in the Callahan area, Tioga Creek and Middle Creek in the late 19th and first half of the 20th century may have fostered the high levels of insect caused mortality observed on the Millicoma Tree Farm in the 50-years before 1945 (Tioga Appendix: Fire History; Vegetation and Disturbance Processes Appendix). The bark beetle populations likely built up in the fire killed and weakened trees and spread into the unburned stands on the Millicoma Tree Farm, and likely into similar timber types on

BLM lands in the Watershed. While the avoidance of bark beetle epidemics in recent years is attributed to prompt salvage of windthrown timber, fire exclusion since 1950 has also helped to keep bark beetle populations low.

Landslides: Landslides usually affect only small areas at a time but the severity of that disturbance can be very high. Landslides result in the loss of the top soil and organic layer at the point of origin. In extreme cases, all soil is lost down to bedrock. Landslides bury developed soil profiles, where they come to rest, with material that is predominantly subsoil and fractured rock. The loss of the organic layer and top soil to landslides sets back plant succession, and favors pioneer species. Red alder is particularly successful in occupying slide tracks and deposits because of its small winged seed facilitates long distance disbursal, rapid juvenile growth, and ability to fix nitrogen. From the stand point of red alder's regeneration strategy, fresh road cuts and fills provide the same conditions produced by landslides. Landslides that reach creeks can deliver structural material (woody debris, and boulders), gravel, fine sediment, and fine organic matter.

The Interrelationship of Riparian Vegetation, Debris Avalanches, Course Woody Debris and Stream Geomorphology: Fires that result in riparian stand replacement are infrequent and also affect large areas outside the riparian zone. Floods and debris flows are more frequent but their effects are limited to the area close to the channels and slide tracks. Riparian trees found on terraces and other sites protected from flooding and debris avalanches tend to be the same age or older than the upland trees (Avina *et.al.* 1996). Trees close to the channel on sites affected by debris avalanches and floods are younger than the upland trees (Avina *et.al.* 1996). Fires and/or debris avalanches in the riparian zone that are severe and/or frequent, can eliminate the local conifer seed source leaving the site to be dominated by shrubs or alders. The higher frequency of disturbance close to the channel, combined with other riparian attributes, creates complex habitats with a high edge to core ratios. With respect to at least songbirds, these more frequently disturbed and younger stands are used by species preferring disturbance initiated habitats (McComb 1996).

The steep narrow “V” shaped 1st and 2nd order draws are source areas for course woody debris and rocky structure collected by debris avalanches and deposited in fish bearing streams. In one study on a Coast Range creek, 60% of the in-stream wood came from debris avalanches (Hibbs 1996). The steepness of the channel, stream junction angles, underlying bedrock, precipitation, degree of debris loading in the head wall and along the creek, and species and age of the trees next to the channel all effect the quantity and quality of course woody debris and rocky structure that enter a fish bearing stream. After a steep 1st or 2nd order draw is “blown out” by a debris avalanche, it may take decades to a century or more before enough material accumulates to precipitate another debris avalanche. The gentle gradient streams that are the recipients of this material typically have many steep tributaries contributing debris avalanches. Therefore, these streams have a higher frequency of disturbance associated with the deposition of debris avalanche material. This higher disturbance frequency is one of several factors that causes 3rd and larger order streams, and some 2nd’s, to have lower conifer basal areas at a given distance from the stream compared with 1st order streams.

Other factors affecting the relative abundance of conifers verses red alders close to streams are the width of the area influenced by the riparian microclimate (generally wider next to larger streams and in more protected areas, narrower on south to west aspects), and availability of a seed source. The relative abundance of a conifer seed source is greater on sites with less frequent disturbance or where the time since the last disturbance is longer than the life expectancy of red alder.

Regulation Changes: Regulations for BLM required 100-foot no-treatment buffers on all streams carrying water at the time units were sprayed with herbicides. This prevented water contamination but also eliminated efforts to control vegetation that competes with conifers along streams inside plantations. The result was that many riparian areas were unintentionally converted from conifer to mixed conifer/hardwood, or red alder, or brush in the 1960s through the early 1980s. Effective methods for manually releasing conifer plantations from vegetation competition became commonly understood and applied after 1989 (DeBell; Turpin 1989).

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