Landtype Association

A hierarchical Approach to Classifying Landforms in the Oregon Coast Range

USDA United States Department of Agriculture

Forest Service

Siuslaw National Forest

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Tables and Diagrams

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Acknowledgments

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Future work

This document should be treated as a working hypothesis, and a first step in classifying the geomorphic and ecological zones in the Coast Range. Future work in refining the descriptions of these landtype associations could include incorporating stream survey data into landtype association descriptions. At this time, stream survey data was not available in a format that could be easily compiled by landtype association. Stream confinement is an important characteristic in determining a stream's character. However, stream confinement data was not included in this effort, because at this time, there is no reliable way to get that information from digital elevation data or remote sensing data. As site-specific data becomes available from watershed analysis or other sources, it could be incorporated into the landtype association descriptions.

More specifically, an additional landtype association for major alluvial bottomlands, which are currently averaged into hillslope landtype associations, may be added to this document. Soil Series descriptions may be utilized to characterize features of temperature regimes, soil depth, rock content and groundwater relationships. A map of intermittent streams may also be developed and included. Lastly, the boundaries and descriptions of the landtype associations are expected to be refined as watershed analyses, late successional reserve assessments, and other landscape assessments provide more detailed analyses of the Coast Range landscape.

A Hierarchical Approach to Classifying Landforms in the Oregon Coast Range

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INTRODUCTION

In the early 1980's, Jim Maxwell, the Forest Hydrologist for the Siuslaw National Forest and John Berry, Assistant Ranger for Resources, Mapleton Ranger District, divided the area covered by the Siuslaw National Forest into landtype associations. Their map was produced by grouping soil resource inventory (SRI) landtypes with similar geologic and geomorphic characteristics into larger map polygons. They combined similar areas "from the bottom up", i.e. small map units were combined to created larger ones (Berry and Maxwell, 1981). At that time, dividing a landscape into areas with common characteristics was a relatively new concept. In the mid-1970's, the idea that a "hierarchy of scales" existed across a landscape began to be developed. Some researchers looked at the terrestrial ecosystem (e.g. Wertz and Arnold, 1972; Wendt et al., 1975; Bailey, 1983), and developed a hierarchy that included provinces, sections, subsections, landtype associations and landtypes. Others worked with the aquatic ecosystem, and developed a hierarchy that included watersheds, stream reaches, and habitat units (e.g. Frizzell et al., 1986).

Complex landforms result from both hill slope and instream erosion processes. Therefore, a single, integrated classification system is necessary to make meaningful interpretations. This integration is complicated by the fact that parts of an individual watershed may have very different landforms, and areas with similar landforms may overlap watershed boundaries.

In this document, we continue the work Jim Maxwell began. We have extended the landtype association mapping to cover the Oregon Coast Range from the Tillamook Highlands in the north to the Umpqua River in the south, and from the coast to the western edge of the Willamette Valley. Our goals include:

1. Providing the beginnings of an integrated hierarchical system that describes areas with similar stream and landscape characteristics.

2. Providing watershed analysis teams with the larger landscape context in which their watersheds fit, and a way to stratify areas within watersheds with different characteristics.

3. Providing a context for setting up sampling and monitoring schemes that will provide the most information with a minimum of duplication. For instance, stream reaches in similar settings should have similar characteristics and functions.

METHODOLOGY

Landtype association boundaries were redrawn using a geologic map to show bedrock lithology (Walker and MacLeod, 1991), and a shaded relief topographic map produced by GIS from a 30 meter DEM (digital elevation model). Both maps were produced at a scale of 1:250,000. Boundaries were redrawn around areas with similar bedrock lithology and topography. We used Maxwell's original boundaries where possible, and modified them if the more recent geologic mapping or shaded relief map suggested changes. The resulting landtype associations are almost identical in concept to Dr. Dave Montgomery's "litho-topo" units (pers. comm). Where apparent differences in landform or stream characteristics were noted, landtype association boundaries were subdivided. Subsequent assessment of the differences allowed for "lumping" the separations where appropriate. (See Appendix A for changes made between the preliminary and the final maps.)

Information on geology, stream density, stream gradient, and slope steepness were used to compare and describe the landtype associations. Because of the large area involved, we needed data sources that are consistent across the study area, and a way to automate data collection as much as possible. The existing stream layer available in the Siuslaw National Forest's GIS system was preferred, but it varies in detail and quality across ownerships, and is non-existent in some areas. Therefore, a stream layer for the study area was generated from DEM data. To test the accuracy of the DEM-generated stream layer against the existing stream layer that was obtained using aerial photos and/or USGS 7.5" maps, two watersheds were compared. Both the North Fork Siuslaw and Nestucca watersheds had recently been subjected to a watershed analysis. As part of the watershed analyses, the stream layers had been updated and corrected using aerial photos and 7.5" topographic maps. Gradient attributes had been added to the data base using topographic maps and some field work. DEM-generated stream layers were compared to the "real" stream layers for both watersheds.

In both test watersheds, the DEM-generated stream layer had fewer high-gradient streams (80% of the mapped streams in the North Fork Siuslaw; 66% of the mapped streams in the Nestucca), and more low-gradient streams (62% more in the North Fork Siuslaw than the mapped streams; and twice as many in the Nestucca). In the broader valleys where the low-gradient (0-1%) streams are usually found, the DEM model had trouble locating the correct stream channel and often drew parallel lines. Both watersheds had slightly more stream miles in the middle gradient classes on the DEM-generated stream layer as compared to the mapped layer. Overall, the DEM- generated stream layer found fewer total stream miles in the North Fork Siuslaw watershed, approximately 80% of the mapped stream miles. Most of the "lost" streams were in the >20% gradient class. In the Nestucca, the total stream miles found on both stream layers

was remarkably close; 1862 miles in the DEM-generated layer as compared to 1877 miles on the mapped layer (See Table 1).

Table 1: Comparison of the number of miles of stream in each gradient class between DEM-generated data and data obtained from aerial photos and 7.5" USGS topographic maps (mapped data).

	North Fork Siuslaw DEM Data		North Fork Siuslaw Mapped Data	
Gradient	Miles	% of total miles	Miles	% of total Miles
0-1%	86.8	20.9	53	10.3
1-2%	14.3	3.5	12.9	2.5
2-4%	22.9	5.5	19.6	3.8
4-8%	36.1	8.7	29.6	5.8
8-20%	124.5	29.9	103.3	20.1
>20%	140.4	33.7	309	59.9
Total miles	425.1		528	

	Nestucca DEM Data		Nestucca Mapped Data	
Gradient	Miles	% of total miles	Miles	% of total Miles
0-1%	210.3	11.3	97.5	5.2
1-2%	61.4	3.3	46.1	2.5
2-4%	96.6	5.2	69.6	3.7
4-8%	181.3	9.7	130.6	7.0
8-20%	732.2	39.3	652.3	34.7
>20%	580.5	31.2	880	46.9
Total miles	1862.3		1877	

We felt the advantages of using the DEM-generated stream layer outweighed the disadvantages of inaccurate representation of high gradient and low gradient streams. The numbers are not intended to be absolute values. The advantages of using the DEM-generated stream layer are a relatively consistent database regardless of ownership or location, and an automated way to acquire data over a large area. The data on stream gradient and, to a lesser degree, on stream order was used as one of the variables to determine the degree of similarity between landtype associations.

Comparing and Contrasting Landtype Associations

In order to compare the similarities and differences between landtype associations that were initially drawn, and to see if any of them could be combined into one map polygon, flowcharts were created. The flowcharts group landtype associations used for

mapping landtype associations, and for describing hydrologic and geomorphic characteristics. They are listed in decreasing order of importance.

The landtype associations were originally mapped on the basis of bedrock geology and topography. Therefore, the first broad category used to group landtype associations is similarities in lithology. The variables used to categorize the landtype associations are listed below in order of descending importance.

Geologic Category

The different rock formations (geologic mapping units) were combined into similar categories for each landtype association. For instance, the Yamhill, Nestucca, Alsea, marine sedimentary rocks and Quaternary alluvium and landslide deposits were included in the fine-grained, easily eroded group of rock formations. The dominant rock types were used to put each landtype association into a geologic category described below (see also Table 2). A more detailed description of Coast Range geology can be found in the section on the general geology and Appendix A.

Coarse Grained Sedimentary rocks:
Dominated by Tyee Sandstone, with the exception of landtype association 4A, which is dominated by coastal sand dunes.

Coarse Grained Sedimentary Rocks mixed with volcanics:
Tyee Sandstone intruded by volcanic rocks, which tend to form erosion-resistant ridges.

Fine-grained and Coarse-grained Sedimentary Rocks:
Mixture of fine-grained sedimentary rocks and coarse-grained sedimentary rocks (Tyee Sandstone, mainly).

Fine-Grained Sedimentary rocks:
Dominated by fine-grained sedimentary rocks, which tend to by highly erodable.

Hard Volcanics:
Dominated by erosion-resistant volcanics.

Siletz River Volcanics
More than 75% of the area covered by Siletz River Volcanics.

Siletz River Volcanics mixed with any sedimentary rocks:
Siletz River Volcanics, which are variable in terms of durability, mixed with any sedimentary rocks.

Volcanics with fine-grained sedimentary rocks***:***
Volcanic rocks (mainly erosion resistant) mixed with fine-grained sedimentary rocks.

Stream Density

Stream density is defined as miles of streams per square mile. Total miles of stream calculated by GIS (including the 0-1% and >20% category) were included because the total miles of streams in the DEM data are very similar to stream miles in the stream layers that had been edited for watershed analyses. Stream density from the DEM data was also used as an indicator of landscape dissection.

Stream Gradient

The stream gradient categories 0-1% and >20% were eliminated from the total stream miles considered because the most discrepancies between the DEM-generated stream layer and edited stream layers occurred with these two end points. The total stream miles used to calculate percent stream miles in the 1-4% category was recalculated using this new total, and was used to compare the landtype associations.

Slope

The percent area greater than 60% slope and less than 60% slope, was calculated for each landtype association. Sixty percent was used as the breakpoint between slope classes because past inventories have shown that erosion potential and landslide hazard increases significantly on slopes greater than 60%.

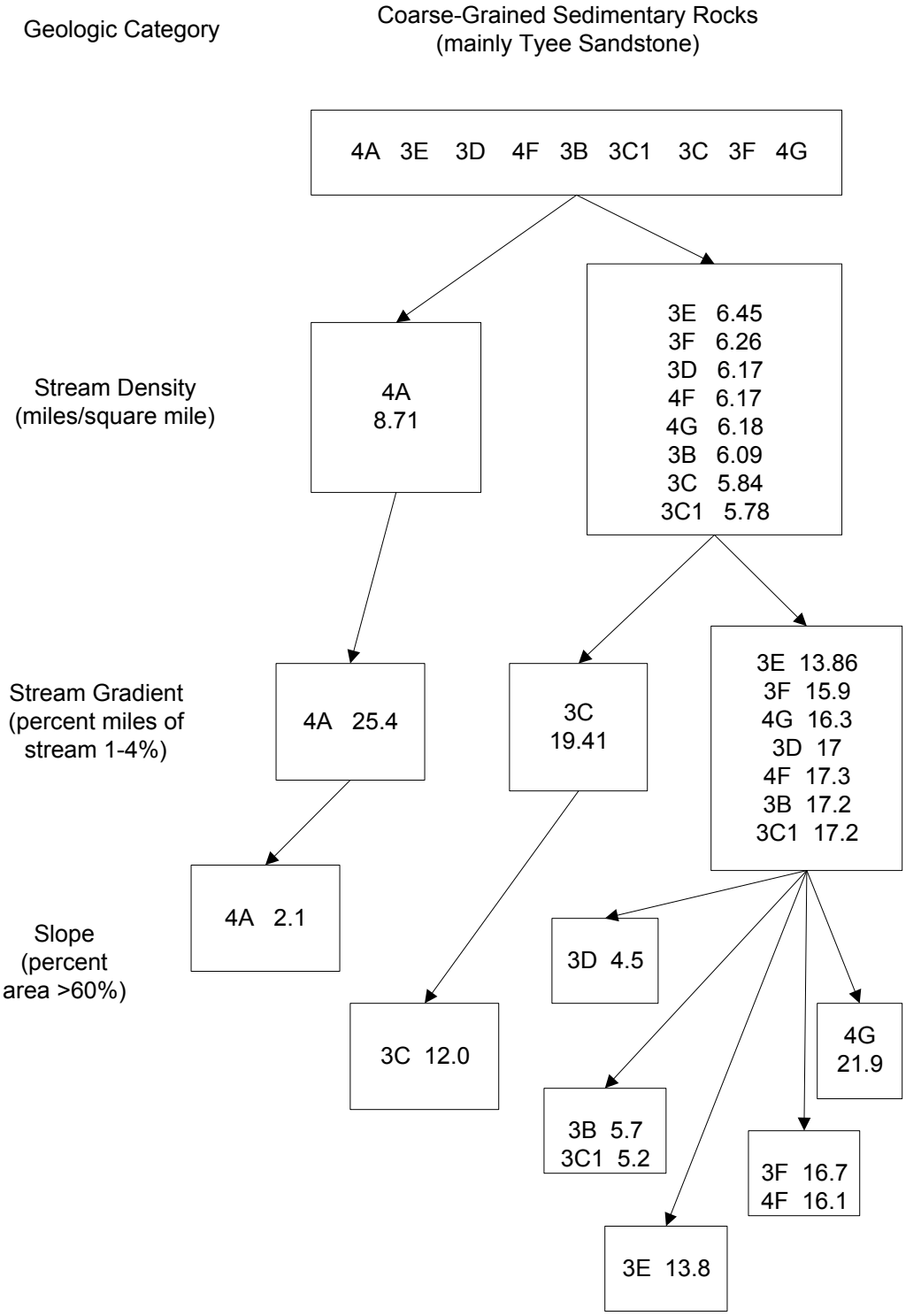
Table 2: Data on geology, stream gradient, stream density, and percent area steeper than 60% by landtype association. This data was used to develop the flowcharts that compare the landtype associations. Geologic categories are defined as follows. cgsed: coarse-grained sedimentary rocks, cgsedvolc: coarse-grained sedimentary rocks mixed with volcanics, fgsed: fine-grained sedimentary rocks, fgcgsed: fine-grained and coarse-grained sedimentary rocks, hardvolc: hard volcanics, Tsr: Siletz River Volcanics, Tsrsed: Siletz River Volcanics mixed with sedimentary rocks, volcfgsed: volcanics with fine-grained sedimentary rocks.

LTA	Geologic Category	% area hard volcanics	% area erodable volcanics	% area fine grained sediments	% area coarse grained sediments	% area mixed volcanics	% miles of stream, Gradient 1-4%	% miles of stream, gradient 4-20% (original data)	Stream Density, mile/square mile	% area with slopes >60%
3B1	Cgsed	0	0	0	100	0	17.2	1.84	6.09	5.7
3C	Cgsed	0	0	2	98	0	19.41	80.22	5.84	12
3B2	Cgsed	1	0	0	99	0	17.2	41.37	5.78	5.2
3D	Cgsed	0	0	2	98	0	17	44.99	6.17	4.5
3E	Cgsed	3	0	5	94	1	13.86	89.9	6.45	13.8
3F	Cgsed	6	0	4	91	0	15.9	33.54	4.57	16.7
4A*	Cgsed			4	84		25.4	28.87	8.71	2.1
4F	Cgsed	1	0	1	97	0	17.3	37.32	6.17	16.1
4G	Cgsed	1	0	1	96	1	16.3	33.37	6.18	21.9
3H	Cgsedvolc	13	0	33	54	0	17	63.74	2.46	1.5
3L	Cgsedvolc	0	0	4	72	18	22.9	45.3	6.12	2.7
3R	Cgsedvolc	7	0	6	85	0	13.24	86.13	6.56	5.9
4R	Cgsedvolc	14	0	0	86	0	17.9	38.77	5.92	12.1
2H	Fgsed	1	97	2	0	0	44.3	42.27	3.03	0.1
2Y	Fgsed	3	0	90	1	0	31.6	50.93	0.25	0
2Z	Fgsed	5	0	95	0	0	40.4	27.17	8.24	1.2
3Z	Fgsed	6	0	82	8	1	30.7	41.76	7.89	0.6
3A	Fgcgsed	1	0	10	81	0	25.7	35.87	7.84	3.8
3W	Fgcgsed	0	0	10	88	2	21.7	57.44	7.01	0.4
4J	Fgcgsed	1	0	28	71	1	15.4	37.1	6.17	12.7
4X	Fgcgsed	0	0	75	25	0	75.1	7.08	11.64	0

Table 2 (continued)

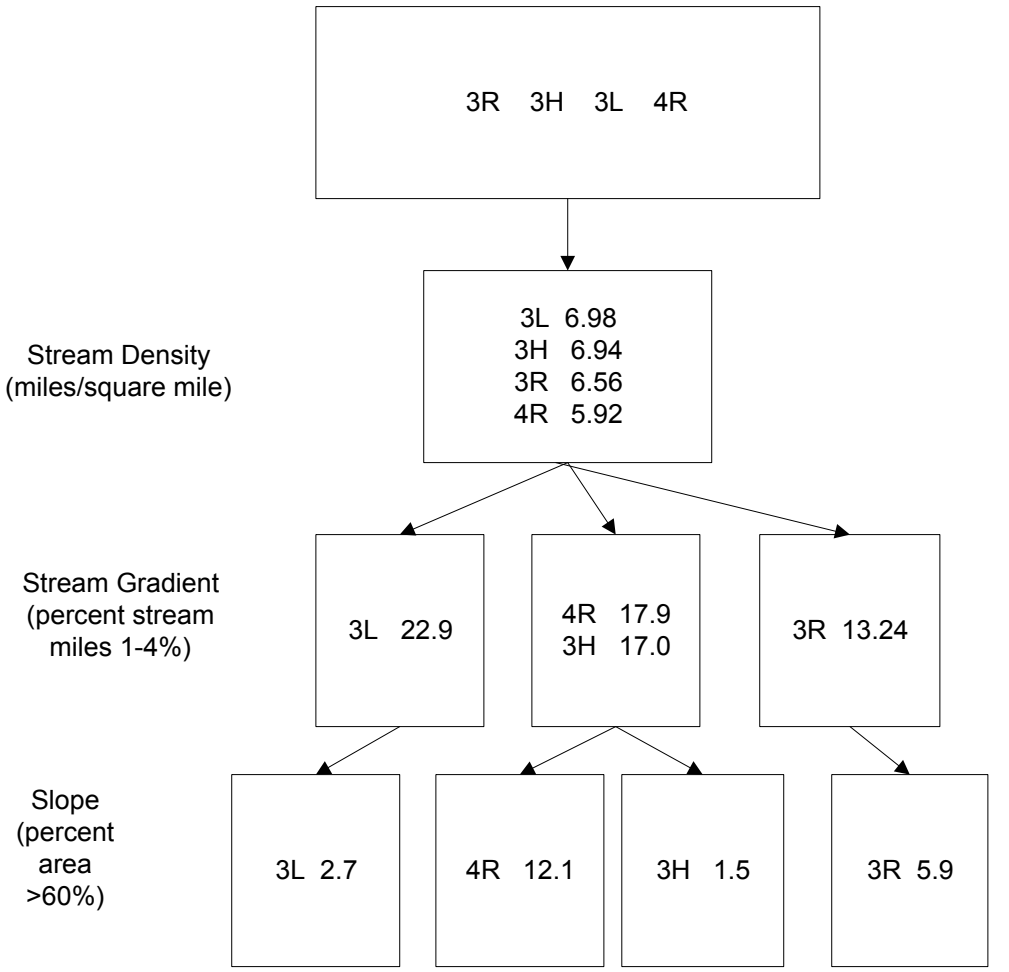
LTA	Geologic Category	% area hard volcanics	% area erodable volcanics	% area fine grained sediments	% area coarse grained sediments	% area mixed volcanics	% miles of stream, Gradient 1-4%	% miles of stream, gradient 4-20% (original data)	Stream Density, mile/square mile	% area with slopes >60%
2M	hard volc						7.99	91.9	6.4	8.25.
3M	hard volc	96	0	1	3	0	15.1	27.07	5.95	17
3T	Hardvolc	68	0	4	25	0	6.9	51.73	6.63	2.8
2P2	Tsr	0	0	4	6	90	19.4	55.74	6.57	2.5
2PSR1	Tsr	12	0	7	0	81	17.8	46.36	6.65	3.9
2PSR2	Tsr	3	0	1	9	87	17.2	55.74	6.39	16.3
2PSR3	Tsr	1	0	4	0	96	10.5	44.29	6.21	8.4
3Q	Tsr	7	0	4	11	78	13.6	41.67	6.82	5.2
3S	Tsr	1	0	3	0	96	22.4	59.51	5.07	0.3
2P	Tsrsed	1	50	20	0	29	13.2	30.01	4.6	22.1
2K	volcfgsed	31	0	49	9	8	9.13	90.39	7.29	4.47
2C	volcfgsed	15	13	47	0	20	14.7	53.84	6.36	2.4
2N	volcfgsed	19	8	71	0	0	21.5	36.39	9.34	2.9
2Q	volcfgsed	23	4	57	13	0	12.8	55.22	6.57	7.8
2S	volcfgsed	29	0	72	0	0				
2T	volcfgsed	14	0	80	5	2	13.31	84.01	4.32	0

***** Landtype Association 4A has 11% of its area covered by lakes.


Geologic Category
Coarse-Grained Sedimentary Rocks
(mainly Tyee Sandstone)
4A 3E 3D 4F 3B 3C1 3C 3F 4G
Stream Density
(miles/square mile)
4A
8.71
3E 6.45
3F 6.26
3D 6.17
4F 6.17
4G 6.18
3B 6.09
3C 5.84
3C1 5.78
Stream Gradient
(percent miles of
stream 1-4%)
4A 25.4
3C
19.41
3E 13.86
3F 15.9
4G 16.3
3D 17
4F 17.3
3B 17.2
3C1 17.2
Slope
(percent
area >60%)
4A 2.1
3D 4.5
3C 12.0
4G
21.9
3B 5.7
3C1 5.2
3F 16.7
4F 16.1
3E 13.8

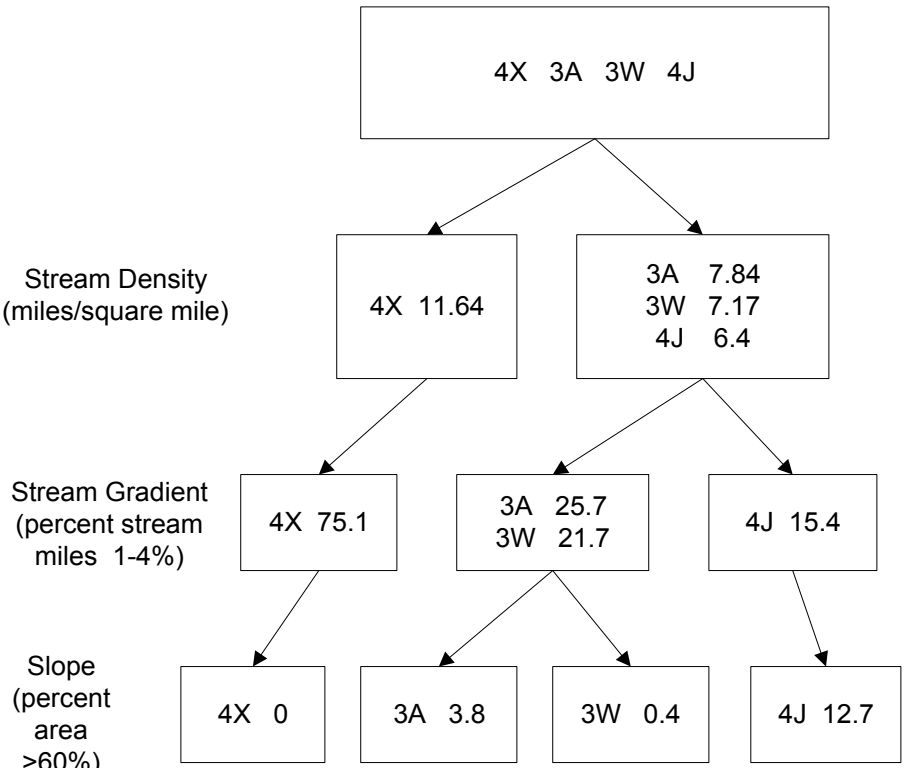
Geologic Category

Coarse-Grained Sedimentary Rocks and Volcanics
(Tyee Sandstone intruded by volcanic dikes)



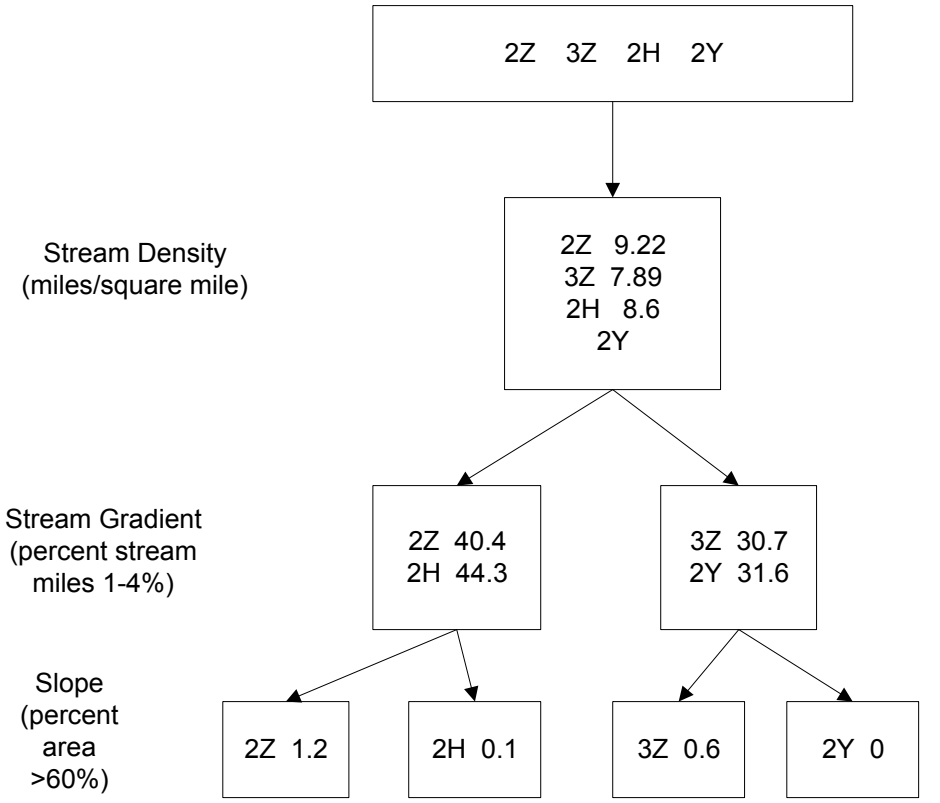
Geologic Category

Fine-Grained and Coarse-Grained Sedimentary Rocks



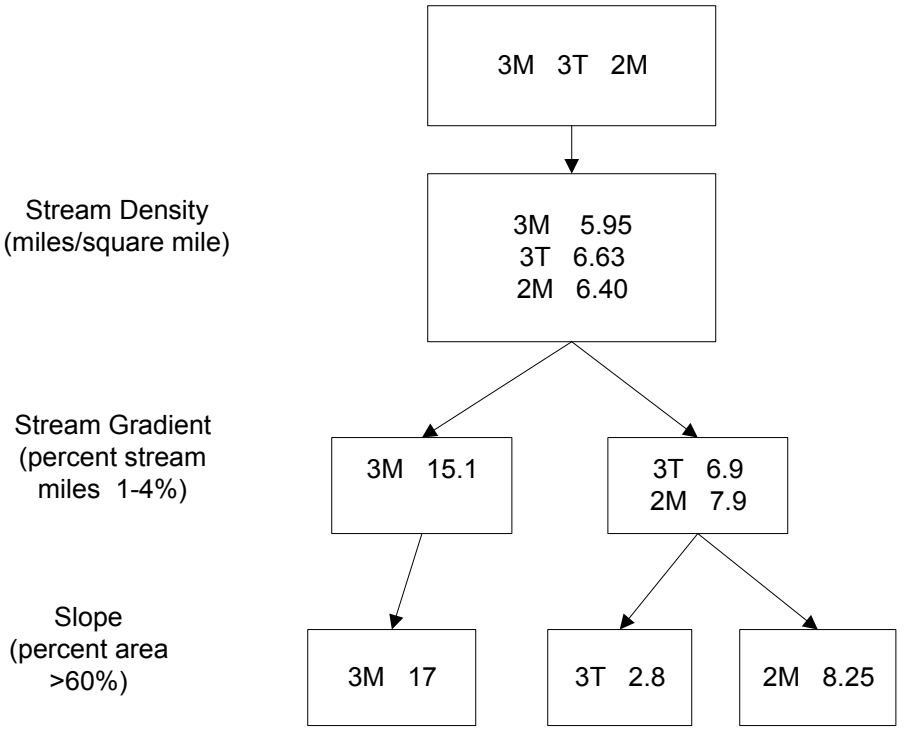
Geologic Category

Fine-Grained Sedimentary Rocks



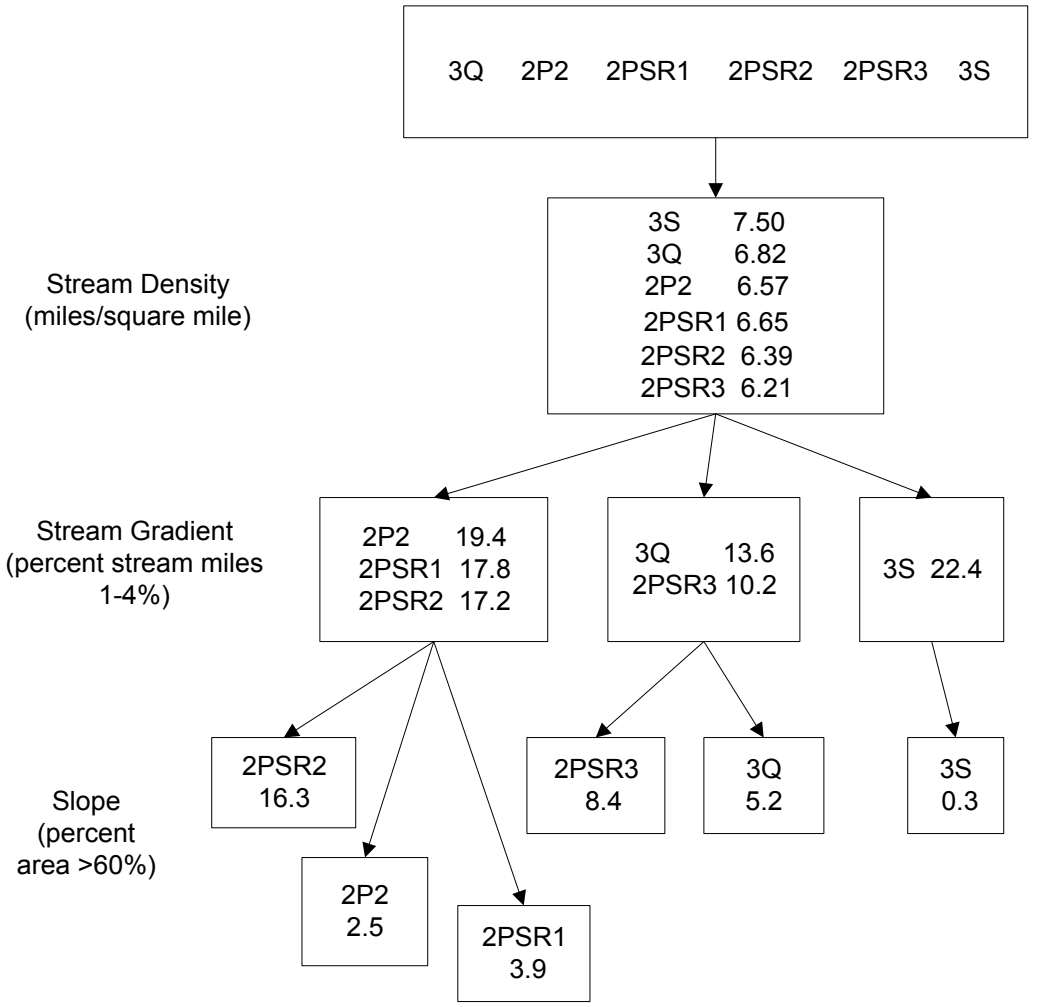
Geologic Category

"Hard" Volcanics

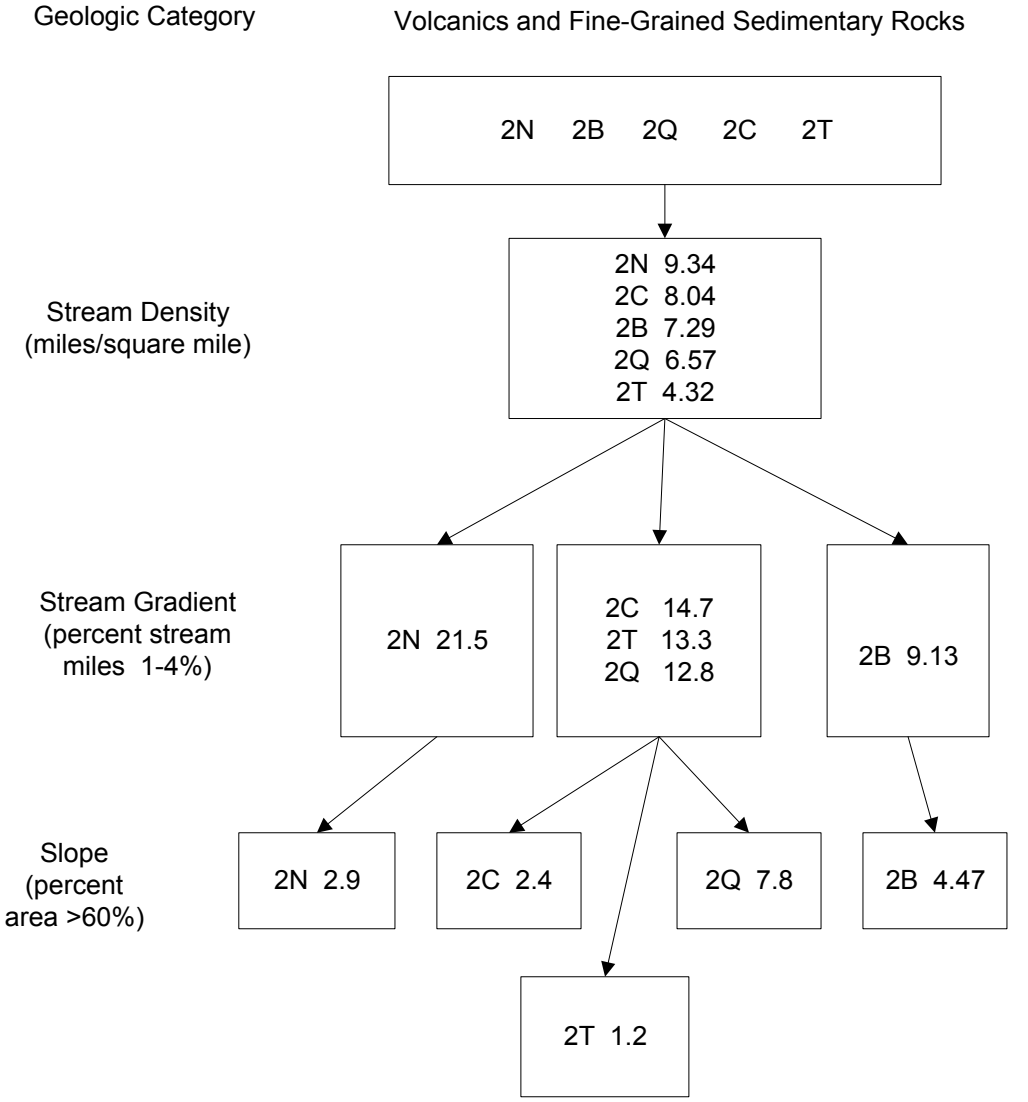


Geologic Category

Siletz River Volcanics



Geologic Category	Siletz River Volcanics and Fine-Grained Sedimentary Rocks
	2P
Stream Density (miles/square mile)	2P 6.79
Stream Gradient (percent stream miles 1-4%)	2P 13.2
Slope (percent area >60%)	2P 22.1


Geologic Category
Volcanics and Fine-Grained Sedimentary Rocks
2N 2B 2Q 2C 2T
Stream Density
(miles/square mile)
2N 9.34
2C 8.04
2B 7.29
2Q 6.57
2T 4.32
Stream Gradient
(percent stream
miles 1-4%)
2N 21.5
2C 14.7
2T 13.3
2Q 12.8
2B 9.13
Slope
(percent
area >60%)
2N 2.9
2C 2.4
2Q 7.8
2B 4.47
2T 1.2

Methodology for Delineating Vegetation Patterns in the Coast Range

Vegetation was not a criterion used in LTA delineation. General patterns of potential natural vegetation are included to characterize LTAs and to demonstrate the interaction of climate and topography on plant communities.

Table 3: Series, plant association groups (PAG), and plant associations

Series	PAG	Plant Associations
Sitka Spruce	Salmonberry	Salmonberry
	Swordfern	Fool's huckleberry-red huckleberry, Devil's club, Oxalis, Swordfern, Swordfern-oxalis
	Salal	Salmonberry-salal
Western hemlock	Salmonberry	Salmonberry, Salmonberry-vine maple, Devil's club-NWO
	Swordfern	Oxalis-NWO, Swordfern-NWO, Vine maple-salal/swordfern-NWO, Vine maple/swordfern-NWO
	Salal	Salal-NWO, Dwarf Oregon grape-NWO, Dwarf Oregon grape-salal-NWO, Vine maple-salal/swordfern-NWO, Dwarf Oregon grape/Oxalis-NWO, Dwarf Oregon grape/swordfern-NWO, Salmonberry-salal, Evergreen huckleberry
	Rhododendron	Rhododendron-dwarf Oregon grape-NWO, Rhododendron-salal-NWO, Rhododendron-evergreen huckleberry, Rhododendron-swordfern
	SW Oregon	Coastal western hemlock associations*
	Warm, dry	Vanilla leaf-dry-NWO, Salal, Salal-evergreen huckleberry, Dwarf Oregon grape dry-NWO, Dwarf Oregon grape-salal-dry-NWO, Douglas-fir-western hemlock/salal, Douglas-fir-western hemlock/rhododendron, Douglas-fir/dwarf Oregon grape-salal-dry-NWO
	High, cool	Vanilla leaf-NWO, Alaska huckleberry/oxalis-NWO
True fir/ Noble fir		Oxalis-swordfern, oxalis-NWO
Grand fir		Vine maple/oxalis, Dwarf Oregon grape-salal, California hazel-Insideout flower, Oceanspray/Swordfern, Poison oak
Douglas-fir		Oceanspray-Dwarf Oregon grape, Oceanspray-snowberry, Oceanspray-Whiple vine, Oceanspray-grass, California hazel-Snowberry/Swordfern, Poison oak
White fir		Coastal western hemlock associations*
Woodland		Not classified yet.

* See *Field Guide to the Forested Plant Associations of Southwestern Oregon* (1996) USDA Forest Service, PNW Region, R6-NR-ECOL-TP-17-96

There are four major vegetation zones in the Coast Range which are named after the climax tree species which would dominate stands in the absence of large scale disturbance. These plant series are Sitka spruce, western hemlock, true fir, and grand fir. The spruce and western hemlock series have been classified into the plant association level for the Siuslaw N.F. (Hemstrom and Logan 1986). These two series have been further subdivided into wet, mesic, well-drained and dry plant association groups (PAGs). Classification of the noble fir and grand fir plant associations in the federal lands of the Coast Range is currently underway. (See Hubbard, 1991, for a classification of grand fir on Oregon State University's McDonald-Dunn Forest in LTA 3S.) These zones are handled at the series level only. Table 3 shows the plant associations making up the PAGs. In the text, reference is made to the series or group level only.

A GIS vegetation layer was produced for the Coast Range using a GIS model developed by Dr. Jan Henderson, Area Ecologist for the Mt. Baker/Snoqualmie and Olympic National Forests. Ecology plot data from the Siuslaw National Forest and Eugene Bureau of Land Management district is combined with elevation, aspect, slope, slope position, and slope shape to predict occurrence of the vegetation sub-series. The spruce series line is partially derived from Siuslaw National Forest soils mapping. For the Salem Bureau of Land Management district and private lands, information at the vegetation series level was derived from inventory plots and Salem BLM stand data and watershed analyses (courtesy of Dr. Janet Ohmann, USFS-PNW, Corvallis Forest Science Laboratory, and Salem BLM silviculturalists, ecologists, and soils specialists, and for OSU lands C. Hubbard, 1991). Map 3 (Plant Association Groups and Landtype Associations) shows the distribution of the sub-series for each landtype association.

Landtype association vegetation descriptions often refer to slope position in sub-series distribution: valley bottom, lower slopes (lower third), mid slope (mid-third), upper slope (upper third) and ridges. Note that slope steepness and slope shape modify the moisture regimes that slope positions generally indicate. Steep or convex slopes behave hydrologically more like higher slope positions, while gentle or concave topography can imitate moisture regimes on lower slope sites. Aspect is also used to describe vegetation distribution. Warm aspects include southwest, south, and southeast facing slopes. Cool aspects are northeast, north, and northwest facing slopes.

The model is not field verified, and can be expected to be less reliable for lands outside of Siuslaw National Forest boundaries. Sub-series percentages are preliminary estimates and only indicate relative importance of series or sub-series. Improvements of the model and more data on BLM lands will result in updated maps and interpretations for each LTA. As of publication, the model does not directly take into account the influence of soils on vegetation.

GENERAL DESCRIPTION OF THE COAST RANGE PROVINCE

General Geology

The Coast Range bedrock consists of ocean floor basalts overlain by sedimentary rocks that were deposited in a marine environment. Younger volcanic flows, dikes and sills intruded these older rocks. The Coast Range has experienced tectonic uplift since the Juan de Fuca plate of the Pacific Ocean floor began to subduct beneath the North American plate 10 million years ago. This combination of lithology and tectonic uplift controls landforms and river morphology in the Coast Range.

Lithology

The Coast Range is underlain by basalts that were originally part of the ocean floor. These units include the Siletz River Volcanics (56 million years old) and the Tillamook Volcanics (53 million years old). The volcanic units include basalt flows, which are relatively resistant, and basaltic ashes (tuffs), breccias and pillow basalts which are more erodable. Pillow basalts tend to weather to clay. The Siletz River Volcanics can be recognized by the presence of zeolites--light colored minerals that are precipitated from sea water circulating through the basalt and deposited in cavities (Orr et al., 1992).

A thick sequence of sand, silt, mud and volcanic debris was deposited in shallow seas over the basalt. The Tyee Formation of the central Oregon Coast Range is a thickly bedded sandstone that grades northward into the finer grained, more thinly bedded Yamhill Formation. Along the coast, the Yamhill Formation is inter layered with basalt. The Yamhill Formation, in turn, is covered by the Nestucca and related formations which are over 5000 feet thick. The Nestucca Formation is a deep-water deposit of silts mixed with ash from the Cascade volcanoes (Baldwin, 1976; Orr et al., 1992)

Between 38 and 29 million years ago, intrusive igneous rocks from below the Coast Range sedimentary basin formed dikes and sills. These igneous rocks are more resistant to erosion and form the highest peaks in the Coast Range. Examples are Mary's Peak near Corvallis, Saddleback Mountain south of Grande Ronde, Grass Mountain northwest of Alsea, and Roman Nose Mountain near Mapleton (Orr et al., 1992).

Approximately 15 million years ago, the Columbia River basalts and related flows were erupted in eastern Oregon and Washington. They flowed westward, and "invaded" the sedimentary layers in the northern part of the Coast Range and Willamette Valley. They are said to be "invasive" rather than "intrusive" because the heavier, fluid lavas were forced under the soft, water-saturated sediments. These lavas form "rootless" dikes and sills in the central and northern Coast Range (Orr et al., 1992).

In general, the sedimentary rocks tend to be more erodable than the volcanics. Therefore, even though the volcanic units cover less area in places, they exert a controlling influence on landforms. For instance, the east-west trending dikes of basalt in the Tyee Formation south of Mary's Peak form high ridges and control the trend of local valleys.

For a more complete description of the rock units, see Appendix A: Description of Geologic Units in the Coast Range. This appendix also contains information on relatively erodability of the different units, and the type of sediment produced by erosion.

Tectonic Overview

The Coast Range lies east of a subduction zone where the Pacific Ocean floor (the Juan de Fuca plate) is being dragged beneath the North American continent. This process began approximately 10 million years ago. As a result, the Coast Range is rising and tilting eastward. The most westerly areas that are closest to the subduction zone are rising the fastest, while the Willamette Valley is either subsiding or rising much more slowly. For instance, uplift rates at Cape Blanco are 1 inch per 35 years, and Astoria is rising 1 inch per 36 years. Vancouver, Washington, however, is sinking at a rate of 1 inch every 40 years (Orr, et al., 1992). The uplift is not uniform in a north-south direction across the Coast Range either. The area north of the Siletz River is tilting to the south, while the area south of the Yaquina River is tilting to the north (Yeats, 1989; Rhea, 1993). This north-south variability in uplift is corroborated by stratigraphic evidence. The thickest sedimentary sections are found along the Yaquina River (Baldwin, 1976). As would be expected, if the area between the Yaquina and Siletz Rivers has experience the least uplift, it would also be the area of the least erosion, and the thickest sections of sedimentary rocks would be preserved.

Tectonic Influence on Landforms and Stream Gradient

Before tectonic uplift of the Coast Range began, this area was a broad coastal plain. Rivers were probably flowing from the Cascade Mountains region directly west into the Pacific Ocean. As tectonic uplift began, these west-flowing rivers initially incised their meanders, until the rate of uplift outpaced the rate of down cutting. Eventually, the rivers were cut in two at the crest of the emerging Coast Range. The section of the river left on the east side of the Coast Range then reversed direction of flow and drained into the Willamette Valley. Examples of these "paired" rivers include the Mary's and Yaquina Rivers, and the Luckiamute and Siletz Rivers. Evidence that these rivers were once connected across the Coast Range include (Niem, 1976):

1. The large amount of volcanic ash from the Cascades deposited in rock layers along the present-day coast that were probably transported by west-flowing rivers.

2. Wind gaps (saddles) in the crest of the Coast Range that are between the Mary's and Yaquina Rivers headwaters and contain gravel bars deposited by rivers.

3. The larger rivers drainage patterns do not appear to be influenced by bedrock geology, implying they existed prior to uplift and flowed across an area with relatively little relief.

Susan Rhea (1993) looked at present-day river gradients and valleys in western Oregon to assess the influence of tectonic uplift on geomorphology. Of the four areas she studied, the western Coast Range, the eastern Coast Range, the Siskiyou-Klamath Mountains and the Cascades, she found the western Coast Range had the most internal variability in river gradients and sinuosity. This variability in river gradients within the western Coast Range is attributed to differences in uplift within this area. As for the influence of lithology on river gradients, the only consistency was that gradients tend to be steeper on volcanic rocks than on the sedimentary units. Gradients on the sedimentary rocks, however, are highly variable. For instance, the Yaquina, Alsea, and Siuslaw Rivers are all on the Tyee Formation. The Yaquina River has the lowest gradient in the western Coast Range, while the Siuslaw River has the steepest.

Tectonic uplift has influenced river morphology and development in several ways:

1. The overall eastward tilting of the Coast Range has caused the eastern Coast Range rivers to have steeper headwater streams and lower gradient, more aggraded lower mainstems than the western Coast Range rivers. Also, rivers on the eastern side of the Coast Range have better developed floodplains. This can be seen on the regional geologic map that shows more Quaternary alluvium along rivers in the southeastern part of the province, especially in landtype 4H. The eastward tilting of the Coast Range has caused the headwaters of the western Coast Range rivers to become less steep, while their lower mainstems have steepened and become more incised.

2. All but two rivers in the western Coast Range, the Yaquina and the Siletz, have highly variable gradients. These two rivers have the lowest gradients and the most sinuosity of all the rivers in the Coast Range. North of the Siletz, the Coast Range is tilting south; south of the Yaquina, the Coast Range is tilting north. Their location corresponds to the "hinge zone" where the least amount of uplift is occurring. On the other side of the crest in the eastern Coast Range, the Mary's River and the Luckiamute River are at approximately the same latitude; and of the eastern Coast Range rivers, they have the steepest gradients.

3. The eastward tilting and uplift has also influenced valley development. River valleys typically become wider downstream in mountainous areas. The western Coast Range is an exception. The valley heads are wider, and the valleys tend to become narrower downstream. Again, the Yaquina River is different from other Coast Range rivers, as it becomes more sinuous and the valley widens downstream. The development of narrower valleys downstream may be the result of eastward tilting, as uplift of the western Coast Range caused rivers to become incised.

As a result of the variability in uplift and lithology, the western Coast Range river basins all have different gradients, sinuosity and valley form. These differences need to be kept in mind in any classification scheme.

General Geomorphic Categories in the Oregon Coast Range

Although a wide spectrum of conditions exist between and across Landtype Associations, four distinct general geomorphic categories can be described. These general categories are useful for making province-wide comparisons and analyses of 4th field watersheds (the river basin scale). Detailed descriptions of each Landtype Association are most useful for comparing physical conditions of 5th field watersheds (major tributaries within river basins).

Steep, Highly-dissected Bedrock Dominated Ridge Systems

Characteristics: Hard, impermeable to slowly permeable sandstone or basalt bedrock; steep, short, angular, even faceted slopes; V-shaped ridge crests and stream channel bottoms; one to six feet deep, low cohesion, gravelly loam and clay loam soils; low to moderate water holding capacity (droughty upper side slopes are common); high ratio of intermittent to perennials streams (perennial system typically begins at the lower end of second order or beginning of third order streams, often far below the ridge crest). Dominant hill slope erosion process is debris avalanche occasionally causing debris torrents where stream intersection angles are acute.

LTAs: 2P, 2PSR1, 2PSR2, 3B, 3C, 3C1, 3F, 3M, 4F, 4G.

Gentle to Steep Bedrock-Dominated Ridges and Valleys

Characteristics: Hard, highly fractured moderately permeable to impermeable sandstone or basalt bedrock; gentle to moderately steep, slightly to moderately dissected, flat to convex slopes; rounded ridge crests and U-shaped valleys intermixed with steep, long concave slopes and steep V-shaped stream channels; three to greater than six feet deep cohesive, gravelly clay loam soils; moderate water holding capacity; intermediate ratio of

intermittent to perennial streams. (Perennial stream system typically begins in second order stream).

LTAs: 2M, 3A, 3D, 3E, 4A, 4R

Hummocky, Moderate to High Relief, Deeply Incised Hills and Valleys

Characteristics: Soft, highly fractured, very permeable volcanic breccia, siltstone, and finely bedded volcanic sedimentary bedrock; lower elevations are characterized by uneven, hummocky convex slopes, very deep unconsolidated ancient earth flow debris that form deep, high cohesion, clay/clay loam soils that are deeply incised by streams; very high water holding capacity; very low ratio of intermittent to perennial streams (perennial system often begin in first order streams near ridge crest). Higher elevations are often dominated by broad, broken to continuous bedrock-controlled ridge systems.

LTAs: 2K, 2C, 2PSR3, 3Q, 3S, 3T

Rolling, Low Relief, Gentle to Moderately Sloping Hills and Valleys

Characteristics: Very soft, highly fractured, highly permeable bedrock; gentle, convex slopes with occasional moderately steep, concave slopes below higher ridge systems composed of hard igneous intrusive and volcanic rocks, greater than 6 feet deep cohesive, clay to clay loam soils, very high water holding capacity; widely dispersed stream system with very low ratio of intermittent to perennial streams. (Perennial stream system typically begin in first and second order streams).

LTAs: 2H, 2N, 2P2, 2Q, 2S, 2Z, 3H, 3L, 3W, 3Z, 4J, 4X

Soil Moisture and Climatic Sub-Categories

Coastal

Characteristics: Very high rainfall, fog and low clouds dominate in summer and winter. High winds are common in the winter. Very small difference between summer and winter air and soil temperatures (isomesic). Extremely high biologic activity and subsequent very high accumulations of soil organic matter. Soils often thixotropic. Soil moisture remains high in summer except on very shallow soils on south slopes;

vegetation is dominated by spruce, cedar and hemlock. Salmonberry and alder are important components.

LTAs: 2K, 2M, 2N, 2Q, 2P2, 2T*, 2Z, 3A, 3M, 3T*, 3Z, 4A, 4X

*2T and 3T extend across Coastal and Coastal Crest climatic sub-categories.

Coastal Crest--Northern Zone

Characteristics: Very wet winters, moist summers. Significant differences (more than 5 degrees C) in soil temperatures from summer to winter over all areas below 3000 feet elevation (mesic). Above 3000 feet, winter soils temperature can be very cold (mesic to cryic); occasional very high winds in winter. High biologic activity accompanied by high decomposition rates and moderate to high accumulations of soil organic matter, soil moisture fluctuations from winter to summer are moderate. Very deep fine-textured soils overlie highly permeable bedrock, generally high soil moisture levels encourage plant communities such as alder, salmonberry, and devils club on side slopes and spur ridges. Douglas fir and hemlock compose majority of conifer communities.

LTAs: 2K, 2P, 2TSR1, 2C, 2T*

* 2T extends across Coastal and Coast Crest climatic sub-categories.

Coast Crest--Central Zone

Characteristics: Wet winters, moist summers. Significant differences (more than 5 degrees C) in soil temperatures from summer to winter over all areas below 3000 feet elevation (mesic). Above 3000 feet, winter soils temperature can be very cold (mesic to cryic); occasional high winds in winter. High biologic activity accompanied by high decomposition rates and moderate accumulations of soil organic matter. Soil moisture fluctuations from winter to summer are moderate. Deep to very deep moderately fine-textured soils overlie moderately to highly permeable bedrock, summer soil moisture levels vary from very high on lower slopes to moderately dry on upper side slopes. Plant communities are generally mixed conifer and alder/salmonberry with either alder or conifer dominating on higher slope positions depending upon summer soil moisture levels. Douglas-fir and hemlock compose the majority of conifer communities.

LTAs: 2PSR2, 2PSR3, 3A, 3B, 3C, 3C1, 3D 3E, 3L, 3Q, 3T*.

* 3T extends across Coastal and Coast Crest climatic sub-categories.

Coast Crest--Southern Zone

Characteristics: Very wet winters, moist summers. Significant differences (more than 5 degrees C) in soil temperatures from summer to winter over all areas below 3000 feet elevation (mesic), above 3000 feet, winter soils temperature range to very cold (mesic to critic); occasional very high winds in winter. High biologic activity accompanied by high decomposition rates and moderate accumulations of soil organic matter. Soil moisture fluctuations from winter to summer are moderate to very great. Shallow to deep, fine to medium textured soils overlie impermeable bedrock, generally moderate to low summer soil moisture levels encourage plant communities dominated by conifers, alder/salmonberry and mixed conifer communities generally occur only in draws and along perennial streams. Douglas fir and hemlock compose the majority of conifer communities.

LTAs: 3F, 4F, 4G, 4R

Valley Border

Characteristics: Moist winters, dry summers, significant difference in soil temperatures from summer to winter (mesic), high winds uncommon. Moderately high biologic activity and moderate decomposition rates and low to moderate accumulations of soil organic matter. Soil moisture fluctuations are high from winter to summer. Low soil moisture common during summers, vegetation dominated by madrone, oak and mixed conifer. Douglas fir is the dominant conifer species, with grand fir regeneration present in many stands.

LTAs: 2H, 2S, 2Y, 3H, 3S, 3W, 4J

General Description of Vegetation Patterns and Climate

Maritime moisture controls the vegetation pattern of the Coast Range. Fog and high precipitation together create optimally moist soils that support the lush conifer forest of the North Coast Province (see attached maps). Fog moderates temperature extremes and adds fog drip to the total moisture available to low lying areas along the coastal strip. Sitka spruce communities thrive in the fog influence, and then decline where the fog declines. Sitka spruce/western hemlock/western red cedar forests are extremely productive. Magnificent spruce three to four feet in diameter are frequently less than a century old. Western hemlock/Douglas fir forests are found along the coast on slopes and ridges rising above the fog, and inland where fog does not penetrate.

Rain laden air moving inland from the Pacific drenches the western slopes. The mountains create a rain shadow near the Willamette Valley. Salmonberry and its early

seral associate, red alder, can dominate the low elevation, highly dissected terrain where precipitation is high. Toward the valley, the salmonberry communities may only be found on stream banks and wet microsites. Salmonberry often captures and remains on a site after disturbance. Its distribution is an important management concern, whether for plantation treatment or watershed restoration prescriptions.

Drier PAGs include the salal and rhododendron groups. Where precipitation is higher, the salal group generally indicates well drained soils in mid- to upper- slope positions. Stand structures tend toward higher stocking levels and smaller diameter trees than in the swordfern and salmonberry PAGs. In the rain shadow, the salal group is found in a wider range of soil drainage and moves down slope and farther around into cooler aspects. Nearest the valley, dry site indicators like ocean spray, California hazel, madrone, and chinquapin increase in abundance in non-riparian environments.

The dry rhododendron PAG is largely confined to the Umpqua subsection. The rhododendron is often associated with warm, droughty sites which can develop symptoms of nitrogen limitation after burning. Steep, highly dissected terrain in the warmer, drier southern subsection provides the most extensive area of these conditions in the Coast Range.

Along the valley margin, grand fir appears at low elevations. The grand fir series can be found at elevations generally below 800-900 feet on warmer aspects. Near the valley, moisture stress in low elevations and warm aspects limits western hemlock regeneration but favors grand fir which can reproduce under the dominant Douglas fir. The forested communities eventually grade into valley floor woodlands with Oregon white oak and scattered Douglas fir.

The highest elevations of the Coast Range support true fir plant associations. On Mary's Peak in LTA 3Q, at 4097 feet the highest point on the Coast Range, the noble fir zone begins at 3400 feet. Noble fir can also be found in LTA 2K, in the upper Siletz area, where a small remnant population of silver fir persists. These upper elevation areas receive very high precipitation, some as snow pack. Often wreathed in clouds or rising into a high fog cover, these areas may also take on some cloud forest characteristics. Though not yet classified, communities in the high elevation areas appear somewhat similar to Cascade Range communities, containing rhododendron, beargrass, false solomons seal, etc.

The vegetation characteristics of LTAs are determined by location and topographic controls on moisture. If an LTA extends into the fog influence, relief will affect the proportion of the LTA in spruce or western hemlock series. Where fog comes up major drainages, spruce may only persist in riparian areas or where the fog layer itself adds enough fog drip to allow spruce on upper slopes. Dissection and slope control the balance between salmonberry/swordfern types and the salal/rhododendron PAGs. Orientation of ridges also contributes to aspect influence on PAG distribution.

SUBSECTION AND LANDTYPE ASSOCIATION DESCRIPTIONS

The following section is a catalog of the landtype associations found in the Coast Range surrounding the Siuslaw National Forest. A general description of each of the three subsections that cover the Oregon Coast Range is provided, followed by a more specific description of the landtype associations within that subsection. Information is given on the geology, geomorphology, relief, stream characteristics, soil characteristics and vegetation. The information is not complete yet, and the descriptions will be revised as more complete data is made available and incorporated. The first number in the landtype association code identifies the subsection in which a landtype association is found. Landtype associations with similar letters across subsections have similar characteristics. For instance, 3F and 4F are both underlain by the Tyee Formation and have similar geomorphic characteristics.

Subsection 2 (Nehalem Subsection) Description

The Nehalem Subsection of the Coast Range is the northern subsection of the three that cover the Siuslaw National Forest. Most of the Hebo Ranger District is located within this subsection.

It has the most varied geology of the Coast Range. Topography is generally more subdued, because of the larger amount of more erodable bedrock (e.g. the finely bedded silts of the Nestucca and Yamhill Formations). The exception is the Tillamook Highlands, where the Tillamook Volcanics underlie steep ridges and V-shaped canyons, and areas underlain by the Siletz River Volcanics, such as the southern part of the Drift Creek Watershed, a tributary to the Siletz River. Large rotational slump block landslides are more common in this section. This hummocky topography creates small, scattered wetlands that are nestled between landslide deposits, larger lakes, and deranged drainage. Intermittent streams are common. Streams on this hummocky topography often disappear into the subsurface and reappear at a lower elevation as healthy springs.

The fog zone extends far inland in the gentle, low relief coastal strip of the Nehalem subsection. Alder and salmonberry are common in early seral stages in the salmonberry and swordfern that are so widespread west of the crest in this subsection. Drier PAGs are more common in landtype associations containing Tillamook and Siletz River volcanics. The Nehalem Subsection receives more rainfall farther inland than the two southern subsections.

Subsection 3 (Alsea Subsection) Description

The majority of the subsection is underlain by the Tyee Formation. The exceptions are the Mary's Peak area (3Q and 3S), the volcanic coastal headlands between Waldport and Florence which are underlain by basalt (3M); and the coastal lowlands (3Z) which are underlain by fine-grained sedimentary rock. Many of the more prominent ridges are held up by resistant basalt dikes. The topography is highly dissected and relief becomes more pronounced from north to south. Debris torrents are the most common type of landslide, and are most frequent on the Tyee Formation.

The western hemlock series dominates all but LTA 3Z (coastal lowlands), though western hemlock itself may be absent in much of the young forest found in the subsection, perhaps due to fire history. The Salmonberry PAG covers 33-45% of the area in the fluvial Tyee Formation landtype associations, depending on relief and precipitation.

Subsection 4 (Umpqua Subsection) Description

This subsection is almost entirely underlain by the Tyee Formation, which is intruded by basalt dikes and sills that form prominent ridges. The exception is the coastal sand dunes in 4X. The topography is highly dissected and steep slopes are common. Debris torrents are the most common type of landslide.

West of the crest, highly dissected terrain at low elevations allows more of the dry rhododendron PAG to show on steep harsh sites on upper slopes and ridges while salmonberry can climb to mid-slope. Precipitation drops off sharply in the rain shadow, and the subsection has the lowest overall rainfall for the Coast Range. The farthest eastern extent of the subsection contains the ecotone between the Coast Range, Cascades, and Southwest Oregon low elevation flora.

Landtype Association 2C ***Name: Interior Fluvial Lands***

Total Acres: 86097 **Forest Service Acres**: 20800 (24%)
Location: Nestucca River Valley

Geologic Category: Volcanics with fine-grained sedimentary rocks
Similar LTAs in this category: 2K, 2N, 2Q, 2T

Geology:
Soft sedimentary rocks: 52%
Yamhill Formation (Ty): 45%
Marine sedimentary rocks: shale, siltstone, sandstone, conglomerate (Tsd): 5%
Tuffaceous siltstone and sandstone (Tss): 2%

Mixed volcanic rocks: 20%
Siletz River Volcanics (Tsr): 20%

Hard volcanic rocks: 15%
Dikes and sills of gabbro (Ti): 14%
Mafic and intermediate intrusive rocks (Tim): 1%

Mixed volcanics: 13%
Sedimentary rocks and pillow basalts associated with Tillamook volcanics (Ttvm): 13%

An almost equal mixture of sedimentary and volcanic bedrock. Most of the sedimentary bedrock is fine-grained and easily erodable. The volcanic rocks are a mixture of erodable volcanic sediment and pillow basalts, and highly durable dikes and sills of intrusive volcanics.

Geomorphology: Hummocky earthflow terrain is common. The area has medium relief.

Percentage of Area by Slope Class:

0-30%:	63.1
30-60%:	34.6
60-90%:	2.3
>90%:	0.1

Stream Density: 6.36 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	6.89
1-2%:	3.32
2-4%:	5.93
4-8%:	10.36
8-20%:	43.48
>20%:	23.99

Soil Description: Soils are deep to very deep on hummocky, incised ancient earthflows and moderately deep on remnant bedrock ridge systems. Soils range from gravelly clay loams on steep slopes to gravelly clay where deeper soils occur.

Productivity: Compared to other soils in the central Coast Range, these soils are very productive. They have high to very high water holding capacities. Soil moisture is limiting only on upper south facing bedrock sideslopes.

Stability: Unstable soils are on lower mid slopes above incised channels and on upper mid slopes that are earth flow escarpment faces. Slumps and small earth flows are the primary hill slope erosion process.

Climatic Sub-Category: Coast Crest--Northern Zone

Vegetation Patterns: This landtype association cuts across the Coast Range and extends from the coastal fog zone spruce series eastward to the valley edge where western hemlock dominates. To the northwest of Mt. Hebo, high precipitation and low relief mean that wet spruce types follow the valleys and lower slopes. Note that much of the potential salmonberry acreages is in private agricultural uses. Spruce swordfern types occur on middle and upper slopes of Buzzard Butte. The spruce becomes restricted to valley bottoms north of Mt. Hebo though scattered spruce may be found on upper slopes, perhaps due to significant fog drip in the elevations where the fog lies for prolonged periods. Western hemlock/salmonberry generally replaces the spruce/salmonberry PAG to Mt. Hebo's east. Valleys and lower slopes in the eastern third of the LTA have more swordfern PAGs rather than western hemlock salmonberry types, while hemlock/salal becomes more common on mid- and upper slope positions. Over 25% of the area is in the salmonberry groups, which indicates productive well-watered sites. Western hemlock/swordfern covers over 40% of the area, almost entirely in the eastern half of the landtype association. Less than one percent of the landtype association is in true fir, at the peak of the Coast Range.

Landtype Association 2H ***Name: Sedimentary Valley Borderlands***

Total Acres: 23417 **Forest Service Acres:** 0
Location: Area south and west of Dallas, Oregon.

Geologic Category: Fine-Grained sedimentary rocks
Similar LTAs in this category: 2Y, 2Z, 3Z

Geology:
Soft sedimentary rocks: 97%
Tuffaceous siltstone and sandstone (Tss): 35%
Yamhill Formation (Ty): 32%
(Qs): 29%
Quaternary river deposits (Qal): 1%

Coarse-grained sedimentary rocks: 2%
Tyee Formation (Tt): 2%

Hard volcanic rocks: 1%
Dikes and sills of gabbro (Ti): 1%

Mixed volcanics: 1%
Siletz River Volcanics (Tsr): 1%

Mixture of sedimentary formations, including Quaternary alluvial sediments, tuffaceous sandstones and siltstones which includes the Nestucca Formation, and the Yamhill Formation. The tuffaceous sandstones and siltstones and the Yamhill Formation are thin to thick bedded, and easily eroded. They tend to erode into small, flat pebble-sized particles.

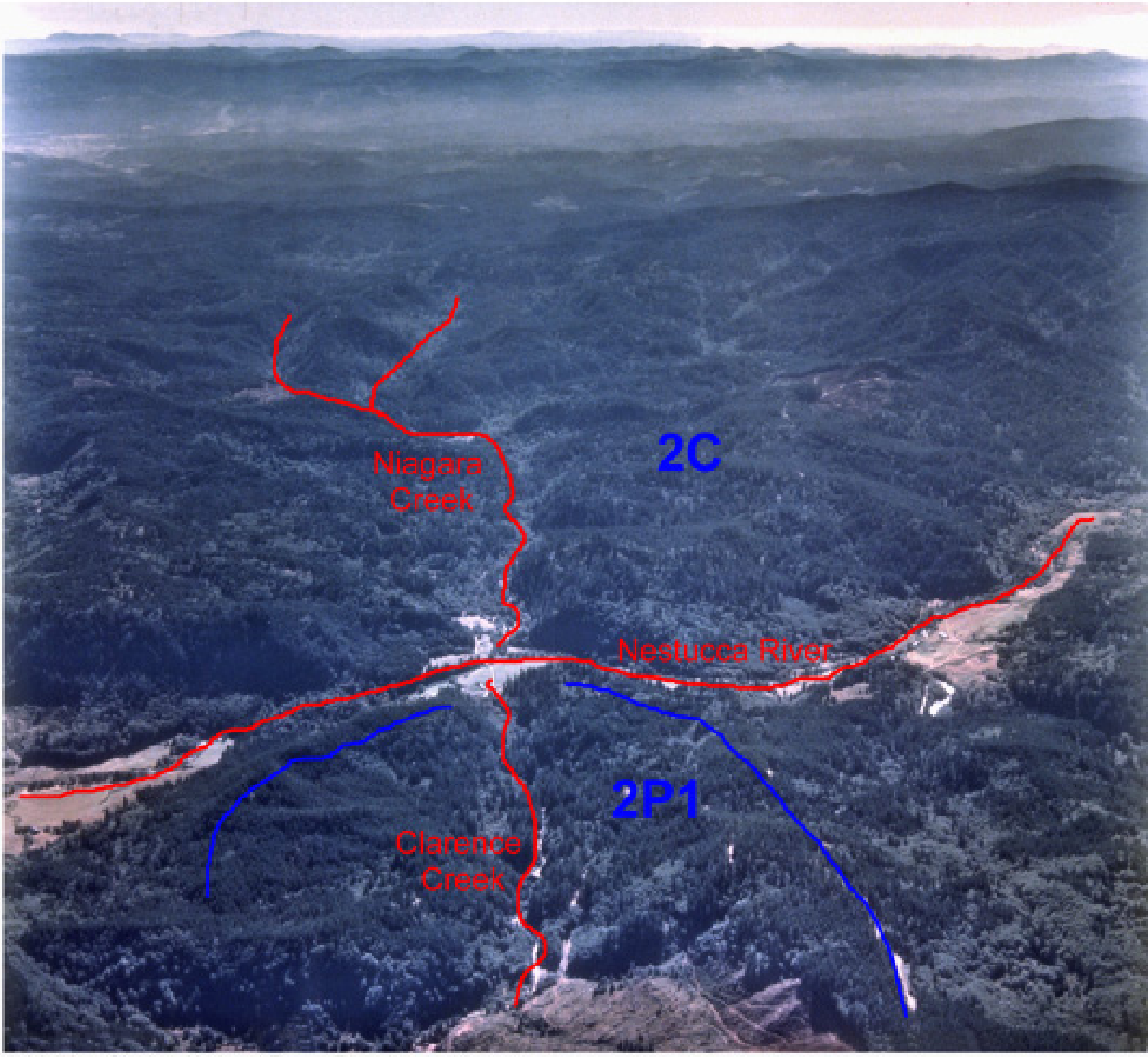
Geomorphology: Gently rolling, to gentle to moderately steep hills and broad valleys adjacent to the Willamette Valley.

Percent of Area by Slope Class:

0-30%:	97.4
30-60%:	2.5
60-90%:	0.1
>90%:	0

Stream Density: 8.6 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):



9-26-73 *Siuslaw National Forest Planning Archive*

2P1-Volcanic Uplands in the foreground
2C-Interior Fluvial Lands in the background

The Volcanic Uplands are not well represented in the photo. Earthflows are more common in Land Type Association 2C than the fluvial lands located on the Tyee Formation to the south.

0-1%:	23.62
1-2%:	15.88
2-4%:	17.78
4-8%:	19.29
8-20%:	22.98
>20%:	0.47

Soil Description: Soils are moderately deep. Soils range from gravelly clay loams on steeper slopes to gravelly clays on lower slope positions.

Productivity: Compared to other soils in the central coast Range, these soils are moderately productive. They have moderately high to high water holding capacities. Soil moisture limits plant growth on south facing upper side slopes most years.

Stability: Unstable soils are not common, but may occur on lower mid slopes above incised channels and upper convex side slopes. Earth flow terrain is not common. Slumps and fluvial channel erosion are the primary hill slope erosion processes.

Climatic Sub-Category: Valley Border

Vegetation Patterns: Non-forested vegetation types dominate this landtype association; half is in Douglas-fir series and more than 5% is in woodland. A quarter of this landtype association, in the fingers of ridges, is the western hemlock series. Moist areas on lower slopes and near streams hold western hemlock/swordfern types. The grand fir types, making up about 5% of the landtype association, are scattered in the transition between the non-forested and western hemlock. However, the hills extending into the Willamette Valley itself are dominated by grand fir types, with the young grand fir regenerating under older Douglas fir. Salmonberry is largely restricted to stream banks in this warm dry zone.

Landtype Association 2K ***Name: Igneous/Sedimentary Uplands.***

Total Acres: 139845 **Forest Service Acres:** 24990 (18%)
Location: Area around Mt. Hebo, and south of the Yamhill Valley

Geologic Category: Volcanics with fine-grained sedimentary rocks
Similar LTAs in this category: 2N, 2Q, 2C, 2T

Geology:
Soft sedimentary rocks: 49%
Yamhill Formation (Ty): 45%
Quaternary landslides (Qls): 3.5%
Quaternary Alluvium (Qal): 1%

Hard volcanic rocks: 31%
Dikes and sills of gabbro (Ti): 30.9%

Coarse-Grained sedimentary rocks: 9%
Tyee Sandstone (Tt): 9%

Mixed volcanics: 7%
Siletz River Volcanics (Tsr): 5.5%
Sedimentary rocks and pillow basalts associated with Tillamook volcanics (Ttvm): 1.7%

Mixture of igneous and sedimentary formations. The igneous rocks include the pillow basalts and basaltic sedimentary rocks associated with the Tillamook Volcanics, as well as intrusive dikes and sills of gabbro. The sedimentary formations include the Tyee Formation, the Yamhill Formation and Quaternary landslide deposits.

Geomorphology: Hummocky terrain is common. Large, deep-seated ancient earth flows are located on the south and west slopes of Mt. Hebo. Deranged drainage is common on the deep-seated earth flow deposits, including seasonally wet sag ponds and wetlands, numerous intermittent streams, disappearing streams and springs.

Percentage of Area by Slope Class:

0-30%:	63.0
30-60%:	32.0
60-90%:	4.4
>90%:	0.11

Stream Density: 7.29 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%: 3.64
1-2%: 1.80
2-4%: 3.76
4-8%: 11.16
8-20%: 44.23
>20%: 35

Soil Description: Soils are deep to very deep on hummocky, incised ancient earth flows and moderately deep on remnant bedrock ridge systems. Soils range from gravelly clay loams on steep slopes to gravelly clay where deeper soils occur.

Productivity: Compared to other soils in the central Coast Range, these soils are very productive. They have high to very high water holding capacities. Soil moisture is limiting only on upper south facing bedrock side slopes.

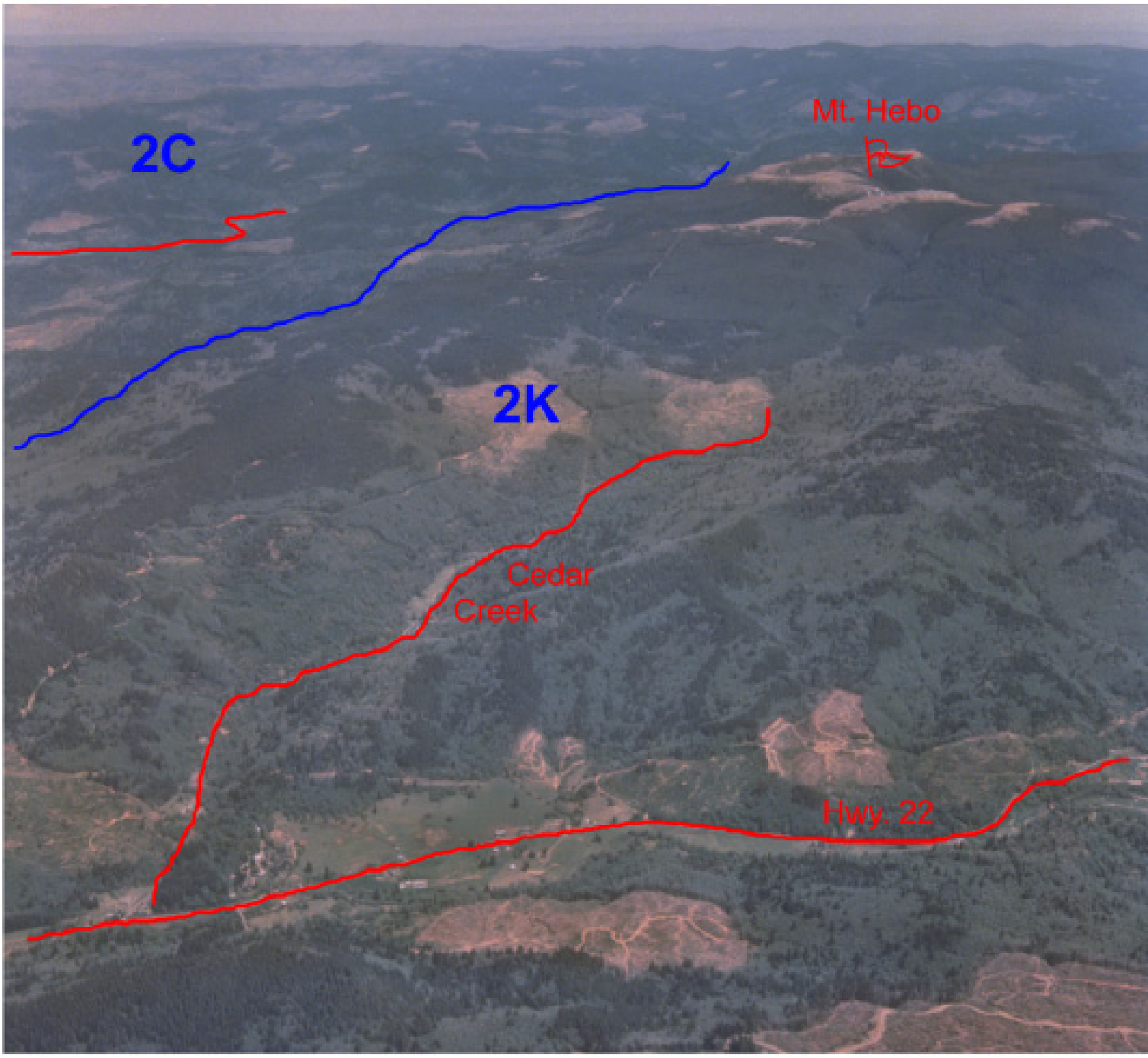
Stability: Unstable soils are on lower mid slopes above incised channels and on upper mid slopes that are earth flow escarpment faces. Slumps and small earth flows are the primary hill slope erosion process.

Climatic Sub-Category: Coastal and Coast Crest--Northern Zone

Vegetation Patterns: Very high precipitation and high elevations in this landtype association give it a unique vegetation distribution. The high ridges catch a great deal of rain and some snow and have most of the rare true fir zone in the Coast Range. Around the upper Siletz River drainage, Bureau of Land Management ecology and soils specialists report western hemlock/rhododendron types in the higher elevations, echoing a more Cascadian pattern with noble fir and a small disjunct population of silver fir capping the elevational gradient. The true fir and western hemlock/rhododendron vegetation also extends into landtype association 2PSR3.

Spruce/salmonberry is the potential vegetation along the valleys and lower north and east facing slopes of the Nestucca and Three Rivers drainages. Western hemlock/swordfern is most common in the fog zone to the west, with scattered spruce types found in drainages. The southern unit of the LTA sprawls eastward toward the valley fringe. The western hemlock zone shows the common east-west change across the precipitation and temperature gradients of the coast Range. In the moister west, salmonberry is found in the valleys, and western hemlock/swordfern is found on foot slopes and gentle mid slopes, while the hemlock/salal ground comes down to lower slope positions.

Wetlands associated with land flow topography and high rainfall are more common in this LTA than in most parts of the Coast Range.



5-5-74 Siuslaw National Forest Planning Archive

2K-Igneous/Sedimentary Uplands in the foreground
2C-Interior Fluvial Lands in the upper left part of the photo.

This photo shows the Cedar Creek drainage on the flanks of Mt. Hebo. Most of the Cedar Creek subwatershed is underlain by ancient earthflow deposits. Gentle, hummocky terrain is common in Land Type Association 2K

Landtype Association 2M ***Name: Igneous Headlands***

Total Acres: 22594 **Forest Service Acres**: 4753 (21%)
Location: Cascade Head, Cape Lookout, and other igneous headlands in Subsection 2

Geologic Category: Erosion-resistant (hard) volcanics
Similar LTAs in this category: 3M, 3T

Geology:
Soft sedimentary rocks: 41%
Marine sedimentary rocks (Tms): 33%
Quaternary river deposits (Qal): 4%
Tuffaceous sandstone and siltstone (Tss): 4%

Hard volcanic rocks: 54%
Columbia River Basalts (Tc): 26%
Porphyritic basalt (Tpb): 28%

Water: 5%

Basalts form resistant headlands that are surrounded by the more erodable marine sedimentary rocks.

Geomorphology: Resistant basalt forms headlands along the coast, including Cascade Head. A few steep, unstable slopes are on spur ridges below the gently rounded, broad ridge systems that dominate the landscape.

Percent of Area by Slope Class:

0-30%:	57.2
30-60%:	34.1
60-90%:	7.9
>90%:	0.8

Stream Density: 6.35 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	3.3
1-2%:	1.51
2-4%:	3.25
4-8%:	11.77
8-20%:	42.99
>20%:	37.14

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2M-Igneous Headlands, surrounded by 2Z-Coastal Lowlands

Cape Lookout is underlain by a series of resistant basalt flows, and is a prominent headland. It is surrounded by the low relief of Land Type Association 2Z, which is underlain by unconsolidated Quaternary sediments and soft sedimentary rocks.

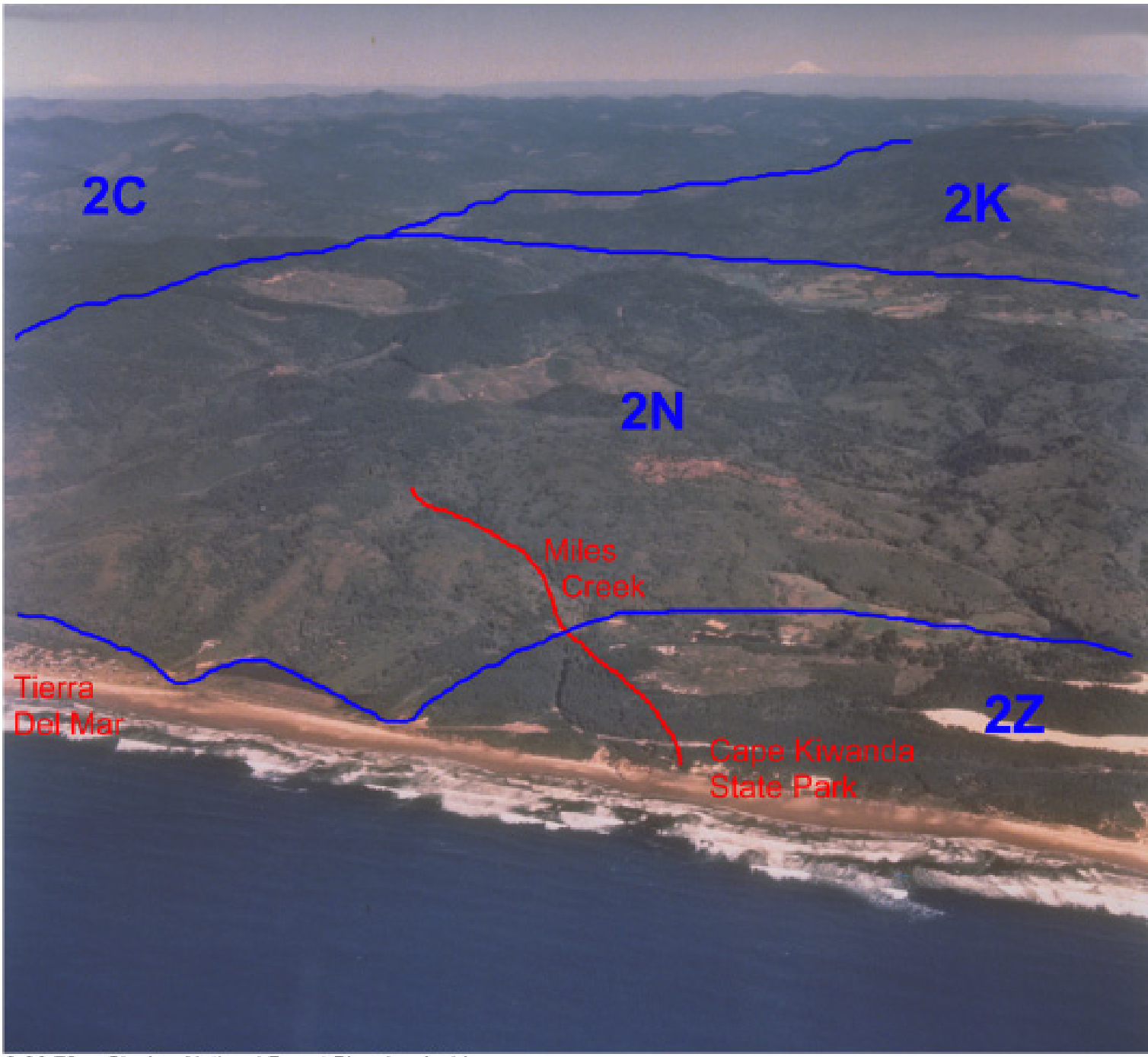
Soil Description: Soils are moderately deep on ridge systems to very deep on lower concave slopes. Soils range from gravelly clay loams on steep slopes to clay loams where deeper soils occur.

Productivity Highly productive compared to other LTA's in the central Coast Range. Moderate to high water holding capacities. Soil moisture probably never limits plant growth or survival.

Stability Infrequent debris slides are the primary hill slope erosion process.

Climatic Sub-Category: Coastal

Vegetation Patterns: Unique headland meadows and estuaries are distinctive features of this LTA's coastal margin. Broad igneous ridges support large patches of the spruce/swordfern. Spruce/salmonberry occupies the drainages, and make up about a third of the area. Western hemlock/swordfern is also found on about a third of the LTA in the higher reaches. Overall, half of this landtype association is in spruce types and half is in western hemlock types. This LTA is an extremely productive area with rich soils and abundant moisture.



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2Z-Coastal Lowlands in the foreground
2N-Igneous Marine Hills
2K-Igneous Sedimentary Uplands
2C-Interior Fluvial Lands

Land Type Association 2Z has very low relief. Land Type Association 2N has a more rounded appearance and gentler slopes than Land Type Association 2K or 2C.

Landtype Association 2N ***Name: Igneous Marine Hills***

Total Acres: 25981 **Forest Service Acres:** 9620 (37%)
Location: North of Cascade Head, west of Cape Kiwanda. The lower Nestucca River flows through it.

Geologic Category: Volcanics and fine-grained sedimentary rocks
Similar LTAs in this category: 2B, 2Q, 2C, 2T

Geology:
Soft sedimentary rocks: 71%
Marine sedimentary rocks: shale, siltstone, sandstone, conglomerate (Tsd): 27%
Tuffaceous siltstone and sandstone (Tss): 27%
Quaternary river deposits (Qal): 14%
Yamhill Formation (Ty): 3%

Hard volcanic rocks: 19%
Mafic and intermediate intrusive rocks (Tim): 10%
Porphyritic basalt (Tpb): 9%

Mixed volcanics: 8%
Sedimentary rocks and pillow basalts associated with Tillamook volcanics (Ttvm): 8%

Mixture of sedimentary and igneous rocks. The sedimentary rocks include tuffaceous marine siltstone and sandstone that is thin to thick bedded, and a mixture of marine sedimentary rocks that include shale, siltstone, sandstone, and conglomerates with basaltic and tuffaceous debris. The conglomerates are moderately erodable, and erode into clays, cobbles and pebbles. The igneous rocks include basaltic intrusive rocks that form resistant dikes and sills, and basalt flows.

Geomorphology: Subdued topography with low, rounded hills. This landtype association includes the broad river valleys of the lower Nestucca River and the Little Nestucca River.

Percent of Area by Slope Class:

0-30%:	70.0
30-60%:	27.0
60-90%:	2.9
>90%:	0.0

Stream Density: 9.34 miles per square mile (This number may be high because of the high percentage of low-gradient, unconfined stream miles.)

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	37.79
1-2%:	4.82
2-4%:	5.14
4-8%:	8.37
8-20%:	28.02
>20%:	15.85

Soil Description: Soils are deep to very deep on hummocky, gently rolling valley fill, and scattered areas of ancient earth flow terrain. Soils are moderately deep to deep on bedrock ridge systems at the higher elevations. Soils range from gravelly clay loams on steep slopes to gravelly clay where deeper soils occur.

Productivity: Soils are very productive. They have high to very high water holding capacities. Soil moisture probably never limits plant growth.

Stability: Unstable soils are not common. They may occur on lower mid slopes above incised channels and on upper mid slopes that are ancient escarpment faces. Although earth flow terrain is not common, slumps and small earth flows are the primary hill slope erosion process.

Climatic Sub-Category: Coastal

Vegetation Patterns: Broad valleys and low hills in the fog zone mean that about two thirds of this landtype association are in the spruce/salmonberry PAG. In the higher relief east of Sand Lake and associated ridges around Buzzard Butte, western hemlock/swordfern communities occupy upper slopes and peaks, with scattered spruce/swordfern in the mid-slopes.

Landtype Association 2P ***Name: Volcanic Uplands-High Relief***

Total Acres: 95873 **Forest Service Acres:** 7398 (8%)
Location: East of the lowlands surrounding Tillamook Bay and west of the Tillamook Highlands, includes East Beaver Creek.

Geologic Category: Siletz River Volcanics and sedimentary rocks
Similar LTAs in this category: 3L

Geology:
Mixed volcanics: 79%
Sedimentary rocks and pillow basalts associated with Tillamook volcanics (Ttvm): 50%
Tillamook Volcanics (Ttv): 28%
Siletz River Volcanics (Tsr): 1%

Soft sedimentary rocks: 20%
Yamhill Formation (Ty): 17%
Marine sedimentary rocks: shale, siltstone, sandstone, conglomerate (Tsd): 2%
Quaternary river deposits (Qal): 1%

Hard volcanic rocks: 1%
Dikes and sills of gabbro (Ti): 1%

The majority of the area is underlain by Tillamook Volcanics, which includes a mixture of basalt flows, basaltic breccia, pillow basalts and tuff. A sedimentary formation derived from the basalt flows and pillow basalts, and the Yamhill Formation (marine sandstones and siltstones) are also present.

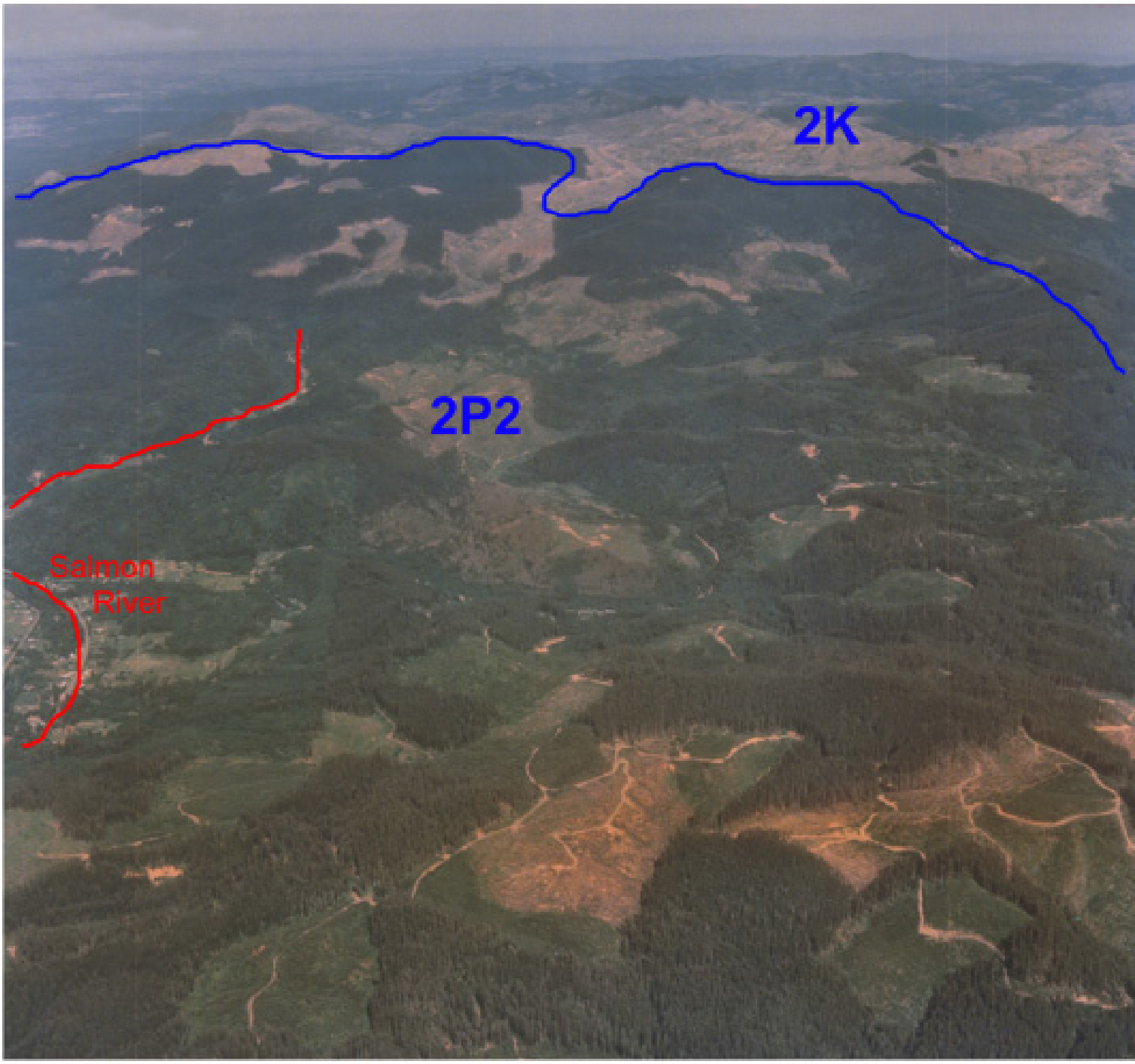
Geomorphology: Steep, V-shaped canyons and narrow ridges are common. High relief, medium to low drainage density.

Percent of Area by Slope Class:

0-30%:	28.8
30-60%:	49.1
60-90%:	20.4
>90%:	0

Stream Density: 4.60 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):



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2p2-Volcanic Uplands, Low Relief in forground
2K-Igneous/Sedimentary Uplands in background

Land Type Association 2P2 has gentle, rounded hills and moderate streem density.

0-1%: 4.0
1-2%: 1.99
2-4%: 2.55
4-8%: 7.07
8-20%: 22.94
>20%: 61.43

Soil Description: Soils range from moderately deep to very deep where local areas of soft volcanic sedimentary rock occur. Soils range from gravelly loams to clay where softer bedrock occurs.

Productivity: Soils are moderately productive and have moderately to very high water holding capacities. Soil moisture does not limit plant growth or survival.

Stability: The steepest, most unstable soils and slopes are on upper portions of spur ridges that extend from long, broad backbone ridge systems. Debris slides are the primary hill slope erosion processes.

Climatic Sub-Category: Coast Crest--Northern zone

Vegetation Patterns: Plot information for this landtype association is limited. However, projecting from similar climatic/topographic areas, it seems that the steep narrow valleys typical of this landtype association mean a limited amount of wet salmonberry types (around 15% of the area) compared to landtype associations with more moderate relief. Spruce/salmonberry follows the major streams from the west, and in the drier eastern half the western hemlock/salmonberry replaces the spruce/salmonberry group. Drier conditions increase the western hemlock/salal on warmer, steeper slopes. Recent sampling demonstrated that true fir PAGs are present at the highest elevations. This LTA and 2PSR2, Siletz River Volcanics, show western hemlock types further westward than for most LTAs in the Nehalem Subsection.

Landtype Association 2P2 Name: Volcanic Uplands-Low Relief

Total Acres: 20658 **Forest Service Acres**: 7744 (37%)
Location: East of lowlands surrounding Lincoln City, includes the headwaters of the Salmon River.

Geologic Category: Siletz River Volcanics
Similar LTAs in this category: 2PSR1, 2PSR2, 2PSR3, 3Q, 3S

Geology:
Mixed volcanics: 90%
Siletz River Volcanics (Tsr): 90%

Coarse-grained sedimentary rocks: 6%
Tyee Formation (Tt): 6%

Soft sedimentary rocks: 4%
Yamhill Formation (Ty): 3%
Quaternary river deposits (Qal): 1%

The majority of the area is underlain by the Siletz River volcanics, a mixture of lava flows, volcanic sediments and pillow basalts.

Geomorphology: Moderate relief with a medium drainage texture. This landtype association has a moderate susceptibility for debris torrents.

Percent of Area by Slope Class:

0-30%:	59.0
30-60%:	38.5
60-90%:	2.4
>90%:	0.1

Stream Density: 6.57 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	7.87
1-2%:	4.17
2-4%:	9.29
4-8%:	16.38
8-20%:	39.36
>20%:	22.92

Soil Description: Soils are deep to very deep on hummocky, gently rolling valley fill, and scattered areas of ancient earth flow terrain. Soils are moderately deep to deep on

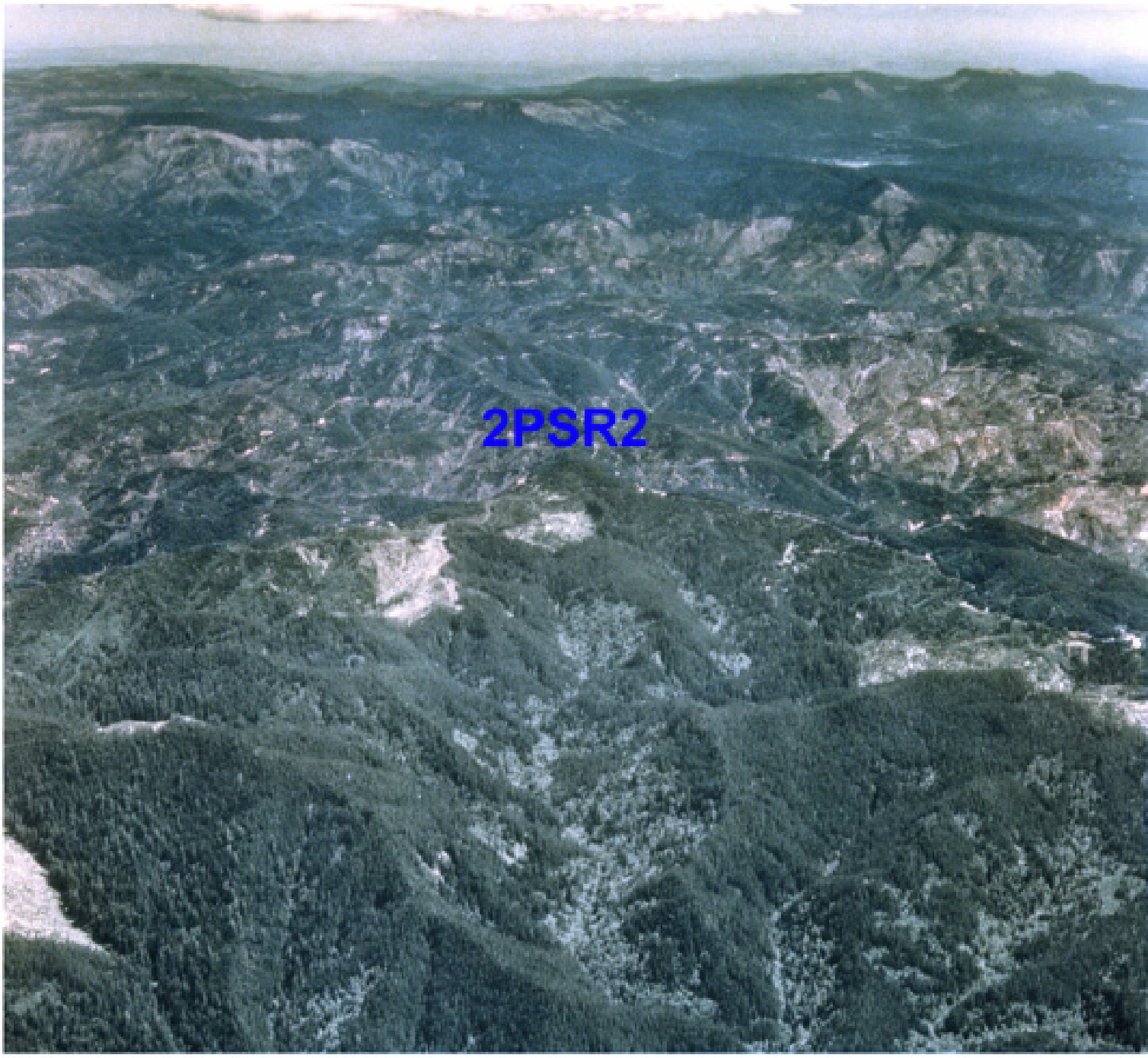
bedrock ridge systems at the higher elevations. Soils range from gravelly clay loams on steep slopes to gravelly clay where deeper soils occur.

Productivity: Soils are very productive. They have high to very high water holding capacities. Soil moisture probably never limits plant growth.

Stability: Unstable soils are not common. They may occur on lower mid slopes above incised channels and on upper mid slopes that are ancient escarpment faces. Although earth flow terrain is not common, slumps and small earth flows are the primary hill slope erosion process.

Climatic Sub-Category: Coastal

Vegetation Patterns: Low relief is evident in the prevalence of salmonberry plant association groups (almost 50%). In the western half of landtype association 2P2, spruce/swordfern types are the potential vegetation on minor ridges or lower slopes, while minor amounts of spruce/salal and western hemlock/salal appear on higher, steeper slopes. Over 40% of the landtype association is western hemlock/swordfern types, which indicates moist areas on lower slopes.



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2PSR2-Seletz River Volcanics, Steep Slopes

The area is underlain by a mixture of resistant volcanics and more erodable sedimentary rocks. It is characterized by steep, highly dissected slopes.

Landtype Association 2PSR1 ***Name: Siletz River Volcanics Uplands***

Total Acres: 113756 **Forest Service Acres:** 0
Location: Southeast corner of the Tillamook Highlands

Geologic Category: Siletz River Volcanics
Similar LTAs in this category: 2P2, 2PSR2, 2PSR3, 3Q, 3S

Geology:
Mixed volcanics: 81%
Siletz River Volcanics (Tsr): 73%
Tillamook Volcanics (Ttv): 8%

Hard volcanic rocks: 12%
Dikes and sills of gabbro (Ti): 12%

Soft sedimentary rocks: 7%
Yamhill Formation (Ty): 5%
Quaternary river deposits (Qal): 1%
Quaternary landslide deposits (Qls): 1%

The Siletz River Volcanics consists of massive lava flows and sills, with some pillow basalts and breccias. The upper part of the volcanics contains basaltic sandstones, siltstones and conglomerates. The Siletz River Volcanics are generally more resistant to erosion than surrounding rocks, and form highlands.

Geomorphology: Moderate to high relief with V-shaped valleys.

Percent of Area by Slope Class:

0-30%:	59.0
30-60%:	38.5
60-90%:	2.4
>90%:	0.0

Stream Density: 6.65 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	4.32
1-2%:	3.89
2-4%:	6.15
4-8%:	12.22
8-20%:	34.14
>20%:	39.27

Soil Description: Soils range from moderately deep to very deep where local areas of soft volcanic sedimentary rock occur. Soils range from gravelly loams to clay where softer bedrock occurs.

Productivity: Soils are moderately productive and have moderately to very high water holding capacities. Soil moisture does not limit plant growth or survival.

Stability: The steepest, most unstable soils and slopes are on upper portions of spur ridges that extend from long, broad backbone ridge systems. Debris slides are the primary hill slope erosion processes.

Climatic Sub-Category: Coast Crest--Northern Zone

Vegetation Patterns: Little plot information is available for this area. However, high elevations along the crest and central location mean that this LTA is projected to show the full spectrum in Nehalem vegetation types. West of the crest, minor amounts of spruce PAGs are found in the major drainages where fog is not blocked off. However, the LTA is dominantly western hemlock, with about half in the western hemlock/salal group. The coastal true fir series may be present in the highest elevations. Toward the valley, western hemlock/swordfern is the most common lower slope and valley bottom PAG.

Landtype Association 2PSR2 Name: Siletz River Volcanics Uplands-Steep Slopes

Total Acres: 66322 **Forest Service Acres**: 15035 (23%)
Location: This landtype association covers most of the Drift Creek of the Siletz watershed east of Lincoln City.

Geologic Category: Siletz River Volcanics
Similar LTAs in this category: 2P2, 2PSR1, 2PSR3, 3Q, 3S

Geology:
Mixed volcanic rocks: 87%
Siletz River Volcanics (Tsr): 87%

Coarse-grained sedimentary rocks: 9%
Tyee Formation (Tt): 9%

Hard volcanic rocks: 3%
Dikes and sills of gabbro (Ti): 3%

Soft sedimentary rocks: 1%
Yamhill Formation (Ty): 1%

The majority of the area is underlain by the Siletz River Volcanics.

Geomorphology: Steep slopes, V-shaped valleys and confined stream channels area common. This landtype association has a high susceptibility for debris torrents. 2PSR2 has a finer drainage texture, and lower elevations that 2PSR1.

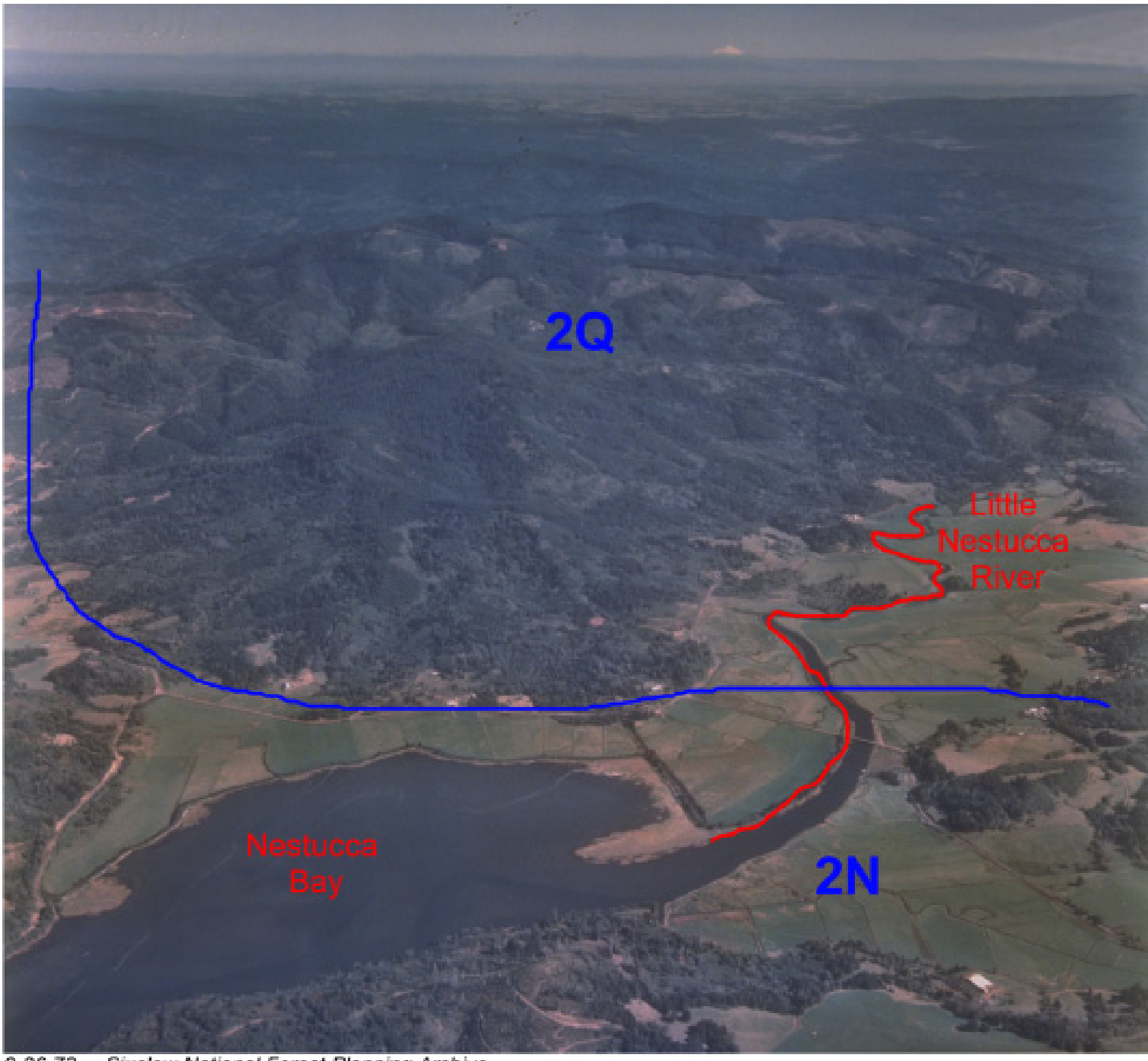
Percent of Area by Slope Class:

0-30%:	30.3
30-60%:	53.4
60-90%:	15.9
>90%:	0.4

Stream Density: 6.39 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	7.52
1-2%:	2.23
2-4%:	4.93
4-8%:	8.14
8-20%:	26.41
>20%:	50.77



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2Q-Igneous Uplands in the midground and background
2N-Igneous Marine Hills in the foreground

The steeper, more dissected landscape of Land Type Association 2Q contrasts with the rounded hills and more gentle topography of Land Type Association 2N. The well-developed floodplains of the Nestucca and Little Nestucca Rivers are part of Land Type Association 2N, This photo shows the broad lower valley of the Little Nestucca River and Nestucca Bay.

Soil Description: Soils range from moderately deep to very deep where local areas of soft volcanic sedimentary rock occur. Soils range from gravelly loams to clay where softer bedrock occurs.

Productivity: Soils are moderately productive and have moderate to very high water holding capacities. Soil moisture does not limit plant growth or survival.

Stability: The steepest, most unstable soils and slopes are on upper portions of spur ridges that extend from long, broad backbone ridge systems. Debris slides are the primary hill slope erosion processes.

Climatic Sub-Category: Coast and Coast Crest--Central Zone

Vegetation Patterns: Higher elevations and steep slopes bring the western hemlock zone near the coast. The dominant (over 60%) PAG for this landtype association is western hemlock/swordfern. In the western half of the landtype association, the steep, V-shaped valleys confine salmonberry types to narrow riparian strips. Spruce/salmonberry types are generally found only in the most western section of the landtype association, with western hemlock/swordfern on slopes above, and hemlock/salal on steep upper slopes or ridge tops.

Landtype Association 2PSR3 Name: Siletz River Volcanics-Moderate Slopes

Total Acres: 56811 **Forest Service Acres**: 1160 (2%)
Location: South of the Yamhill Valley, west of Dallas, Oregon, National Forest land is located within the Rickreal Creek watershed, the Dallas municipal water supply. Mill Creek is located on the northern edge, Rickreal Creek is on the southern edge.

Geologic Category: Siletz River Volcanics
Similar LTAs in this category: 2P2, 2PSR1, 2PSR2, 3Q, 3S

Geology:
Mixed volcanics: 96%
Siletz River Volcanics (Tsr): 96%

Soft sedimentary rocks: 4%
Yamhill Formation (Ty): 4%

Hard volcanic rocks: 1%
Dikes and sills of gabbro (Ti): 1%

Geomorphology:. Moderate relief, includes relatively flat plateau on top of the Siletz River Volcanics.

Percent Area by Slope Class:

0-30%:	45.3
30-60%:	46.3
60-90%:	8.3
>90%:	0.1

Stream Density: 6.21 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	3.51
1-2%:	1.78
2-4%:	3.39
4-8%:	9.79
8-20%:	34.50
>20%:	47.01

Soil Description: Soils are deep to very deep on hummocky, incised ancient earth flows, and moderately deep on remnant bedrock ridge systems. Soils range from gravelly clay loams on steep slopes to gravelly clay where soils are very deep.

Productivity: Soils are moderately productive. They have high to very high water holding capacities. Soil moisture is rarely limiting.

Stability: Unstable soils are on lower mid slopes above incised channels and on upper mid slopes that are earth flow escarpment faces. Unstable soils may also occur on steep headwalls on the upper backbone ridge systems that dominate the higher elevations. Slumps and small earth flows are the primary hill slope erosion processes at lower elevations. Debris slides occur infrequently at higher elevations.

Climatic Sub-Category: Coast Crest--Central Zone

Vegetation Patterns: Moderate elevations, moderate slopes and plateaus east of the Coast Range crest combine topography and precipitation to put a third of this landtype association in the western hemlock/salal group, and a quarter in western hemlock/swordfern. Relatively low precipitation and warm climates of the eastern slopes of the Coast Range combine to make a quarter of this landtype association grand fir and western hemlock-warm, dry. Salmonberry is restricted to the lowest elevation riparian zones (less than 2% of the area). A small part of the upper Siletz River drainage holds vegetation typical of LTA 2K, including the higher elevation rhododendron types and true fir.

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2M-Igneous Headlands
2T-Igneous/Sedimentary Contact Lands

Cascade Head is underlain by resistant basalt flows, which create the high relief and steep sea cliffs. Land Type Association 2T has lower relief.

Landtype Association 2Q ***Name: Igneous Uplands***

Total Acres: 14249 **Forest Service Acres:** 9944 (70%)
Location: Southeast of the confluence of the Nestucca and Little Nestucca Rivers.

Geologic Category: Volcanics and fine-grained sedimentary rocks
Similar LTAs in this category: 2N, 2K, 2C, 2T

Geology:
Soft sedimentary rocks: 61%
Yamhill Formation (Ty): 55%
Sedimentary rocks and pillow basalts associated with Tillamook volcanics (Ttvm): 4%
Tuffaceous siltstone and sandstone (Tss): 1%
Quaternary river deposits (Qal): 1%

Hard volcanic rocks: 23%
Mafic and intermediate intrusive rocks (Tim): 23%

Coarse-grained sedimentary rocks: 13%
Tyee Formation (Tt): 13%

Mixed volcanic rocks: 5%
Siletz River Volcanics (Tsr): 5%

Sedimentary rocks with intrusions of basalt dikes and sills. The sedimentary rocks include the Yamhill and Tyee Formations.

Geomorphology: Steep, dissected slopes are in the northeastern part which is underlain by intrusive volcanic rocks. Gentle slopes are in the southwestern part, which is underlain by the Yamhill Formation and other easily erodable sedimentary bedrock.

Percent Area by Slope Class:

0-30%:	53.3
30-60%:	38.9
60-90%:	7.5
>90%:	0.3

Stream Density: 6.57 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	5.29
1-2%:	2.34
2-4%:	5.58
4-8%:	13.23
8-20%:	41.99
>20%:	32.93

Soil Description: Soils are moderately deep to deep on moderately steep hills and narrow valley bottoms. Soils are deep in lower slopes and valley bottoms to moderately deep on bedrock ridge systems at the higher elevations. Soils range from gravelly loams on steep slopes to gravelly clay loams on lower slope positions.

Productivity: These soils are very productive. They have moderately high to high water holding capacities. Soil moisture rarely limits plant growth.

Stability: Unstable soils are not common. They may occur on lower mid slopes above incised channels and occasionally on upper convex side slopes. Although earth flow terrain is not common, slumps and small earth flows are the primary hill slope erosion processes.

Climatic Sub-Category: Coastal

Vegetation Patterns: Steep, dissected slopes on the intrusive volcanics concentrate the spruce/swordfern communities in the east part of this landtype association. The salmonberry groups make up over half of the landtype association, but is concentrated in the lower, gentler sedimentary section. About 10% of the landtype association holds spruce/swordfern types. Only about 5% of this area is in the drier western hemlock/salal and western hemlock-high, cool.

Landtype Association 2S ***Name: Igneous Valley Borderlands***

Total Acres: 171396 **Forest Service Acres:** 0
Location: East side of the northern Coast Range along the Willamette Valley.

Geologic Category: Volcanics and fine-grained sedimentary rocks
Similar LTAs in this category: 2N, 2K, 2Q, 2C, 2T

Geology:
Soft sedimentary rocks: 71%
Marine sedimentary rocks: shale, siltstone, sandstone, conglomerate (Tsd): 30%
Yamhill Formation (Ty): 25%
Quaternary river deposits (Qal): 6%
Tuffaceous siltstone and sandstone (Tss): 5%
Quaternary lake and river deposits (Qs): 3%
Quaternary landslide deposits (Qls): 1%
Quaternary river terrace deposits (Qt): 1%

Hard volcanic rocks: 29%
Columbia River and Grande Ronde Basalts (Tc and Tcg): 20%
Dikes and sills of gabbro (Ti): 9%

Mixed volcanics: 1%
Siletz River Volcanics (Tsr): 1%

Marine sedimentary and volcanic ash deposits (Tmst): 1%

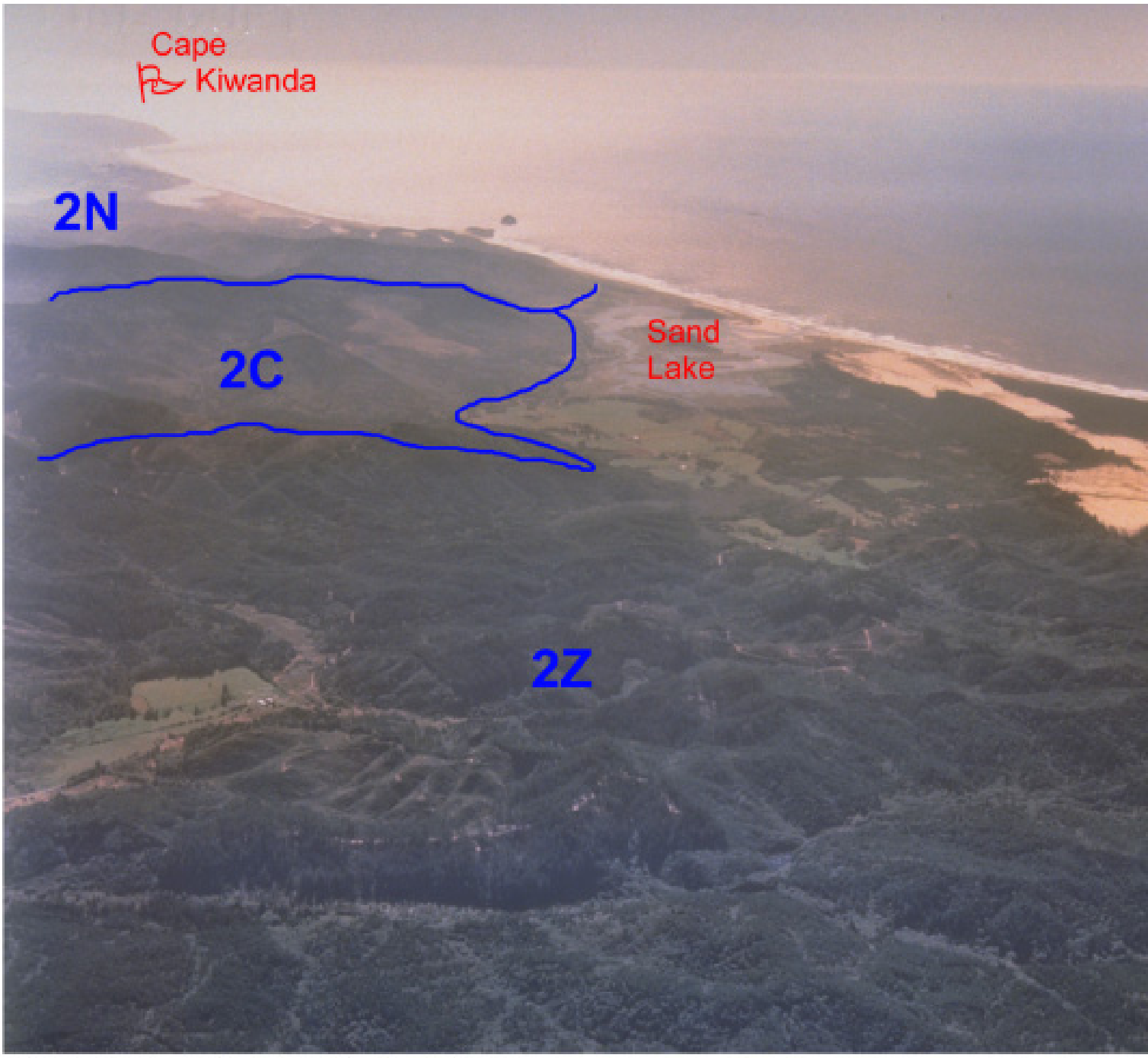
Columbia River Basalts overly and intrude sedimentary bedrock. Sedimentary formations include the tuffaceous siltstones and sandstones, the Yamhill Formation, marine sedimentary rocks, shale, siltstone, sandstone, conglomerate, and Quaternary alluvium.

Geomorphology: Gently rolling to gentle to moderately steep hills and broad valleys adjacent to the Willamette Valley.

Percent Area by Slope Class: no information

Stream Density: no information

Percentage of total stream miles by gradient class (values are approximate):
no information



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2Z-Coastal Lowlands in the foreground
2C-Interior Fluvial Lands and 2N-Igneous Marine Hills in the upper left.

Land Type Association 2Z is characterized by low lying, gentle ground that is underlain by unconsolidated Quaternary sediment, such at the sand dunes around Sand Lake, and easily eroded sedimentary rock.

Soil Description: Soils are moderately deep. Soils range from gravelly clay loams on steeper slopes to gravelly clays on lower slope positions.

Productivity: Compared to other soils in the central Coast Range, these soils are moderately productive. They have moderately high to high water holding capacities. Soil moisture limits plant growth on south facing upper side slopes most years.

Stability: Unstable soils are not common, but may occur on lower mid slopes above incised channels and upper convex side slopes. Earth flow terrain is not common. Slumps and fluvial channel erosion are the primary hill slope erosion processes.

Climatic Sub-Category: Valley Border

Vegetation Patterns: In the eastern part of this landtype association, the grand fir series occurs on hills extending into the Willamette Valley, which may be capped with western hemlock/salal and western hemlock/swordfern types on cooler aspects. On the slopes of this hilly intrusion, grand fir is restricted to the warmer lower slopes. Western hemlock/swordfern is on cooler, moister sites, with the western hemlock/salal and Douglas-fir groups on drier upper slopes.

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3Z-Coastal Lowlands in the background
3A-Sedimentary Coastal Hills in the foreground

Land Type Association 3A has rounded hils and moderate relief. The broad valley of the Siuslaw River is in the foreground. The beach and sand dunes that are part of Land Type Association 3Z can be seen in the background

Landtype Association 2T ***Name: Igneous-Sedimentary Contact Lands***

Total Acres: 193444 **Forest Service Acres:** 32709 (17%)
Location: Large area north of the Yamhill Valley and a small area east of Cascade Head

Geologic Category: Volcanics and fine-grained sedimentary rocks
Similar LTAs in this category:2N, 2K, 2Q, 2C, 2S

Geology:
Soft sedimentary rocks: 80%
Tuffaceous siltstone and sandstone (Tss): 64%
Yamhill Formation (Ty): 11%
Quaternary river deposits (Qal): 2%
Quaternary lake and river deposits (Qs): 2%
Quaternary landslide deposits (Qls): 1%

Hard volcanic rocks: 14%
Dikes and sills of gabbro (Ti): 12%
Mafic and intermediate intrusive rocks (Tim): 1%
Porphyritic basalt (Tpb): 1%

Coarse-grained sedimentary rocks: 5%
Tyee Formation (Tt): 5%

Mixed volcanics: 3%
Siletz River Volcanics (Tsr): 2%
Sedimentary rocks and pillow basalts associated with Tillamook volcanics (Ttvm): 1%

Mixture of sedimentary rocks with intrusions of dikes and sills of gabbro (a coarse-grained rock with the same mineral content as basalt). The sedimentary rocks include the tuffaceous marine sandstone and siltstone, mudstone, and Yamhill and Tyee Formations.

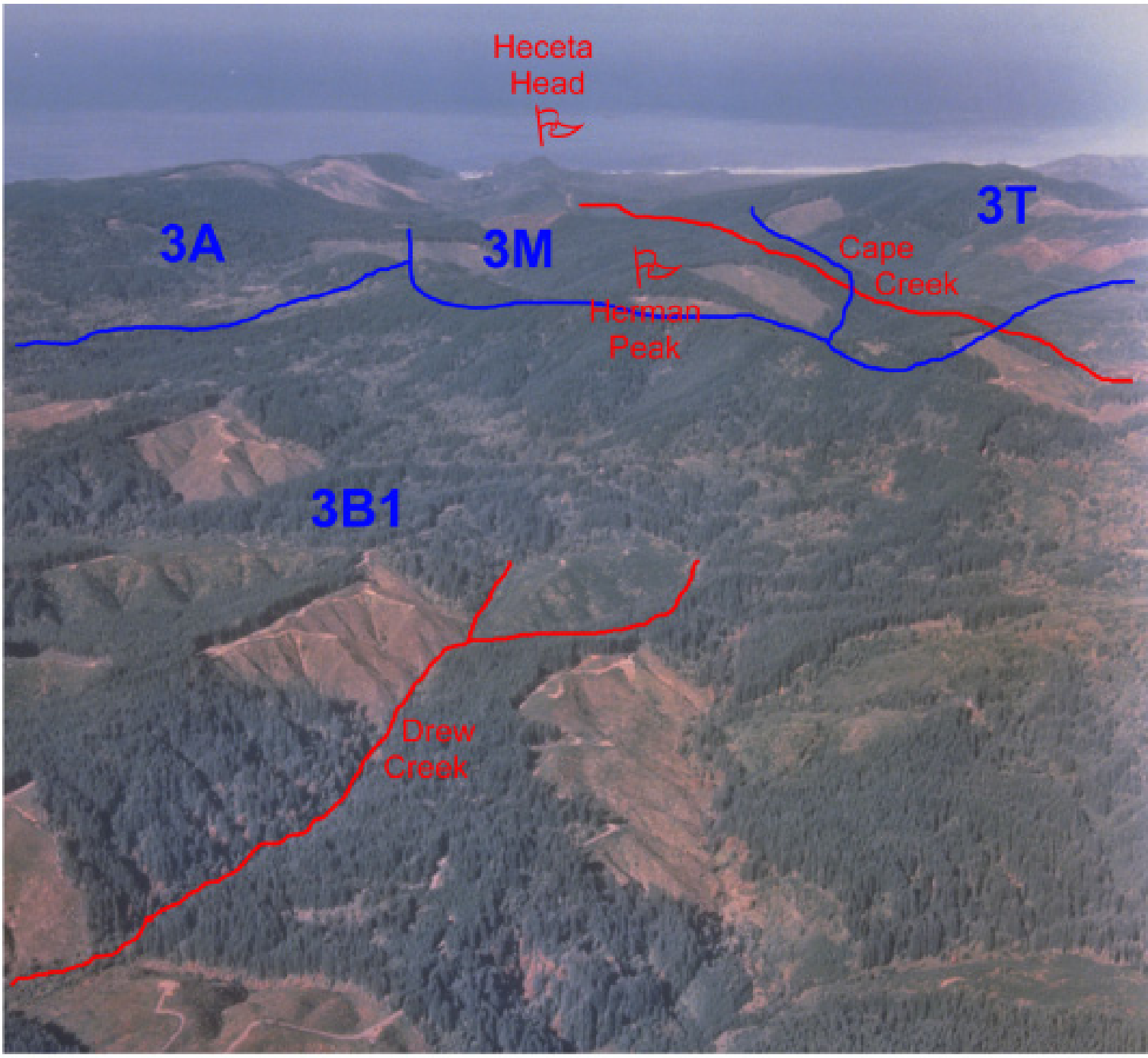
Geomorphology: Hummocky topography with low relief, gentle slopes and rounded ridges. High drainage density.

Percent Area by Slope Class:

0-30%:	78.0
30-60%:	20.8
60-90%:	1.2
>90%:	0

Stream Density: 4.32 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):



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3A-Sedimentary Coastal Hills in the upper left
3M-Igneous headlands in the middle background
3T-Igneous/Sedimentary Contact Lands in the upper right
3B1-Asymmetric Ridge Landscape in the foreground

Land Type Association 3B1 is characterized by distinctive parallel ridges that are steeper and more dissected on the northeast side, and more gentle and planar on the southwest side. In this photo, the shorter, steeper slopes can be seen to the left of Drew Creek, and the longer, more gentle slopes can be seen to the right of Drew Creek.

0-1%:	5.68
1-2%:	3.63
2-4%:	6.65
4-8%:	13.85
8-20%:	53.14
>20%:	17.02

Soil Description: Soils are deep to very deep on hummocky, incised ancient earth flows, and moderately deep on remnant bedrock ridge systems. Soils range from gravelly clay loams on steep slopes to gravelly clay where soils are very deep.

Productivity: Soils are moderately productive. They have high to very high water holding capacities. Soil moisture is rarely limiting.

Stability: Unstable soils are on lower mid slopes above incised channels and on upper mid slopes that are earth flow escarpment faces. Unstable soils may also occur on steep headwalls on the upper backbone ridge systems that dominate the higher elevations. Slumps and small earth flows are the primary hill slope erosion processes at lower elevations. Debris slides occur infrequently at higher elevations.

Climatic Sub-Category: Coastal and Coastal Crest

Vegetation Patterns: The vegetation pattern is described from data from only the southern unit of 2T. The western most part of that unit lies within the fog zone and has spruce community distribution similar to 2Q and 2P2. The remainder stretches almost to the valley margin and is largely within the western hemlock series. Salmonberry is common along riparian zones and on cool aspects of gentle slopes on the western half of 2T. Western hemlock/swordfern types (~30%) occur on cool slopes with the hemlock/salal group (~30%) on ridges and steep slopes. In the eastern half, the salmonberry types drop out and are replaced by hemlock/swordfern in moist or foot-slope positions, with increasing areas of the hemlock/salal group farther down the slopes. Grand fir and Douglas-fir become an increasingly important component of the valley fringe of this landtype association's eastern edge. It fills in the slopes above the valley floor and below the hemlock/salal group which retreats to the higher cooler slopes in the valley.

Landtype Association 2Y ***Name: Interior Valley***

Total Acres: 955639 **Forest Service Acres:** 2411 (0.25%)
Location: Yamhill and Willamette Valleys

Geologic Category: Fine-grained sedimentary rocks
Similar LTAs in this category: 2Z, 3Z, 2H

Geology:
Soft sedimentary rocks:
Quaternary lake and river deposits (Qs): 51%
Quaternary river deposits (Qal): 22%
Coarse to fine-grained sandstone and silt found on southeast side of Willamette Valley (Tffe): 8%
Quaternary river terrace deposits (Qt): 4%
Tuffaceous siltstone and sandstone (Tss): 4%
Yamhill Formation (Ty): 3%

Hard volcanic rocks:
Grande Ronde Basalt (Tcg): 3%
Basaltic rocks (Tfeb): 2%
Fossiliferous marine sedimentary rocks (Tsm): 1%

Coarse-grained sedimentary rocks:
Tyee Formation (Tt): 1%

Predominantly Quaternary alluvium with some Yamhill Formation.

Geomorphology: Broad, low relief valley of the Yamhill and Willamette Rivers.

Percent Area by Slope Class:

0-30%:	96.9
30-60%:	3.1
60-90%:	0
>90%:	0

Stream Density: 0.25 miles per square mile (numbers are uncertain)

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	23.07
1-2%:	8.46
2-4%:	15.05
4-8%:	20.44
8-20%:	30.49
>20%:	2.48

Soil Description: Soils are deep to very deep on low relief, gently rolling hills and wide valleys. Soils are deep in lower slopes and valley bottoms to moderately deep on bedrock ridge systems at higher elevations. Soils range from clay loams to gravelly clay loams to sandy loams.

Productivity: Soils are very productive. Water holding capacity is high. Soil moisture probably never limits plant growth, except in the eastern portion of this landtype association, where it borders the Willamette Valley.

Stability: Unstable soils are not common. They may occur on lower mid slopes above incised channels. Although ancient earth flow terrain is common, slumps and small earth flows are uncommon. Fluvial erosion in channels is the primary hill slope erosion process.

Climatic Sub-Category: Valley Border

Vegetation Patterns: The interior valley is described mainly from data in the southern half of the valley. The northeastern section of this landtype association is quite undefined. The heart of the interior valley is in non-forested vegetation, with potential vegetation communities including prairies, oak woodlands, and Douglas fir/grand fir forests. As landtype association 2Y follows the Yamhill River valley up into the Coast Range, the grand fir is replaced by the western hemlock/swordfern on the lowest slopes and the hemlock/salal group on upper or steeper slopes. The westernmost piece of 2Y fingers into the high precipitation/low relief topography of the upper Yamhill drainage, which is dominated by western hemlock/swordfern and western hemlock/salmonberry. Spruce may be expected along creeks only along the farthest western extension of landtype association 2Y.

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The entire photo is within Land Type Association 3C, the Interior Fluvial Lands. The moderate relief and V-shaped valleys with little floodplain devlopment is seen in this photo. Debris torrents, which are a common form of mass-wasting in the land type associations underlain by the Tyee Formation, can be seen just north and south of Herman Creek in harvest units.

Landtype Association 2Z ***Name: Coastal Lowlands***

Total Acres: 89212 **Forest Service Acres:** 4490 (5%)
Location: Lowlands around Tillamook Bay, Cape Kiwanda, mouth of the Nestucca River, and Lincoln City.

Geologic Category: Fine-grained sedimentary rocks
Similar LTAs in this category: 2H, 2Y, 3Z

Geology:
Soft sedimentary rocks: 83%
Marine sedimentary rocks: shale, siltstone, sandstone, conglomerate (Tsd): 29%
Quaternary river deposits (Qal): 27%
Quaternary river terrace deposits (Qt): 10%
Marine sedimentary rocks (Tms): 9%
Yamhill Formation (Ty): 5%
Tuffaceous siltstone and sandstone (Tss): 3%

Mixed volcanic rocks:
Tillamook Volcanics (Ttv): 5%

Water: 11%

Quaternary alluvium and terrace deposits, with marine shale, siltstone, sandstone and conglomerates (Tsd), and fine to medium grained tuffaceous marine siltstone and sandstones (Tms).

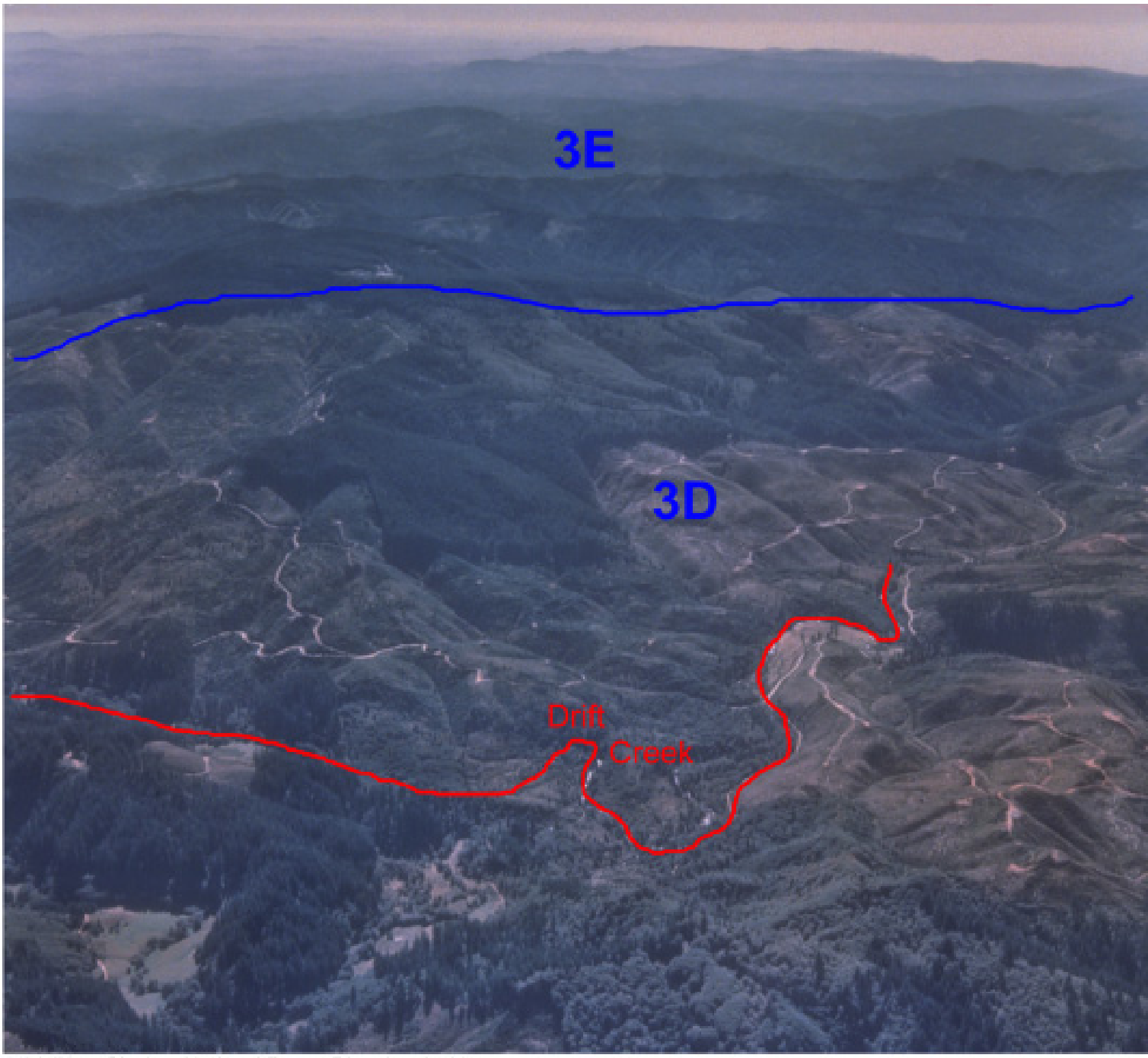
Geomorphology: Areas of low relief that includes the floodplains and estuaries of the Tillamook and Salmon Rivers, the coastal plains around Tillamook and Lincoln City, and the sand dunes around Cape Kiwanda.

Percent Area by Slope Class:

0-30%:	93.3
30-60%:	6.6
60-90%:	0.2
>90%:	0

Stream Density: 8.24 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):



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3D-Central Coast Range Fluvial Lands in the foreground
3E-Transitionsl Fluvial Lands in the background

Land Type Association 3D has slightly less relief and gentler slopes than other landtype associations on the Tyee Formation. Compare the more gentle topography and rounder ridges in Land Type Association 3D to the steeper slopes and more prominent ridges in 3E in the background.

0-1%:	53.02
1-2%:	8.59
2-4%:	9.87
4-8%:	12.16
8-20%:	15.01
>20%:	1.37

Soil Description: Soils are deep to very deep on low relief, gently rolling hills and wide valleys. Soils are deep in lower slopes and valley bottoms to moderately deep on bedrock ridge systems at higher elevations. Soils range from clay loams to gravelly clay loams to sandy loams.

Productivity: Soils are very productive. Water holding capacity is high. Soil moisture probably never limits plant growth.

Stability: Unstable soils are not common. They may occur on lower mid slopes above incised channels. Although ancient earth flow terrain is common, slumps and small earth flows are uncommon. Fluvial erosion in channels is the primary hill slope erosion process.

Climatic Sub-Category: Coastal

Vegetation Patterns: With over 90% of landtype association 2Z in slopes greater than 30%, 60% of the coastal lowlands is in the spruce/salmonberry group, and in the southernmost polygon the landtype is almost entirely in spruce/salmonberry. Upper slopes also show over 10% in spruce/swordfern and over 10% in western hemlock/salmonberry group. Floodplains, estuaries, and sand dunes host plant communities which form special habitats in this landtype association.

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3E-Transitional Fluvial Lands

Land Type Association 3E has higher relief and longer slopes than other landtype associations on the Tyee Formation. Like other Tyee Formation land type associations, the slopes are highly dissected with sharp ridges.

Landtype Association 3A ***Name: Sedimentary Coastal Hills***

Total Acres: 20163 **Forest Service Acres:** 6978 (34%)
Location: Area around the lower North Fork Siuslaw River east of Florence.

Geologic Category: Fine-grained and coarse-grained sedimentary rocks
Similar LTAs in this category: 3W, 4J, 4X

Geology:
Coarse-grained sedimentary rocks: 81%
Tyee Formation (Tt): 81%

Soft sedimentary rocks: 10%
Quaternary river deposits (Qal): 8%
Alsea Formation (Ta): 2%

Hard volcanic rocks: 1%
Porphyritic basalt (Tpb): 1%

Water: 8%

Predominantly Tyee Formation with Quaternary river deposits along the Siuslaw and North Fork Siuslaw Rivers. Small amount of porphyritic basalt in the northern part of the landtype association.

Geomorphology: Area of moderate relief, includes the mouth of the North Fork Siuslaw River and its estuary. Gentle, rounded broad ridge systems dominate the landscape.

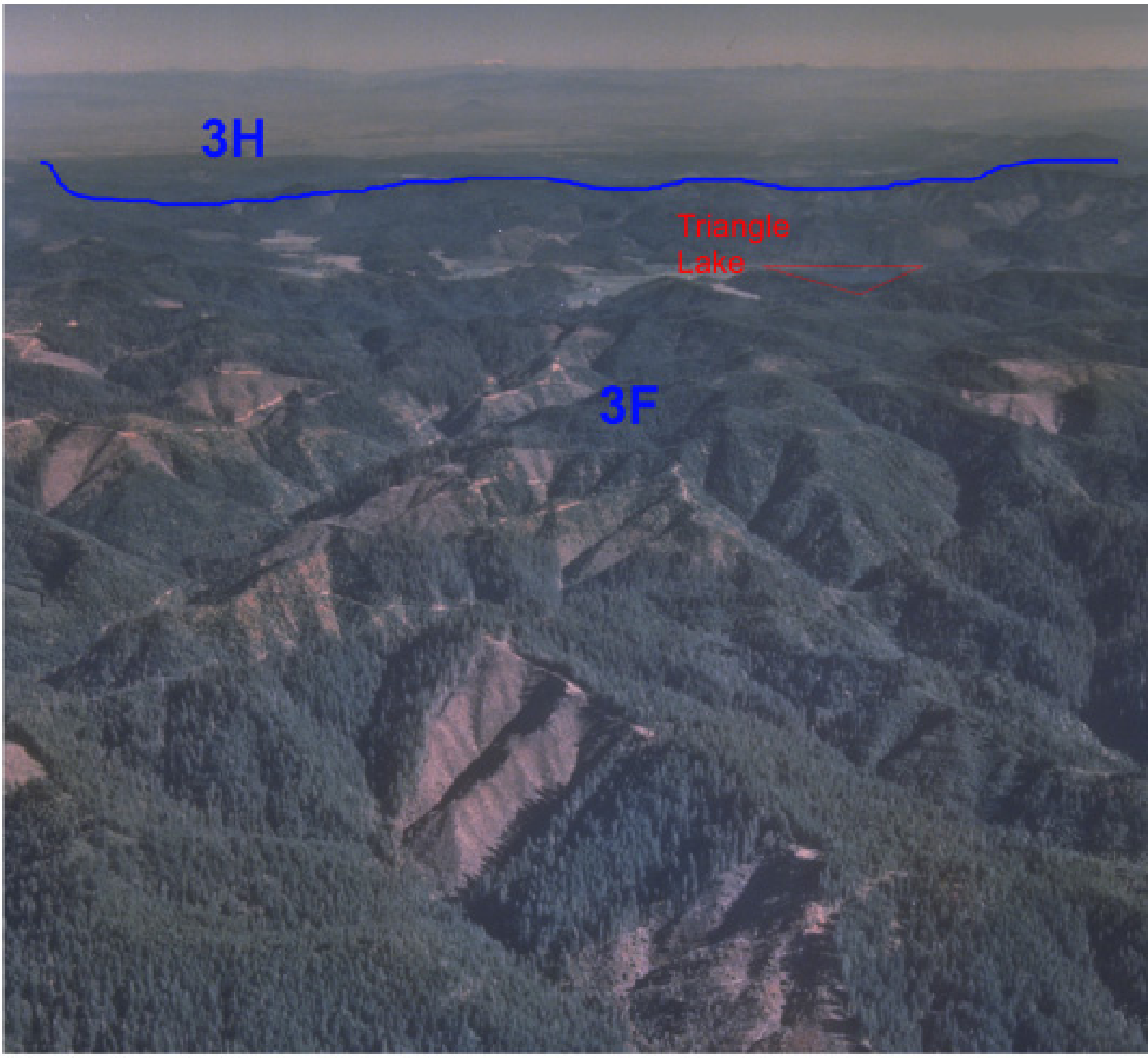
Percent Area by Slope Class:

0-30%:	65.0
30-60%:	30.0
60-90%:	3.7
>90%	0.1

Stream Density: 7.84 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	37.69
1-2%:	5.66
2-4%:	6.81
4-8%:	8.63
8-20%:	27.24
>20%:	13.99



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3F-Fine-textured Fluvial Lands

Steep, highly dissected slopes with sharp ridge lines are characteristic of the landtype association. Triangle Lake is in the background.

Soil Description: Soils are deep on ridge systems to very deep where scattered ancient earth flows occur. Soils range from gravelly loams on steep slopes to clay where deeper soils occur.

Productivity: These soils are moderately productive to very productive. They have moderate water holding capacities. Soil moisture rarely limits plant growth or survival on steep south slopes.

Stability: Steepest, most unstable slopes are on spur ridges below the gently rounded broad ridge systems. Though infrequent, debris slides are the primary hill slope erosion process. Local deep-seated landslides occasionally occur where earth flow terrain is incised by streams.

Climatic Sub-Category: Coastal and Coast Crest--Central Zone

Vegetation Patterns: The eastern edge of this landtype, where the relief is low near the coast, is dominated by the spruce series, and over half of this spruce PAG is in the wet spruce/salmonberry group. Some spruce/salal communities appear along steeper ridges. In the inland half of landtype association 3A, western hemlock appears with salmonberry in valleys and lower slopes, making up almost two thirds of this landtype association. The hemlock/swordfern group is found on over 15% of this landtype association on hillsides. Western hemlock/salal types are a minor part of the landscape, mainly along steep ridge tops.

Landtype Association 3B1

Name: Western Fluvial Lands-Asymetric Ridge Landscape

Total Acres: 29511 **Forest Service Acres:** 25132 (85%)
Location: Contains the western tributary streams to the North Fork Siuslaw River, east of the Rock and Cummins Creek Wilderness areas.

Geologic Category: Coarse-grained sedimentary rocks
Similar LTAs in this category: 3C, 3C1, 3D, 3E, 3F, 4A, 4F, 4G

Geology:
Coarse-grained sedimentary rocks: 100%
Tyee Formation (Tt): 100%

Geomorphology: Steep northeast-facing slopes prone to debris torrents with more gentle southwest facing slopes that are more likely to have slumps and earth flows. The ridges are asymmetric. Major streams flow southeast parallel to the trend of the ridges. This is the only landtype association where the cuestaform landscape is so well developed.

Percent Area by Slope Class:

0-30%:	43.2
30-60%:	51.1
60-90%:	5.6
>90%:	0.1

Stream Density: 6.09 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	7.24
1-2%:	3.86
2-4%:	4.85
4-8%:	9.31
8-20%:	32.53
>20%:	42.21

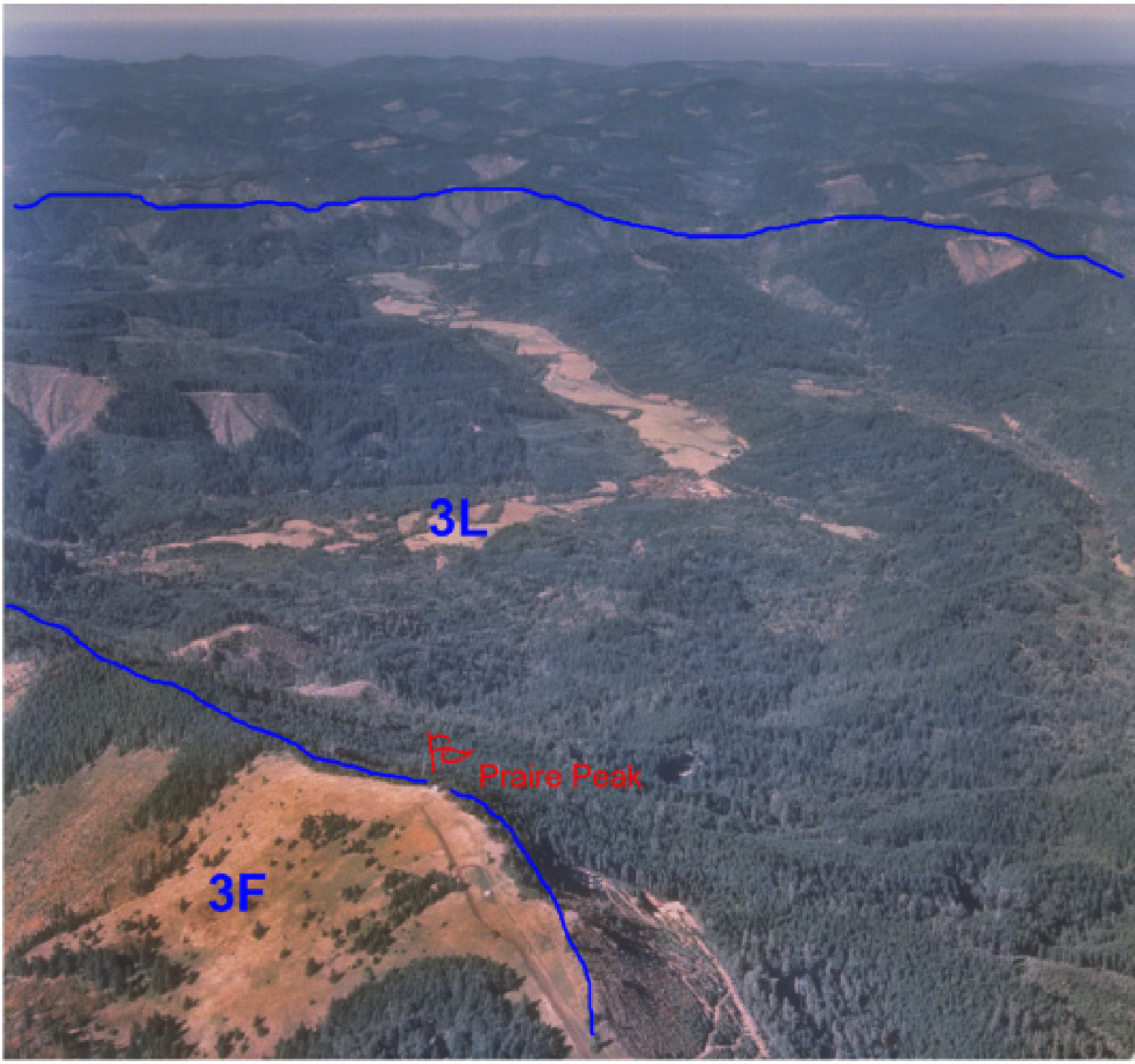
Soil Description: Soils range from shallow on middle to upper slopes and ridge systems to moderately deep in concave slope positions. Soils are very deep over ancient earth flow deposits. Soils are usually gravelly loam to clay loam.

Productivity: Compared to other central Coast Range soils, these soils are moderately productive to very productive, and have high water holding capacities. Soil moisture rarely limits plant growth or survival.

Stability: The steepest, most unstable slopes are on middle to upper portions of narrow spur ridge systems. Debris slides and debris torrents are the primary hill slope erosion processes.

Climatic Sub-Category: Coast Crest--Central Zone

Vegetation Patterns: This landtype association is almost entirely (98%) in the western hemlock series. Minor amounts of spruce are limited to valleys nearest the coast. Western hemlock/salmonberry types are found in large quantities (40%) in the valleys and lower slopes, but hemlock/swordfern communities are dominant, covering almost half of the landtype association. More hemlock/salal types are found in the north portion on southwest aspects along higher ridges.



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3L-Interior Lowlands

Land Type Assessment 3L has more subdued topography and more floodplain development than other landtype associations on the Tyee Formation. Note the gentle slopes and well-developed floodplain of the river.

Landtype Association 3B2 ***Name: Western Fluvial Lands***

Total Acres: 57700 **Forest Service acres:** 49471 (86%)
Location: Northeast of the Cummins and Rock Creek Wilderness areas, southeast of Waldport.

Geologic Category: Coarse-grained sedimentary rocks
Similar LTAs in this category: 3B, 3C, 3D, 3E, 3F, 4A, 4F, 4G

Geology:
Coarse-grained sedimentary rocks: 99%
Tyee Formation (Tt): 99%

Hard volcanic rocks: 1%
Porphyritic basalt (Tpb): 1%

Dominantly Tyee Formation with a small amount of basalt in the northern part.

Geomorphology: Moderate relief with moderate stream density. Debris torrents are the most common type of landslide.

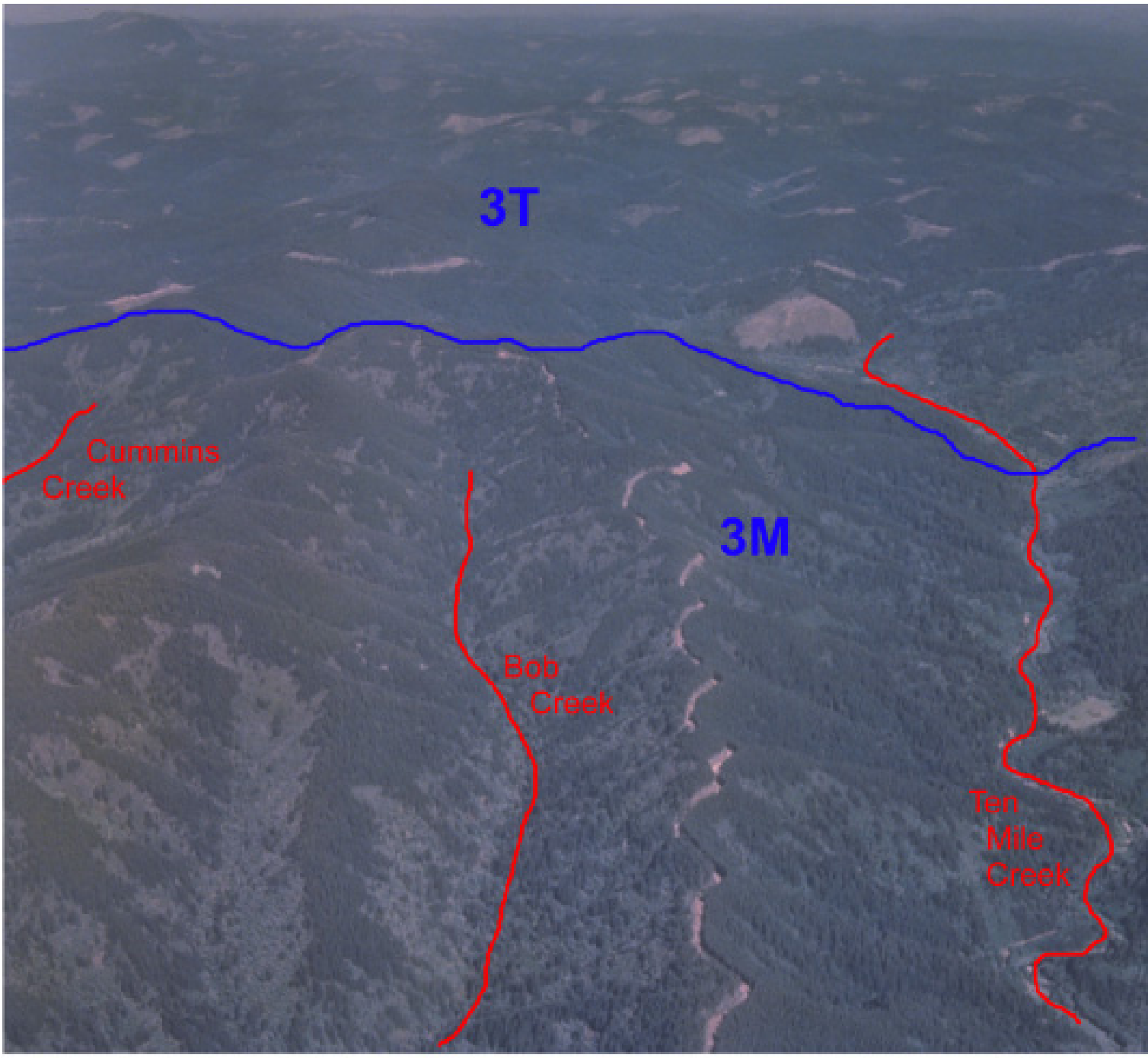
Percent Area by Slope Class:

0-30%:	42.7
30-60%:	52.1
60-90%:	5.2
>90%:	0

Stream Density: 5.78 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	6.96
1-2%:	3.37
2-4%:	5.22
4-8%:	9.87
8-20%:	31.50
>20%:	43.08



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3M-Coastal Headlands in the foreground.
3T-Igneous/Sedimentary Contact Lands in the background

Land Type Assessment 3M has parallel streams and ridges, and a distinctive trellis drainage pattern. Note the steep, liniar tributary streams that enter Bob and Ten Mile Creeks at right angles.

Land Type Assessment 3T has more gentle slopes and a dendritic drainage pattern.

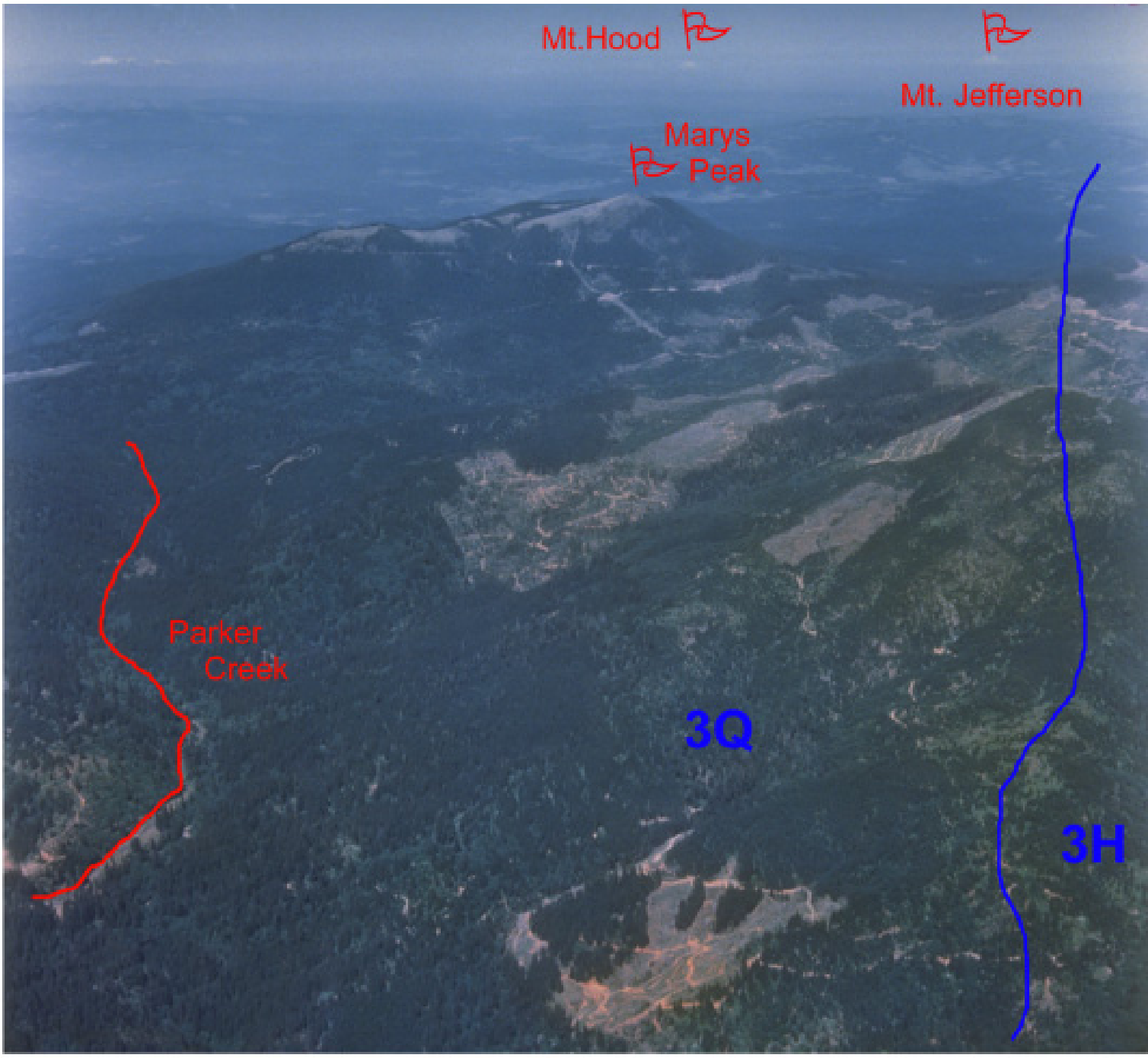
Soil Description: Soils are moderately deep throughout most of the areas underlain by bedrock. Soils range from gravelly loams on steep slopes to clay where deeper soils occur. River terraces and a few ancient earth flows have deep loam to clay loam soils.

Productivity: By central Coast Range standards, soils are moderately productive to very productive. Soil moisture limits plant growth or survival on steep south slopes less than10% of the time.

Stability: The steepest, most unstable slopes are on upper portions of long ridge systems. Debris slides are the primary hill slope erosion process.

Climatic Sub-Category: Coast Crest--Central Zone

Vegetation Patterns: Swordfern (45%) and salmonberry (45%) communities reflect the moderate relief of the fluvial Tyee landtype associations. Spruce communities are restricted to the low-lying Yachats River drainage which allows fog to penetrate eastward. Wet spruce/salmonberry types dominate the west side of 3B2, with spruce/swordfern on lower slopes and spruce/salal types on upper slopes. Western hemlock/salal types may appear near ridges where upper slopes escape fog influence. Inland, 3B2 shows the potential for large patches of western hemlock/salmonberry communities where wide, low gradient valleys have been formed, although valley floors in private lands have largely been converted to other vegetation communities. Lower slopes in warmer aspects are generally western hemlock/swordfern types, with ridges and long southwest slopes supporting hemlock/salal types. This landtype association shows a strong dominance of the western hemlock/swordfern group (44%), typical of the fluvial landtype associations of the Alsea subsection.



5-17-73 Siuslaw National Forest Planning Archive

3Q-Igneous Uplands

Land Type Assessment 3Q is an area of high relief due to igneous intrusions that are more resistant to erosion than the surrounding sedimentary rocks. Marys Peak is underlain by a layer of gabbro, and is the highest peak in the Coast Range.

Landtype Association 3C ***Name: Interior Fluvial Lands***

Total Acres: 62476 **Forest Service Acres**: 53312 (85%)
Location: South of the Alsea River, east of Five Rivers, and north of the Siuslaw River

Geologic Category: Coarse-grained sedimentary rocks
Similar LTAs in this category: 3B, 3C1, 3D, 3E, 3F, 4A, 4F, 4G

Geology:
Coarse-grained sedimentary rocks: 100%
Tyee Formation (Tt): 100%

Geomorphology: Moderate relief with moderate stream density. Very little floodplain development along streams and rivers. Debris torrents are the most common type of landslide. Quaternary river terraces are located along the Siuslaw River in the southern part of the landtype association.

Percent Area by Slope Class:

0-30%:	34.6
30-60%:	53.4
60-90%:	11.7
>90%:	0.4

Stream Density: 5.7 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	10.88
1-2%:	3.36
2-4%:	5.52
4-8%:	10.26
8-20%:	26.62
>20%:	43.34

Soil Description: Soils are moderately deep on ridge systems to very deep where few scattered areas of ancient earth flows occur. Soils range from gravelly loams on steep slopes to clay where deeper soils occur.

> **Productivity:** Compared to other soils in the central Coast Range, these soils are moderately productivity to very productive. They have moderate water holding capacity. Soil moisture limits plant growth approximately 10% of the time.
>
> **Stability:** The steepest, most unstable slopes are on upper portions of long ridge systems. Debris slides are the primary hill slope erosion processes.

Climatic Sub-Category: Coast Crest--Central Zone

Vegetation Patterns: This interior landtype association is entirely within the western hemlock series. Going eastward, salmonberry (20%) is increasingly confined to valley bottoms, though much of the potential salmonberry type is likely to have been converted to agricultural use on private lands. Western hemlock/swordfern (60%) is the dominant type on low ridges and most side slopes, but higher or steeper ridges carry the western hemlock/salal group (over 10%) and western hemlock/rhododendron (4%), especially along the divide between the Indian and Deadwood watersheds and Five Rivers, and in more dissected terrain near McLeod Creek.

Landtype Association 3D ***Name: Central Coast Range Fluvial Lands***

Total Acres: 198828 **Forest Service Acres:** 47240 (24%)
Location: East of landtype association 3Z, the coastal plain. Contains the Yaquina River drainage, the area south of the Siletz River, and the lower part of the Drift Creek of the Alsea drainage.

Geologic Category: Coarse-grained sedimentary rocks
Similar LTAs in this category: 3B, 3C, 3B2, 3E , 3F, 4A, 4F, 4G

Geology:
Coarse-grained sedimentary rocks: 98%
Tyee Formation (Tt): 98%

Soft sedimentary rocks: 2%
Quaternary river terrace deposits (Qt): 2%

Dominated by Tyee Formation.

Geomorphology: This landtype association has lower relief and more floodplain development that other landtype associations underlain by the Tyee Formation.

Percent Area by Slope Class:

0-30%:	52.1
30-60%:	43.5
60-90%:	4.4
>90%:	0.1

Stream Density: 6.17 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	9.12
1-2%:	3.56
2-4%:	6.28
4-8%:	10.86
8-20%:	34.13
>20%:	36.05

Soil Description: Soils are moderately deep on ridge systems to deep on lower side slopes and where scattered ancient earth flows occur. Soils range from gravelly loams on steep slopes to clay loams where deeper soils occur.

Productivity: Soils are moderately productive to productive. They have moderate to high water holding capacities. Soil moisture rarely limits plant growth or survival.

Stability: Steepest, most unstable slopes are on spur ridges below the gently rounded, broad ridge systems. Though infrequent, debris slides are the primary hill slope erosion process. Local deep seated landslides occasionally occur where landslide deposits are incised by streams.

Climatic Sub-Category: Coast Crest--Central Zone

Vegetation Patterns: The vegetation patterns along the western portion are very similar to the western portion of landtype association 3B2, while the central and eastern parts of landtype association 3D resemble 3C's more interior vegetation distribution. The spruce series is found on the coastal side where spruce/salmonberry communities follow fog up the low valleys of Drift Creek, the Alsea River to Tidewater, and the Yaquina River to Elk City. Upper slopes and ridges may have spruce/swordfern or spruce/salal communities, with western hemlock series on higher ridges rising out of the fog influence. In the interior, low wide valleys are in western hemlock/salmonberry types (45%). Western hemlock/swordfern communities are far more common in the upper slopes as western hemlock/salal types due to relatively low relief.

Landtype Association 3E ***Name: Transitional Fluvial Lands***

Total Acres: 44881 **Forest Service Acres**: 8523 (19%)
Location: West of Mary's Peak and south of the Yaquina River.

Geologic Category: Coarse-grained sedimentary rocks
Similar LTAs in this category: 3B, 3C, 3C1, 3D, 3F, 4A, 4F, 4G

Geology:
Coarse-grained sedimentary rocks:
Tyee Formation (Tt): 91%

Hard volcanic rocks: 4%
Dikes and sills of gabbro (Ti): 4%

Mixed volcanics: 3%
Siletz River Volcanics (Tsr): 3%

Soft sedimentary rocks: 1%
Quaternary river deposits (Qal): 1%

Tyee Formation intruded by a small number of dikes and sills made of basalt and gabbro. Quaternary river deposits found along the Alsea River in the southern part of the landtype association.

Geomorphology: High relief and steep slopes. Several of the ridges are underlain by resistant volcanic dikes. Table Mountain in the western part of the landtype association is underlain by an alkalic intrusive rock, syenite, which is highly resistant to erosion and contributes to the high relief.

Percent Area by Slope Class:

0-30%:	37.0
30-60%:	49.1
60-90%:	13.4
>90%:	0.4

Stream Density: 6.31 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	5.35
1-2%:	1.74
2-4%:	3.0
4-8%:	6.14
8-20%:	23.32
>20%:	60.44

Soil Description: Soils are moderately deep on spur ridge systems to very deep on broad, backbone ridges. Soils range from gravelly loams on steep slopes to clay where deeper soils occur.

Productivity: Soils are moderately productive to productive. The have moderate water holding capacities. Soil moisture may limit plant growth or survival on steep south slopes.

Stability: Steepest, most unstable ridges are on spur ridges below the gently rounded broad ridge systems that dominate the landscape. Though infrequent, debris slides are the primary hill slope erosion process.

Climatic Sub-Category: Coast Crest--Central Zone

Vegetation Patterns: The higher and longer slopes of the volcanic intrusions show large patches of the western hemlock/salal group on warm mid-slopes, upper slopes, and broad ridges. Almost a quarter of the area is in the western hemlock/salal group, which is unusually high for this subsection. A small amount of true fir is on the top of Grass Mountain (1%). The wet western hemlock/salmonberry communities are restricted to large low valleys, also reflecting the moderate dissection of landtype association 3E. Western hemlock/swordfern communities (55%) are the most common in the LTA, especially on the lower slopes and cooler exposures. The spruce series is a minor component (1%), and follows the fog into the valley bottom along the middle reaches of the Alsea River near Tidewater.

Landtype Association 3F ***Name: Fine-textured Fluvial Lands***

Total Acres: 186278 **Forest Service Acres:** 26666 (14%)
Location: North of the Siuslaw River, south of Lobster Creek, east of Five Rivers.

Geologic Category: Coarse-grained sedimentary rocks
Similar LTAs in this category: 3B3C, 3C1, 3D, 3E, 4A, 4F, 4G

Geology:
Coarse-grained sedimentary rocks: 91%
Tyee Formation (Tt): 91%

Hard volcanic rocks: 6%
Dikes and sills of gabbro (Ti): 6%

Soft sedimentary rocks: 4%
Quaternary river deposits (Qal): 3%
Quaternary lake and river deposits (Qs): 1%

Tyee Formation, with generally east-west trending dikes of basalt and gabbro. The Quaternary river deposits are in the northeastern part of the landtype association.

Geomorphology: This landtype association is a transition zone from the extremely steep, and very dissected terrain south of the Siuslaw River to the steep, moderately dissected backbone ridge systems to the north. The east-west trending dikes form high ridges that are more resistant to erosion.

Percent Area by Slope Class:

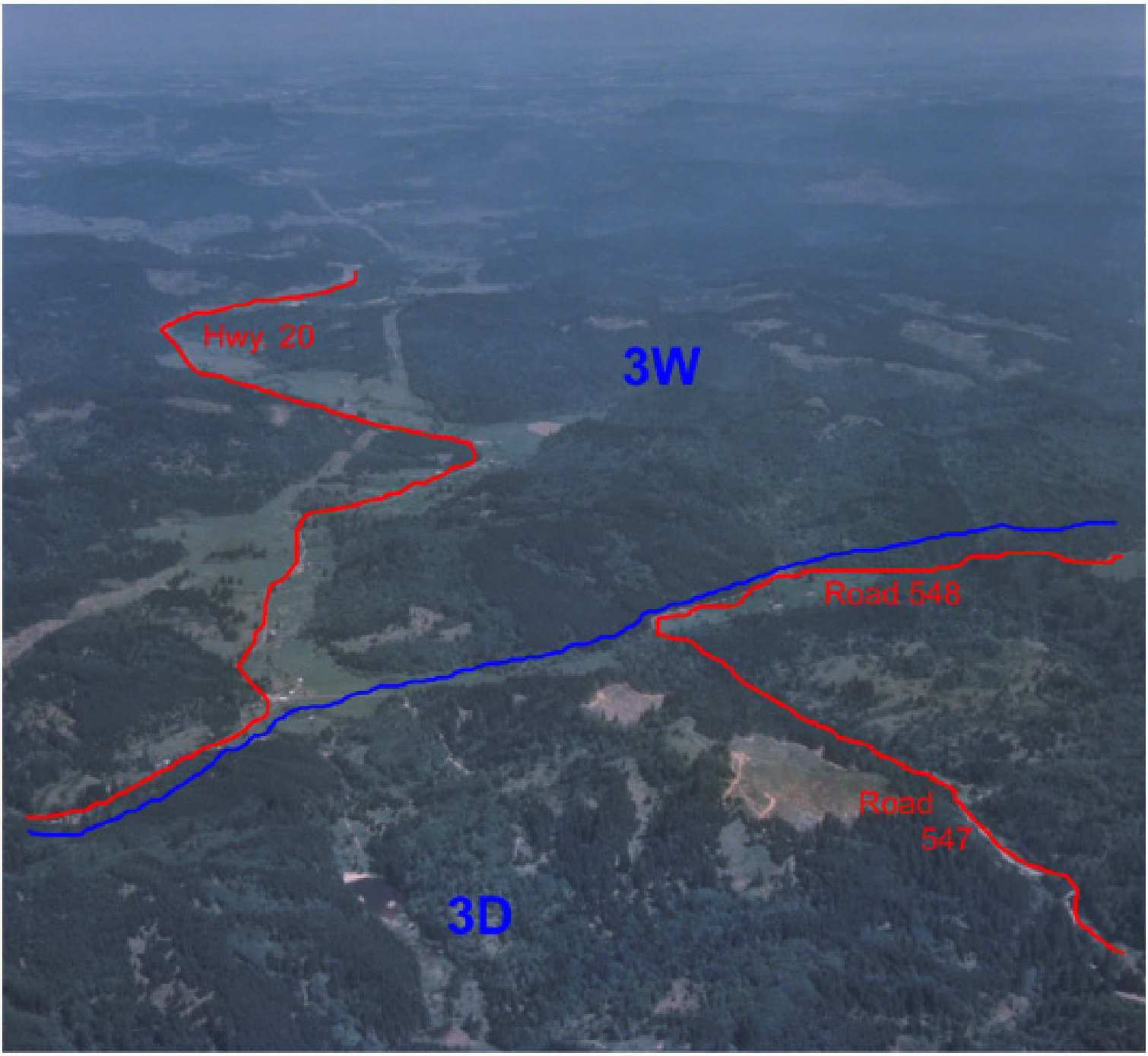
0-30%:	31.3
30-60%:	51.9
60-90%:	16.3
>90%:	0.4

Stream Density: 4.57 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	12.91
1-2%:	2.43
2-4%:	3.91
4-8%:	8.21
8-20%:	25.33
>20%:	47.21

Soil Description: Soils are moderately deep on main ridge systems to shallow on spur ridge crests. There are very deep soils where scattered areas of ancient earth flows occur.



5-17-73 Siuslaw National Forest Planning Archive

3D-Central Coast Range Fluvial Lands in foreground
3W-Low Relief Fluvial Lands in background

Both of these Land Type Associations have lower relief and more gentle topography than many of the land type associations underlain by the Tyee Formation. The broad, flat Willamette Valley can be seen in the distance.

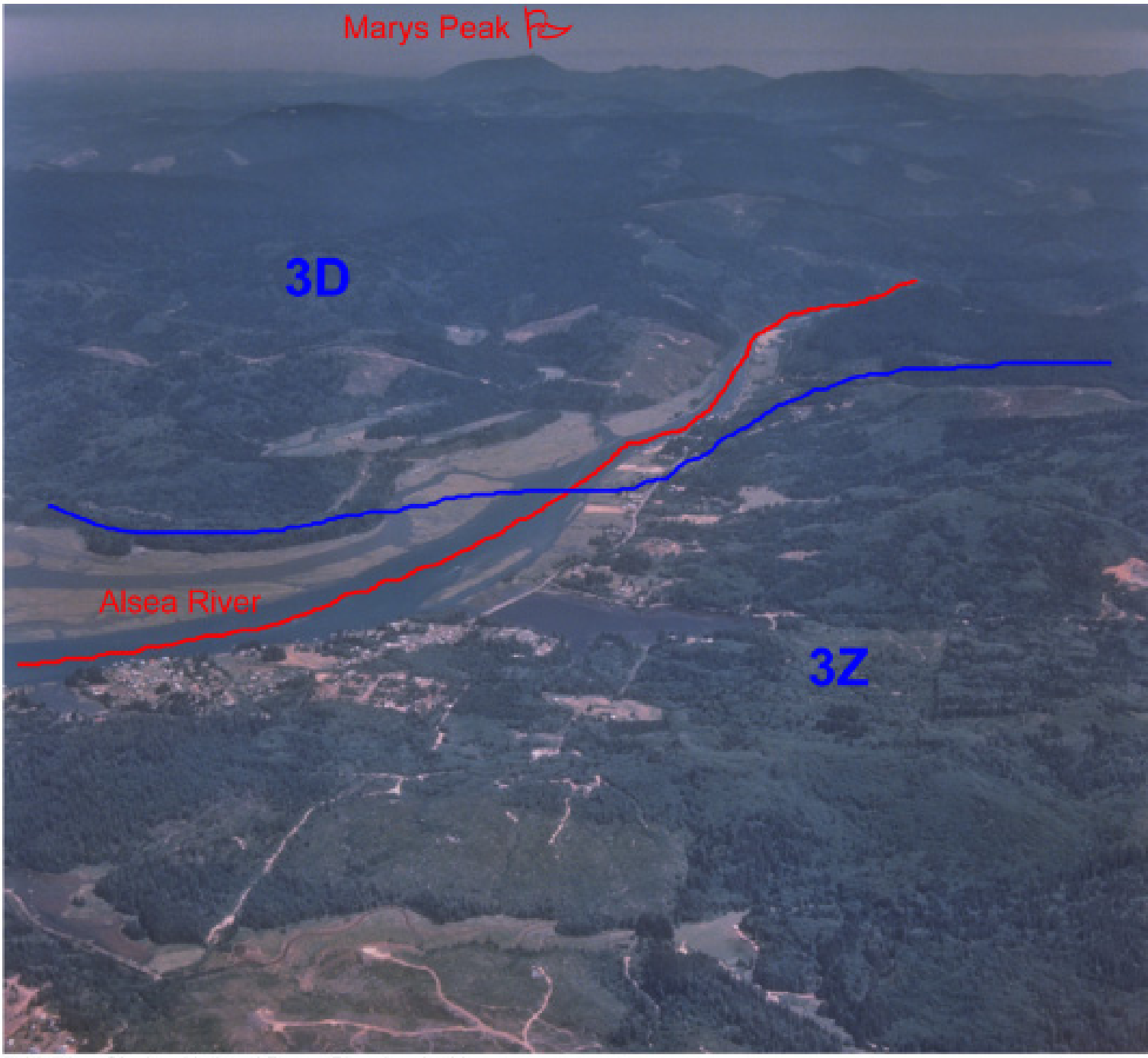
Soils range from gravelly loams on steep slopes to gravelly clay loams where deeper soils occur.

Productivity: Compared to other soils in the central Coast Range, these soils are moderately productive. They have low to moderate water holding capacities. Soil moisture frequently limits plant growth or survival on all but northern slopes.

Stability: Steepest, most unstable slopes are on the middle to upper portions of the spur ridge systems. Debris slides and debris torrents are the primary hill slope erosion processes.

Climatic Sub-Category: Coast Crest--Southern Zone

Vegetation Patterns: The vegetation pattern is similar to other Alsea subsection Tyee landtype associations, with western hemlock/salal groups present mainly on upper slopes or warm mid slopes along the pronounced ridge systems. Wet western hemlock /salmonberry communities (5%) are found in the valley bottoms and foot slopes along the Siuslaw River and Deadwood drainages, but become more restricted to creek side surfaces in the drier eastern portion of the landtype association. The grand fir series (5%) may appear at the margins of the Willamette Valley at elevations less than 800 feet. Western hemlock/rhododendron communities (5%) may be found on the ridge tops or appear on steep dry sites on the south end of landtype 3F, and on the north end of 3F minor amounts of true fir may cap the Prairie Mountain ridge.



7-28-73 Siuslaw National Forest Planning Archive

3Z-Coastal Lowlands (mixed sedimentary) in the forground
3D-Central Coast Range Fluvial Lands in the background

Land Type Association 3Z has very low relief compared with Land Type Association 3D.

Landtype Association 3H ***Name: Sedimentary Valley Borderlands***

Total Acres: 126508 **Forest Service Acres**: 36
Location: Southeast of Mary's Peak.

Geologic Category: Coarse-grained sedimentary rocks and volcanics (Tyee Sandstone intruded by volcanic dikes)
Similar LTAs in this category: 4R, 3R, 3L

Geology:
Coarse-grained sedimentary rocks: 54%
Tyee Formation (Tt): 54%

Soft sedimentary rocks: 33%
Tuffaceous siltstone and sandstone (Tss): 23%
Quaternary river deposits (Qal); 6%
Quaternary lake and river deposits (Qs): 3%
Quaternary river terrace deposits (Qt): 1%

Hard volcanic rocks: 13%
Dikes and sills of gabbro (Ti): 13%

Tyee Formation with tuffacous siltstone and sandstone along the eastern edge that borders the Willamette Valley. Scattered intrusions of basalt and gabbro.

Geomorphology: Gently rolling to gentle to moderately steep hills and broad valleys adjacent to the Willamette Valley.

Percent Area by Slope Class:

0-30%:	76.6
30-60%:	21.9
60-90%:	1.5
>90%:	0

Stream Density: 2.46 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	5.8
1-2%:	4.9
2-4%:	8.08
4-8%:	15.81
8-20%:	47.93
>20%:	18.20

Soil Description: Soils are moderately deep. Soils range from gravelly clay loams on steeper slopes to gravelly clays on lower slope positions.

5-4-74 Siuslaw National Forest Planning Archive

4X-Eolian Coastal Dunes in the foreground
4A-Coastal Lakes and Dunes in the background

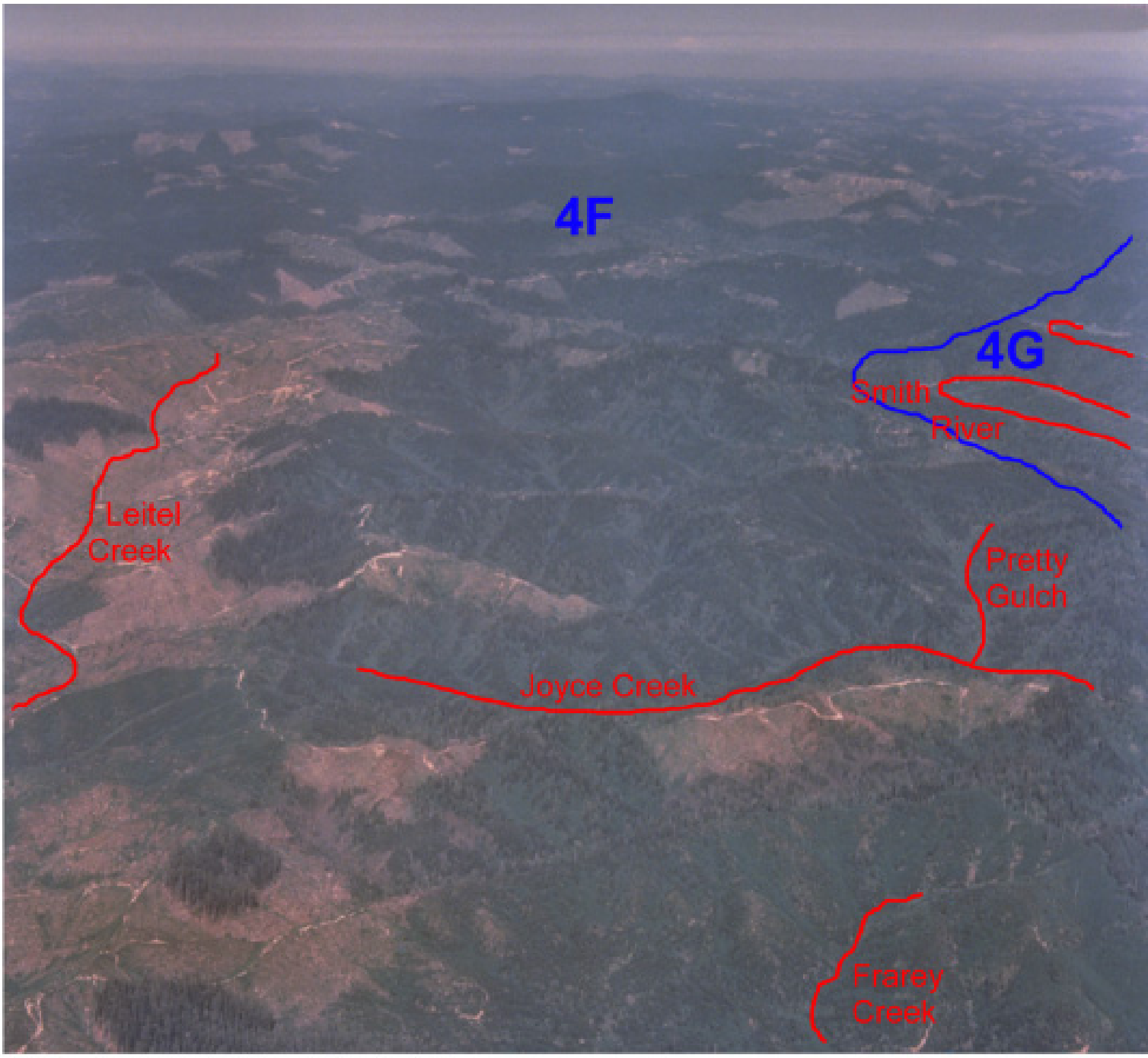
Both Land Type Association 4X and 4A have low relief and gentle topography. Land Type Association 4X is dominated by the active dune sheet along the coast. Note the small lakes that are nestled between the sand dunes. Land Type Association 4A is characterized by large coastal lakes, gentle topography and a high streem density.

Productivity: Compared to other soils in the central coast Range, these soils are moderately productive. They have moderately high to high water holding capacities. Soil moisture limits plant growth on south facing upper side slopes most years.

Stability: Unstable soils are not common, but may occur on lower mid slopes above incised channels and upper convex side slopes. Earth flow terrain is not common. Slumps and fluvial channel erosion are the primary hill slope erosion processes.

Climatic Sub-Category: Valley Border

Vegetation Patterns: The Alsea subsection borderlands are dominantly western hemlock forest (45%), with about 30% in the Douglas-fir and 15% in the grand fir series. Non-forested vegetation (2%), now mainly converted to agricultural use, follows Greasy Creek up to the east of Mary's Peak. The western hemlock/swordfern group covers 20% of the area. Since the landtype association is mostly in the rain shadow of the Coast Range, the hemlock/swordfern types are scattered in valley bottoms, toe slopes, and lower slopes. Upper slopes, mid slopes, and dry lower slopes are generally in the hemlock/salal group. Immediately adjacent to the valley, the grand fir series appears on low elevation slopes on the eastern edge of this landtype.



5-4-74 Siuslaw National Forest Planning Archive

4F-Fine-textured Fluvial lands

Land Type Association 4F is similar to 4G, however, the degree of dissection by streams is slightly less.

Landtype Association 3L ***Name: Interior Lowlands***

Total Acres: 42132 **Forest Service Acres:** 540 (1.3%)
Location: South of Mary's Peak, contains the confluence of the North and South Forks of the Alsea River, and the town of Alsea.

Geologic Category: Siletz River Volcanics and sedimentary rocks
Similar LTAs in this category: 3R, 3H, 4R.

Geology:
Coarse-grained sedimentary rocks: 72%
Tyee Formation (Tt): 72%

Mixed volcanics: 18%
Siletz River Volcanics (Tsr): 18%

Hard volcanic rocks: 6%
Dikes and sills of gabbro (Ti): 6%

Soft sedimentary rocks: 4%
Quaternary river deposits (Qal): 4%

Tyee Formation, Siletz River Volcanics, some dikes and sills of basalt, and Quaternary alluvium.

Geomorphology: The Alsea River Valley is the broadest in this landtype association. Gentle to moderate relief, broad river valleys, and moderate stream density.

Percent Area by Slope Class:

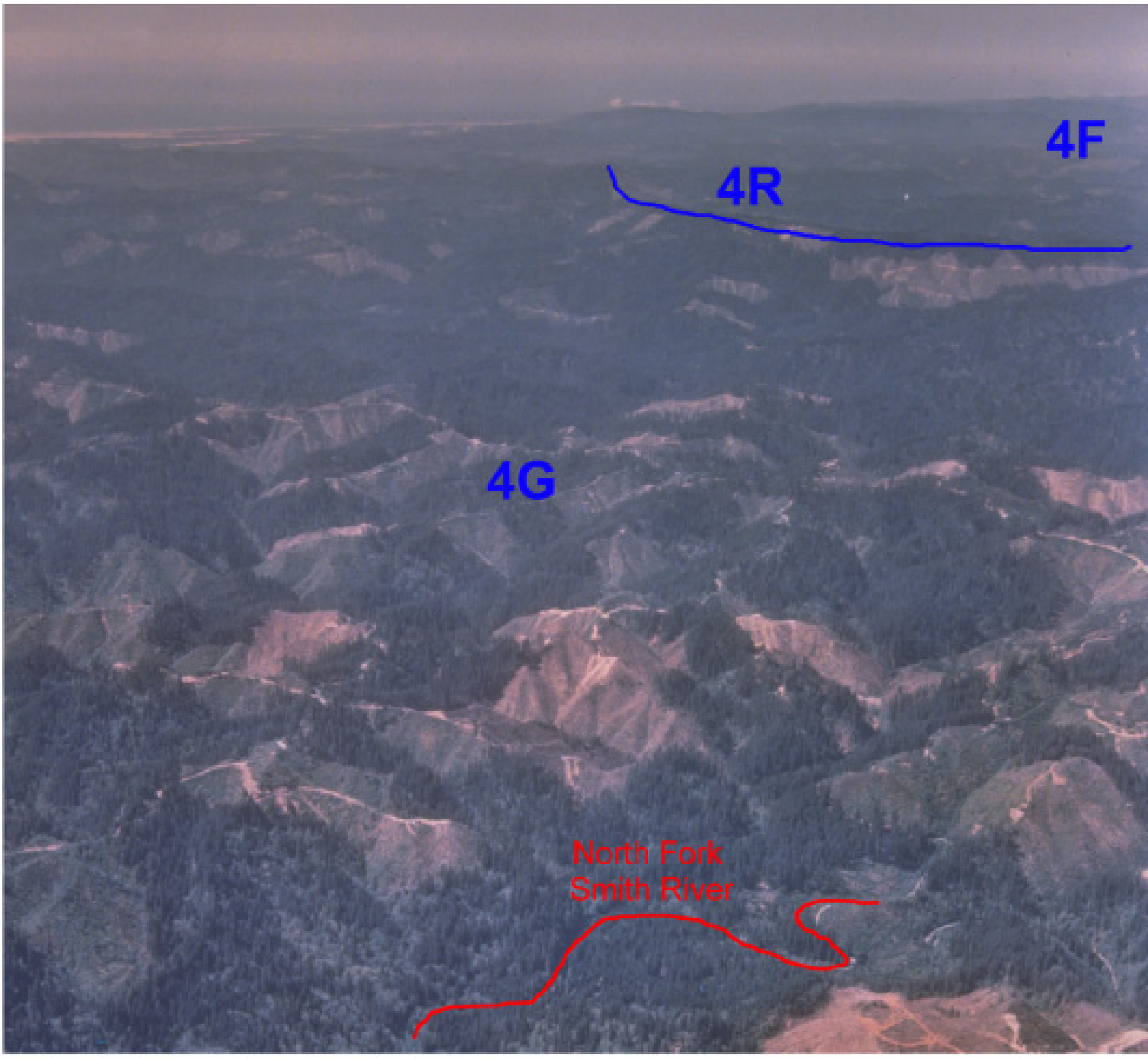
0-30%:	64.0
30-60%:	33.3
60-90%:	2.7
>90%:	0

Stream Density: 6.12 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	10.11
1-2%:	6.21
2-4%:	7.19
4-8%:	9.63
8-20%:	35.67
>20%:	31.17

Soil Description: Soils are deep to very deep on gently rolling hills and broad, undulating valleys. Soils are moderately deep on ridges to very deep on valley bottoms.



5-4-74 Siuslaw National Forest Planning Archive

4G-Very Fine-textured Fluvial Lands in foreground
4R-Intrusive Table Lands in background

This photo illustrates the high degree of dissection of the landscape by stream channels, the steep slopes and the sharp ridges characteristic of Land Type Association 4G. Debris torrents can be seen in several ofthe harvest units.

The prominent, linear ridge that is held up by a basaltic dike can be seen in the upper part of the photo in Land Type Association 4R

Soils range from gravelly loams on steep slopes to gravelly clay loams on lower slope and valley positions.

Productivity: These soils are moderately productive. They have moderately high water holding capacities. Soils moisture may limit plant growth during dry summers, and in all summers on south slopes.

Stability: Unstable soils are not common. They may occur on lower mid slopes above incised channels and rarely on upper convex side slopes. Fluvial erosion in channels in the primary hill slope erosion process.

Climatic Sub-Category: Coast Crest--Central Zone

Vegetation Patterns: This interior landtype association is almost entirely within the western hemlock series. Western hemlock/salmonberry types follow the valleys of Lobster, Little Lobster, and Bummer Creeks, and account for 20% of the area. This amount of the western hemlock/salmonberry group is high for the landtype associations found on Tyee Formation, but reflect the lowland nature of landtype association 3L. Much of the valley land is in private ownership, and has been converted to other vegetation types. The eastern half of 3L has little of the hemlock/salmonberry, with the hemlock/swordfern group (60%) replacing it in riparian areas and valley bottoms. The hemlock/salal group (10%) is more common in the higher, drier portions of the landtype association near Prairie Peak and to the east, closer to the valley on mid and upper slopes and ridges. Minor amounts of true fir are found on top of Prairie Mountain (less than 1%).

Landtype Association 3M ***Name: Igneous Headlands***

Total Acres: 42483 **Forest Service Acres:** 37386 (88%)
Location: North of Florence, south of Waldport, contains the Rock and Cummins Creek Wilderness areas, and Cape Perpetua.

Geologic Category: Erosion-resistant (hard) volcanics
Similar LTAs in this category: 2M, 3T

Geology:
Hard volcanic rocks: 96%
Porphyritic basalt (Tpb): 96%

Soft sedimentary rocks: 1%
Tuffaceous siltstone and sandstone (Tss): 1%

Coarse-grained sedimentary rocks: 3%
Tyee Formation (Tt): 3%

Predominantly porphyritic basalt, with a small amount of sedimentary rocks along the northeastern edge.

Geomorphology: Forms the rugged coastal headlands of the Cummins Creek-Rock Creek area. High relief, with high gradient streams. The jointing in the basalt produces trellis drainage patterns. As a result, steep tributaries join mainstem streams at acute angles, and debris torrents tend to be deposited at stream junctions, rather than traveling down the mainstem.

Percent Area by Slope Class:

0-30%:	24.7
30-60%:	58.2
60-90%:	16.8
>90%:	0.2

Stream Density: 5.95 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	4.11
1-2%:	1.98
2-4%:	2.58
4-8%:	5.85
8-20%:	21.22
>20%:	64.0

Soil Description: Soils are deep on ridge systems and very deep in concave middle and lower slope positions. Soils range from gravelly clay loams on steep slopes to clay where deeper soils occur.

> **Productivity:** Compared to other soils in the central Coast Range, soils are very productive. They have very high water holding capacities. Soil moisture probably never limits plant growth or survival.
>
> **Stability***:* Steepest, most unstable slopes are on middle to upper portions of spur ridge systems. Debris slides and debris torrents are the primary hill slope erosion process**.**

Climatic Sub-category: Coastal

Vegetation Patterns: Fog moving up the straight, narrow valleys of the coastal headlands is limited by the steep rise of the upper drainages. The spruce zone is restricted by these landforms to the lower reaches where spruce/salmonberry types (15%) cover the valley floor and lower slopes, while spruce/swordfern communities (15%) climb the mid slopes and cooler upper slopes. Warm upper slopes and ridges, even relatively near the coast, are covered by the western hemlock/salal group (20%). The upper drainages of Cummins, Ten Mile, Rock and Big Creeks are beyond the major fog zone, and are dominated by western hemlock/salal group, with western hemlock/swordfern types (35%) on lower slopes and wet types a fairly minor component along headwater streams or intermittent streams.

Landtype Association 3Q ***Name: Igneous Uplands***

Total Acres: 35381 **Forest Service Acres**: 8574 (24%)
Location: Area surrounding and including Mary's Peak.

Geologic Category: Siletz River Volcanics
Similar LTAs in this category: 2P2, 2PSR1, 2PSR2, 2PSR3, 3S

Geology:
Mixed volcanics: 78%
Siletz River Volcanics (Tsr): 78%

Coarse-grained sedimentary rocks: 11%
Tyee Formation (Tt): 11%

Hard volcanic rocks: 7%
Dikes and sills of gabbro (Ti): 7%

Soft sedimentary rocks: 4%
Quaternary river deposits (Qal): 3%
Quaternary landslide deposits (Qls): 1%

Geomorphology: Hummocky terrain occurs on little more than one third of the landtype association. The area has high relief; Mary's Peak is the highest point in the Coast Range.

Percent Area by Slope Class:

0-30%:	48.7
30-60%:	46.1
60-90%:	5.2
>90%:	0

Stream Density: 6.82 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	3.41
1-2%:	2.07
2-4%:	4.35
4-8%:	8.19
8-20%:	32.48
>20%:	49.50

Soil Description: Soils are deep to very deep on hummocky, incised ancient earth flows, and moderately deep on remnant bedrock ridge systems. Soils range from gravelly clay loams on steep slopes to gravelly clay where soils are very deep.

Productivity: Soils are moderately productive. They have high to very high water holding capacities. Soil moisture is rarely limiting.

Stability: Unstable soils are on lower mid slopes above incised channels and on upper mid slopes that are earth flow escarpment faces. Unstable soils may also occur on steep headwalls on the upper backbone ridge systems that dominate the higher elevations. Slumps and small earth flows are the primary hill slope erosion processes at lower elevations. Debris slides occur infrequently at higher elevations.

Climatic Sub-Category: Coast Crest-Central Zone

Vegetation Patterns: The Mary's Peak rises into the true-fir series at about 3400 feet on cool aspects, but is mostly in the western hemlock PAGs. The top of the peak is in open meadows. The moist peak communities (noble fir with Oregon oxalis, and starry solomon's seal) show a cloud forest effect. Below the highest elevations, the western hemlock/salal group is dominant (one third of the area) on long upper slopes and mid slopes, with hemlock/swordfern types (half the area) on gentle/lower slopes and near creeks. Western hemlock/salmonberry types are generally minor (over 5%) beyond creek banks. The grand fir series is found on the foot slopes of Mary's Peak below 800 feet.

Landtype Association 3R ***Name: Intrusive Tablelands***

Total Acres: 78029 **Forest Service acres**: 0
Location: North of landtype association 3D, contains the abandoned town of Valsetz and Valsetz Lake.

Geologic Category: Coarse-grained sedimentary rocks and volcanics (Tyee Sandstone intruded by volcanic dikes)
Similar LTAs in this category: 3H, 4R, 3L

Geology:
Coarse-grained sedimentary rocks: 85%
Tyee Sandstone (Tt): 85%

Hard volcanic rocks: 8%
Dikes and sills of gabbro (Ti): 8%

Soft sedimentary rocks: 6%
Quaternary alluvium (Qal): 3%
Quaternary landslide deposits (Qls): 3%

Tyee Formation with intrusions of basaltic dikes.

Geomorphology: South half of landtype association has resistant dikes which produced moderately high relief. The north half has relatively low relief with broad river valleys.

Percent Area by Slope Class:

0-30%:	52.63
30-60%:	41.61
60-90%:	5.72
>90%:	0.16

Stream Density: 6.56 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	6.22
1-2%:	2.86
2-4%:	4.77
4-8%:	10.57
8-20%:	39.46
>20%:	36.10

Soil Description: Soils are moderately deep on spur ridge systems to very deep on broad, backbone ridges. Soils range from gravelly loams on steep slopes to clay where deeper soils occur.

Productivity: Soils are moderately productive to productive. They have moderate water holding capacities. Soil moisture may limit plant growth or survival on steep south slopes.

Stability: Steepest, most unstable ridges are on spur ridges below the gently rounded broad ridge systems that dominate the landscape. Though infrequent, debris slides are the primary hill slope erosion process.

Climatic Sub-Category: Coast Crest--Central Zone

Vegetation Patterns: The western hemlock/salal group follows the igneous intrusions in this landtype association to form large patches, making up a high percentage (11%) of the drier types for the core of the Central Coast Range (compare to landtype association 3D on the Tyee Formation just to the south). Western hemlock/salmonberry types (over 20%) are found in the major drainages of the Siletz River near Valsetz, and the upper reaches of the Rock Creek watershed. The salmonberry types also follow smaller creeks up the slopes, and fragment the hemlock/swordfern types (over 60%), which form the matrix of landtype association 3R.

Landtype Association 3S ***Name: Igneous Valley Borderlands***

Total Acres: 83874 **Forest Service acres**: 1498 (2%)
Location: Area northeast of Mary's peak

Geologic Category: Siletz River Volcanics
Similar LTAs in this category: 2P2, 2PSR1, 2PSR2, 2PSR3, 3Q

Geology:
Mixed volcanics: 96%
Siletz River Volcanics (Tsr): 96%

Soft sedimentary rocks: 3%
Quaternary river deposits (Qal): 1%
Quaternary lake and river deposits (Qs): 1%
Quaternary river terrace deposits (Qt): 1%

Hard volcanic rocks: 1%
Dikes and sills of gabbro (Ti): 1%

Siletz River Volcanics with a small amount of Quaternary alluvium

Geomorphology: Gentle hills with low to moderate relief. Has more relief than the sedimentary valley borderlands, 3H and 2H, because of the more resistant volcanic bedrock.

Percent Area by Slope Class:
0-30%: 84.5
30-60%: 15.2
60-90%: 0.3
>90%: 0

Stream Density: 5.07 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):
0-1%: 6.16
1-2%: 5.67
2-4%: 11.52
4-8%: 18.95
8-20%: 40.56
>20%: 17.14

Soil Description: Soils are deep to very deep on hummocky, incised ancient earth flows and moderately deep on remnant bedrock ridge systems. Soils range from gravelly clay loams on steep slopes to gravelly clay where deeper soils occur.

Productivity: Compared to other soils in the central Coast Range, these soils are very productive. They have high to very high water holding capacities. Soil moisture is limiting only on upper south facing bedrock side slopes.

Stability: Unstable soils are on lower mid slopes above incised channels and on upper mid slopes that are earth flow escarpment faces. Slumps and small earth flows are the primary hill slope erosion process.

Climatic Sub-Category: Valley Border

Vegetation Patterns: The grand fir series (20%) and Douglas-fir series (almost 30%) is generally found on low elevation hills and lower slopes bordering the Willamette Valley, with valley bottom vegetation such as oak woodlands in broad valleys. The western hemlock/salal group (15%) is found along ridges. The western hemlock/swordfern group (over 10%) is found in narrower valleys, on toe slopes and on cool lower slopes. Western hemlock/salmonberry types (1%) are very minor, occurring on moist sites or creek banks.

Landtype Association 3T ***Name: Igneous/Sedimentary Contract Lands***

Total Acres: 23609 **Forest Service Acres**: 19053 (81%)
Location: Headwaters of Rock and Cummins Creeks, east of 3M, the igneous headlands.

Geologic Category: Erosion-resistant (hard) volcanics
Similar LTAs in this category: 2M, 3M

Geology:
Hard volcanic rocks: 68%
Porphyritic basalt (Tpb): 68%

Coarse-grained sedimentary rocks: 25%
Tyee Formation (Tt): 25%

Soft sedimentary rocks: 4%
Quaternary alluvium (Qal): 3%
Alsea Formation (Ta): 3%
Tuffaceous siltstone and sandstone (Tss): 1%

Combination of volcanic and sedimentary rocks.

Geomorphology: Plateau-like area with low to moderate relief in the headwaters of the Rock and Cummins Creeks. It has dendritic drainage, as compared to the trellis drainage to the west in landtype association 3M.

Percent Area by Slope Class:

0-30%:	61.4
30-60%:	35.8
60-90%:	2.7
>90%:	0.1

Stream Density: 6.63 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	2.03
1-2%:	0.96
2-4%:	2.9
4-8%:	9.9
8-20%:	41.83
>20%:	42.38

Soil Description: Soils are deep to very deep on hummocky, incised ancient earth flows and moderately deep on bedrock ridge systems.

Productivity: Soils are very productive. They have moderately high to high water holding capacities. Soil moisture is limiting only on upper south-facing bedrock side slopes.

Stability: Unstable soils are on lower mid slopes above incised channels and on upper mid slopes that are ancient earth flow escarpment faces. Although earth flow terrain is the minor landform, slumps and small earth flows are the primary hill slope erosion process.

Climatic Sub-Category: Coastal and Coast Crest--Central Zone

Vegetation Patterns: Although the more eastern, inland part of landtype association 3T is close to the coast, it is perched above the fog influence zone, and is therefore mostly in the western hemlock series. The low to moderate relief limits the amount of western hemlock/salal group to approximately 10% of the landtype association's area. Western hemlock/rhododendron (12%) is found on the drier high peaks. The western hemlock/swordfern group (over 40%) is found on the gentle and/or lower slopes. Western hemlock/salmonberry (12%) is concentrated along the mainstems of the major creeks. This distribution stands in contrast to the more dissected landtype associations found on the Tyee Formation to the east.

The unit of 3T that lies on the coast resembles landtype association 3M. It shows a similar increase in spruce/salal communities, compared to other coastal landtype associations, due to the dominance of the igneous ridges.

Landtype Association 3W ***Name: Low-Relief Fluvial Lands***

Total Acres: 64641 **Forest Service Acres**: 63
Location: North of Mary's Peak

Geologic Category: Fine-grained and coarse-grained sedimentary rocks
Similar LTAs in this category: 3A, 4J, 4X

Geology:
Coarse-grained sedimentary rocks: 88%
Tyee Formation (Tt): 88%

Soft sedimentary rocks: 10%
Quaternary river deposits (Qal): 8%
Quaternary lake and river deposits (Qs): 2%

Mixed volcanics: 2%
Siletz River Volcanics (Tsr): 2%

Tyee Formation, with Quaternary alluvium in broad river valleys.

Geomorphology: Low, gentle relief with broad valleys.

Percent Area by Slope Class:

0-30%:	83.2
30-60%:	16.4
60-90%:	0.4
>90%:	0

Stream Density: 7.01 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	16.31
1-2%:	6.21
2-4%:	9.68
4-8%:	16.66
8-20%:	40.78
>20%:	10.36

Soil Description: no data

Productivity: no data

Stability: no data

Climatic Sub-Category: Valley Border

Vegetation Patterns: The low relief of this inland landtype association is expressed in the dominance of the western hemlock/swordfern group (60% of the area). Most landtype associations along the gentle eastern side of the Coast Range, such as landtype association 3W, have proportionately more area in the western hemlock/salal group. The western hemlock/salal group (over 6% of the area) is found on warmer mid slopes, upper slopes and ridges, while a scattering of grand fir series (4%) is on very low elevation warmer lower slopes near the valley margin. Hemlock/salmonberry (15%) is mostly restricted to moist sites and creek banks.

Landtype Association 3Z ***Name: Coastal Lowlands (mixed sedimentary)***

Total Acres: 169201 **Forest Service Acres**: 15726 (9%)
Location: Coastal lowlands that reach from Lincoln City to south of Waldport. The southern boundary is landtype association 3M, the coastal headlands of the Cummins and Rock Creek Wilderness areas.

Geologic Category: Fine-grained sedimentary rocks
Similar LTAs in this category: 2Z, 2H, 2Y

Geology:
Soft sedimentary rocks:
Yaquina Formation (Tyq): 20%
Quaternary river terrace deposits (Qt): 14%
Alsea Formation (Ta): 13%
Tuffaceous siltstone and sandstone (Tss): 10%
Marine sedimentary rocks (Tms): 9%
Yamhill Formation (Ty): 7%
Quaternary lake and river deposits (Qs): 7%
Quaternary river deposits (Qal): 1%

Coarse-grained sedimentary rocks: 8%
Tyee Formation (Tt): 8%

Hard volcanic rocks:
Porphyritic basalt (Tpb): 5%
Columbia River Basalts (Tc): 1%

Mixed volcanics:
Siletz River Volcanics (Tsr): 1%
Sand dunes (Qd): 1%

Water: 5%

Quaternary alluvium along the Siuslaw, Alsea and Yaquina rivers. Easily erodable sedimentary formations have a north-south trend (strike), and outcrop in relatively narrow bands north of the volcanic headlands around Cape Perpetua.

Geomorphology: Low, gentle relief.

Percent Area by Slope Class:

0-30%: 81.6
30-60%: 17.8
60-90%: 0.6
>90%: 0

Stream Density: 7.89 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):
0-1%: 33.61
1-2%: 7.35
2-4%: 11.17
4-8%: 14.49
8-20%: 27.27
>20%: 6.21

Soil Description: Soils are deep to very deep on low relief, gently rolling hills and wide valleys. Soils are deep in lower slopes and valley bottoms to moderately deep on bedrock ridge systems at higher elevations. Soils range from clay loams to gravelly clay loams to sandy loams.

Productivity: Soils are very productive. Water holding capacity is high. Soil moisture probably never limits plant growth.

Stability: Unstable soils are not common. They may occur on lower mid slopes above incised channels. Although ancient earth flow terrain is common, slumps and small earth flows are uncommon. Fluvial erosion in channels is the primary hill slope erosion process.

Climatic Sub-Category: Coastal

Vegetation Patterns: Spruce/salmonberry types dominate this low elevation, low relief coastal landtype association and cover almost half of the area. Low, gentle terrain limits spruce/salal communities (10%) to warm aspects of mid slopes or to upper slopes of higher ridges, while the western hemlock series (25%) occurs where ridges pop out of the fog influence. Lodgepole pine may be found on the extreme coastal edge.

Landtype Association 4A ***Name: Coastal Hills and Lakes***

Total Acres: 61267 **Forest Service Acres**: 7961 (13%)
Location: East of and adjacent to the Oregon Dunes National Recreation Area (landtype association 4X)

Geologic Category: Coarse-grained sedimentary rocks
Similar LTAs in this category: 3B, 3C, 3C1, 3D, 3E, 3F, 4F, 4G

Geology:
Coarse-grained sedimentary rocks: 84%
Tyee Formation (Tt): 84%

Soft sedimentary rocks: 4%
Quaternary river deposits (Qal): 2%
Quaternary river terrace deposits (Qt): 2%

Water: 10% freshwater lakes

Mostly Tyee Formation.

Geomorphology: Coastal lakes present. Relatively low relief, highly dissected by streams.

Percent Area by Slope Class:

0-30%:	63.6
30-60%:	34.3
60-90%:	2.1
>90%:	0

Stream Density: 8.71 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	51.54
1-2%:	3.76
2-4%:	5.57
4-8%:	8.48
8-20%:	20.39
>20%:	10.26

Soil Description: Soils are moderately deep to deep on ridge systems to very deep where scattered ancient earth flows are present. Soils range from gravelly loams on steep slopes to gravelly clay loams where deeper soils occur.

Productivity: Soils are moderately productive to very productive. They have moderate to high water holding capacities. Soil moisture rarely limits plant growth or survival.

Stability: Though infrequent, debris slides are the primary hill slope erosion process. Local deep-seated landslides occasionally occur where earth flow terrain is incised by streams.

Climatic Sub-Category: Coastal

Vegetation Patterns: Low relief, lake influences, and a high stream density mean that this coastal area is predominantly in the salmonberry vegetation type (western hemlock/salmonberry 55%, spruce/salmonberry 28%). Hill slopes are generally spruce/swordfern types, with steep upper slopes or ridge tops showing a minor amount of spruce/salal communities or western hemlock/swordfern. Where the spruce series grows on ancient dunes sheets, dry spruce types reflect water holding limitations of the substrate. Lodgepole pine may be present on the dunes side of landtype association 4A.

Landtype Association 4F ***Name: Fine-textured Fluvial Lands***

Total Acres: 99694 **Forest Service Acres**: 42423 (43%)
Location: East of landtype association 4A, the coastal lakes and hills. The northern part contains the mainstem of the lower Siuslaw River.

Geologic Category: Coarse-grained sedimentary rocks
Similar LTAs in this category: 3B, 3C, 3C1, 3D, 3E, 3F, 4A, 4G

Geology:
Coarse-grained sedimentary rocks: 97%
Tyee Formation (Tt): 97%

Hard volcanic rocks: 1%
Dikes and sills of gabbro (Ti): 1%

Soft sedimentary rocks: 1%
Quaternary river deposits (Qal): 1%

Tyee Formation with minor intrusions of basaltic dikes.

Geomorphology: Moderate relief, with moderate drainage density and steep slopes.

Percent Area by Slope Class:

0-30%:	27.1
30-60%:	56.8
60-90%:	15.9
>90%:	0.2

Stream Density: 6.17 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	12.90
1-2%:	2.89
2-4%:	4.94
4-8%:	9.86
8-20%:	27.46
>20%:	41.95

Soil Description: Soils are very shallow to moderately deep on flat to convex ridge slopes, and moderately deep to deep in concave slope positions. Soils range from gravelly loams on steep slopes to gravelly clay loams where deeper soils occur.

Productivity: Compared to other soils in the central Coast Range, these soils are moderately productive. They have low water holding capacities. Soil moisture limits plant growth or survival on all but north slopes during most summers.

Stability: Steepest, most unstable slopes are on upper portions of short, even faceted ridge systems. Debris slides and debris torrents are the primary hill slope erosion processes.

Climatic Sub-Category: Coast Crest--Southern Zone

Vegetation Patterns: Low elevation, moderate relief, and steep slopes in 4F and 4G give these fluvial landtype associations a distinctive vegetation pattern. Wet western hemlock/salmonberry types form the matrix (almost 40%) of this landscape, and are found in the valley bottoms, lower slopes, and even mid slope on cooler aspects. Aspect plays a stronger role in the southern portion of the Coast Range. Western hemlock/swordfern communities (almost 40%) are found on mid to upper slopes on cooler aspects. Western hemlock/rhododendron types (5%) are found on west to south exposures on steep mid-slopes and on upper slope positions and ridges. More clear weather and hotter summer days, plus steeper slopes with poorer soils, may be related to a shift in species composition similar to those found in the low elevation Cascades or areas farther south. Rhododendron, and even dry site species such as madrone and poison oak, are evident, particularly on southern aspects.

The spruce zone (3%) includes the westernmost fringe of 4F along the lower reaches of the Siuslaw River and just east of Siltcoos Lake, with a vegetation pattern similar to 4A.

Landtype Association 4G ***Name: Very Fine-textured Fluvial Lands***

Total Acres: 256113 **Forest Service acres**: 37433 (15%)
Location: North of the Umpqua River, south of Roman Nose Mountain.

Geologic Category: Coarse-grained sedimentary rocks
Similar LTAs in this category: 3B, 3C, 3C1, 3D, 3E, 3F, , 4A, 4F

Geology:
Coarse-grained sedimentary rocks: 96%
Tyee Formation (Tt): 96%

Hard volcanic rocks: 1%
Dikes and sills of gabbro (Ti): 1%

Mixed volcanics: 1%
Siletz River Volcanics (Tsr): 1%

Soft sedimentary rocks: 1%
Quaternary river deposits (Qal): 1%

Mostly Tyee Formation with a very small number of igneous intrusions. The Quaternary river deposits are primarily along the Umpqua River.

Geomorphology: Moderate relief, extremely steep slopes, high susceptibility to debris torrents. Contains the North Fork Smith River and lower Smith River.

Percent Area by Slope Class:

0-30%:	26.6
30-60%:	51.6
60-90%:	20.9
>90%:	1.0

Stream Density: 6.18 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	3.64
1-2%:	2.33
2-4%:	4.21
4-8%:	7.58
8-20%:	25.79
>20%:	46.45

Soil Description: Soils are very shallow to moderately deep on flat to convex ridge slopes, and moderately deep to deep in concave slope positions. Soils range from gravelly loams on steep slopes to gravelly clay loams where deeper soils occur.

Productivity: Compared to other soils in the central Coast Range, these soils are moderately productive. They have low water holding capacities. Soil moisture limits plant growth or survival on all but north slopes during most summers.

Stability: Steepest, most unstable slopes are on upper portions of short, even faceted ridge systems. Debris slides and debris torrents are the primary hill slope erosion processes.

Climatic Sub-Category: Coast Crest--Southern Zone

Vegetation Patterns: The vegetation in 4G is similar to 4F, the other fine-textured fluvial landtype association in this subsection. However, the western hemlock/rhododendron are slightly more important. The proportion of western hemlock/salmonberry in 4G (15%) is similar to 4F in the mid section of this landtype. Again, areas nearest the coast show spruce series communities, with spruce/salmonberry types in valleys and lower slopes, and some spruce/swordfern or spruce/salal types along ridges.

Landtype Association 4H ***Name: Sedimentary Valley Borderlands***

Acres: 381450 **Forest Service acres:** 0
Location: West of the Willamette Valley and north of Umpqua River.

Geologic Category: Fine-grained and coarse-grained sedimentary rocks
Similar LTAs in this category: 4X, 3A, 3W

Geology:
Coarse-grained sedimentary rocks: 71%
Tyee Formation (Tt): 71%

Soft sedimentary rocks: 27%
Yamhill Formation (Ty): 16%
Tuffaceous siltstone and sandstone (Tss): 6%
Quaternary river deposits (Qal): 5%

Hard volcanic rocks: 1%
Dikes and sills of gabbro (Ti): 1%

Mixed volcanics: 1%
Siletz River Volcanics (Tsr): 1%

Primarily Tyee Formation with finer grained marine sediments along the eastern edge that borders the Willamette Valley. Minor intrusions of dikes and sills. Quaternary river deposits cover slightly more area than landtype associations to the west.

Geomorphology: Fine-textured drainage pattern, moderate relief.

Percent Area by Slope Class:

0-30%:	40.8
30-60%:	46.5
60-90%:	12.3
>90%:	0.4

Stream Density: 6.17 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	16.47
1-2%:	2.53
2-4%:	4.23
4-8%:	8.60
8-20%:	28.50
>20%:	39.66

Soil Description: Soils are moderately deep to deep on short, steep, low relief, densely dissected hills and narrow valley bottoms. Soils are deep in lower slopes and valley bottoms to moderately deep on bedrock ridge systems. Soils range from gravelly loams on steep slopes to gravelly clay loams on lower slope positions.

Productivity: These soils are moderately productive. They have moderately high water holding capacities. Soil moisture is limiting on south slopes most years.

Stability: Unstable soils may occur at lower mid slopes above incised channels and on upper convex side slopes. Earth flow terrain is not common. Fluvial erosion and small debris flows are the primary hill slope erosion processes.

Climatic Sub-Category: Valley Border

Vegetation Patterns: The southern half of landtype association 4H is outside of the area covered by the vegetation model. However, 4H is within the western hemlock series (40%), dominated by the warm, dry types. Riparian areas are most often in the swordfern plant association groups. In the far western finger of the landtype association, salmonberry may be present in riparian and foot slope sites.

Landtype Association 4R ***Name: Intrusive Tablelands***

Total Acres: 20665 **Forest Service Acres**: 13743 (67%)
Location: Area surrounding Kentucky Falls.

Geologic Category: Coarse-grained sedimentary rocks and volcanics (Tyee Sandstone intruded by volcanic dikes)
Similar LTAs in this category: 3H, 3R, 3L

Geology:
Coarse-grained sedimentary rocks: 86%
Tyee Formation (Tt): 86%

Hard volcanic rocks: 14%
Intrusions of gabbro (Ti): 14%

Tyee Formation with intrusions of gabbro.

Geomorphology: High relief and steep slopes due to volcanic intrusions that are resistant to erosion. Most streams are first order, high gradient streams.

Percent Area by Slope Class:

0-30%:	36.5
30-60%:	51.4
60-90%:	11.9
>90%:	0.2

Stream Density: 5.92 miles per square mile

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	2.90
1-2%:	2.57
2-4%:	4.21
4-8%:	9.37
8-20%:	29.4
>20%:	49.89

Soil Description: Soils are moderately deep on spur ridge systems to very deep on dominant broad ridge crests and toe slopes. Soils range from gravelly loams on steep slopes to clay loams where deeper soils occur.

Productivity: Soils are moderately productive to productive. They have moderate water holding capacities. Soil moisture may limit plant growth or survival on steep south slopes.

Stability: Steepest, most unstable slopes are on spur ridges below the gently rounded broad ridges. Debris slides, though infrequent, are the primary hill slope erosion processes.

Climatic Sub-Category: Coast Crest--Southern Zone

Vegetation Patterns: Steep slopes off volcanic dikes in the southern interior climate zone make western hemlock/swordfern (< 45%) and western hemlock/rhododendron (32%) types the dominant vegetation type. Western hemlock/salmonberry communities (> 5%) are confined to the valley bottoms and lowest slope positions. Western hemlock/salal occurs on drier microsites and mid-to upper slopes.

Landtype Association 4X ***Name: Eolian Coastal Dunes ___***

Total Acres: 40469 **Forest Service Acres**: 28793 (71%)
Location: Oregon Dunes National Recreation Area.

Geologic Category: Fine-grained and coarse-grained sedimentary rocks
Similar LTAs in this category: 3A, 3W, 4J

Geology:
Soft sedimentary rocks: 96%
Quaternary sand dunes (Qd): 54%
Quaternary river deposits (Qal): 2%
Quaternary river terrace deposits (Qt): 5%

Coarse-grained sedimentary rocks: 25%
Tyee Formation (Tt): 25%

Water: 13%

Active sand dunes along the coast, with Quaternary river deposits in the lowlands, Tyee Formation in the uplands along the eastern edge.

Geomorphology: Coastal sand dunes with low relief, wet deflation planes between fore dunes and active dunes, and small lakes.

Percent Area by Slope Class:

0-30%:	96.7
30-60%:	3.3
60-90%:	0
>90%:	0

Stream Density: 11.64 miles per square mile (this number may be high)

Percentage of total stream miles by gradient class (values are approximate):

0-1%:	71.27
1-2%:	13.54
2-4%:	7.84
4-8%:	4.31
8-20%:	2.77
>20%:	0.26

Soil Description: Soils are deep to very deep on low relief, gently rolling hills and wide valleys. Soils are deep in lower slopes and valley bottoms to moderately deep on

bedrock ridge systems at higher elevations. Soils range from clay loams to gravelly clay loams to sandy loams.

Productivity: Soils are moderately productive where soil water is sufficient to allow plant growth. Soil moisture probably never limits plant growth except on areas of open sand and high relief.

Stability: Unstable soils are not common. They may occur on lower mid slopes above incised channels. Although ancient earth flow terrain is common, slumps and small earth flows are uncommon. Fluvial erosion in channels is the primary hill slope erosion process.

Climatic Sub-Category: Coastal

Vegetation Patterns: The great dunes provide unique habitats for a number of specialized communities. Growing on the stabilized dunes are shore pine and spruce rhododendron types. Dune types are further described in Plant Associations of the Oregon Dunes National Recreation Area (R6-NR-ECOL-TP-09-98). Forests in tree islands and along the margins of the dunes include spruce and lodgepole pines. The northern extent of Port Orford cedar is also found in this landtype association. Salmonberry types make up 70% of the landtype association. Spruce/salal types can be found on forested portions of ancient dunes sheets.

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Appendix A: Changes in Landtype Association Polygons between the Preliminary Map and Final Draft

Changes were made in the landtype association polygons between the beginning of the project and the final draft. The preliminary polygons were used in some watershed analyses (Indian-Deadwood, and Drift Creek/Alsea) and in the Assessment of Federal Lands in the Coast Range (1995). The changes that were made are listed below.

Landtype association **2T1** was changed to **2B**. 2T1 is similar to 2B in geology and landslide potential.

Both landtype associations **2T1 and 2B** were changed to **2K**. The name of 2B was changed in order to avoid confusing it with the cuestaform geomorphology found in 3B.

Landtype association **2M1** was changed to **2M** and combined with the original 2M.

Landtype **2P1** was a small island within **2C**. 2P1 was changed to 2C.

The name of landtype **3B** was changed to **3B1**.

The name of landtype **3C1** was changed to **3B2**.

Landtype association **3E1** was changed to **3E** and combined with the original 3E.

Landtype associations **3C, 3C2** and **3F1** were combined into one polygon and named 3C.

Landtype associations **3V and 3K** were combined, and the name was changed to **3R** because of its similarity in geology and topography to 4R.

The northernmost landtype associations were extended northward for the Adaptive Management Area Assessment after all the GIS data had been compiled for this area. The LTAs that were extended include: **2K, 2M, 2P, 2PSR1, 2S, 2T and 2Y**. Data on stream density, stream gradient, geology and slope only cover the southern portions of these LTAs.

APPENDIX B: Descriptions of Geologic Units in the Coast Range Province

Descriptions of geologic units in the Coast Range are based on the Geologic Map of the State of Oregon, compiled by Walker and MacLeod (1991). Each description includes the lithology, erodability ("hard" versus "soft" rocks), and the types of sediment expected to be produced by weathering and erosion. The geologic symbol (e.g. Qal) that is used on Walker and MacLeod's (1991) map are shown following the name of the formation. This map is available in the Geographical Information System (GIS) data library at the Siuslaw National Forest. Except for the lithology descriptions, the other information is in italics, and is based on professional experience of Forest Service personnel.

Quaternary Alluvium Qal: Sand, gravel and silt forming floodplains and filling channels of present day streams. Locally contains soils with abundant organic matter. *Highly erodable material. Products of erosion include sand, silt, gravel and cobbles.*

Quaternary Terrace Deposits Qt: Unconsolidated deposits of gravel, cobbles and boulders interlayered and intermixed with clay, silt and sand. Mostly found on terraces above present day flood plains.
Highly erodable material, but more stable than the alluvium because of its location. Products of erosion include sand, silt, gravel and cobbles.

Quaternary Landslide Deposits Qls: Deposits of sand, silt, clay, cobbles and boulders from large landslides and debris flows. Deposits are usually not stratified or sorted. *Erodable material, and potentially unstable with regard to future landslides. Products of erosion includes material of all sizes.*

Columbia River Basalt Group (Miocene) Tc and **Grande Ronde Basalt Group** Tcg: Basalt flows, breccias, and pillow basalts related to the basalts of eastern Oregon and Washington. In places, it may contain tuffaceous sedimentary beds between the basalt flows. Mainly found in the Willamette Valley north of Salem and in the northern Coast Range.
Highly resistant to erosion. Weathers to clay, iron-rich soils, cobbles and boulders. The boulders and cobbles are durable substrates in streams. If the basalt flows overlie more erodable sedimentary layers, the basalt may be undercut, which produces block falls.

Marine sedimentary rocks (Middle and lower Miocene) Tms: Fine to medium grained marine siltstone and sandstone that commonly contains volcanic ash (tuff).

Erodable to highly erodable soft sediments with a high clay content. Products of erosion include silt and clay, pebbles are not durable. Earth flows and deep-seated landslides are common, and are underlain by these formations tend to have low relief (e.g. the Yamhill Valley).

Yaquina Formation (lower Miocene and upper Oligocene) Tyq: Thick to thin bedded sandstone, conglomerate and tuffaceous siltstone that was deposited in a river delta. Thin

coal beds found in places. In places, it contains thick lenses of marine tuffaceous siltstone and fine-grained sandstone.
Erodable to highly erodable, moderately unstable. Products of erosion include silt, sand and a minor amount of pebbles. Tends to underlie areas of low relief.

Alsea Formation (Oligocene and upper Eocene) Ta: Massive to thick bedded tuffaceous marine siltstone and fine-grained sandstone.
Erodability and products of erosion are similar to the marine sedimentary rocks (Tms).

Sedimentary rocks (Oligocene and Eocene) Tsd: Marine shale, siltstone, sandstone and conglomerate.
Erodability and products of erosion similar to marine sedimentary rocks (Tms).

Porphyritic Basalt (upper Eocene) Tpb: Lave flows and breccia of porphyritic basalt. Includes basalt of Cascade Head. Also includes minor pillow basalts and tuff breccias interbedded in the Nestucca Formation.
Lava flows are highly resistant to erosion, and form areas of high relief. Products of erosion include clay, cobbles and boulders. The cobbles and boulders from the lava flows form durable substrates in streams. The breccias break down into clays, pebbles and cobbles. Pillow basalts weather to clay.

Tillamook Volcanics (upper and middle Eocene) Ttv: Basalt flows, pillow basalt flows, breccias and tuff with interbeds of basaltic sandstone, siltstone and conglomerate.
Erodability and products of erosion similar to the porphyritic basalts.

Marine facies of Tillamook volcanics Ttvm: Basaltic sedimentary rocks and pillow basalts associated with the Tillamook volcanics.
Erodable, less resistant to erosion than the basalt flows. Pillow basalts break down into clay, the sedimentary rocks erode into a basaltic sand.

Tuffaceous siltstone and sandstone (upper and middle Eocene) Tss: Thick to thin bedded marine tuffaceous mudstone, siltstone and sandstone, fine to coarse grained. Includes the Nestucca Formation.
Highly erodable, forms areas of low relief. Moderately unstable, prone to deep-seated landslides and earth flows. Products of erosion include silt and sand. Pebbles are not durable substrate.

Yamhill Formation and related rocks (upper and middle Eocene) Ty: Massive to think-bedded marine siltstone and thin interbeds of sandstone. Locally contains interbedded basalt flows and tuff.
Erodability and products of erosion similar to marine sedimentary rocks (Tms).

Tyee Formation (middle Eocene) Tt: Very thick deposit of well-bedded medium to fine grained marine sandstone and siltstone. Contains minor interbeds of volcanic ash in the upper part of the formation.

Moderately erodable to erodable, as compared to other sedimentary units. Forms areas of higher relief than other sediments, with asymmetric ridges. The short, steep slopes are prone to debris torrents in intermittent stream channels, the longer, more gentle slopes may have deep-seated rotational slumps. Products of erosion include sand, with some pebbles and cobbles. The pebbles and cobbles form a less durable substrate in streams than the volcanics.

Siletz River Volcanics (middle and lower Eocene and Paleocene) Tsr: Pillow basalt flows, tuff-breccias, and massive basalt lava flows and sills. Upper part of formation contains numerous interbeds of basaltic siltstone and sandstone, tuff, and locally derived basalt conglomerate. Rocks are pervasively veined with calcite and zeolite minerals. This unit is commonly thought to have originated as oceanic crust and seamounts. It is the oldest rock unit in the Coast Range.
Erodability and products of erosion similar to the Tillamook Volcanics.

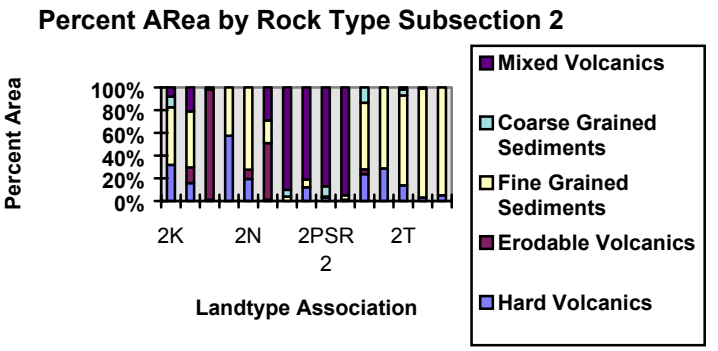
Mafic and intermediate intrusive rocks (Miocene): Dikes and sills of gabbro and minor amounts of andesite.
Highly resistant to erosion. Form areas of high relief, and have a strong influence on local landforms. Weather more slowly. Products of erosion are clays, gravels, cobbles and boulders, which are highly durable. They are the only source of durable stream substrate in areas dominated by the Tyee Formation.

Mafic intrusive rocks (Oligocene) Ti: Dikes and sills of gabbro.
Erosion potential and products of erosion similar to the Mafic and intermediate intrusive rocks.

Alkalic intrusive rocks (Oligocene and Eocene) Tia: Sills, dikes and other intrusions of nepheline, nepheline-syenite, and phonolite. These rocks are lighter in color than basalt, and contain less iron, magnesium and other heavy metals, and more calcium and potassium.
Erosion potential and products of erosion similar to the mafic and intermediate intrusive rocks.

Table 1-1: Lithology of the landtype associations grouped by similar rock types. Numbers are percentage of area covered by rock types.

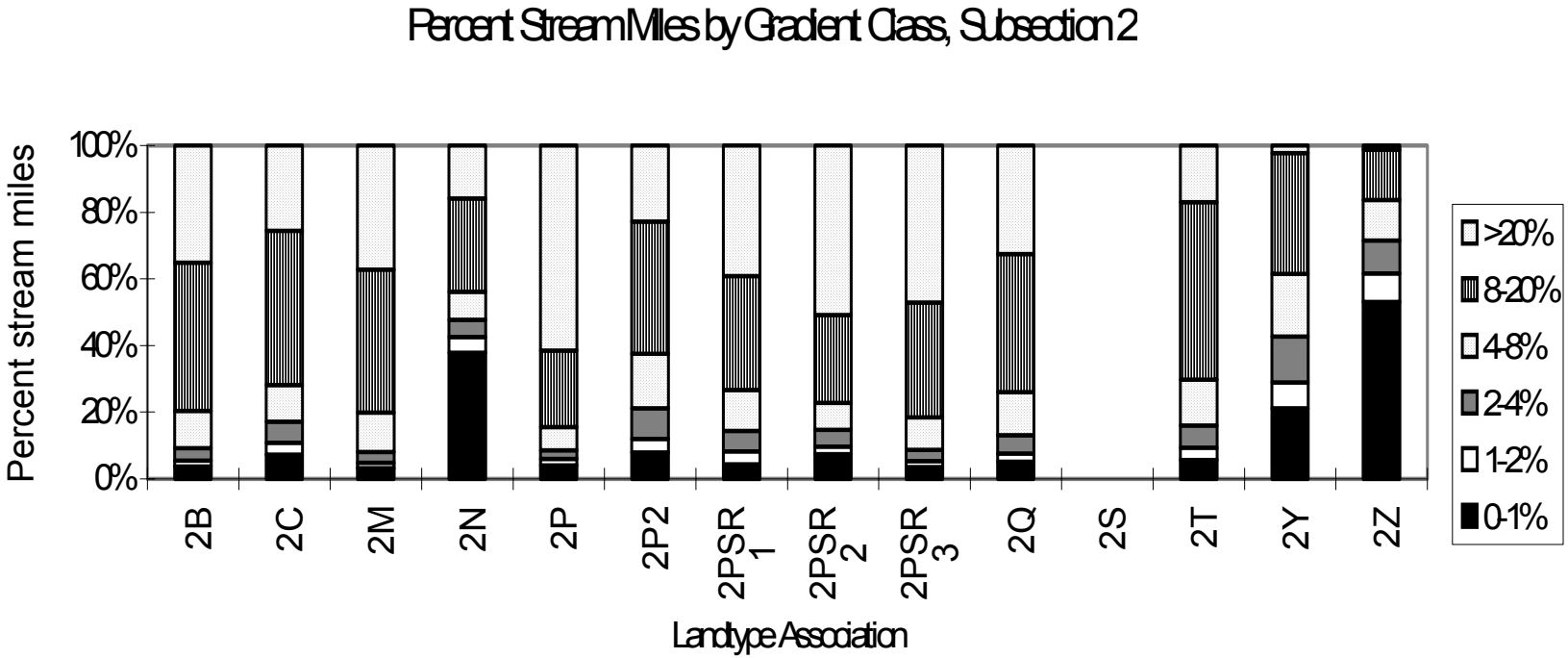
LTA	Hard Volcanics	Erodable Volcanics	Fine Grained Sediments	Coarse Grained Sediments	Mixed Volcanics
2K	31	0	49	9	8
2C	15	13	47	0	20
2H	1	97	2	0	0
2M	54	0	40	0	0
2N	19	8	71	0	0
2P	1	50	20	0	29
2P2	0	0	4	6	90
2PSR1	12	0	7	0	81
2PSR2	3	0	1	9	87
2PSR3	1	0	4	0	96
2Q	23	4	57	13	0
2S	29	0	72	0	0
2T	14	0	80	5	2
2Y	3	0	90	1	0
2Z	5	0	95	0	0
3A	1	0	10	81	0
3B1	0	0	0	100	0
3B2	1	0	0	99	0
3C	0	0	2	98	0
3D	0	0	2	98	0
3E	3	0	5	94	1
3F	6	0	4	91	0
3H	13	0	33	54	0
3L	6	0	4	72	18
3M	96	0	1	3	0
3Q	7	0	4	11	78
3R	8	0	6	85	0
3S	1	0	3	0	96
3T	68	0	4	25	0
3W	0	0	10	88	2
3Z	6	0	82	8	1
4A	0	0	4	84	0
4F	1	0	97	0	
4G	1	0	1	96	1
4J	1	0	28	71	1
4R	14	0	0	86	0
4X	0	0	75	25	0

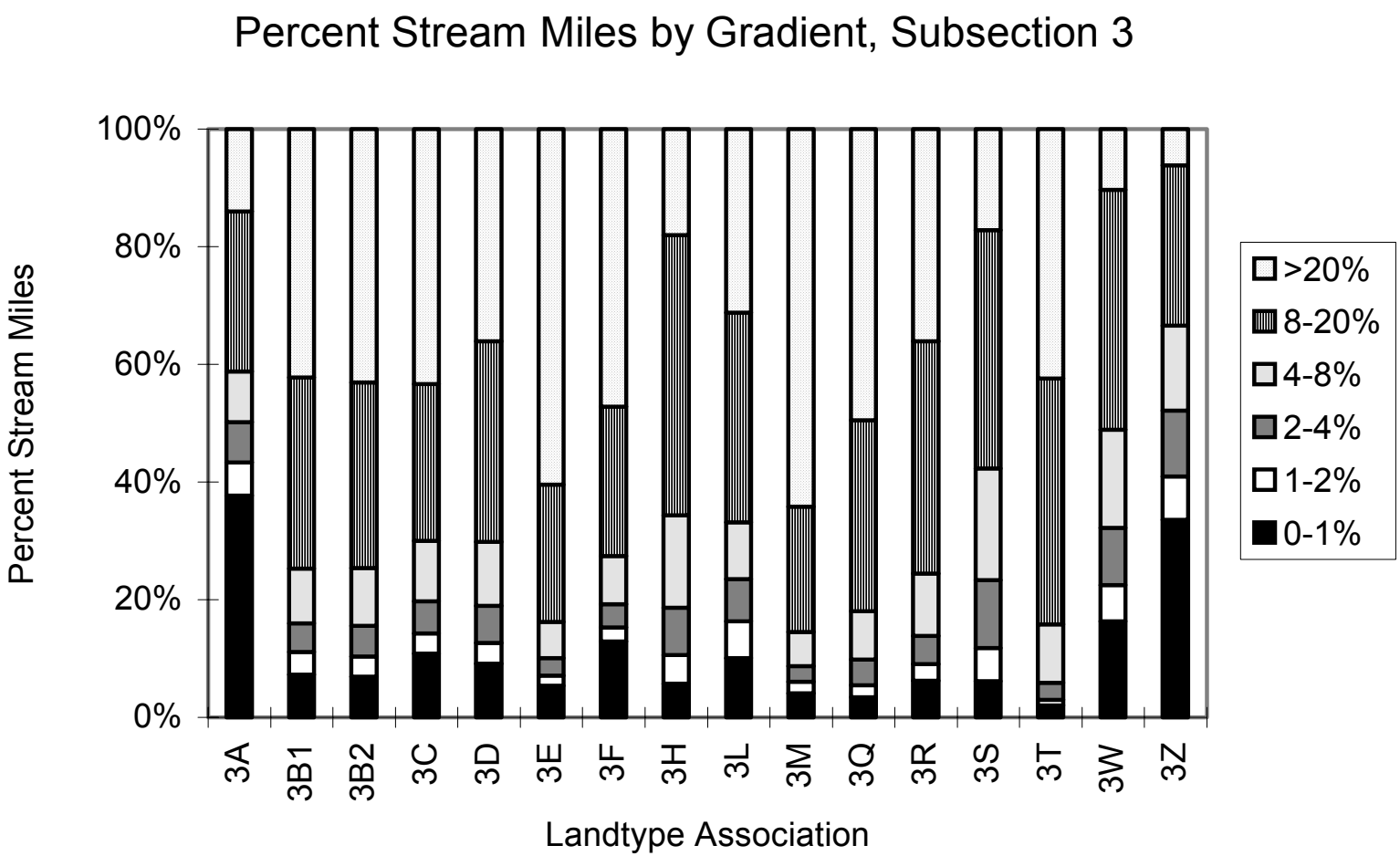

Percent ARea by Rock Type Subsection 2
Percent Area
100%
80%
60%
40%
20%
0%
2K
2N
2PSR 2
2T
Landtype Association
Mixed Volcanics
Coarse Grained Sediments
Fine Grained Sediments
Erodable Volcanics
Hard Volcanics

Appendix C: Tables of Stream Gradient Class and Slope Class by Landtype Association

Table 1: Percentage of total stream miles in each Landtype Association in each stream gradient class

LTA	0-1%	1-2%	2-4%	4-8%	8-20%	>20%
2K	3.64	1.80	3.76	11.16	44.23	35.00
2C	6.89	3.32	5.93	10.36	43.48	23.99
2M	3.3	1.51	3.25	11.77	42.99	37.14
2N	37.79	4.82	5.14	8.37	28.02	15.85
2P	4.0	1.99	2.55	7.07	22.94	61.43
2P2	7.87	4.17	9.29	16.38	39.36	22.92
2PSR1	4.32	3.98	6.15	12.22	34.14	39.27
2PSR2	7.52	2.23	4.93	8.14	26.41	50.77
2PSR3	3.51	1.78	3.39	9.79	34.50	47.01
2Q	5.29	2.34	5.58	13.23	41.99	32.93
2S	no data					
2T	5.68	3.63	6.65	13.85	53.14	17.02
2Y	23.07	8.46	15.05	20.44	30.49	2.48
2Z	53.02	8.59	9.87	12.16	15.01	1.37
3A	37.69	5.66	6.81	8.63	27.24	13.99
3B1	7.24	3.86	4.85	9.31	32.53	42.21
3B2	6.96	3.37	5.22	9.87	31.50	43.08
3C	10.88	3.36	5.52	10.26	26.62	43.34
3D	9.12	3.56	6.28	10.86	34.13	36.05
3E	5.35	1.74	3.00	6.14	23.32	60.44
3F	12.91	2.43	3.91	8.21	25.33	47.21
3H	5.80	4.90	8.08	15.81	47.93	18.20
3L	10.11	6.21	7.19	9.63	35.67	31.17
3M	4.11	1.98	2.58	5.85	21.22	64.00
3Q	3.41	2.07	4.35	8.19	32.48	49.50
3R	6.22	2.86	4.77	10.57	39.46	36.10
3S	6.16	5.67	11.52	18.95	40.56	17.14
3T	2.03	0.96	2.90	9.90	41.83	42.38
3W	16.31	6.21	9.68	16.66	40.78	10.36
3Z	33.61	7.35	11.17	14.49	27.27	6.12
4A	51.54	3.76	5.57	8.48	20.39	10.26
4F	12.90	2.89	4.94	9.86	27.46	41.95
4G	13.64	2.33	4.21	7.58	25.79	46.45
4J	16.47	2.53	4.23	8.60	28.50	39.66
4R	2.90	2.57	4.21	9.37	29.4	49.89
4X	71.27	13.54	7.84	4.31	2.77	0.26


Percent Stream Miles by Gradient Class, Subsection 2
Percent stream miles
100%
80%
60%
40%
20%
0%
2B
2C
2M
2N
2P
2P2
2PSR 1
2PSR 2
2PSR 3
2Q
2S
2T
2Y
2Z
Landtype Association
>20%
8-20%
4-8%
2-4%
1-2%
0-1%


Percent Stream Miles by Gradient, Subsection 3
Percent Stream Miles
100%
80%
60%
40%
20%
0%
3A
3B1
3B2
3C
3D
3E
3F
3H
3L
3M
3Q
3R
3S
3T
3W
3Z
Landtype Association
>20%
8-20%
4-8%
2-4%
1-2%
0-1%

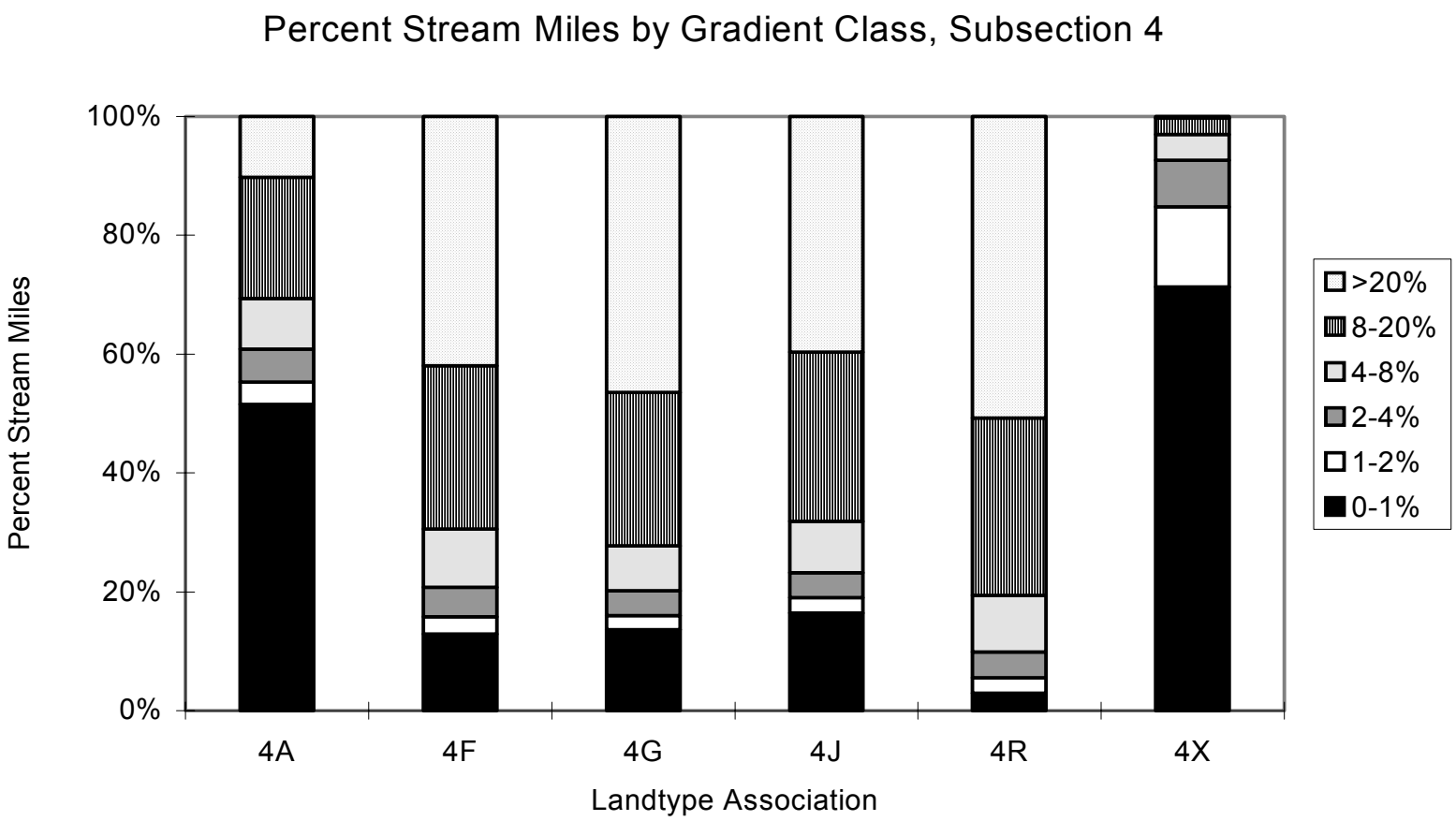
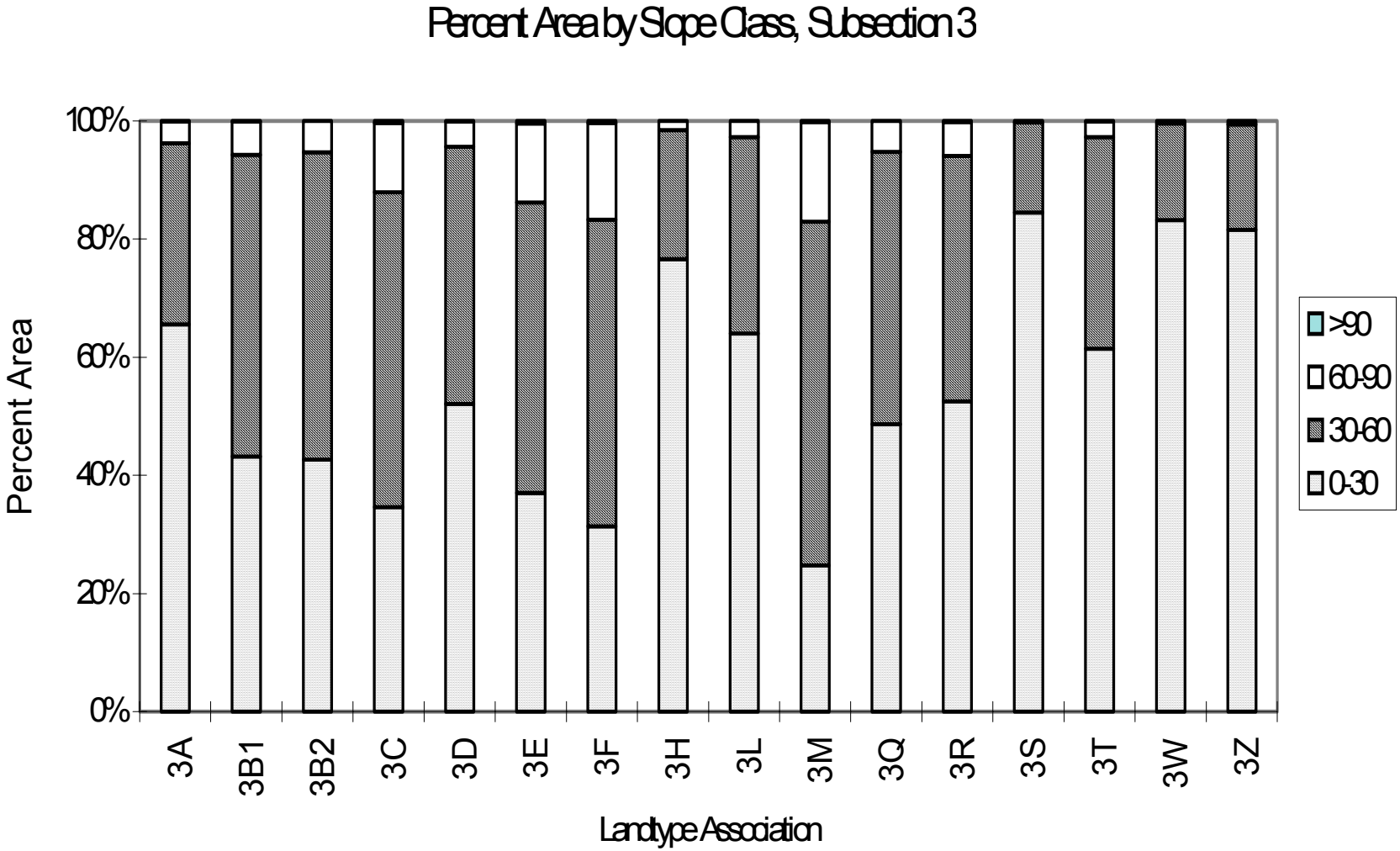
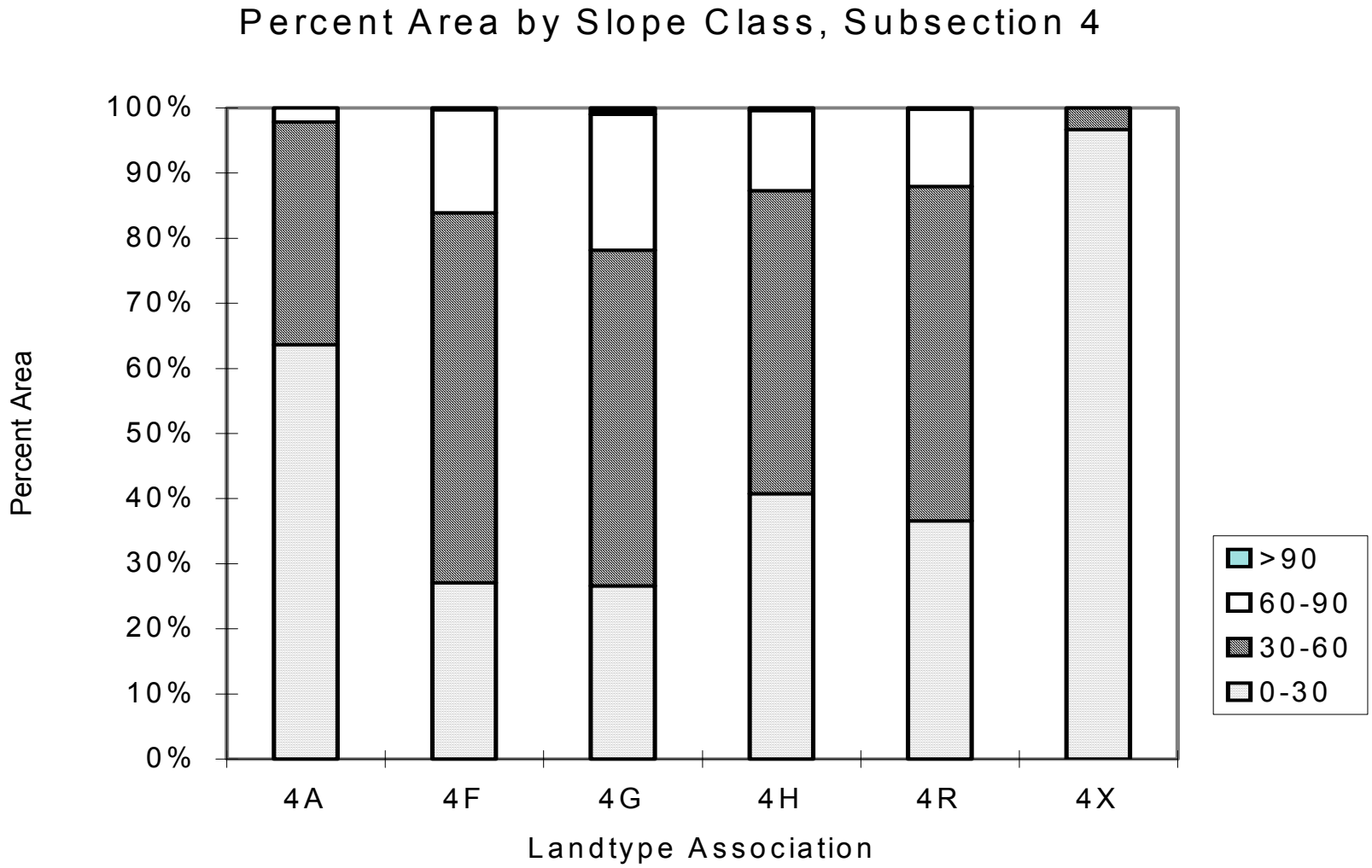

Percent Stream Miles by Gradient Class, Subsection 4
100%
80%
60%
40%
20%
0%
Percent Stream Miles
4A
4F
4G
4J
4R
4X
Landtype Association
>20%
8-20%
4-8%
2-4%
1-2%
0-1%

Table 2: Percentage of total area in each Landtype Association in each slope class

LTA	0-30%	30-60%	60-90%	>90%
2K	63.0	32.0	4.4	0.11
2C	63.1	34.6	2.3	0.1
2M	57.2	34.1	7.9	0.8
2N	70.0	27.0	2.9	0
2P	28.8	49.1	20.4	0
2P2	59.0	38.5	2.4	0.1
2PSR1	59.0	38.5	2.4	0
2PSR2	30.3	53.4	15.9	0.4
2PSR3	45.3	46.3	8.3	0.1
2Q	53.3	38.9	7.5	0.3
2S	no data			
2T	78.0	20.8	1.2	0
2Y	96.9	3.1	0	0
2Z	93.3	6.6	0.2	0
3A	65.6	30.7	3.7	0.1
3B1	43.2	51.1	5.6	0.1
3B2	42.7	52.1	5.2	0
3C	34.6	53.4	11.7	0.4
3D	52.1	43.5	4.4	0.1
3E	37.0	49.1	13.4	0.4
3F	31.3	51.9	16.3	0.4
3H	76.6	21.9	1.5	0
3L	64.0	33.3	2.7	0
3M	24.7	58.2	16.8	0.2
3Q	48.7	46.1	5.2	0
3R	52.63	41.61	5.72	0.16
3S	84.5	15.2	0.3	0
3T	61.4	35.8	2.7	0.1
3W	83.2	16.4	0.4	0
3Z	81.6	17.8	0.6	0
4A	63.6	34.3	2.1	0
4F	27.1	56.8	15.9	0.2
4G	26.6	5136	20.9	1.0
4J	40.8	46.5	12.3	0.4
4R	36.5	51.4	11.9	0.2
4X	96.7	3.3	0	0


Percent Area by Slope Class, Subsection 3
Percent Area
100%
80%
60%
40%
20%
0%
3A
3B1
3B2
3C
3D
3E
3F
3H
3L
3M
3Q
3R
3S
3T
3W
3Z
Landtype Association
>90
60-90
30-60
0-30


Percent Area by Slope Class, Subsection 4
Percent Area
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
4A
4F
4G
4H
4R
4X
Landtype Association
>90
60-90
30-60
0-30

APPENDIX D: DOCUMENTATION OF FOG AND STRATUS GRIDS

The original grids are in ARC ASCIIGRID format, compressed with gzip. The value -999 = missing. Units are tenths of percent of hours in each condition for marine stratus in July, e.g., 301=30.1%. Note that these are full modeling grids, which means that there are some edge effects on the extreme north and south. Therefore, use the northern and southern 1/2 degree or so with more caution than you would the rest of the region.

For the CLAMS study area, the average resolution of the original model grids is 795 m. (We smoothed the model grids to 25 m for use in CLAMS analyses.)

The cloud ceiling of <300 ft and/or visibility of <1 mile almost never occurs in Corvallis in July, but is reserved for near-coastal areas that particularly exposed to the coastal fog. The ceiling of 5000 ft and/or visibility of <5 miles is less restrictive and reaches farther inland.

Summary of Methods

The maps were created in four main steps:

(1) Advection Model.--A coastal advection model is run to get first-guess, unscaled estimates of coastal influence. The coastal advection model, developed in-house, is a cost-benefit algorithm that assesses the optimal path a surface air parcel might take as it moves from the coast to each inland pixel. The basic assumption is that the mean coastal influence experienced at a site will be the result of a flow path from the coast that minimizes two factors: (a) modification of the air by continental influences, which accumulates as the path length over land increases; and (b) loss of momentum caused by flowing over terrain obstacles. Predominant mesoscale flow patterns, which will aid certain flow paths and cause more effective inland penetration, are also accounted for. Details on the advection model formulation and application to Puerto Rico are in a manuscript currently in review:

Daly, C., E.H. Helmer, and M. Quinones. 2002. Mapping the climate of Puerto Rico, Vieques and Culebra. Submitted to International Journal of Climatology.

(2) Satellite Guidance.--Develop a satellite composite of marine stratus episodes that do not penetrate too far inland. Rerun advection model with this guidance. This gives the advection model information about areas along the coast where stratus preferentially penetrates and where it does not. This corrects model results for complex circulation patterns that are not taken into account. For example, the advection model shows that fog ought to be able to spill through the Van Duzer Corridor (near Willamina) pretty readily, but that doesn't appear to happen in reality. Hypotheses to account for this include terrain features upwind and near the coast that may break up the NW coastal flow as it approaches the corridor; the viscosity of the air, keeping it from getting through the gap so easily; and evaporation of the stratus by warm, dry Willamette-Valley air as the stratus comes through the gap.

(3) Scale to Observed Sky Conditions, Develop Low Stratus Map.--Develop a low stratus climatology from airfield summaries for stations in the region (including WA and CA). The July percent of hours reporting a cloud ceiling of <5000 ft and/or a visibility of <5 miles was used as an indicator of stratus conditions. There were 17 stations in this dataset, which is pretty poor coverage. However, Daly found a very strong linear relationship between July mean daily maximum temperature and the frequency of low stratus (R2=0.98). This allowed Daly to use temperature observations from 151 stations in the area to estimate low stratus frequency, which is much better coverage.

Using estimated low stratus frequency at the 151 temperature stations, Daly developed a strong (R2=0.87) log-linear relationship between the satellite-guided advection model index and the low stratus frequency. This was applied to the coastal index map to get a first-guess low stratus frequency map. Since there were fairly significant regional variations in the log-linear relationship, Daly used a splining procedure to spatially distribute the residuals from the log-linear relationship. This map of residuals was then added to the first-guess map to produce the final low stratus map.

(4) Derive Fog Map.--The observational data that seemed to most closely represent an actual fog (as opposed to stratus) condition was the frequency of a cloud ceiling <300 ft and/or visibility <1 mile. There must be some pretty substantial cloud to cause this. (Incidentally, there was no summarized information on frequency of actual "foggy" conditions.) There was a strong (R2=0.91) linear relationship between the frequency of <5000 ft, < 5 mi and <300 ft, < 1 mi, so this was applied to produce the final fog map. There were two stations that were outliers, and had to be removed from the regression data set: Astoria and Hoquiam. They have a much lower fog frequency than their stratus frequency would indicate, probably because they are somewhat sheltered from the actual coastline. So stratus gets in unimpeded, but the real low stuff is hindered.