Chapter 3 - Issues and Key Questions

The Northwest Forest Plan (USDA 1994) provides management direction for 81% of the land in Indian/Deadwood, and therefore focused identification of issues to the few most immediate concerns surrounding implementation of the new plan. The watershed analysis team also met with Mapleton district specialists and interested publics, primarily residents and landowners, to learn what additional concerns or opportunities they thought should be addressed. The information gathered at those meetings and field trips was used to strengthen the set of key questions that were selected for each issue. A few of the public's concerns were beyond the scope of this watershed analysis, but are documented for future use in Appendix A.

The highest priority issues are listed below with the key questions that were used to address the issues. These questions were used to focus the analysis presented in Chapters 4 and 5. The three issues are identified again in Chapter 6 in the discussion of management opportunities for the watershed.

ISSUE 1

What opportunities exist for protecting, maintaining and restoring the streams and riparian areas in the watershed?

Background

The anadromous salmonid runs on the Oregon coast have declined precipitously since 1990. On the Siuslaw National Forest, 28 anadromous salmonid stocks at risk were documented by the American Fisheries Society in 1991. In July 1995, the National Marine Fisheries Service proposed listing the coho salmon as a threatened species throughout the Oregon coast. Fish populations in Indian and Deadwood Creek watersheds have reportedly declined significantly since the 1970's.

A large segment of the public, including environmental interest groups, local Indian tribes, and commercial fishermen, have expressed concerns for many years about declines in anadromous salmonid populations in the Pacific Northwest. The Northwest Forest Plan was released in 1994 in response to overwhelming public and scientific concern about loss of late-successional forests and associated fish habitat. The Aquatic Conservation Strategy is a primary component of the Plan, calling for restoration and maintenance of ecological health of watersheds and aquatic ecosystems on public land. Many interest groups hold high expectations that the federal land management agencies will implement the Plan and restore health to the streams.

Results of research and stream surveys, summarized in reports such as Watershed Protection and Restoration in the Mid-Oregon Coast Range (USDA 1993) and Assessment of Federal Lands in and Adjacent to the Oregon Coast Province (USDA 1995b), indicate that most streams on the Forest, including those in in this watershed, are deficient in large woody debris and that riparian areas lack large conifer trees. Few stream systems have structure needed to dissipate stream energy, store water flows, trap nutrients and provide high quality fish habitat. Monitoring of stream temperatures on the Forest indicate many of the streams exceed state water quality standards suitable for fish habitat. In addition, road construction for access to timber harvest areas increased rapidly on the Siuslaw and in

Indian/Deadwood watershed since 1960. Roads built prior to the mid-1970's are known to greatly increase the potential for landslides and be a major source of sedimentation to streams.

Residents of both Deadwood Creek and Indian Creek would like to see fish populations return to past levels. At the same time, most residents of Indian/Deadwood have become dependent on the road network to access their properties and travel to local towns. Many would like to see most of the roads maintained at least for high clearance vehicles, because they are concerned about fire dangers and do not want to see the Forest investment in roads wasted. On the other hand, some residents would like to see the road network reduced if that would decrease traffic, especially from hunters.

One resident of Indian Creek has a permit to graze cattle on a Forest Service allotment (Indian Creek allotment). Currently, no grazing is allowed on the allotment until an analysis of allotment condition and effects of grazing on the riparian meadow environments can be completed. The permittee and forest managers need to determine how to meet the Aquatic Conservation Strategy objectives of the NFP when assessing future grazing opportunities in the watershed.

Forest managers want to know what the most appropriate and important management activities might be for restoring stream conditions. Opportunities are limited by funding and accessibility to streams, so it is critical to identify the most beneficial actions.

Key Questions

The following key questions were identified as important information needed to address the issue:

Streams -

1. What is the current water quality condition, particularly temperature? How does water quality in the watershed compare to state water quality standards?
2.
3. How has the amount, timing and delivery of water, sediment and wood in the watershed changed?

4. What is the anadromous fish distribution, spatially and temporally, in this watershed? (Past and Present). What is the current trend in distribution?

5. What natural and human activities have affected fish distribution, riparian vegetation, stream condition, water quality and flows? Examples of human activities: recreation, domestic water use, farming, grazing, logging, road building.

6. Are there any good to excellent anadromous fish production areas remaining in the watershed? If so, where are they and what makes them high quality?

7. Are there any known historic hotspots that are currently degraded, but which have a high potential for successful restoration?

8. What is the importance (or role) of the streams in Indian/Deadwood to the water quality and anadromous fish habitat of the Siuslaw River Basin?

Riparian Areas -

1. What is the vegetation structure and composition of the natural stands in riparian areas?

2. What were the major natural disturbances prior to human settlement; what are the major disturbances today? what are the relationships between upland and riparian disturbances?

3. What is the likely riparian succession?

4. Are there vegetation or physical features in the riparian areas that will limit certain aspects of restoration?

5. Are there factors that are presently affecting the production of other aquatic species? How?

6. How will restoration activities affect human uses of the watershed, i.e., grazing, access, recreation, hunting?

ISSUE 2

What is the condition of the Late-Successional Reserve lands and how can they be managed to function as a late-successional ecosystem?

Background

About half of the Oregon Coast Province is in private landownership and little, if any, of this provides late-successional forest habitat. The federal lands make up about 27% of the area and less than half of those lands currently provide older forest conditions. In addition, the remaining older forest is found in numerous small patches surrounded by young plantations. The Federal Lands Assessment (USDA 1995b) found that most mid to late-seral stage vegetation on the Siuslaw National Forest is very fragmented from past timber harvest activity. This condition is not conducive to sustaining populations of several species associated with mature forests, including the northern spotted owl, a federally listed threatened species.

Regional and national environmental interest groups would like the remaining late-successional forests in the Pacific Northwest protected to sustain viable populations of species associated with those habitats. The NFP calls for protection and enhancement of conditions for late-succession and old-growth forest ecosystems on a system of Late-Successional Reserves on federal land.

About 85% of the federal lands in the Indian/Deadwood watershed are allocated to Late-Successional Reserve (LSR) under the Plan. Forest managers want to know how to promote late-successional forest structure in the even-aged, young plantations present in the managed stands today. Results of fire history research, summarized in the Federal Lands Assessment, indicate that Coast Range vegetation patterns have been affected by large, but infrequent, natural fire disturbance that probably varied by geographic location across the Forest. To understand how to manage forest stands for late-successional conditions, managers should understand how natural processes operate in the watershed.

Key Questions

The following key questions were identified as important information needed to address the issue:

Forest Vegetation -

1. What were the historic seral conditions (vegetation stages) in the watershed? What were the natural disturbances that led to those conditions?

2. What are the current seral conditions? What disturbances led to those conditions?

3. Given natural disturbance, what is the range of variability for seral conditions? What is the range of variability of within-stand structure?

4. What are the differences in landscape structural features, e.g., landscape fabric, patch sizes, fragmentation, etc., between current and natural (premanagement) conditions?

5. What are the differences in "within-stand" structural features, e.g., species composition, canopy layers, and levels of snags and coarse woody debris, between current and historic conditions?

6. How extensive are noxious weeds? Are they inhibiting native flora and fauna?

Late-Successional Habitat -

1. How much of the current forest is considered to be mature conifer? What is the spatial distribution of the mature conifer? How could the current condition be improved to meet needs of late-successional forest species guilds?

2. How much of the current mature conifer is considered "interior mature habitat" (habitat > 500 feet from edges)? What is the spatial distribution of the interior habitat? How could the current condition be improved to meet needs of late-successional forest species guilds?

3. How much suitable habitat is available for spotted owls and marbled murrelets and what is their distribution?

4. Are there specific areas outside federal lands in the watershed which serve an important function for connectivity?

5. What is the importance (or role) of the LSR lands in this watershed compared to the entire LSR? e.g., contribution to habitat, contribution to resident owl population?

6. Concerning riparian areas as habitat for terrestrial species, how fragmented or continuous is the vegetation along the stream courses and between upslope and riparian areas?

7. What other species habitats exist in the watershed? What conditions are they in?

8. Are there any sensitive plant species in the watershed?

9. What unique habitats occur in the watershed?

10. How are people currently using the LSR lands, e.g., hunting, collecting special forest products, using trails or special sites? Will these uses prevent attainment of LSR conditions?

ISSUE 3

How should the remaining forest areas (Matrix) be managed?

Background

The Northwest Forest Plan allocated about 8,800 acres to Matrix lands. Matrix offers an opportunity for wood fiber production. About 85 percent of all Siuslaw Forest lands fall within Riparian Reserves because of the high density of streams found on the short, steep slopes. On the Siuslaw National Forest, Matrix lands falling outside Riparian Reserves are in very small patches along ridgelines. Riparian Reserves were selected in the Plan to protect aquatic resources and, as such, constrain traditional timber harvest management practices.

Some publics, at both local and regional areas, have high expectations that the Forest will produce wood fiber on lands not needed for late-successional species. In addition, some local residents would like to have timber receipts return to higher levels in order to generate revenues for local roads and schools.

Findings from the Federal Lands Assessment (USDA 1995) indicated that timber sales from Matrix lands on the Siuslaw would not be able to provide large timber volumes by themselves, but would need to be combined with adjacent thinning sales from LSR lands in order to create a feasible sale. Forest managers would like to know how best to manage the small, scattered Matrix and intermingled Riparian Reserve lands to meet some timber production objectives and Aquatic Conservation Strategy objectives of the Northwest Forest Plan.

Key Questions

The following key questions were identified as important information needed to address the issue:

1. How will Matrix lands be managed to fit the objectives of the watershed?

2. How is the role of Riparian Reserves in Matrix lands different than that in Riparian Reserves in LSR?

3. What are the vegetation conditions, e.g., age and species, in Matrix lands?

Chapter 4 - Natural Resources: Characteristics and Processes

This chapter describes the physical and biological resources of the watershed and explains some of the interactions between them. The range of forest stand types and stream conditions expected to occur naturally across the watershed is presented and explained to be a function of the soils, climate and natural disturbance processes. This is the story of how the watershed functioned prior to Euroamerican settlement. The goal of this watershed analysis is to provide an understanding of the natural processes so they will be used as a basis for selection of appropriate management activities to ensure long-term sustainability of resources in the watershed.

The watershed analysis is tiered to a larger-scale analysis conducted for the Federal Lands Assessment (USDA 1995b). The Assessment identified some province-wide ecological strata that were helpful in placing the watershed in context of larger phenomena, including soil-climate zones, fire regime blocks, landtype associations (LTAs) and plant association groups (PAGs).

CLIMATE

The climate of the Coast Range is influenced by the position and intensity of high and low pressure systems over the North Pacific Ocean, and by variation in topography. The Indian/Deadwood watershed is located on the west slope and crest of the Coast Range and experiences moderate summer and winter temperatures. Generally the mean temperature of the coldest month (January) is 15 - 20°F lower than that of July. Most of the precipitation falls as rain from November to March with some intense winter storms. Precipitation is lower in the major valley bottoms and increases as elevation increases. The normal annual precipitation in the watershed for the last 35 years ranges from 85" at the mouth of Lake Creek to 115" at Prairie Mtn. Strong winds (70-100 mph), often associated with rainstorms, may occur during the fall and winter. Heavy rain for several days saturates soils and, in addition to strong winds, may trigger landslides and cause patches of blown down trees.

In general, between 40-50% of the annual precipitation falls during December to February, 20-25% in the fall, 20-25% in spring and only 6% in summer. Stream flow reflects this with an annual cycle of high flashy flows during the winter and low baseflows during the dry summer months, when most of the flow in channels is derived from emerging groundwater. Flooding due to heavy rains occurs about once in two years, usually in the late fall and winter. This level of high water maintains the channel condition. Large floods occur less frequently and result in more significant channel and riparian vegetation changes. In coastal drainages notable flood years have been 1861, 1890, 1909, 1927, 1953, 1955, 1964, 1974, 1982, 1983 and 1996.

GEOLOGY

The Indian/Deadwood watershed is underlain by the Tyee Formation. This formation is a thick deposit of rhythmically bedded, micaceous sandstone grading upward into siltstone that was deposited in shallow seas over basalts about 40-60 million years ago (Eocene). There are some basaltic intrusions that are not extensive in Indian/Deadwood, but exert a controlling influence on some of the landforms. The Coast Range has experienced tectonic uplift for the last 10 million years as the Juan de Fuca plate of the Pacific Ocean floor subducts beneath the North American plate. Major

earthquakes occur just off the coast about every 300 years as subduction continues, and these events are reflected in estuarine deposits along the coast.

The uplift is not uniform in a north-south direction but is rising and tilting eastward. This combination of lithology and tectonic uplift controls landforms and drives channel development and morphology in the Coast Range. Stream gradients on sedimentary rocks are highly variable. Relative to the other major drainages dominated by the Tyee formation (e.g., the Yaquina and Alsea) the Siuslaw River has the steepest gradient. Variable river and valley gradients in the western Coast Range to have been attributed to differences in uplift. The western Coast Range is an exception to the typical widening in a downstream direction of river valleys and this is attributed to the eastward tilting. Differential rates of uplift and eastward tilting may have resulted in the lower reaches of Indian, Deadwood and Lake Creeks being moderately confined. (Stream confinement is shown on Map 4.7, Stream Function Segments.)

Products of erosion of the Tyee Formation include sand with some pebbles and cobbles. The pebbles and cobbles form a less durable substrate in streams than those produced from basaltic formations to the west. The Tyee streams also have more variable and less steep stream gradients.

The soils of Indian/Deadwood are predominantly gravely clay loams that have high infiltration rates. High biologic activity accompanied by high decomposition rates results in moderately high accumulations of soil organic matter. Soil moisture fluctuations from winter to summer are moderate to great depending on specific soil characteristics and slope position. Soil depth ranges from 20 to greater than 60 inches.

SOIL/CLIMATE ZONES AND LAND TYPE ASSOCIATIONS

Six Landtype Associations (LTAs), having distinct physical characteristics, are found in the watershed (Map 4.1). LTAs stratify the landscape into areas of similar shape, geology and soils, which influence vegetation characteristics and stream channel form and process (USDA 1995b). All the LTA's in Indian/Deadwood are in the physiographic category of steep, highly-dissected bedrock dominated ridge systems. Shallow rapid landslides are the predominant erosion process with scattered areas of deep seated rotational failures. This is in contrast to the hummocky, moderate to high relief, deeply incised hills and valleys to the west or the gentle to steep bedrock dominated ridges and valleys to the north of the watershed.

The LTAs in Indian/Deadwood fall into two soil/climate zones-- central interior zone to the west and southern interior zone to the east. Basic differences are shown in Table 4.1.

Differences in available soil moisture in the central Coast Range vary only during short periods of low rainfall in mid to late summer. Soils are not limited in their potential for plant growth by soil moisture during the rest of the year. Coarse-scale available soil-moisture classes, ranging from 1 to 3, (wet to dry, respectively), were developed for the Federal Lands Assessment. These are relative ratings that compare seasonal available soil moisture within an eco zone that generally has much higher available soil moisture levels during all seasons than virtually any place in the west.

Table 4.1. Characteristics of Soil/Climate Zones

Soil/Climate Zone	LTA's	Climate Characteristics	Soil Moisture
Central Interior (West side)	3B, 3C, 3C1, 3C2, 3T	Wet winters, moist summers; significant differences (>5 ° C) in soil temperatures from summer to winter.	Soil moisture fluctuations from winter to summer are moderate: summer levels vary from very high on lower slopes to moderately dry on upper sideslopes.
Southern Interior (East side)	3F	Very wet winters, moist summers; significant differences (>5 ° C) in soil temperatures from summer to winter.	Soil moisture fluctuations from winter to summer are moderate to very great; summer levels vary from moderate to low.

The Indian/Deadwood watershed has predominantly (87%) class 3, dry soils. Exceptions occur in the alluvial deposits of the valley bottoms and on steep slopes (56% of the area has 30-60 % slopes; 14% has 60+% slopes). Significant differences in available soil moisture were not evident at this coarse scale but a closer look at soil characteristics and slope classes revealed an important gradation of conditions across the watershed, with higher proportions of dry environments in the east transitioning to wetter environments in the west. (See Appendix B for details of this analysis.)

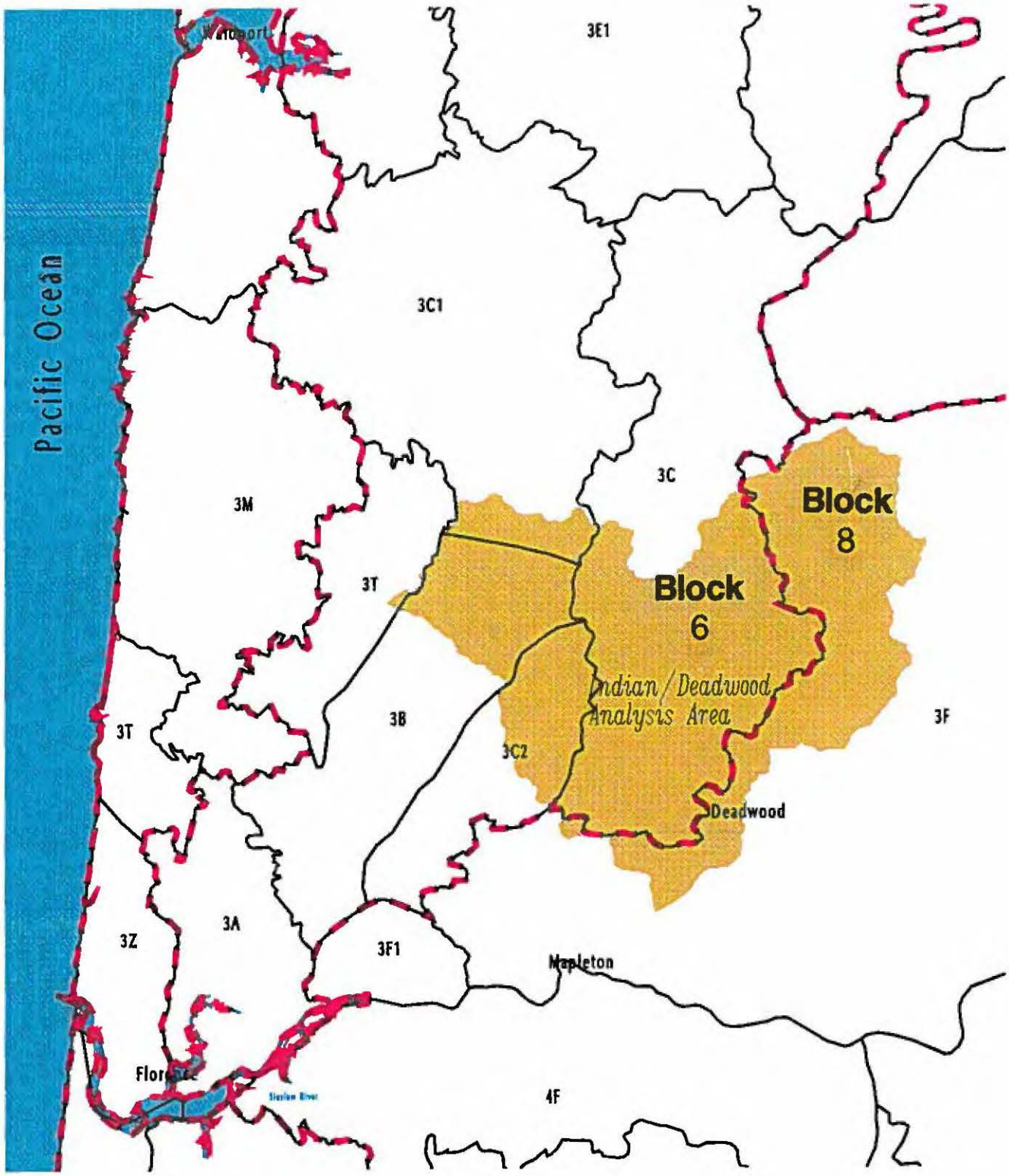
NATURAL DISTURBANCE PROCESSES

Four natural disturbances that are important in the watershed are fire, floods and landslides, laminated root rot and high winds. The scale at which they occur is important for understanding how they affect the resources spatially and temporally. **Fire** occurs infrequently, but across the landscape at a very large scale. **Floods and landslides** occur primarily in riparian areas affecting smaller portions of the watershed, but significantly affecting aquatic resources throughout the stream system. **Laminated root rot** (*Phellinus weirii*) is pervasive in the Deadwood drainage, but is a slow moving disturbance agent which operates at a small-scale. **High winds** occur occasionally and affect small (1-10 acre) patches of forest vegetation.

Fire

In general, natural fire disturbances in the Coast Range are described as low frequency (> 200 years apart) and high severity, though probably not occurring on a regular cycle (Agee 1993, Teensma et al. 1991). Climatic changes are most likely responsible for these large fires. Although the fire record is not long enough to infer a cyclic pattern of fires, ignition increases from north to south due to increased lightning frequency and reduced summer precipitation. The last large fire to burn through much of the Indian/Deadwood watershed was in 1849. That fire affected about 800,000 acres between the Siuslaw and Siletz Rivers. Smaller fires are known to have burned parts of the watershed since then, including a fire east of Deadwood Creek in the 1930's. Some of the later fires may have been the result of settlers clearing land.

A recent study of Coast Range fire history indicates there appear to be relative differences in fire frequency and intensity from the coastal and interior zones to the southern valley margin (Impara 1995). Eight fire regime blocks were delineated in the Federal Lands Assessment based on different fire return intervals and/or severity and size. The fire regime blocks correspond closely to the


LTAs
Fire Regime Blocks
Fire Regime Blocks
& Land Type Association
Pacific Ocean
Waldport
3E1
3C1
3C
3M
3T
3T
3B
3C2
3F
3Z
3A
3F1
4F
Block
8
Block
6
Indian / Deadwood
Analysis Area
Deadwood
Mapleton
Florence

Map 4.1

soil/climate zones since the gradation of fire effects appear strongly related to climate and landform characteristics (USDA 1995b).

Indian/Deadwood was identified as lying within two different fire regime blocks (Map 4.1). An ongoing fire history study by Peter Impara, an OSU student, includes a field transect through the Indian/Deadwood watershed. Preliminary results confirm the spatial gradation of fire pattern and were used to verify the boundaries and descriptors of severity and frequency of the two regime blocks covering the watershed (Impara, pers. communication). The western portion of the watershed has fire and vegetation patterns that typify the moist western hemlock forests, and the eastern portion is in an ecotonal zone that reflects some characteristics of the fire regime of the Willamette Valley.

Central Interior - Alsea (Fire Regime Block 6)

This block appears to cover the area west of Deadwood Creek. Fire in this block has been infrequent and severe, occurring with strong east winds in drought years. Large to jumbo patches of a single seral stage (1,000 to >10,000 acres) dominated the landscape. These patches were expected to have changed over time from early seral to mid and then to late seral stage because of the low frequency of subsequent disturbance. Douglas-fir, western hemlock and western redcedar are primary components of mid and late seral conditions.

Southern Interior (Fire Regime Block 8)

The area east of Deadwood Creek shows different historic vegetation patterns, which may be a reflection of different fire behavior. Fire pattern in this block appears to have been of low to moderate (<100 - 300 years) frequency and moderate to high severity (30 - >70% mortality). Vegetation patches were of variable size. Block 8 has a more complex topographic relief pattern which could account for a more patchy burn and patchy vegetation patterns. Although east winds may occur in this block, deeply dissected ridges create barriers to wind movement and fire spread and could be responsible for variable fire effects. This would result in variable patch size and more diverse tree species composition and remnant live trees than in Regime Block 6.

Analysis of topography in the watershed reveals that lands within Regime Block 6 are of lower topographic relief than the lands within Block 8. This seems to confirm the assumptions used to develop the fire regime blocks, i.e., Block 6 would have less variation in burning intensity than Block 8 and provide little protection for small patches of trees to survive as remnants after a fire.

Floods and Landslides

Floods are not just high water, rather they include multiple processes: debris slides and flows, sediment-laden streamflows, movement of woody debris and disturbance to riparian vegetation. These processes are tightly linked in a flood disturbance system. Large floods are responsible for the most extensive and persistent changes in river, valley and riparian vegetation. The few hours when a flood is peaking can modify the landscape more than in all the intervening decades combined, however, the changes are not uniformly distributed across the landscape. Therefore, the effects of floods are both temporally and spatially variable.

Two important upslope erosional processes in the Indian/Deadwood area are debris slides and torrents and slumps. Often described as shallow-rapid failures, debris slides and torrents are the predominant erosional process in this area. They usually start in intermittent headwater stream channels and flow

rapidly downstream with tremendous force. They most commonly occur during heavy rainstorms following high antecedent soil moisture. Landslides occur when downslope shear stress exerted by the weight of the saturated slope exceeds soil shear strength and the force of gravity moves material downhill (NCASI 1985). The resulting debris slides and torrents are a mixture of mud, rock and organic debris that tend to scour the upper 1st and 2nd order stream reaches and eventually deposit sediment and wood in lower reaches (>3rd order). Dam break floods may also be associated with debris torrent deposits that temporarily impound water and sediment, but then break through to create a large flood wave down the stream channel (Montgomery and Buffington, 1993).

The recurrence interval for debris slides or torrents from a single location in the central Coast Range is on the order of hundreds to thousands of years. Periodically, lower reaches impacted by large torrents will be aggraded by the influx of sediment, then gradually degraded as the stream downcuts through the deposit. This cycle of aggrading and downcutting occurs in a timeframe of hundreds to thousands of years, depending on the size of the deposits and the flow regime of the channel. Valley width, channel gradient and tributary angle influence how far a debris torrent travels and where it will deposit its load, but it is not uncommon for debris torrents to scour headwalls and channels to bedrock for hundreds of feet. Debris torrents on Tyee generally produce deposits ranging from 500 to 5000 cubic yards in size, averaging approximately 2000 cubic yards.

Slumps are present in Indian/Deadwood but are not as common as debris slides. They are large, deep-seated slides that move downhill on a curved plane of weakness. They can cover areas as large as entire hillsides and can move either slowly and continuously or rapidly during large storm events.

Map 4.2 shows an estimate of the most slide-prone areas in Indian/Deadwood. It is based on a debris slide hazard rating of the area (see Appendix C for analysis methods). The model used to develop this map was based on relationships between slope form and slope gradient. With the knowledge that debris slides and torrents often occur in areas where thin soils overlay bedrock, a final variable factoring in soil thickness was layed over areas given a "high probability" rating by the original model. As a result, designated areas shown on Map 4.2 include soils less than 3.5 feet thick in areas containing concave slopes greater than 35% or planar slopes greater than 65%. It should not be assumed that shallow-rapid landslides will occur only in marked areas of this map. However, this information, coupled with data from past landslide and stream surveys, may provide insight into locations of high probability for sediment and wood influxes to the aquatic environment. In addition, this map will alert land managers to areas where more site specific analyses should occur at the project level. The map does not identify areas of possible slumps.

Insects and Disease

Laminated root rot, caused by the fungus *Phellinus weirii*, is the most commonly encountered forest disease disturbance agent in the watershed. The Deadwood watershed has a high incidence of laminated root rot relative to the rest of the Coast Range. From surveys conducted in the mid-1980's, the northeast portion of Deadwood was found to contain openings caused by this disease in 32 percent of the areas surveyed (Goheen et al 1983, 1984 and 1986).

Root rot fungus is a parasite that kills host trees of all sizes and ages. The fungus extensively decays roots of highly susceptible host trees and either causes windthrow or kills them by destroying their ability to take up water and nutrients. Infected saplings and small poles usually die standing; larger trees are more likely to be windthrown (Hadfield 1986). Douglas-fir and grand fir are the most

susceptible host trees. Deciduous trees are immune, cedars and redwood are resistant, and western hemlock is moderately resistant.

Phellinus weirii, like other root pathogens, has coevolved with its host through time and thus is a natural part of many forest ecosystems. Spreading through forest stands by means of root contacts, it kills susceptible host trees resulting in scattered groups of dead trees, openings in the canopy, increased volume of down woody debris and increased species diversity in the plant community (Thies and Sturrock 1995). In the absence of host trees, the fungus can survive on decaying conifer roots for up to 75 years. It clearly has the potential to produce landscape level diversity in the central coastal area.

The Douglas-fir bark beetle also occurs in the watershed, usually increasing in numbers following a blowdown. Trees infected by root rot become more susceptible to windthrow, but the trees may also be host to bark beetle before they blow over.

Wind

Strong winds with gusts up to 100 mph occur with major storm events. The effect of such strong winds in the Coast Range is the creation of 1-10 acre forest openings due to tree blowdown. Most of the blowdowns in Indian/Deadwood occur along ridgetops. The blowdowns provide places for successional development by opening the canopy and releasing suppressed understory climax species.

Major wind storms in recent history include the following:

- October 1962 (Columbus Day Storm)
- March 27, 1963 -- gusts over 100 mph occurred along the Oregon coast
- December 27-29, 1965 -- 75-120 mph winds unofficially recorded on the coast
- October 2, 1967 -- 100-115 mph winds recorded along the coast
- March 26, 1971 -- scattered damage along the coast
- December 18 - 22, 1971 -- coastal area, Willamette Valley wind and rain caused a lot of damage-
- January 7, 1975 -- gusts reaching 70mph
- March 24, 1976
- February 12-13, 1979
- November 14-15, 1981 -- most intense storm since the Columbus day storm of 1962
- December 19-26, 1983 and November 1-2, 1984 -- 90 mph winds on the coast
- December 12, 1995 -- 120 mph winds on the coast

These wind speeds were recorded on the coast. There is a loss of intensity inland with a corresponding reduction in amount and frequency of blow down.

Role of Disturbance in Vegetative and Aquatic Population Dynamics

Natural wildfires usually reset a stand or landscape back to an earlier seral stage, while wind and root rot tend to move a stand or landscape forward to more advanced seral stages. (See "Generalized Forest Succession" later in this chapter for a discussion of species composition changes with seral stage development.) Fire, especially stand-replacing events, kills most of the trees and produces an early seral forest which then moves through succession as one large block, finally remaining in later