United States
Department
of Agriculture

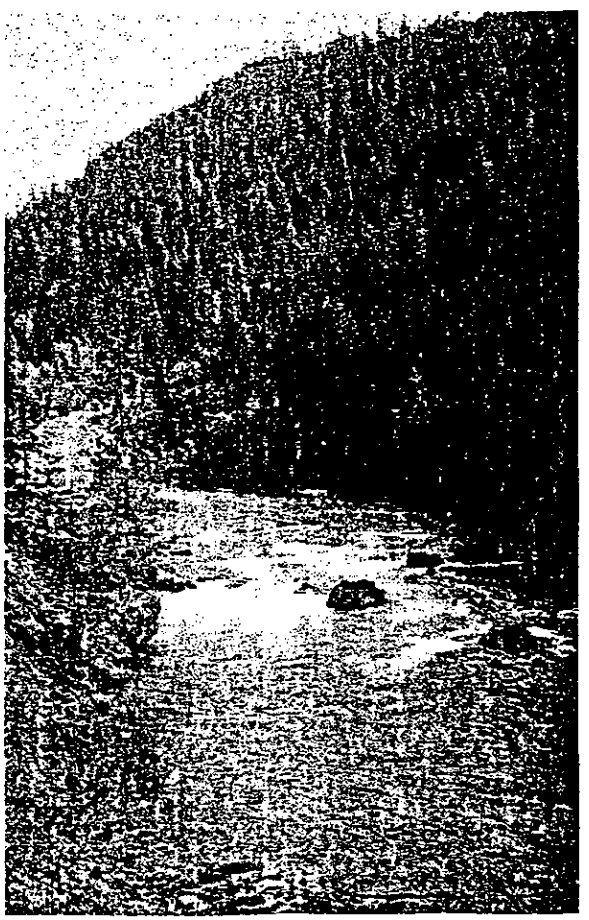
Forest Service

Lower Clackamas River Watershed Analysis

Pacific Northwest Region
1996

Mt. Hood National Forest
Bureau of Land Management

BLM



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INTRODUCTION AND SETTING

Purpose for Watershed Analysis

The purpose of watershed analysis is to develop and document a scientifically-based understanding of the ecological structures, functions, processes and interactions occurring within a watershed, and to identify trends, conditions, and restoration opportunities. The understanding gained through Watershed Analysis is critical to sustaining the health and productivity of natural resources and in understanding the consequences of management actions before implementing those actions.

Watershed analysis is essentially *ecosystem analysis at the watershed scale*. Federal agencies are conducting watershed analyzes to shift focus from species and site management, to the ecosystems that support them. Watershed Analysis is conducted as part of implementing the Northwest Forest Plan (Record of Decision for Amendments to the Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (USDA, USDI 1994). Watershed Analysis is not a decision making process. It is an ongoing, iterative process. This document is a product of that analysis. This document is dynamic, and it is intended to be revised and updated as new information becomes available.

The Process Used

Three key questions were identified by the Lower Clackamas Watershed Analysis team. They are:

1) Key Natural Processes

> How do present and future conditions of the watershed contribute to the habitat needs of species associated with riparian, aquatic, terrestrial and special habitats, and geologic and hydrologic conditions?

2) Human Use and Infrastructure

> Which components are critical to the balance of human use and management of infrastructure while protecting and managing resources?

3) Late Successional Reserves

> What is the compatibility of current and projected human use with the Late Successional Reserve?

These three key questions were reviewed during a public meeting on March 29, 1996. The majority of comments from the public were concerning roads and maintaining access for recreation use. No other key questions were identified.

In this document the reader will find:

A description of the watershed setting
Answers to the key questions
Products of the landscape analysis and design process
Recommendations for monitoring, information needs, project implementation, restoration, access and travel management, and some site specific recommendations.

The six step process was used. As identified in the Federal Guide for Watershed Analysis (1995) the six steps are:

1) Characterization of the watershed
2) Identification of issues and key questions
3) Description of current conditions
4) Description of reference conditions
5) Synthesis and interpretation of information
6) Recommendations

Steps 3, 4 and 5 are self contained within the document chapters answering the three key questions.

Watershed Setting

The Lower Clackamas Watershed is located on the Clackamas River Ranger District, Mt. Hood National Forest, in Clackamas County, Oregon. It is 30 miles southeast of Portland, and 10 miles southeast of Estacada (Map 1-1). The watershed contains 43,250 acres. Table 1 shows ownership of those acres.

Table 1. Ownership of Lower Clackamas Watershed

Landowner	Number of Acres	Percentage of Acres
U.S. Forest Service	40,387	93%
U.S. Bureau of Land Management	994	2%
private	1,870	5%

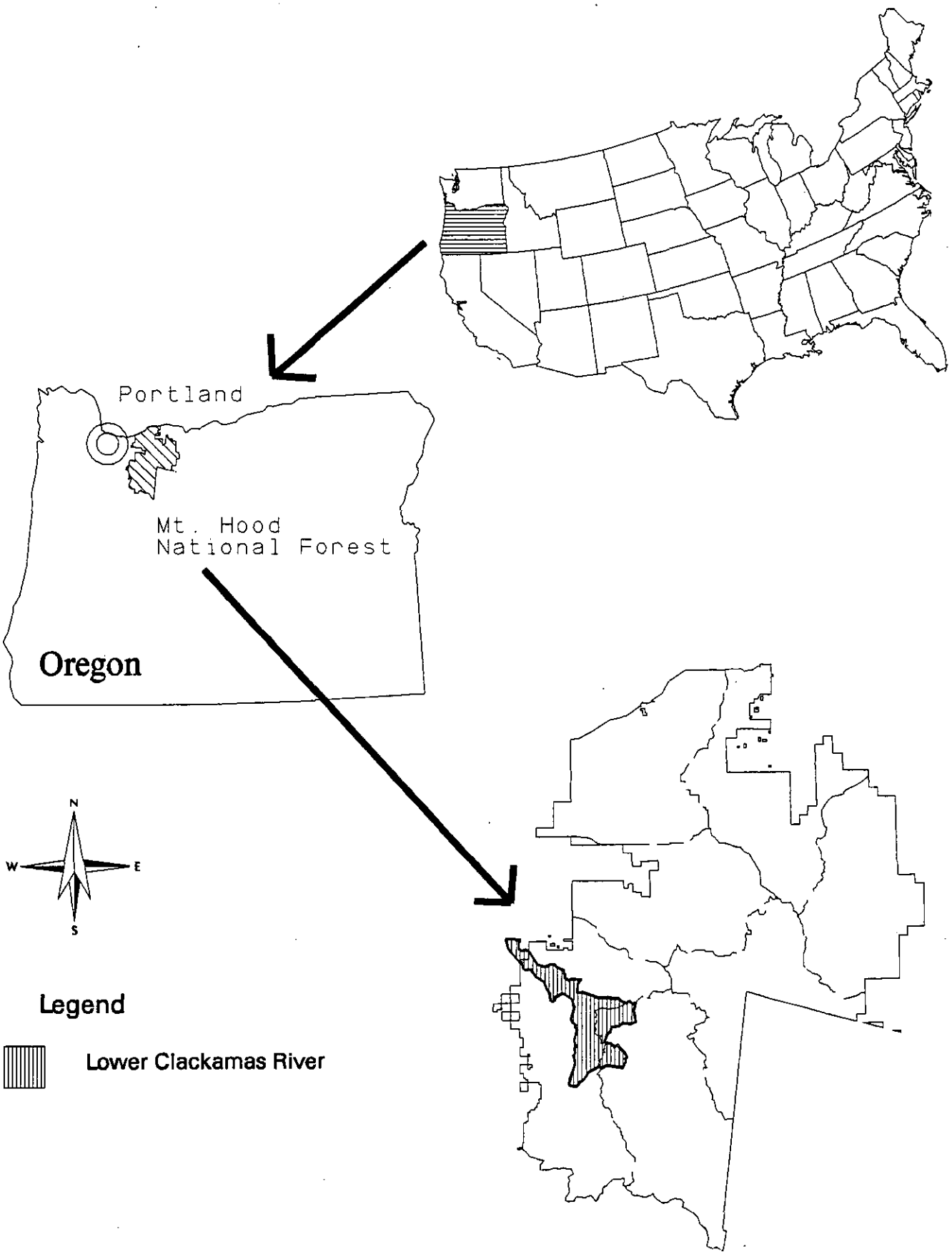
The lower Clackamas watershed is a "collector" watershed. It does not meet the definition of a normal watershed. Instead, it is comprised of a series of small watersheds feeding into the mainstem of the Clackamas River (such as Trout Creek and Cripple Creek), plus the mainstem of the Clackamas River from the National Forest boundary to the confluence of the Clackamas River with the Collawash River. Water quality and sediment delivery are directly influenced by upstream events. This process is best displayed at the confluence of the Clackamas River and Collawash River. During winter storm events turbidity levels are much greater in the Collawash. The Clackamas River runs much clearer and the water quality of the lower Clackamas River is defined by those two systems.
The dominant human imposed feature of the lower Clackamas watershed is highway 224, which parallels the river often only a few feet from the river's bank.

Geology

The magnificent geology of the Lower Clackamas Watershed sets the stage for all other resource discussions. The underlying geologic feature of the Lower Clackamas River is the ancient lava flows from the Columbia Basin. Over 15 million years old, these lava flows are from the same parent source as the basalt outcroppings seen along the Columbia River Gorge. In fact, it is theorized the Columbia River once flowed in the same general vicinity as the Clackamas River. Along the Clackamas River from the Forest boundary upstream the remnants of the ancient lava flows are still seen. Towering basalt bluffs rise vertically from the river. These bluffs and outcroppings continue for the next 25 miles.

The other major geologic feature of the Lower Clackamas River watershed is 12 million year old ancient volcanoes. Postulated to be located near the headwaters of Trout Creek and near the watershed boundary, the ancient volcanoes are the source of the Rhododendron formation. The Rhododendron formation is composed of tephra and ash fallout, a much more water-impermeable geologic layer compared to the lava flows. The implications of the two types of formations are discussed in the soils and geology report in Chapter 2.

VICINITY MAP



MAP 1-1

Stratification

An analysis tool commonly used in watershed analysis is stratification. Stratification is sub-dividing a watershed into smaller geographic areas to better meet analysis needs. The Lower Clackamas Watershed has been divided into four analysis areas, described below. Analysis areas are displayed on Map 1-4.

Late-Successional Reserve/Corridor
Along the Clackamas River corridor there are many overlapping land designations. For analysis purposes, we combined those into a stratification designated "late-successional reserve/corridor". The dominating land allocations are the late-successional reserve (LSR) identified in the Northwest Forest Plan and the Federally designated Wild and Scenic River. There are 25,250 acres in this analysis area. In addition to the river corridor this area contains the upland flats of the Dinner Creek/Mt. Mitchell area. Elevation ranges from 700 feet at river level at the Forest boundary to 4,800 feet at the upper reaches of the Three Lynx drainage.

Administration
Along the southeast border of the LSR is an area containing the two major administrative sites on the Clackamas River Ranger District, the Timber Lake Job Corps and the old Ripplebrook Ranger Station. This area is called Administration, and contains 2,354 acres. Frog Lake, an over-flow pond, is located in the Administration area and is managed by Portland General Electric. There is a 60 acre tract of private land known as the Davis ranch. Elevations range from 1,000 to 3,600 feet.

Buttes
To the south and east of the Administration area and to the west of Oak Grove Butte are two small sub-watersheds, Tag and Tar Creeks. They are geographically isolated from the other areas of the Lower Clackamas Watershed and are their own analysis area. There are 3,145 acres in the Buttes analysis area.

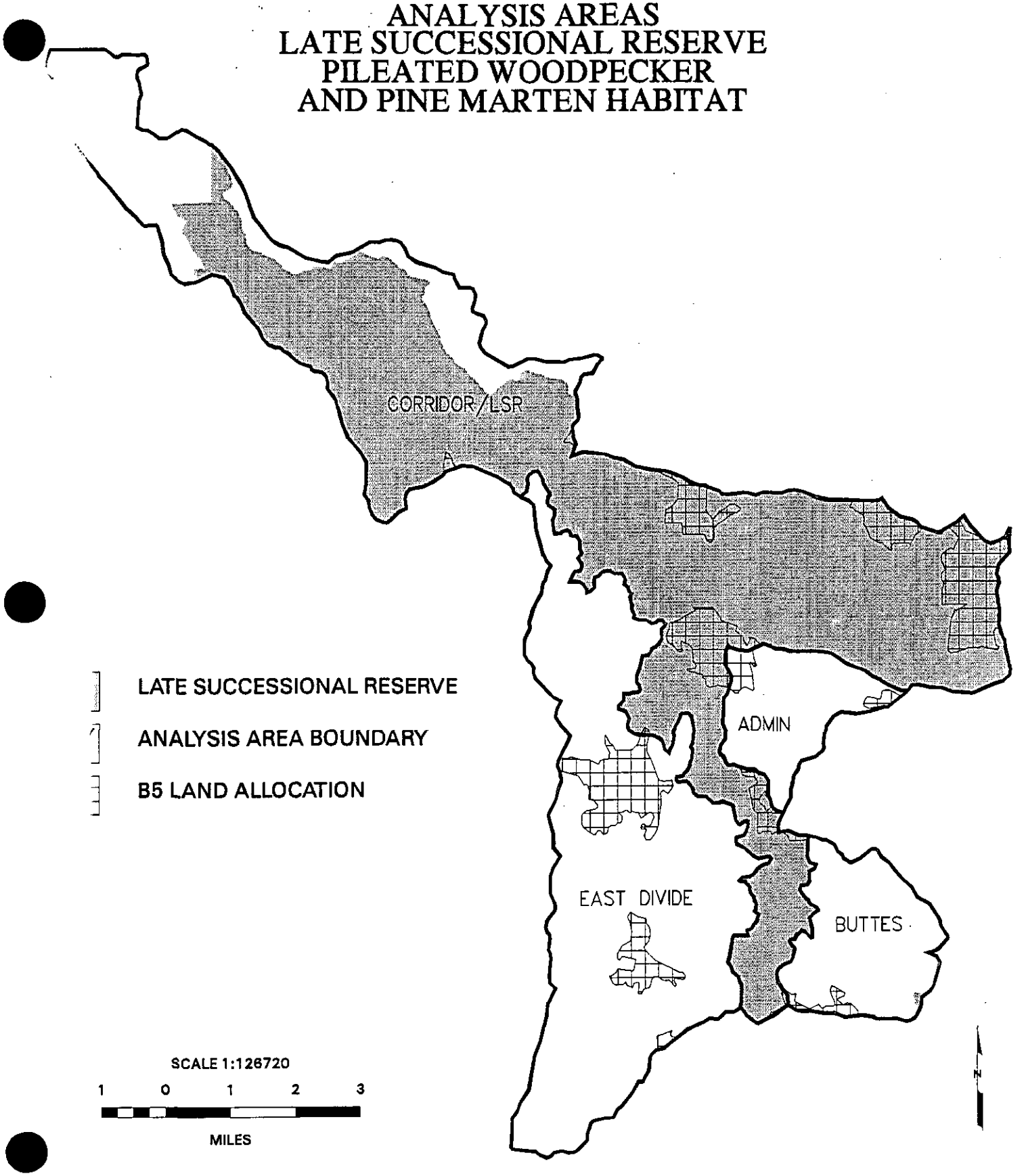
Divide
The fourth analysis area is called Divide. It is the south-western portion of the watershed analysis area. The area covers the east side of the Fish Creek divide and includes the sub-watersheds Pup Creek, Sandstone Creek, Big Creek and Trout Creek. There are 12,503 acres in the Divide. Elevations range from 1,000 at the Clackamas River to 5,100 at Whales Head.

Table 1-2 summarizes the acres of the analysis stratification areas.

Name of Area	Acres	Percentage
Corridor	25,250	58%
Administration	2,354	6%
Buttes	3,145	7%
Divide	12,503	29%
Total	43,250	100%

LOWER CLACKAMAS WATERSHED

ANALYSIS AREAS
LATE SUCCESSIONAL RESERVE
PILEATED WOODPECKER
AND PINE MARTEN HABITAT



MAP 1-4

Land management actions in the Lower Clackamas Corridor are guided by two documents, the Mt. Hood National Forest Land Management Resource Plan and the Northwest Forest Plan. Table 1-3 lists the land allocations from the Mt. Hood Forest Plan. Table 1-4 list the land allocations from the Northwest Forest Plan. Mt. Hood Forest Plan land allocations are displayed on Map 1-5.

Table 1-3. Land Allocations from Mt. Hood Forest Plan.

Allocation	Description	Acres	Percentage
A-4	Spec Interest Area	3,272	8
A-9	Key Site Riparian	541	1
A-13	Bald Eagle	434	1
A-7	Old Growth	469	
B-1	Wild and Scenic River	4,484	10
B-2	Scenic Viewshed	15,187	35
B-6	Spec Emphasis Watershed	59	
B-8	Earthflow	8,170	19
C-1	Timber Emphasis	8,302	19
	Other Ownership	2,332	5

Table 1-4. Land Allocations from the Northwest Forest Plan

Land Allocation	Acres **
Late Successional Reserve	21,094
Riparian Reserve	15,458
Matrix	not available at this time

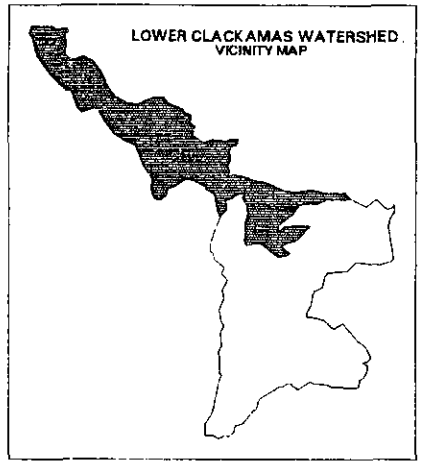
** land allocations overlap and to sum acres may be misleading

History of the Lower Clackamas watershed

The greater Clackamas River drainage represents one of the most important river systems in the Northern Oregon Cascades. The resources supplied by this system and its surrounding mountains have sustained human populations in the region for up to 10,000 years. Maps 1-2 and 1-3 display important roads, waterways, recreation sites, landscape features and other ownerships.

Despite the limited ground surface visibility imposed by dense forest vegetation there are over 100 prehistoric and historic archaeological sites identified in the watershed (80 prehistoric and 34 historic sites). Many of our managed campgrounds and dispersed camping areas are archaeological sites. This indicates for thousands of years, including today, people have been seeking out desirable flat areas near the river for term habitation.

LOWER CLACKAMAS WATERSHED
BASE MAP - NORTH HALF



BLM Land

Other Ownership

Creeks

Clackamas River

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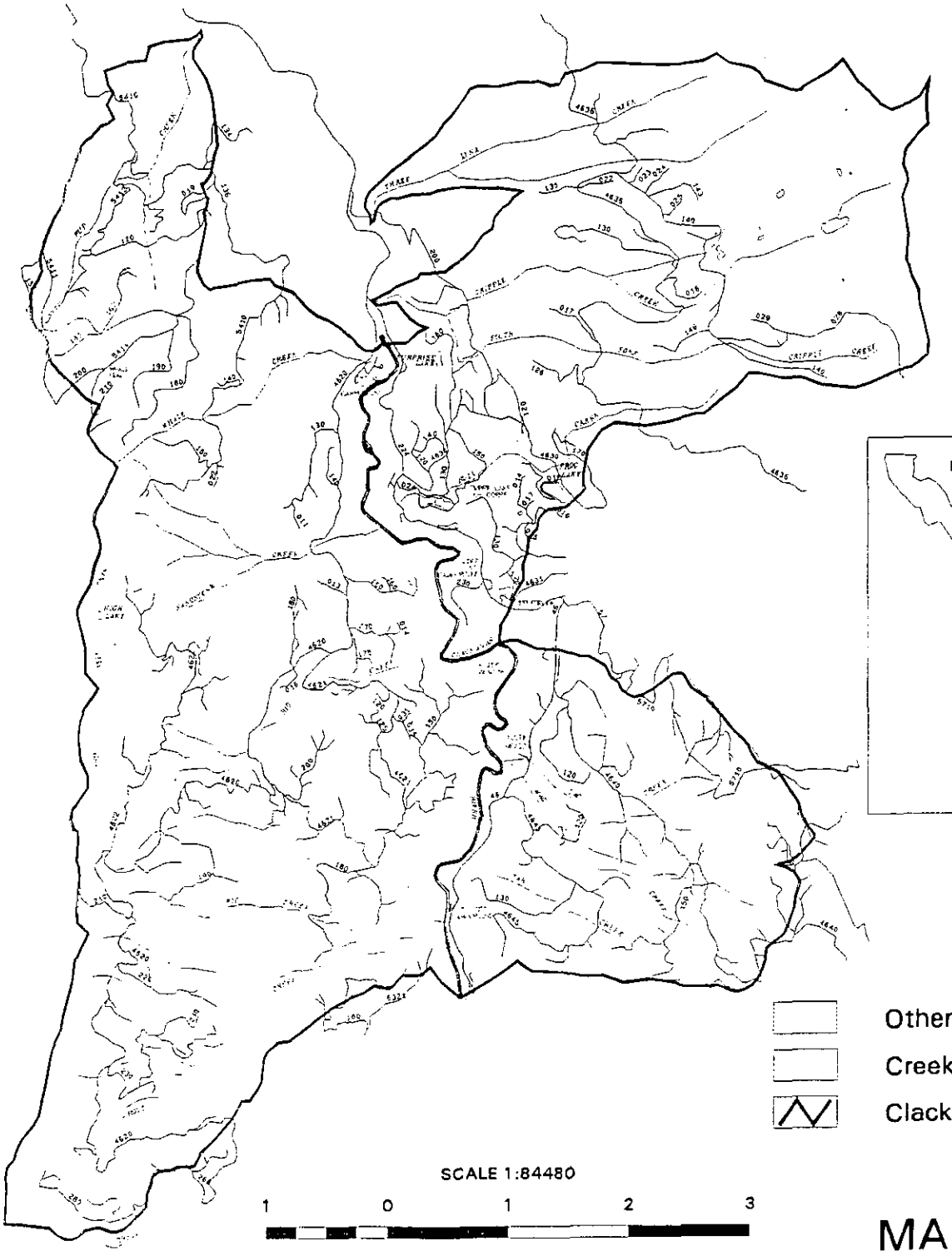
MILES

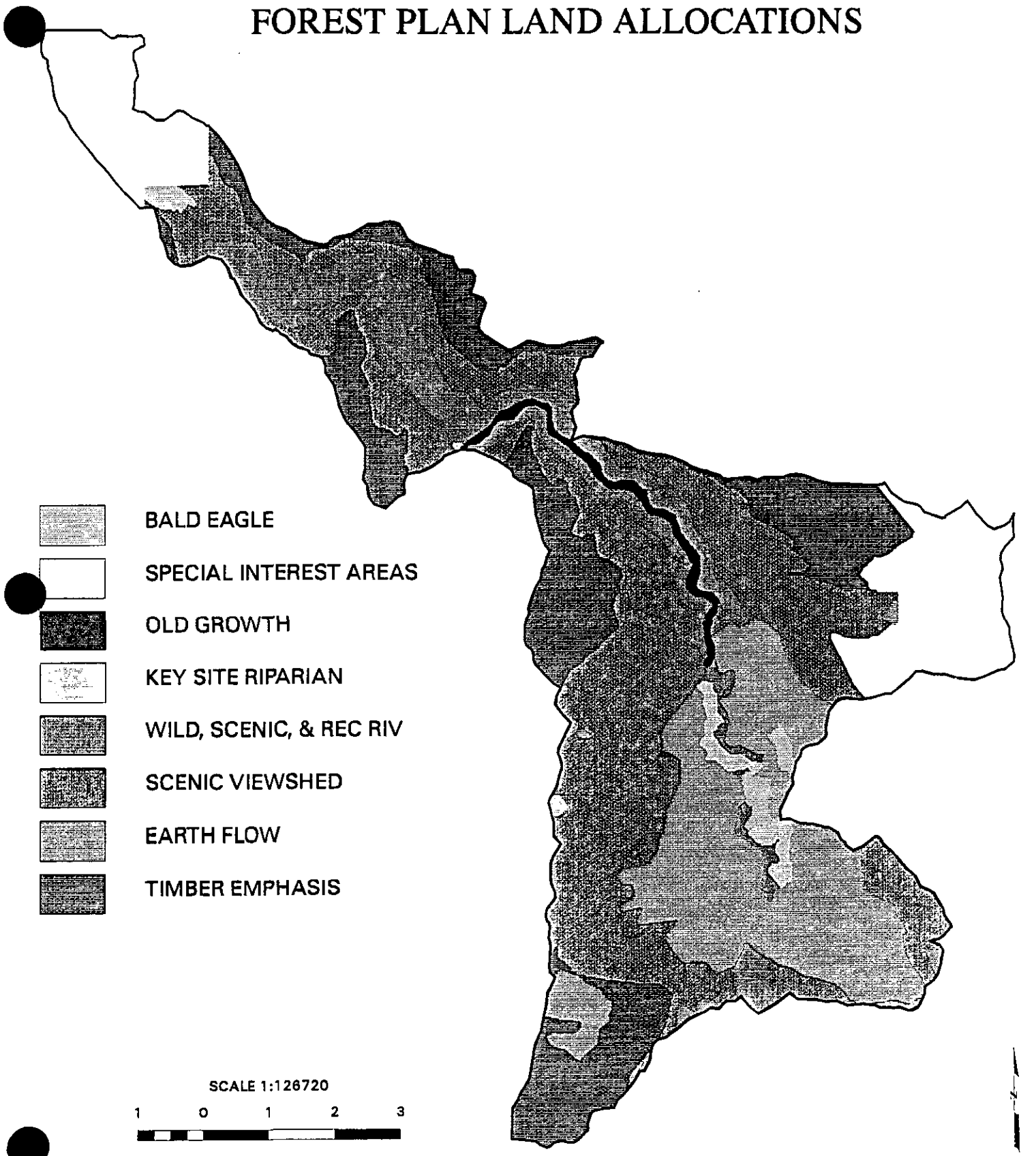
MAP 1-2

LOWER CLACKAMAS WATERSHED
BASE MAP - SOUTH HALF



MAP 1-3

LOWER CLACKAMAS WATERSHED
FOREST PLAN LAND ALLOCATIONS



MAP 1-5

Prehistory

It is likely late summer productivity of plant and animal resources near the river combined with the presence of salmon runs made the river and its nearby landforms particularly desirable throughout much of the prehistoric past. The density of archaeological remains in riverine context is a reflection of its importance and consequent repeated use.
The types of identified prehistoric localities reflect at least two of the primary economic pursuits practiced in the vicinity of the river--big game hunting and fiber collection for containers, mats and clothing.

Prehistoric highlights -

* Prehistoric use was probably greatest along the Clackamas River near its confluence with other major anadromous fish bearing rivers such as Roaring River.

* The lower elevation and perhaps milder climate, along with the availability of resources may have contributed to stays of longer duration than higher elevations in the watershed.

* Huckleberries were an important dietary staple, along with fish and wildlife to prehistoric peoples. There is evidence that huckleberries were also an important staple found at higher elevations and that huckleberry fields were actively maintained through the rotation of selective burns to insure a continued source of this valuable commodity.

* Gathering of roots and medicinal plants was also an important activity prehistorically.

* Cedar bark was used extensively for a variety of purposes, such as storage containers for collected commodities, clothing, cordage, etc.

Archaeological localities identified to date in the Clackamas watershed are only a sample of a much larger site population actually preserved near the Clackamas.

Historic

Historic period sites recorded along the Clackamas River corridor are few in number, but reflect two general trends. First, their locations show a marked focus on lower elevations along the river. And secondly, these sites are related to activities dating within little more than a century before the present.

Historic site locations are generally very near the water - within 250 feet. This pattern indicates perhaps that historic exploitation along the corridor was strongly tied to the river itself and/or resources immediately adjacent to water's edge.

There are three broad categories of historic use within the lower Clackamas watershed:

1). Transient use - exploration and recreation
2). Human occupation - homesteading and Forest Service facilities

3). Commodity extraction - mining, grazing, timber production. Commodity extraction reflects most of the historic sites in the drainage. Dams, fish hatcheries, and springboard stumps related directly or indirectly to commodity extraction along the river.

Trails

By the turn of the century the trail system was still limited. New trails were gradually being added by the Forest Service to provide fire lookout access and to allow rapid access for fire suppression. The Telegraph Trail was established in 1916.

Railroads

The Oregon Power and Railway company extended an interurban line up the Clackamas River to Cazadero in 1903. In 1921 the line was pushed father up the Clackamas River when the Union Lumber Company and Portland General Electric Company jointly financed its extension to the North Fork of the Clackamas River for shipping raw logs to downstream mills. The railroad above Cazadero also functioned as a recreational vehicle, "speeder" cars could take picnickers, anglers, and sightseers on weekends to various stops along the river up to Three Lynx for $1.00.

In the 1930's, due to public demand for easier access to the upper Clackamas River the railroad abandoned, the tracks removed and the route transformed into a road suitable for automobile and truck traffic.

Hydroelectric Facilities

By the turn of the century increasing demands by Portland and other communities surpassed the output capabilities of the 1889 Willamette Falls and powerhouse. Cazadero dam was completed in 1907 and the River Mill facility, which began operation in 1911, were the first subsequent hydroelectric projects. In the following decade Portland General Electric's Oak Grove project was underway, involving crews of 1,500 men in construction of the Oak Grove Dam and Three Lynx powerhouse. The plant began producing power in 1924.

Current Human Use

The most obvious characteristic of the Lower Clackamas watershed is Highway 224. The river, highway and power lines share the narrow canyon floor and are in almost constant visual contact. Long segments of fill slope of the highway are unvegetated riprap. The road shoulder is either barren or weedy appearing. The south facing slopes of the corridor are a mosaic of mature Douglas-fir groves, maple and oak clumps and grassy openings. North facing slopes are an almost unbroken canopy of old-growth fir, cedar and hemlock.

Most of the campgrounds of the Clackamas River Ranger District occur within the Lower Clackamas watershed. Other structures are the Memaloose scaling station, Timberlake Job Corps and the old Ripplebrook Ranger Station.

During holiday weekends such as the Fourth of July and Memorial Day people are the dominant

feature. On these high use weekends thousands of people visit the Clackamas River filling all campgrounds. Dispersed recreation use explodes, and campsites are created on roadside pullouts, waste disposal areas and any other available flat area.

Floods of the Winter of 1996

Two major flood events occurred during the winter of 1996. The first occurred in late November, 1995 and is postulated to be a 50 year flood event (meaning there is a one in fifty chance of that magnitude of flood occurring in any given year). The second flood occurred in mid February and is postulated to be a 100 year event. Effects of the flood in the Lower Clackamas watershed varied. The most noticeable effect was to Highway 224. Twenty slides requiring repair to the highway occurred between milepost 25.6 and milepost 48.8. A major slide occurred at milepost 47, the area known are Foreman Hill. The road is expected to remain closed until the highway is rerouted in 1998. Current repair costs along this section of Highway 224 is about $14 million.

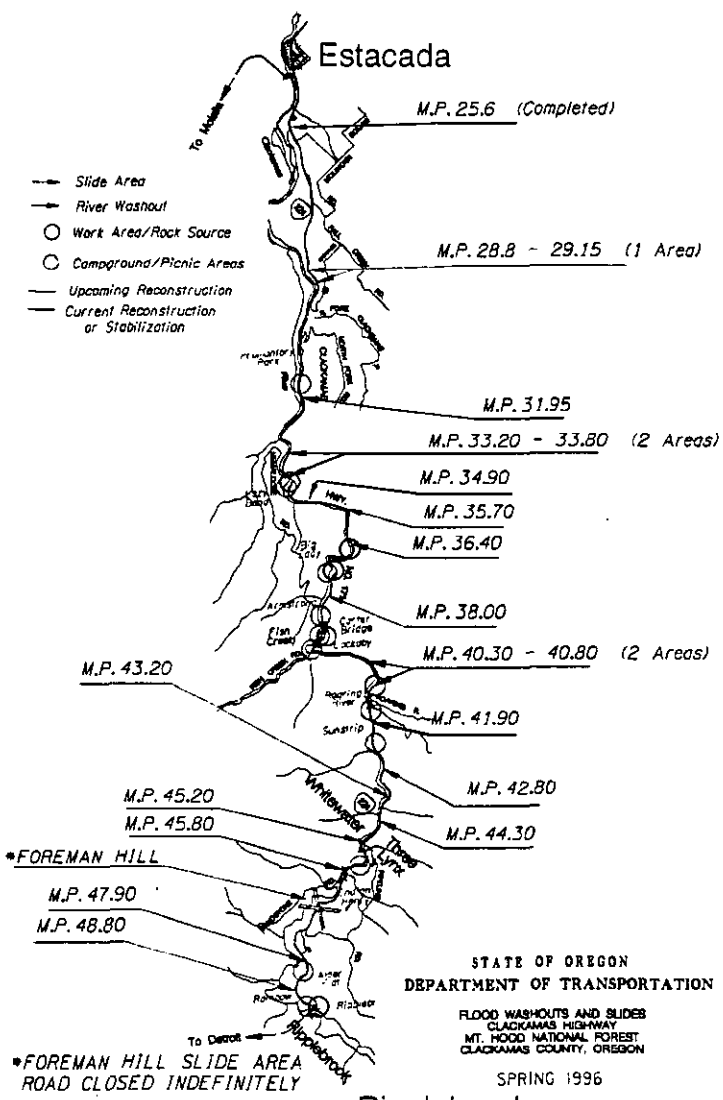
These closures have required significant changes in recreation, administrative and commercial access. Many campgrounds were closed part or all of the summer of 1996. Administrative traffic for Timberlake Job Corps, Portland General Electric and the Forest Service has been temporarily rerouted along Forest Road 4630. Commercial access, primarily log haul but also Special Forest Products, has changed and resulted in "catastrophic modifications" of 20 of 25 sales under contract. See following pages for examples of information sheets developed for the public by Oregon Department of Transportation to answer questions regarding flood impacts to access into the Lower Clackamas River watershed.

CLACKAMAS HIGHWAY FLOOD

June/July 1996 Volume Three

REPAIR UPDATE

Construction crews continue to rebuild flood-ravaged Oregon Highway 224.



CREWS MAKE PROGRESS

Construction crews continue to rebuild flood-ravaged Oregon 224 above Estacada. The scenic highway which meanders along the Clackamas River was reopened as scheduled May 24 up to Fish Creek Road (milepost 39), but remains closed between Fish Creek and Ripplebrook. Although repair work is slightly ahead of schedule, officials with Oregon Department of Transportation say the highway is to remain closed at Fish Creek Road until August 1.

The popular route into the Mt. Hood National Forest was devastated during the February flood suffering about $14 million in damages. The highway was battered by numerous slides and washouts along a 23 mile section between Estacada and Ripplebrook. High water and strong currents from the Clackamas River demolished travel lanes and roadway shoulders, washed out the roadway beneath the pavement and severely undermined the embankment.

The contractor, Goodfellow Brothers Inc., of Wenatchee Washington, is working two, 10 hour shifts, five days a week in an effort to reopen the highway as soon as possible. No work is occurring on the weekends in order to accommodate recreational traffic.

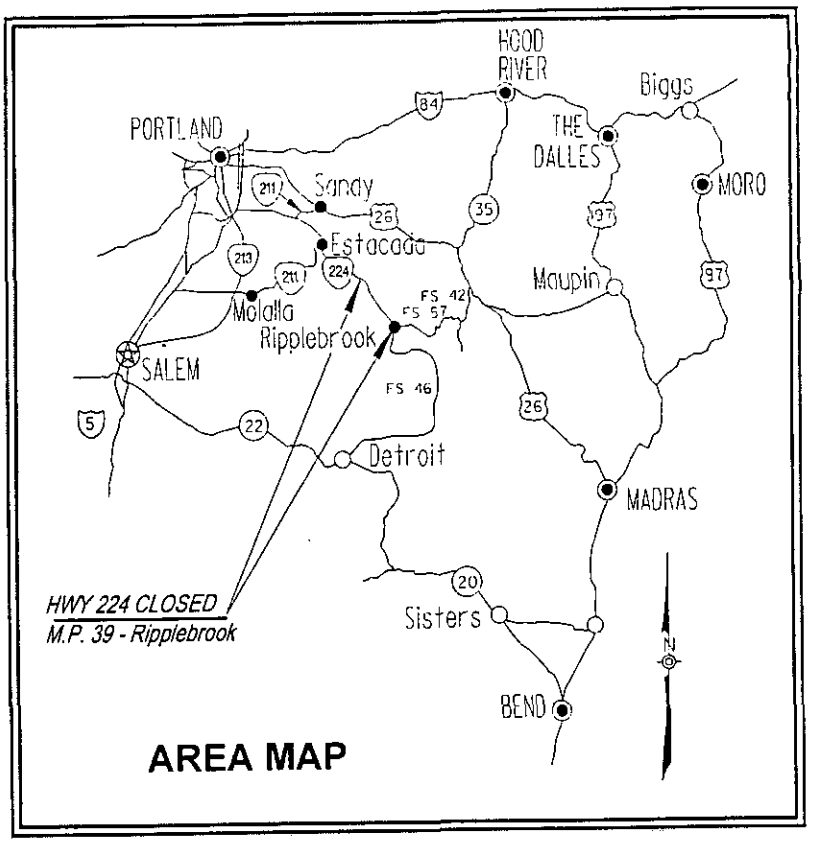
USE CAUTION IN WORK AREAS

Even though the section of highway up to Fish Creek Road is open to traffic, there is still work at locations beyond Promontory Park. That means drivers need to watch for construction crews and heavy equipment on the roadway. These crews are committed to completing repairs and opening the roads as soon as possible, but they need your patience and cooperation. So please slow down and drive carefully in this area.

Foreman Hill Update

The highway will remain closed at milepost 47 for up to two years. This section of roadway known as Foreman Hill collapsed during the February flood after heavy rainfall and snow runoff saturated the hillside. Because the area remains extremely unstable and is prone to similar washouts in the future, crews will be prevented from rebuilding the road at the same location.

As a result, final engineering and design work is under way for a proposed realignment project that would shift a one and one-half mile section of the roadway to the north of the existing highway. The U.S. Forest Service, Federal Highway Administration, and Oregon Department of Transportation will gather public testimony on the plan at a public open house in the meeting room at Estacada City Hall on Wednesday, June 26 from 3-5 p.m. and 6-8 p.m.



Alternate Routes Available

Public access into the Mt. Hood National Forest above the Ripplebrook Ranger Station is available via Timothy Lake (US 26 and Forest Service Roads 42 and 57) and through the community of Detroit (Oregon 22 and Forest Service Road 46).

For more information call ODOT at (503) 731-8263 or the U.S. Forest Service at (503) 630-6861. Both agencies thank you for your patience during the flood repair work.

ODOT employees survey slide damage.

KEY NATURAL PROCESSES

How do past and present conditions of the watershed contribute to the habitat needs of species associated with riparian, aquatic, terrestrial and special habitats, and geologic and hydrologic conditions?

The answer to this question is presented by describing:

Terrestrial Conditions

Vegetation

- Forest Series
- Range Of Natural Variability
- Vegetation Patterns in the Four Analysis Areas
- Fire History
- Windthrow
- Insects and Disease

Wildlife

- Threatened and Endangered Species
- Survey and Manage Species
- Other Wildlife Species
- Wildlife Habitat
  - Coarse Woody Debris
  - Forest Guilds
  - Species Richness and Diversity
  - Special Habitats

Soils

Geology Landforms

Aquatic Conditions

Fisheries

Hydrology

Key Points and Findings

Key points summarizes relevant findings of Chapter 2.

Terrestrial Conditions

Vegetation

Forest Series

Three forest series occur within the Lower Clackamas watershed: Western Hemlock, Pacific Silver Fir and Mountain Hemlock. Each of these climax species occur in different elevation zones within the watershed and represent major variations in ecological factors. Variations include plant community composition, growing season, productivity (the maximum size and growth rate of vegetation) and wildlife use patterns. General characteristics of each forest series are described in table 2.1.

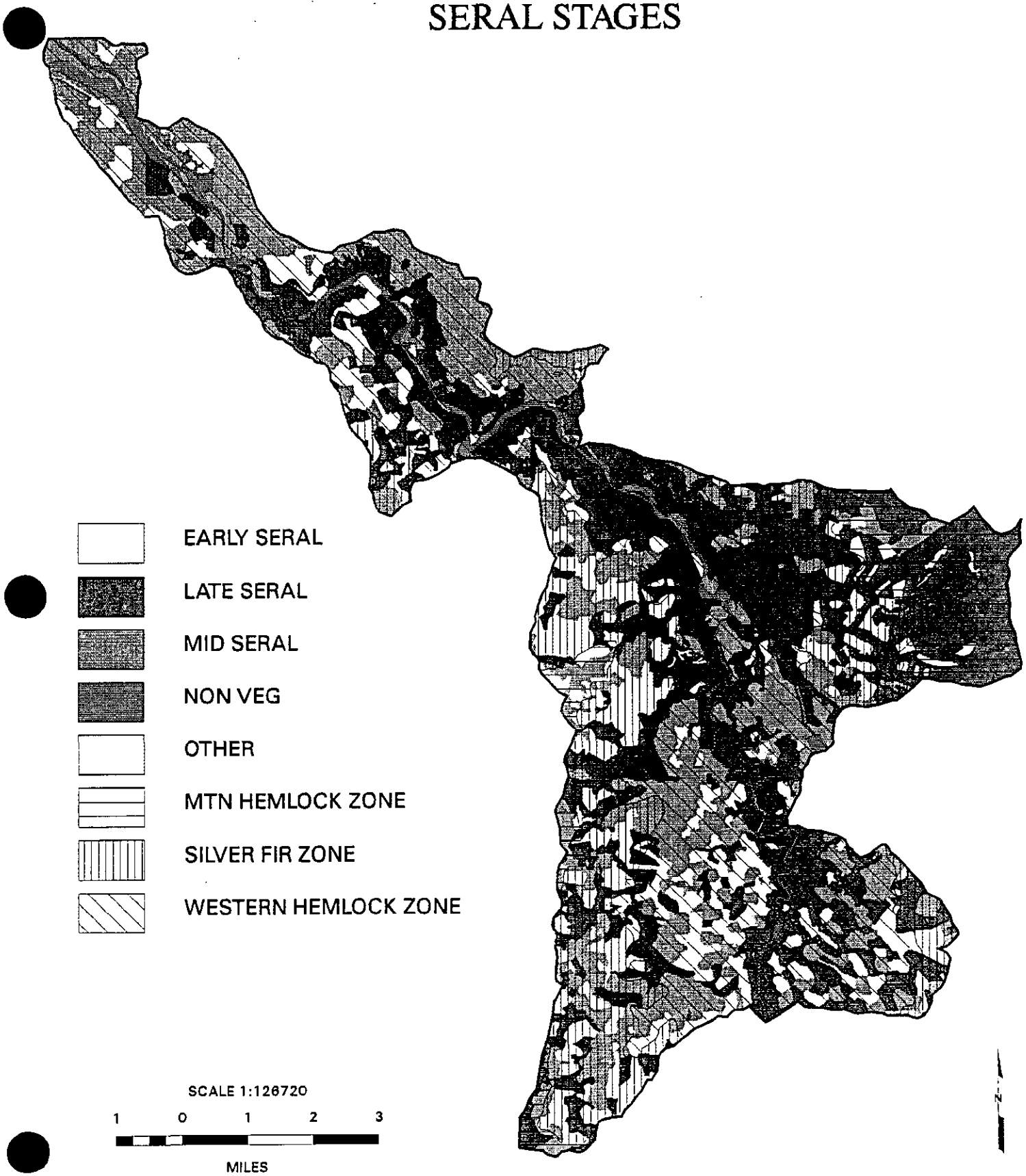
Table 2.1 Description of Forest Series

Series	Climate	Elevation
Western Hemlock	warm, wet winters warm, dry summers highly productive soils	0 to 3,500 feet
Pacific Silver Fir	cool, wet winter deep snow pack relatively dry summers moderately productive soils	3,000 to 5,000 feet
Mountain Hemlock	cold, dry winters persistent deep snow pack short growing season shallow, poor soils	over 5,000 feet

Figure 2-1 displays the percentage of each forest series which occurs in the Lower Clackamas watershed, and map 2-1 displays their location.

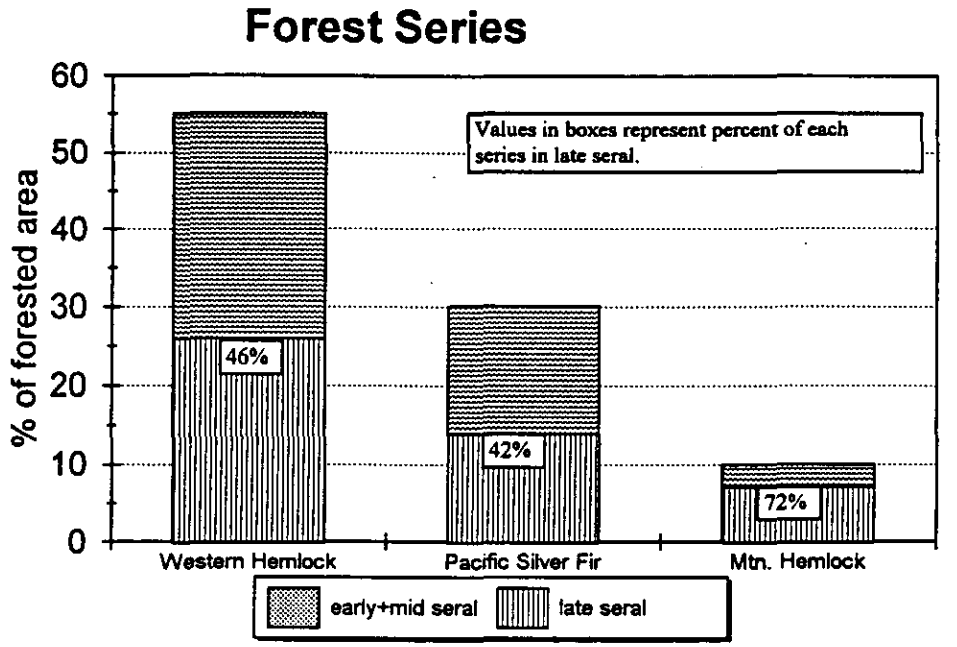
LOWER CLACKAMAS WATERSHED

SERAL STAGES



MAP 2-1

Figure 2-1. Forest Series.



Range of Natural Variability

Range of Natural Variability (RNV) is based on the concept that ecosystems are not static and vary over any given period of time. This dynamic nature exemplifies the need to compare the range of these natural conditions against current conditions.

In 1993, the Pacific Northwest Region undertook an assessment of the RNV for elements believed to determine ecosystem health. This analysis was done at the sub-basin scale (i.e. the Clackamas River), and examined historic conditions for the period between 1600 and 1850.

Figures 2-2 and 2-3 indicate the relationship between the estimated RNV for the entire Clackamas subbasin and the Lower Clackamas Watershed for the amount of early and late seral vegetation. These figures reflect a percentage of the total area within each of the Forest Series and Pacific Silver Fir Zones. The figures indicate there is a greater proportion of early seral component in the Western Hemlock and Pacific Silver Fir zones, and a greater proportion of late seral in the Mountain Hemlock zone as compared to the historic range.

Figure 2-2. Current condition compared to historic range of amount of late seral vegetation.

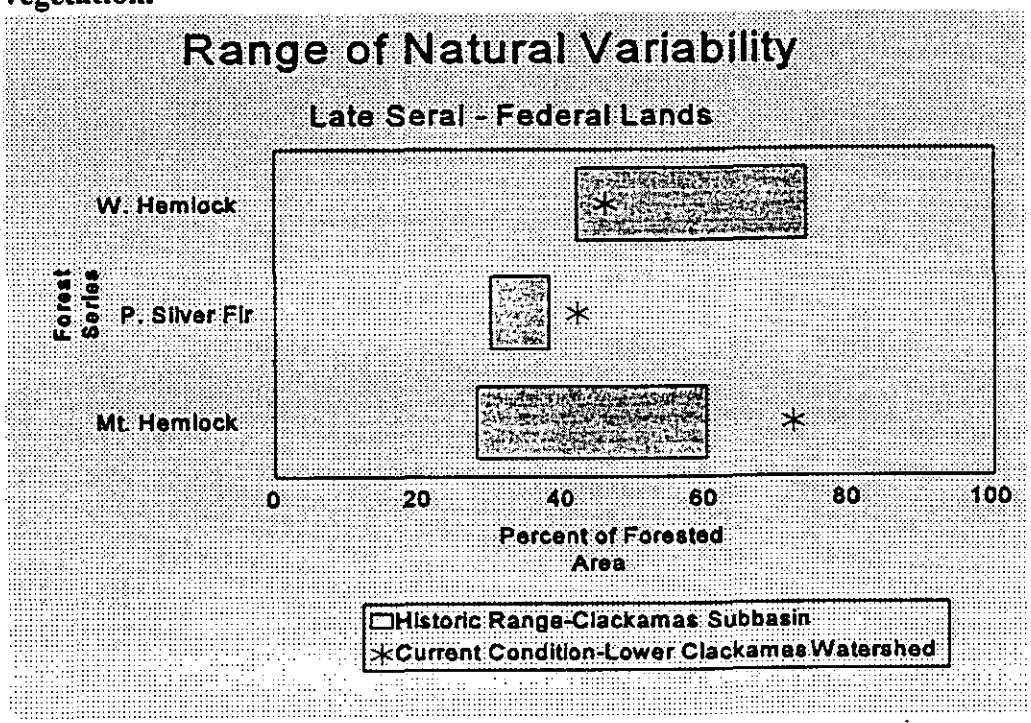
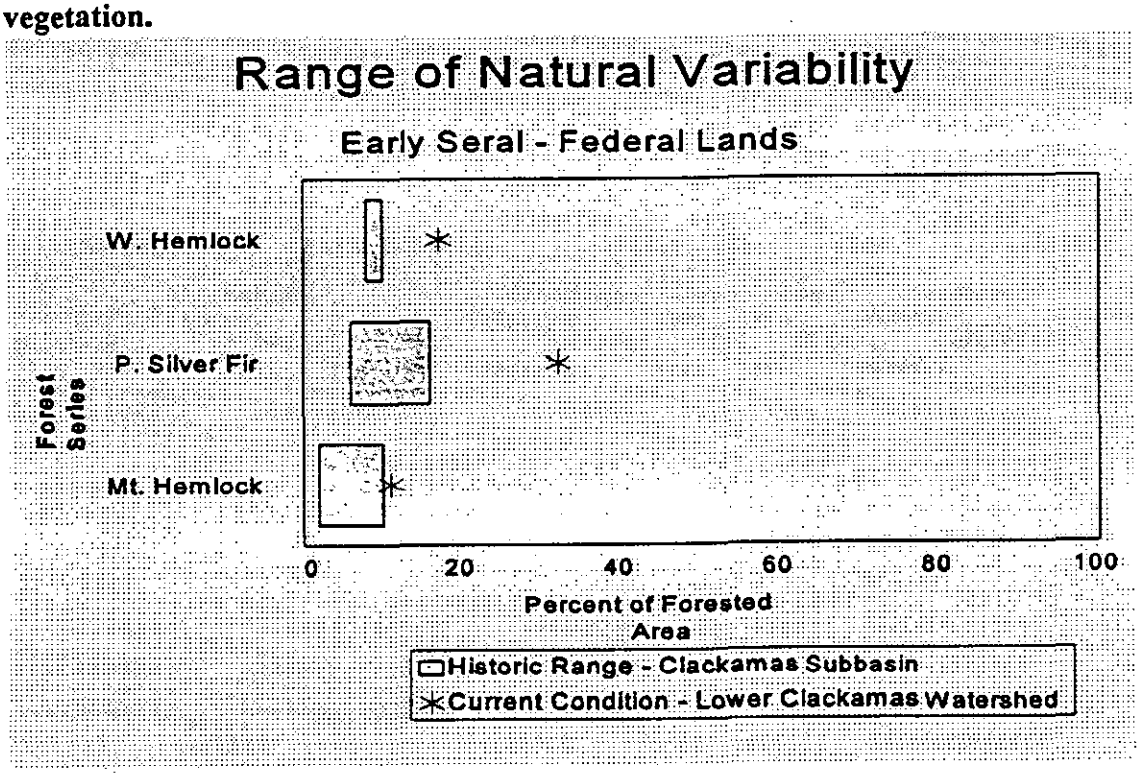


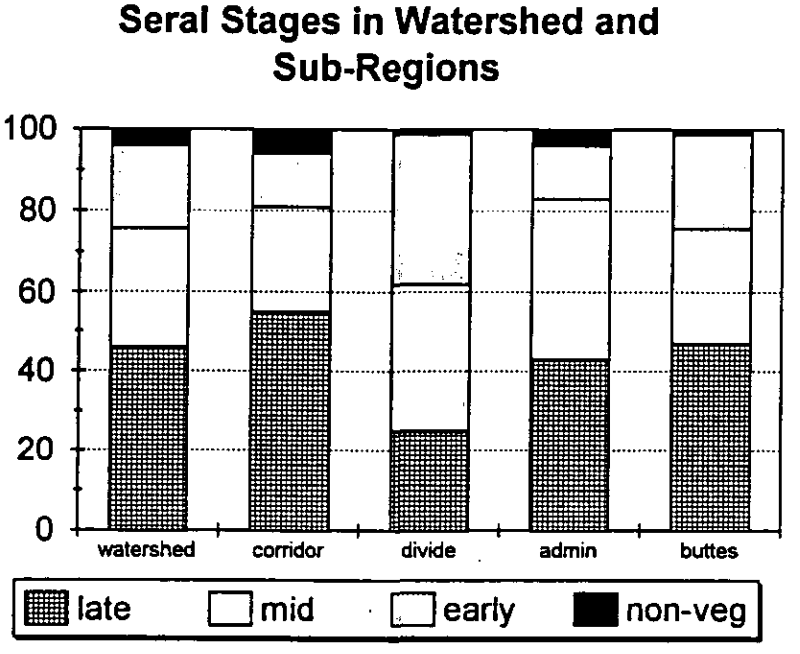
Figure 2-3. Current condition compared to historic range of amount of early seral vegetation.



Under a natural regime, there was likely a great deal of variability between watersheds in the Clackamas sub-basin. At any one point, some watersheds probably had a high proportion of early seral vegetation as a result of large (several thousand acre), stand replacing fires, while in other adjacent watersheds may have been predominantly late seral. Based on Figure 2.2 it appears the Lower Clackamas watershed is only moderately outside the range of historical norms. However, fragmentation of the existing vegetative patterns within the watershed (outside the LSR) is not similar to the large fire created openings. There is little unfragmented late seral forest outside the LSR (see Map 2-4) compared to 1944 historic seral stage conditions (see Map 2-3).

It is worth noting this is a broad comparison. This watershed is 43,252 acres, compared to the 400,000 acre size of the Clackamas River area used for generating historical RNV.

Figure 2-4. Seral Stages by Analysis Area.



Vegetation Patterns in the Four Analysis Areas

LSR/Corridor

The LSR/Corridor is the largest of the four analysis areas. 10% (2,483 acres) is designated for timber production, the remaining 90% is managed for Wild and Scenic River values and the Late Successional Reserve. Active vegetation management has been minimal along the river corridor since Highway 224 was completed in the 1940's. There have been minor disturbances, such has campground construction, but these are isolated patches.

Fire has played a minor role in determining current stand structure since the turn of the century. The LaDee fire (early 1930's) in the most northerly area, and the Salmon-Huckleberry fire in the

eastern portion (late 1800's) originated the mid-seral stands.

Prior to the Northwest Forest Plan, approximately 10,000 acres had been managed for timber production. As a result 5,400 acres in the LSR/Corridor are in the sapling/small saw seral stage.

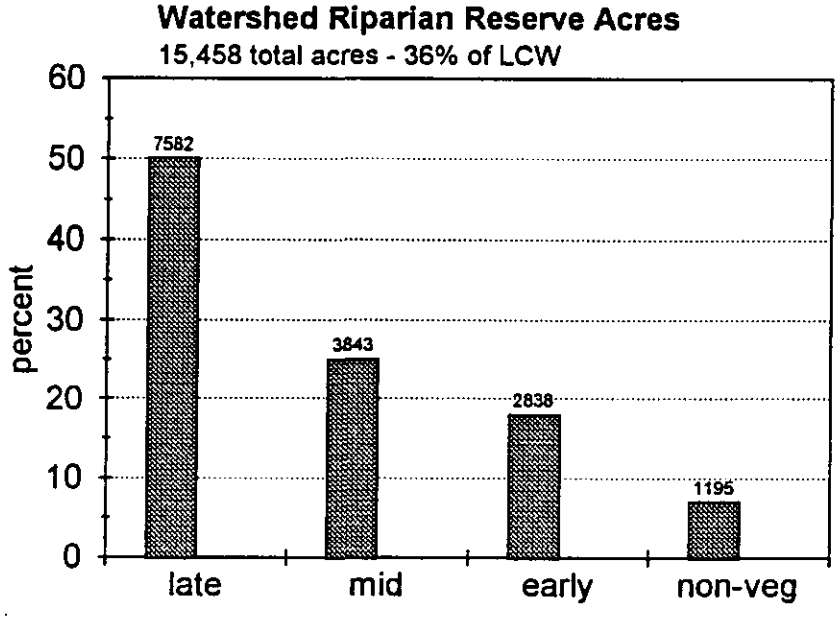
The Northwest Forest Plan set objectives for LSR's. They are to serve as functional, interactive, late successional and old growth ecosystems. In the LSR/Corridor analysis area 19,500 acres are designated as LSR. Approximately 70%, or 14,000 acres currently meets criteria for old growth conditions. There is also another 10% of the LSR that is not vegetated. Non-vegetation features include natural rock openings, Highway 224 and administrative sites.

Other dominant vegetative features include red alder along the edge of the Clackamas river and other riparian areas. Big leaf maple and red alder are common on sites unable to support conifers, such as steep, rocky canyon walls and unstable slopes.

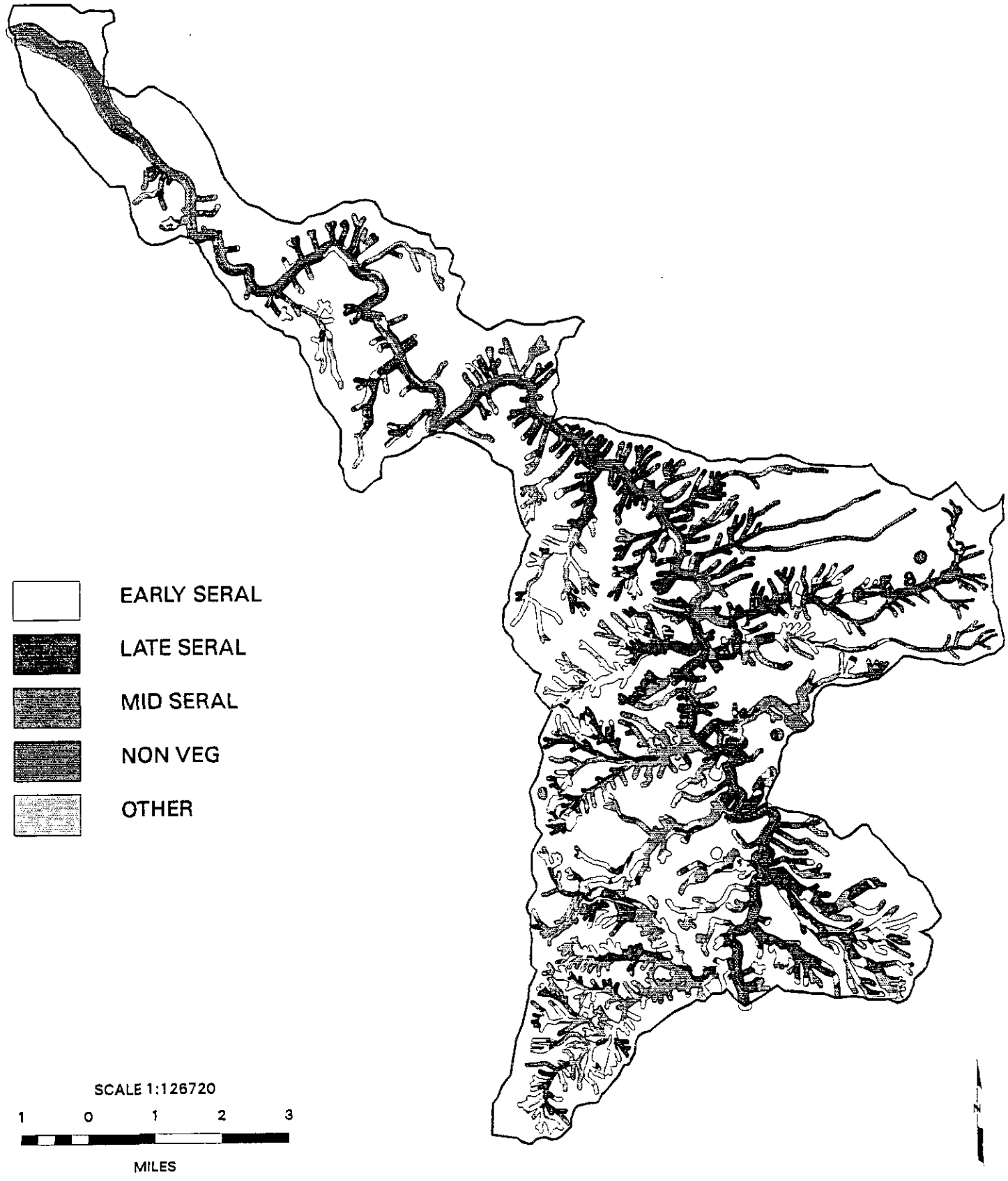
Administration

The Administration analysis area is moderately roaded and managed. Forty-three percent of the area remains in old growth (1,008 acres). Eighty-five percent of the Administration analysis area is composed of a closed canopy forest, about half old growth and half early and mid seral stands. There are 1,000 acres of mapped Riparian Reserve, and 71% of that is in mid or late seral condition (Figure 2-5). Riparian Reserves for all analysis areas are displayed on Map 2-2.

Figure 2-5. Riparian Reserve Seral Stages.



LOWER CLACKAMAS WATERSHED
RIPARIAN RESERVE SERAL STAGES



MAP 2-2

Eighty-five percent of this analysis area is closed canopy forest. Forty-three percent are early and mid seral stands created by past harvest activities. The few natural openings are rock, red alder/vine maple, and grassy meadows. Approximately 100 acres of the Administration analysis area is occupied by developed sites such as Timber Lake Job Corps and Ripplebrook Ranger Station. Seventy-one percent of the 1000 acres of mapped Riparian Reserves are in a mid or late seral condition. Geologic instability and scenic quality needs will provide objectives for future silvicultural activities.

Divide

With the completion of Highway 224 in the 1940's logging began in the Divide area. By 1944 Wilson Lumber Company was logging 30 million board feet in the lower Sandstone drainage in support of the national war effort. Intensive logging efforts continued through the mid-1980's. The resulting landscape is the most altered of the four analysis areas. Mid and early seral stands dominate this region (72%) with 25% in late seral. The pattern of timber harvest has created a highly fragmented stand structure with numerous small (10-80 acre) patches. Isolated patches of old growth range in age of 300 to 500 years old. Approximately 3,000 acres are in old growth.

Over 36% of the area is occupied by Riparian Reserves. These lie on moderate slopes with wet meadows and sag ponds, or in deeply dissected, highly erosive drainages. Only 27% of the riparian reserves are in late seral conditions.

In the early and mid seral stands large standing or downed woody debris is present in only small quantities. In these stands canopy closure is almost equally open and closed. The open canopy stands are vigorous and capable of crown closure within this decade, while the closed canopy stands are currently under consideration for commercial thinning. Most of the young, fast growing stands within Divide are at or near optimum stocking level for maximum growth and forest health.

Fire has had a minimal role since the turn of the century. Windthrow along the edges of stands in the 1980's has been a major disturbance factor. Commercial thinning of stands harvested in the 1940's began in the late 1980's.

Butte

This small area (3,145 acres) is highly fragmented. Mid-seral and early seral stands occupy 52% of the land base. Timber harvest activities began in the 1950's. This area is matrix in the Northwest Forest Plan, and 800 acres of the mid-seral stands are of small pole sized timber. Commercial thinning of these stands began in the 1980's. Fertilization and pruning of mid-seral stands began in the late 1980's. Young plantations of Noble fir have recently provided commercial harvest of boughs for Christmas wreaths.

Higher elevation areas in Buttes are dominated by shallow, rocky soils and steep cliffs. Rhododendron, characteristic of poor site quality, is a common understory species. Lower

elevation areas have the characteristic deep, moist soils associated with toes of earthflows. Large Douglas-fir and western hemlock dominate drier sites, and western red cedar and red alder are common in riparian areas. Thirty-seven percent of the Buttes analysis area are mapped Riparian Reserves.

Fire History

While portions of large, stand replacement fires affected the northernmost edges of the watershed in the 1920's and 1930's, fire has not been a significant factor in determining vegetative structure. Exposed ridgetops, particularly those with a southern exposure, indicate an evidence of infrequent lightning generated fire. The combination of fire, geology and topography combined to create harsh and low productivity sites.

Old growth forests in the watershed range in age from 300 to 500 years old. The oldest trees are in or near riparian areas. This indicates stand replacement fires within the watershed were infrequent and residual patches of trees provided a genetic pool for future generations of vegetation. During the 1940's the Lower Clackamas was a relatively undisturbed watershed. Map 2-3 displays the dominance of old growth prior to vegetation management.

Windthrow

Windthrow has not been a major factor in determining vegetative patterns in the Lower Clackamas watershed. Windthrow which has occurred has been recent and almost exclusively related to the edge exposure of old growth timber by adjacent clearcuts in Big Creek drainage and Trout Creek drainage.

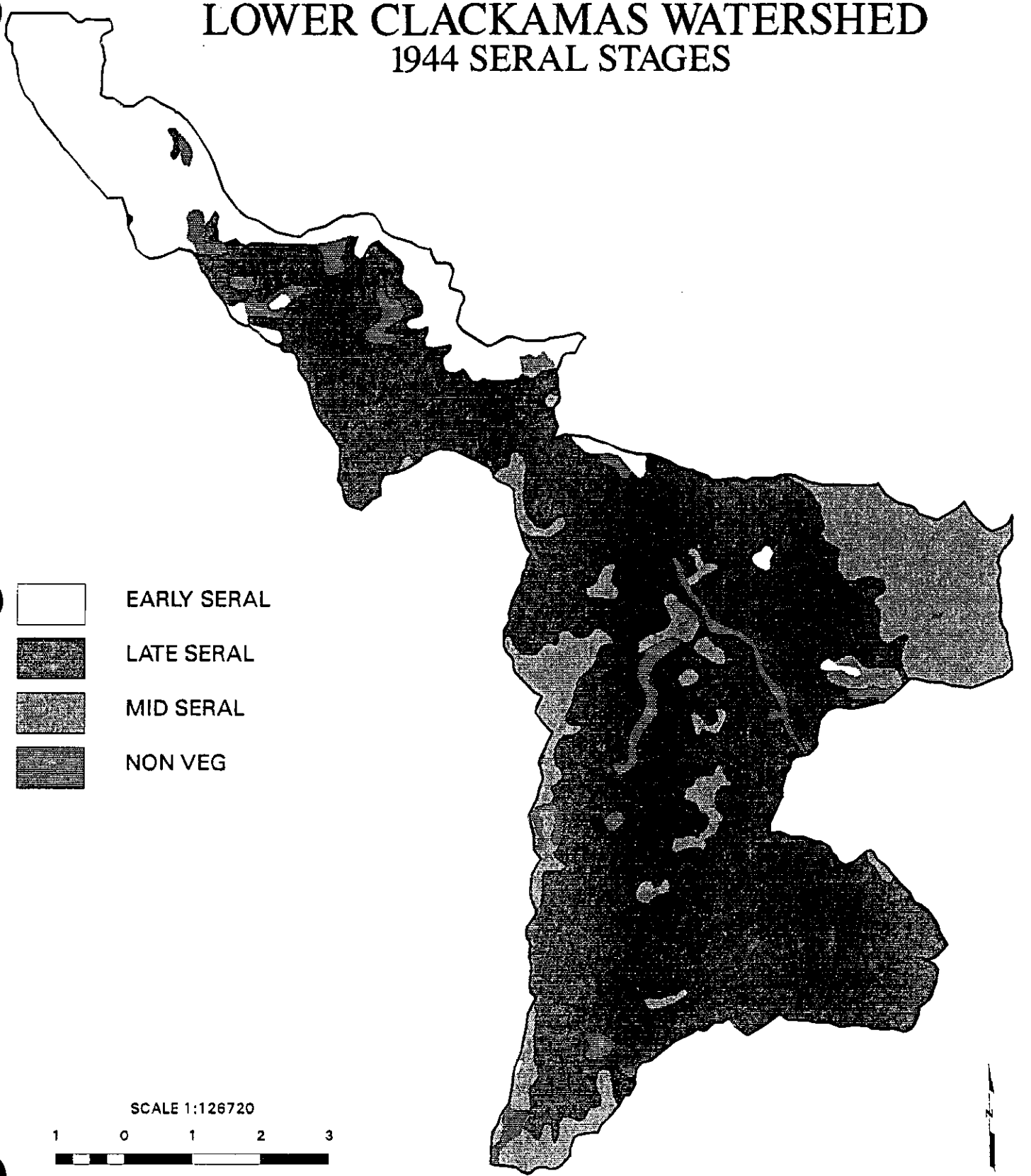
Insects and Disease

Current conditions in the watershed for forest health range from good to excellent. The numerous young stands of vigorous trees have contributed to this condition. Isolated pockets of various root rots (primarily *Phellinus weirii*) exist in most forested ecosystems west of the Cascades and the Lower Clackamas watershed is no exception. These pockets range in size from less than one acre to five acres and spread at a rate of less than one foot per year. These fungi create individual or pockets of snags.

A greater threat to future stand vigor is the overstocking of maturing early and mid seral stands. As stands mature they tend towards decreasing vigor as crown closure occurs and competition for nutrients and moisture accelerates. This loss of vigor increases risk of insect and disease damage. Presently, many stands within the entire analysis area are near or above optimum stocking levels for optimum vigor.

Recent Douglas-fir bark beetle activity within the watershed appears to have a direct correlation to windthrow and stand vigor. Large volumes of woody debris associated with windthrow provide excellent opportunity for the incubation of bark beetle larva. As the larvae multiply and the food source of the down material is exhausted, nearby old growth stands or stands of poor vigor are utilized as hosts perpetuating the outbreak. No large scale threat of insect infestation appears imminent within the Lower Clackamas watershed.

LOWER CLACKAMAS WATERSHED
1944 SERAL STAGES



MAP 2-3

Plant Species of Concern

Threatened, Endangered, and Sensitive Species (T,E, and S)

There are no known Threatened or Endangered plant species within the Lower Clackamas watershed. Streams associated with the Lower Clackamas drainage includes habitat for four species of Sensitive plants. Three plant species found in and adjacent to cool canopied streams in Lower Clackamas include *Corydalis aquae-gelidae* (cold water corydalis), *Huperzia occidentalis* (fir club moss) and *Wolffia columbiana* (Columbia water-meal). *Huperzia occidentalis and Corydalis aquae-gelidae,* are found growing in or adjacent to seeps, springs, and streams. Wolffia columbiana is found floating just below the surface of the water in quiet streams. The former is found on duff, moss covered rocks, and downed logs and the latter, in cool headwater habitats and in the gravels of moderately scoured streambeds. Other species *Aster gormanii* (Gorman's aster) is found associated with rock outcrops, *Cimicifuga elata* (tall bugbane) are found in moist, shady woods.

Survey and Manage Species

The Northwest Forest Plan calls for the survey and management of several species of fungi, lichens, bryophytes, and vascular plants. Information on the occurrences of these species within the Lower Clackamas watershed is lacking, especially for nonvascular plants. Of these species, one vascular plant, *Corydalis aquae-gelidae* has documented sightings. *Corydalis aquae-gelidae* is on the Northwest Forest plan C-3 list and requires buffer or special habitat prescriptions. Finalized Survey Protocols and Management Recommendations are due out for these species in 1996.

Noxious Weeds

The introduction of nonnative plant species, especially noxious weeds, is a potential threat to native biological diversity. Noxious weed invasions can reduce biodiversity through the displacement of plant species necessary for wildlife habitat and can also adversely effect reforestation, visual quality, and recreational activities. Noxious weed species occurring within the Lower Clackamas watershed include *Hypericum perforatum* (St. Johnswort), *Senecio jacobaea* (tansy ragwort), *Cirsium arvense* (Canada thistle), and *Cytisus scoparius* (scotch broom). These species are found throughout the watershed in areas associated with roads, timber harvest activities, and recreational use. Nonnative seed can be carried to areas of ground disturbance through vehicle use, logging equipment, and contaminated erosion control and forage seed mixes, as well as by wind and biological vectors.

Wildlife

Threatened, Endangered or Sensitive Species (TE&S)

The Appendix displays a complete listing of the TE&S species potentially occurring within the Lower Clackamas watershed. Of those potential species, six are known to occur within the watershed and five of these species reproduce annually. Habitat exists for several other species, but confirmation of their presence is unknown at this time (table 2-2, TE&S species) . Known species include: Northern spotted owl, bald eagle, peregrine falcon, harlequin duck, red-legged frog, and Cope's giant salamander.

The S & G of the ROD should maintain the viability of the following late-successional habitat dependent species:

* Northern spotted owl

Species whose life history needs are not completely met by the Forest Plan/President's Plan and are still considered to be at risk for viability include:

* Bald eagle

* Peregrine falcon

* Townsend's big-eared bat

* California wolverine

Note: Inherent in this conclusion is the assumption that these species currently enjoy a population level and distribution at least adequate to maintain viability. Data sufficient to verify this assumption are very difficult to obtain and not currently available (USDA, 1994). Furthermore, the analysis completed for the S & G of the President's plan ROD is specific to land management practices and does not address the impacts of public use within the LSR's and riparian reserves. The Lower Clackamas watershed is unique in its nature because of the direct and indirect impacts which have and will occur due to the demands of the public.

Table 2-2. Threatened, Endangered, and Sensitive Species.

Species	Status By Agency			Habitat in Lower Clackamas River	Known Occurrence in Lower Clackamas R.
	Federal	State	Region 6		
Spotted owl	Threatened	Threatened	Threatened	Yes	Yes
Bald eagle	Threatened	Threatened	Threatened	Yes	Yes
Peregrine falcon	Endangered	Endangered	Sensitive	Yes	Yes
Harlequin duck	_____	Sensitive	Sensitive	Yes	Yes
Sandhill crane	_____	Sensitive	Sensitive	No	No
Pacific Western big-eared bat	Former C-2	Sensitive	Sensitive	Yes	No
Wolverine	Former C-2	Sensitive	Sensitive	Yes	No
White-footed vole	Former C-2	Sensitive	Sensitive	Yes	No
Red-legged frog	Former C-2	Sensitive	Sensitive	Yes	Yes
Western pond turtle	_____	_____	Sensitive	Yes	No
Painted turtle	_____	_____	Sensitive	Yes	No
Cope's giant salamander	_____	Sensitive	Sensitive	Yes	Yes

Habitat for Threatened, Endangered and Sensitive Species:

Bald Eagle

Suitable nesting and roosting habitat occurs on the Clackamas River. The Lower Clackamas watershed contains three bald eagle habitat areas (A-13 Forest Plan land allocations). One of the bald eagle habitat areas is just below the entrance to the forest on Hwy 224 and along the Clackamas River. The two other bald eagle habitat areas are further south along the Clackamas River near the Ripplebrook Ranger Station. Bald eagle habitat areas have been established Forest wide to protect and manage nesting and winter communal roost areas in order to meet or exceed recovery levels established in the Pacific Bald Recovery Plan, also a secondary goal is to maintain a mature and over mature stand condition. The eagle management areas are generally located

near bodies of water and are 40 acres or greater in size with food sources appropriate for nesting bald eagles.

The Clackamas River corridor from Promontory Park to the Two Rivers Campground on the junction of Forest Service (FS) Hwy 46 and FS Hwy 63 has been identified in the Mt. Hood National Forest Plan as Recovery territories for the bald eagle and the peregrine falcon.

Bald eagles have been observed during the spring-summer period in various areas along the Clackamas River drainage, however there are no confirmed nest sites or communal winter roost identified within the Clackamas River corridor (USDA, 1990).

Habitat for bald eagles is described in terms of foraging, nesting, roosting, and perching. In the lower portion of the Clackamas River watershed nesting quality has been identified as fair. The overall roosting quality along the Lower Clackamas River is fair with prey availability being limiting. Suitability of nest trees is fair, most stands in the area range from moderate-sized trees with large crowns capable of supporting a nest platform to large mature trees with an old-growth component. In addition, suitable perch trees along the Lower Clackamas River are abundant and have good densities of relatively large trees with irregular crowns. The eagles accessibility to a reliable prey base can be characterized as fair in most sections, however, the river is fairly narrow limiting the flight path. Disturbance from human activities is ongoing.

Harlequin Duck

The harlequin duck has been observed in all watersheds of the Clackamas river drainage. The harlequin duck is found in fast-flowing streams, in loafing sites/side pools within the stream corridor with dense vegetation and the absence of humans. They brood in low gradient side tributaries with pool areas. Nesting can occur within the corridor of the stream or within stream adjacent timber stands. There have been reductions in the overall amount of harlequin duck habitat throughout the Clackamas River drainage due to habitat modification from removal of wood in stream channels and loss of streambank vegetation. The Lower Clackamas River watershed contains essential habitat characteristics for the harlequin duck.

California Wolverine

The California wolverine is found in a broad variety of habitats, but are generally associated with montane forested areas. The home range of the wolverine is very large and encompasses the Lower Clackamas River watershed. Seasonal elevation shifts occur with the wolverine; there is a distinct movement to higher elevations in spring to hunt, then they move to lower elevations in the fall and winter to ungulate winter ranges. The Lower Clackamas River watershed contains a large section of deer and elk normal and severe winter range, therefore the Lower Clackamas watershed potentially contains important fall and winter habitat for the California wolverine. Lack of human presence is an essential characteristic of wolverine habitat. Extensive human use in the Lower Clackamas reduces quality of habitat for wolverines.

Red-legged Frog

The red-legged frog is known to exist within the Lower Clackamas River watershed. Red-legged frogs require ponds or wet areas lasting into late May or early June, but also are known to utilize permanent waters. The waters used must have little or no current and must contain fairly sturdy underwater stems or other linear objects for egg attachment (Storm, 1990). The above mentioned habitat is prevalent throughout the watershed.

Cope's Giant Salamander

The cope's giant salamander is known to exist within the Lower Clackamas watershed. This species is normally restricted to streams and seepage in moist coniferous forest (Storm, 1983). The preferred stream and seep substrate is primarily rocky with small boulders, however animals have been found in less than preferred habitat, pebbles/cobbles and or small amounts of large woody material. The above mentioned habitat characteristics is prevalent throughout the watershed.

Peregrine Falcon

Peregrine falcons formerly nested in a variety of habitats and geographical locations within Oregon. The most preferable sites for peregrine falcon nesting are sheer cliffs 150 ft. or more in height with small caves or overhangs large enough to contain three or four full-grown nestlings (USFWS, 1982). Peregrines need a water source close to the eyrie to provide a prey base. The peregrine falcon is re-establishing its self as a nesting species in the Cascade range. There is one known nesting pair of peregrine falcons within the Clackamas river corridor. In 1993 an estimate of potential nest sites was made. The Lower Clackamas River watershed contains four high potential peregrine falcon sites, one medium site and three low potential peregrine nest sites. There is an active peregrine falcon site near the Lower Clackamas River watershed.

White-footed Vole

The white-footed vole is considered the rarest vole in North America. This species has been found in the forest west of the Cascade crest in Oregon. The white-footed vole uses riparian forests as its preferred habitat; red alder leaves are its preferred food. Surveys for this species within the Clackamas River basin were conducted in 1991 and 1992, results were negative. Habitat for the white-footed vole is present throughout the Clackamas River watershed, however the this species has not been observed within the Lower Clackamas watershed.

Townsends Big-eared Bat

The townsends big-eared bat is found in caves, lava tubes and abandoned buildings. Temperature is a critical factor in selection of breeding, roosting and hibernation sites by the species. Nursery colonies are warmer, generally above 10 degrees Celsius (50 degrees Fahrenheit) [WDFW, 1987]. The Clackamas River basin has two known hibernacular, other hibernacula and maternity roosts

are likely within the Clackamas River basin. The Lower Clackamas watershed contains habitat characteristics for hibernacula and maternity roosts sites.

The Northern Spotted Owl

See Chapter 4, Key Question #3.

Survey and Manage Species

Survey and Manage wildlife species in Lower Clackamas include:

1. Red tree vole
2. Larch Mt. salamander
3. Townsend big-eared bat
4. Great grey owl

Other Wildlife Species:

Many other species of animals potentially exist in the Lower Clackamas River watershed; The diverse vegetation and habitat types within the watershed play a key role in the survival of known species. Beaver dams and beaver sign are present in several wetland locations throughout the drainage. The shrub and meadow habitats support a small mammal population that lends itself to the prey base as well. Small mammals such as townsend chipmunk, brush rabbit, golden mantled ground squirrel, Douglas squirrel, and porcupine all may be found in abundance within the watershed. Common predator species within Lower Clackamas River watershed include: coyote, and black bear. Mink, weasel, and mountain lion are also present (USDA, 1994).

The Mt. Hood National forest has selected 4 mammals and 4 birds for use as management indicator species. Silver-gray squirrels and merrian's turkey do not have suitable habitat within the Lower Clackamas River watershed. Four other species; deer, elk, bald eagles and the northern spotted owl; are covered separately. The other management indicator species are pine martens and pileated woodpeckers. The principle method for assuring enough suitable habitat for pine martens and pileated woodpeckers on the forest is the establishment of a system of habitat areas (otherwise know as MR's) for each species.

There are 2 pileated woodpecker and 4 pine marten habitat areas in the Lower Clackamas watershed. There are 3 pine marten habitat areas and 2 pileated woodpecker areas which extend into the watershed. See the Mt. Hood Forest Plan B5 pileated woodpecker/pine marten for Forest Wide standards . The Northwest Forest Plan abandoned B5 areas unless analysis shows a need to retain. See Recommendations section for results of analysis.

Fisher

The fisher is a solitary animal, controlling a large territory of ten square miles, from which it excludes other fishers except during breeding periods. The population probably never was large.

The fisher needs dense mature coniferous or mixed forests for winter cover, especially where deep snow could restrict movements. Fishers will also select for ecotones and dense wetland/riparian forest types with conifer understory (Weaver, 1993). The fisher has been observed within the Lower Clackamas River watershed, however, siting of this species have not been verified. The Mt. Hood National Forest has identified the essential habitat characteristics associated with the fisher and mapping those characteristics over the forest The Lower Clackamas River watershed contains approximately 4,900 acres of primary fisher habitat.

Migratory Birds

Like all wildlife, migratory birds are exposed to increasing threats of human origin. Their habitats are modified or destroyed through agriculture, forestry, fishing, recreation, water management, urbanization, industrialization, transport facilities and building works. The fact that many migrants concentrate migration at specific sites, and follow fixed flyways, makes them even more vulnerable to ecological alterations at key sites. Diverse habitat features are disappearing rapidly, in addition, the human recreational pressure on diverse lakeside habitats very often results in the destruction of reed beds and other natural shoreline vegetation zones (Salathe, 1991). The opening up of large boreal forest tracts has led to the disappearance of some species which only inhabit large tracts of forest. It has also created much more forest edge and mammalian and avian nest - predators. The negative impact of predators and parasites is assumed to be involved in the decline of many populations of long - distance migrants (Salathe, 1991). Furthermore, human disturbance may pose a significant problem to migrants concentrating in large numbers in one place for feeding or roosting. Disturbance provoked by hunting and various recreational activities puts substantial stress on the time - and energy - budget of the many individuals concerned, and this can significantly lower their chances of survival (Salathe, 1991).

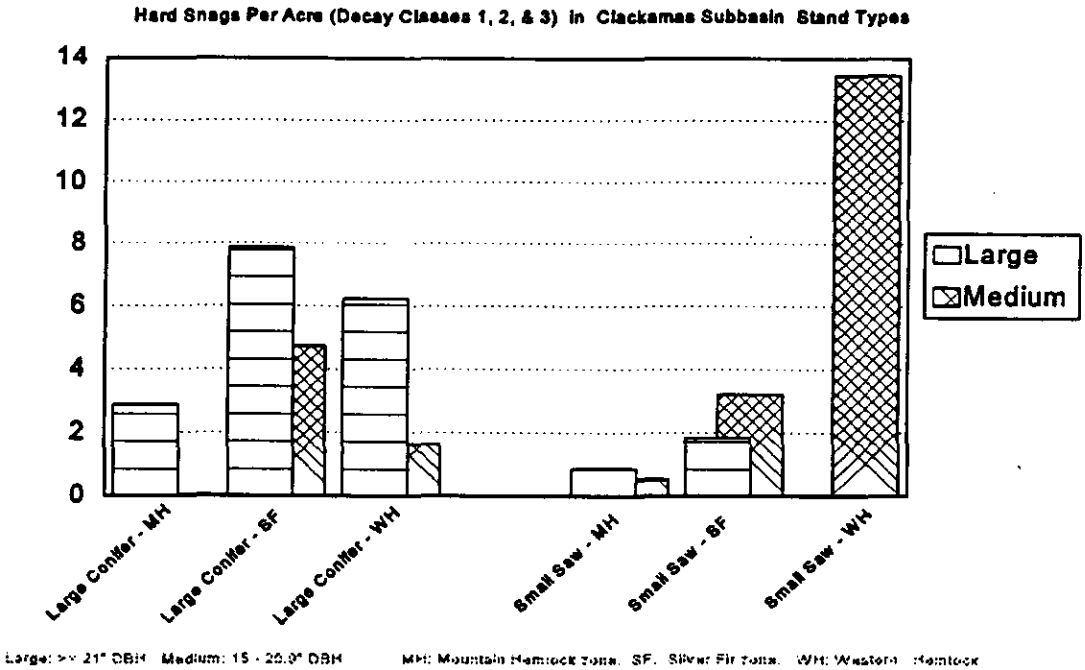
Migratory bird monitoring has occurred within the Clackamas River basin since 1993. As stated in the September, 1993 R6 Draft Monitoring plan, Level 2 monitoring is where we are most deficit in Region 6 (level 2 - measure species abundance relative to habitat associations or management practices). There are 123 migratory birds that occur in Oregon, these species use variety of habitats of which have been prioritized. The key habitat types include; coniferous old growth, riparian, and mixed conifer. All key habitat types occur within the Lower Clackamas watershed. Currently the Lower Clackamas River watershed contains approximately 43,252 acres; 45% is in late seral; 30% in mid seral; 20% in early seral and 5% in a non - vegetated state. These numbers suggest this watershed is relatively evenly diversified into different seral stages which would promote migratory bird use, however the fragmentation and creation of edge by forest management has reduced essential migratory bird habitat while also potentially contributing to an increase in mammalian and avian nest predators. In contrast, a 1944 seral stage picture of the Lower Clackamas River watershed shows (approximations); 80% late seral; 4% mid seral; 12 % early seral, 4% non-vegetated. The fragmentation of the forest along with the increasing amount of edge within the watershed has lead to the decline and disappearance of some migratory birds associated with the Lower Clackamas River watershed.

Wildlife Habitat

Coarse Woody Debris

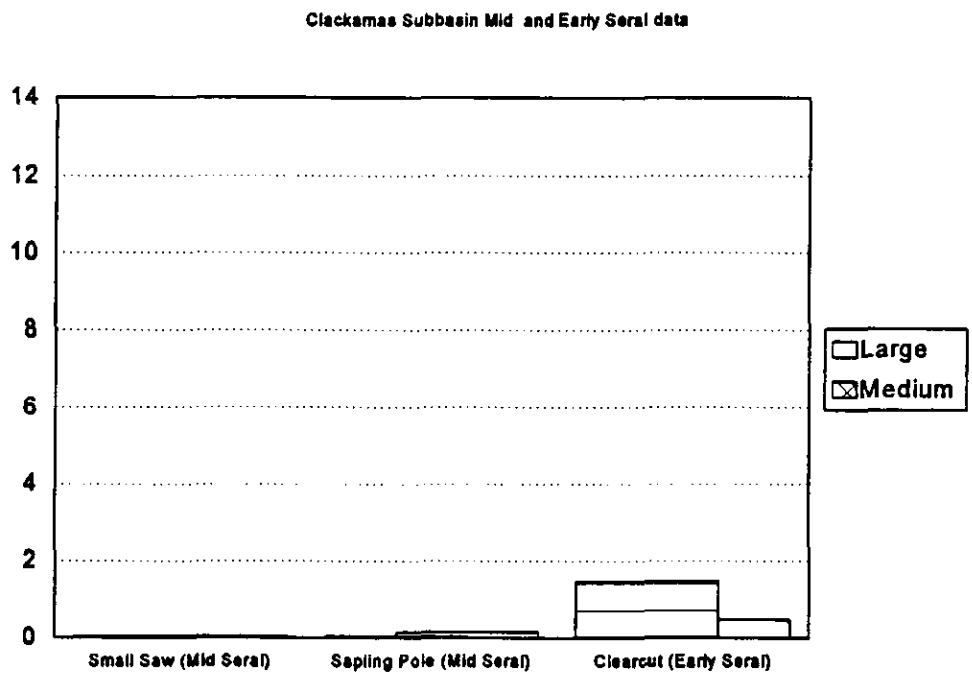
Surveys completed over the last several years have shown that certain structural elements that are often found after catastrophic fire disturbance (patches of unburned trees, scattered large snags, large downed logs) are missing or present in low densities in harvest created openings. Figures 2-6, 2-7, 2-8 and 2-9 display the densities of medium and large snags and down logs in different structural stages. The figures show that managed stands contain, on average, far fewer large snags and logs than unmanaged stands. Large snags and down log density are also influenced by stand structure and forest series. In general the large conifer stands have greater densities of large and medium sized logs than small saw timber stands. The mountain hemlock zone contains far fewer snags and logs than the other series (USDA, 1995).

Figure 2-6. Snag Density - Unmanaged Stands



Large: >= 21" DBH Medium: 15 - 20.9" DBH MH: Mountain Hemlock zone. SF: Silver Fir zone. WH: Western Hemlock

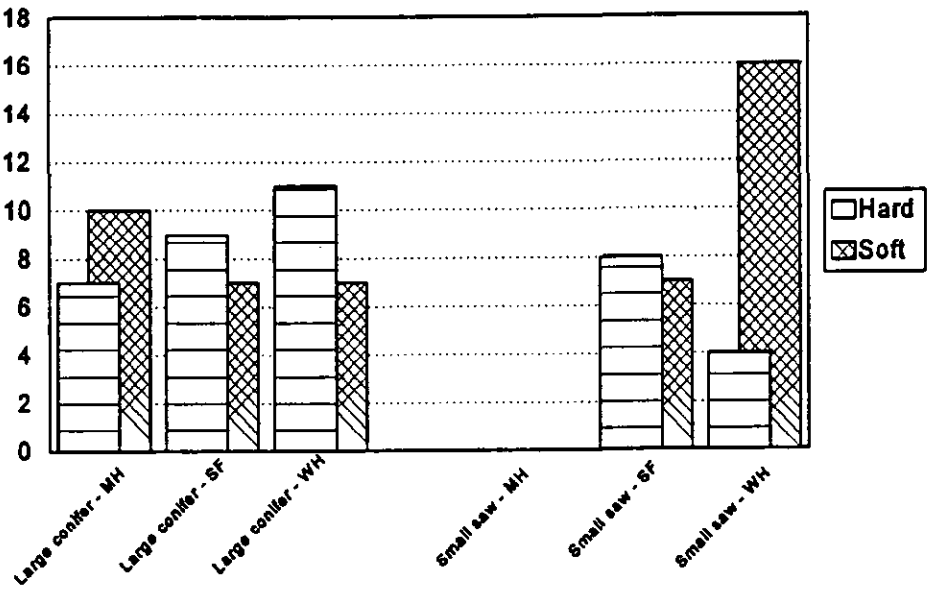
Figure 2-7. Snag Density - Managed Stands



Densities for Hard Snags (Decay Classes 1, 2 and 3) averaged over all vegetation series. Large: >=21" DBH. Medium: 15-20.9" DBH

Figure 2-8. Log Density in Unmanaged Stands

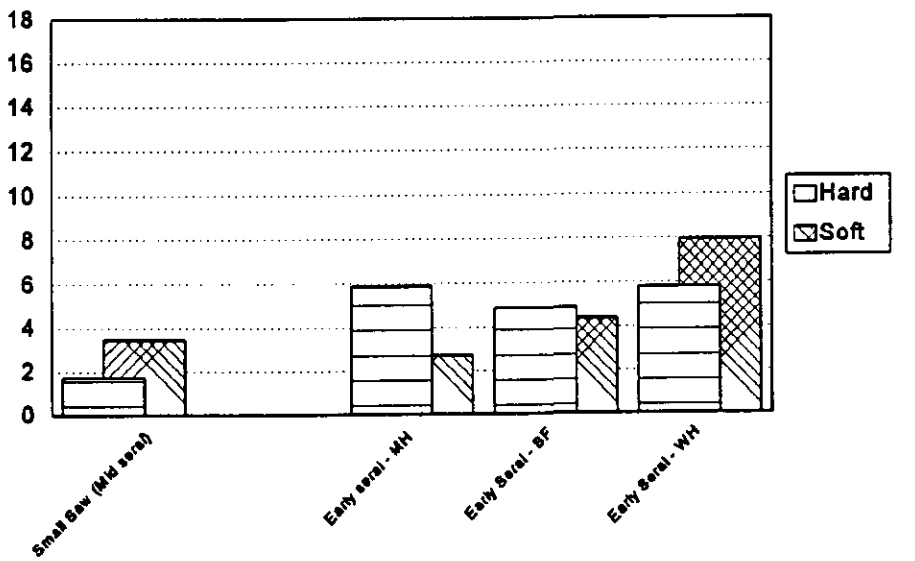
Pieces per Acre >= 21" DBH and > 16' long.



Based on Forest-wide data from natural stands in late and mid seral. MH: Mountain hemlock series. SF: Silver fir series. WH: Western hemlock series. Hard: Includes decay classes 1, 2, and 3. Soft: Includes decay classes 4 and 5

Figure 2-9. Log Density in Managed Stands (Plantations)

Pieces Per Acre >= 21" in Diameter and > 16' Long



Hard: Decay Classes 1, 2, and 3 Soft: Decay Classes 4 and 5. MH: Mountain Hemlock series. SF: Silver Fir series. WH: Western Hemlock series.

The Mt. Hood Forest Plan and the Northwest Forest Plan each tie snag retention levels to a certain percentage of the theoretical population potential (carrying capacity) of cavity nesting birds in the landscape. Minimum levels across the landscape are set at 40% by the ROD and LMP while the LMP sets a minimum level of 60% through time to be retained in new harvest units.

Coarse woody debris is important for denning areas, invertebrate prey sources for , insectivorous birds and salamanders, and habitat for voles, shrews, and various fungi which are utilized by the northern flying squirrel and other small mammals. Coarse woody debris density and condition is available from the surveys conducted in 1987 and 1992 that were described above. Figures 2-8 and 2-9 illustrate the distribution of coarse woody debris in the unmanaged and managed stands, respectively. Coarse woody debris availability corresponds well with the snag availability discussed above namely, logs are most abundant (between 15 - 20 hard logs per acre) in the unmanaged large conifer and small saw categories and least abundant in the managed stands (between 5 - 6 hard logs per acre). The forested segment of the Lower Clackamas River watershed is approximately at 32% of biological potential currently.

Forest Guilds

In early 1994 a forest wide biodiversity assessment was completed. The assessment, based on the Species Community and Conservation Assessment (SCCA) methodology, accounts for the influences that seral stage association, home range size and patch configuration (landscape pattern) are thought to exercise on the distribution of animals in the landscape. Under the SCCA, certain criteria were used to classify wildlife species into guilds (Table 2-3). Seventeen terrestrial guilds were designated at the forest level. Guilds group together species that exploit the same class of environmental resources in a similar way. without regard to their taxonomic similarities to each other (Marcot et. al., 1992). Table 2-4 shows the total amount of habitat available for each terrestrial guild within the watershed, as well as a subjective assessment of the connectivity of the available habitat. Habitat is most abundant for the generalist species of any home range size (TOSTSHRG and TSLTSHRMG) and the large tree, medium home range mosaic guild (TLTMHRMG). The Lower Clackamas River watershed provides a significant quantity of habitat for the following guilds: TSTSHRP (small tree small home range patch guild), TSTSHRM (small tree, small home range mosaic guild), TSLTSHRG (small/large tree, small home range generalist), TOSTSHRG (open/small tree, small home range generalist), TLTSHRP (large tree, small home range patch guild), TLTMHRM (large tree, medium home range, mosaic guild) and TLHRC (large home range contrast guild).

Table 2-3. Criteria used to group species by life history into guilds.

TERRESTRIAL: Terrestrial habitat users (may use riparian or special habitats as well but do not require them).

Home Range

SMALL: Home ranges < 60 acres

MEDIUM: Home ranges 60-100 acres

LARGE: Home ranges >100 acres

Patch Type

PATCH: Species requiring one homogenous patch (one structural stage) during life cycle (or breeding period for migrants).

MOSAIC: Species capable of aggregating patches of like structural stages that are dispersed in a mosaic pattern across the landscape.

CONTRAST: Species requiring juxtaposition of two dissimilar structural stages.

Stage

EARLY: Early structural stage required.

LATE: Late structural stage required.

GENERAL: Can use any structural stage.

EARLY-MID: Early or mid structural stage required.

MID-LATE: Mid or late structural stage required.

N/A: Not applicable.

Table 2-4. Forest guilds associated with lower Clackamas River watershed.

GUILDS	TOTAL ACRES	% WATER-SHED	CONNEC-TIVITY	PATCH TYPE	SERAL STAGE	HOME RANGE SIZE
TMHRCG-Medium Home Range Contrast	9925	23	Low/Moderate	Contrast	N/A	Medium
TLHRCG-Large Home Range Contrast	15686	36	High/Moderate	Contrast	N/A	Large
MHTLTRMG-Large Tree Medium Home Range Mosaic	19101	44	High	Mosaic	Late	Medium
TLTLHRMG-Large Tree Large Home Range Mosaic	13662	32	Moderate	Mosaic	Late	Large
TLTSHRPG-Large Tree Small Home Range Patch	13817	32	High	Patch	Late	Small
TOSTHRG-Open/Small Tree, Small Home Range Generalist	19305	45	High	Generalist	Early	Small
TSLTSHRG-Small/Large Tree, Small Home Range Generalist	38659	89	High	Generalist	N/A	Small
TOHSHRMG-Open Habitat, Small Home Range Mosaic	8329	19	Low/Moderate	Mosaic	Open	Small
TOHMHRPG-Open Habitat, Medium Home Range Patch	9497	22	Moderate/Low	Patch	Open	Medium
TSTSHRMG-Small Tree, Small Home Range Mosaic	13662	32	Moderate	Mosaic	Early	Small
TSTSHRPG-Small Tree, Small Home Range	11132	26	Moderate/Low	Patch	Early	Small
TOHSHRG-Open Habitat, Small Home Range	6578	15	Moderate/Low	Patch	Open	Small

The current arrangement of late, mid, and early seral patches on the landscape is considerably altered from the arrangement thought to be typical in the past. One result is that the distribution of habitat for terrestrial guilds is probably well outside the range of natural variability. In particular, patch, mosaic and contrast guilds have altered quantities and arrangements. Patch guilds contain species that required minimum contiguous acreage of habitat in their preferred seral stages. As patch size has decreased, so has the amount of habitat available for medium or large sized patch species. Increasing the number of patches and decreasing their size also affects dispersal for patch species, especially those with small home ranges. Species with small home ranges that require patches would be expected to persist within even small patches - until the patch size falls below about 20 acres. Most of the patch species in the watershed do fall within the small home range type. Mosaic guilds (TLTLHRM, TLTMHRM and TSTSHRM,) are sensitive to landscape fragmentation. Although species in these guilds can aggregate fragmented patches within their home ranges, patches that are too isolated are not likely to be used. Thus isolated patches cannot be expected to contribute to population maintenance of mosaic species. Contrast species respond favorably to fragmentation (but only where late seral meets early seral).

Species Richness and Diversity

Species richness/diversity is measured by the number of species within an area. The Lower Clackamas River watershed encompasses a variety of vegetational communities and structures, these vegetational communities are diversely spread across the associated subwatersheds: The corridor, Admin, The Divide, and The Buttes. The species composition associated with each subwatershed varies according to the habitat characteristics contained within each watershed. The Corridor subwatershed provides the habitat characteristics to support the most species. Approximately eleven guilds are able to meet their essential habitat needs within the corridor. The second most species rich subwatershed is the Divide, approximately 9 guilds function within this sub watershed.

Diversity is the distribution and abundance of different plant and animal communities and species, also maintaining significant representation of all ecosystems and seral stages. The Lower Clackamas River watershed encompasses the western hemlock and the pacific silver fir zones. The watershed is primarily within the western hemlock zone, however a small segment of the pacific silver zone embraces Lynx and Cripple Creek subwatersheds.

The Lower Clackamas River watershed western hemlock zone contains potentially 15 plant associates See Appendix A for a complete listing. In addition, the pacific silver fir zone contains potentially another 17 plant associations (also listed in Appendix A).

Connectivity

Connectivity is a measure of the extent to which the landscape pattern of the late-successional / old growth ecosystem provides for biological and ecological flows that sustain late-successional / old growth animal and plant species across the region.

The overall connectivity of the Lower Clackamas River watershed is moderate. The late-successional forest is at least 25% of the landscape, and the matrix contains some small areas for dispersal habitat.

Connectivity within Subwatersheds:

* Connectivity within the Corridor (Lower Clackamas River Trib., Cripple Creek and Three Lynx Creek) subwatershed is strong. Total proportion of landscape in late-successional / old growth conditions, including small patches is at least 50%, so that the late-successional condition is still the dominant cover type.

* Connectivity within the Divide (Pup Creek, Whale Creek Sandstone Creek, Big Creek and Trout Creek) subwatersheds are moderate. The late-successional forest is at least 25% of the landscape, and the matrix contains some smaller areas for dispersal habitat.

* Connectivity within the Admin (Lower Clackamas River Timber Lake) subwatershed is moderate. The late-successional forest is at least 25% of the landscape, and the matrix contains some smaller areas for dispersal habitat.

* Connectivity within the Buttes (Tag Creek) subwatershed is moderate. The late-successional forest is at least 25% of the landscape, and the matrix contains some smaller areas for dispersal habitat.

Fragmentation

Habitat fragmentation occurs when large contiguous habitats become subdivided in small habitat patches. Fragmentation of old growth and mature forest has general negative effects on old growth interior species. Effects occur five different ways:

1) Total acreage is reduced lowering carrying capacity

2) If remaining patches are small only small subpopulations may be present

3) If remaining patches are smaller than home range requirements for some species, those species may not be able to maintain sustainable populations

4) juvenile dispersal may be limited

5) there will be increases in the ratio of forest edge to forest interior

The Lower Clackamas River watershed contains more late seral forest conditions then other non-wilderness watersheds. Approximately 50% of late seral habitat characteristics within the Lower

Clackamas River watershed has been lost between 1944 and 1996. Fragmentation has occurred throughout the watershed, primarily outside of the Clackamas River corridor and subwatersheds have been highly fragmented (see Map 2-4).

Deer and Elk

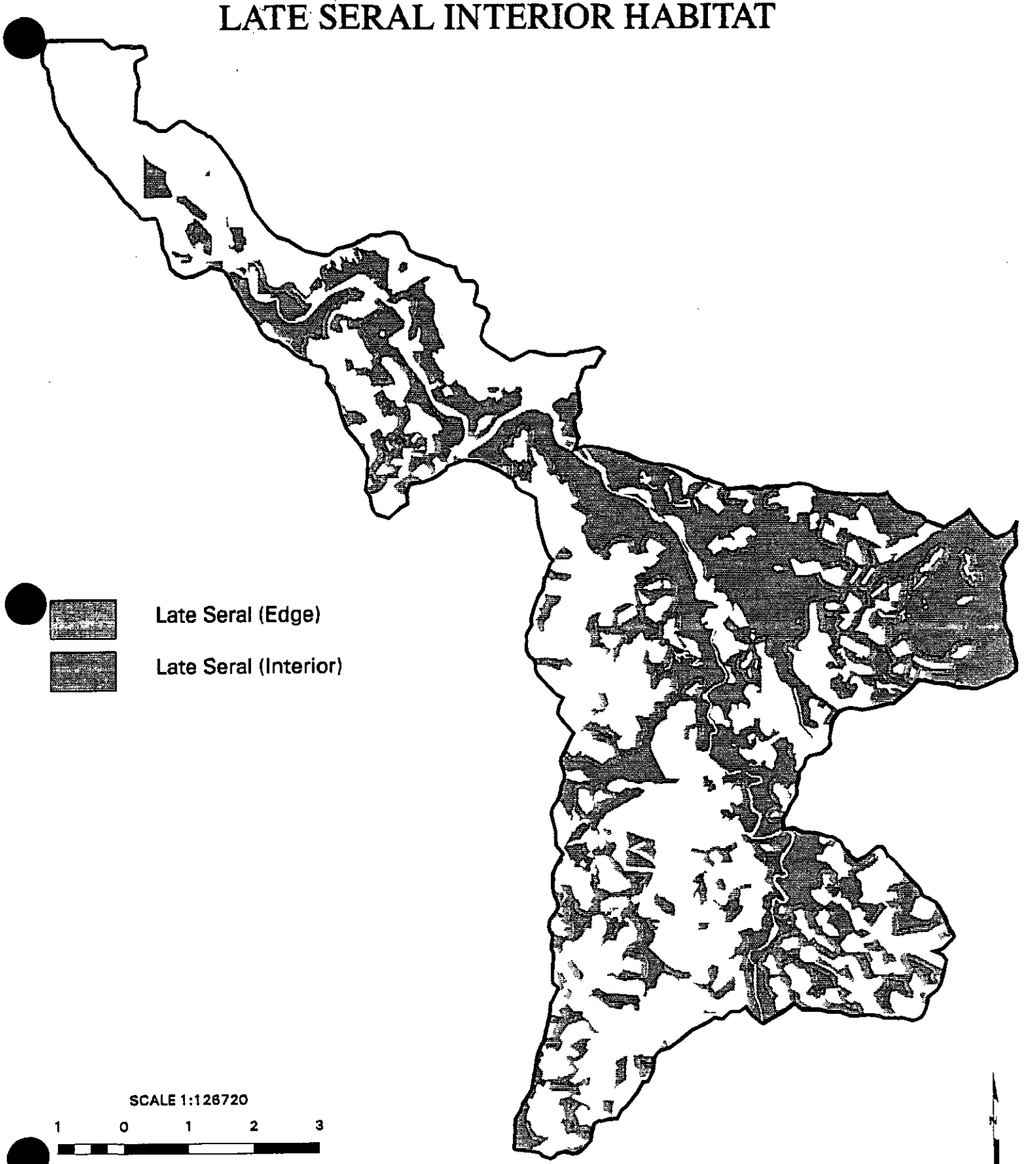
The Lower Clackamas River watershed contains suitable habitat for deer and elk and supports hunted populations. Severe and normal inventoried winter range subsist throughout the watershed (Map 2-5). Inventoried severe and normal winter range within the Lower Clackamas River watershed begins at the forest entrance on highway 224 following the Clackamas River corridor, Oak Grove Fork of the Clackamas River corridor and the Collawash River corridor. The Lower Clackamas River watershed contains 5,098 acres of severe and normal winter range, which equates to 12% of the total watershed.

The winter habitat for deer and elk on the forest has been identified as an area having snow depths of less than 18 inches. Deer and elk winter range has been categorized as either normal winter or severe winter range. Normal winter range is defined as the land area used by animals during mild winters; these winters occur in eight or nine years out of every ten. Severe winter range is used during severe winter conditions, which occur one or two years out of every ten. It also includes areas that are during severe cold or snow conditions (USDA, 1990).

In 1987 the Mt. Hood National Forest in cooperation with the Oregon Department of Fish and Wildlife did a Clackamas River drainage elk telemetry study.
The results:

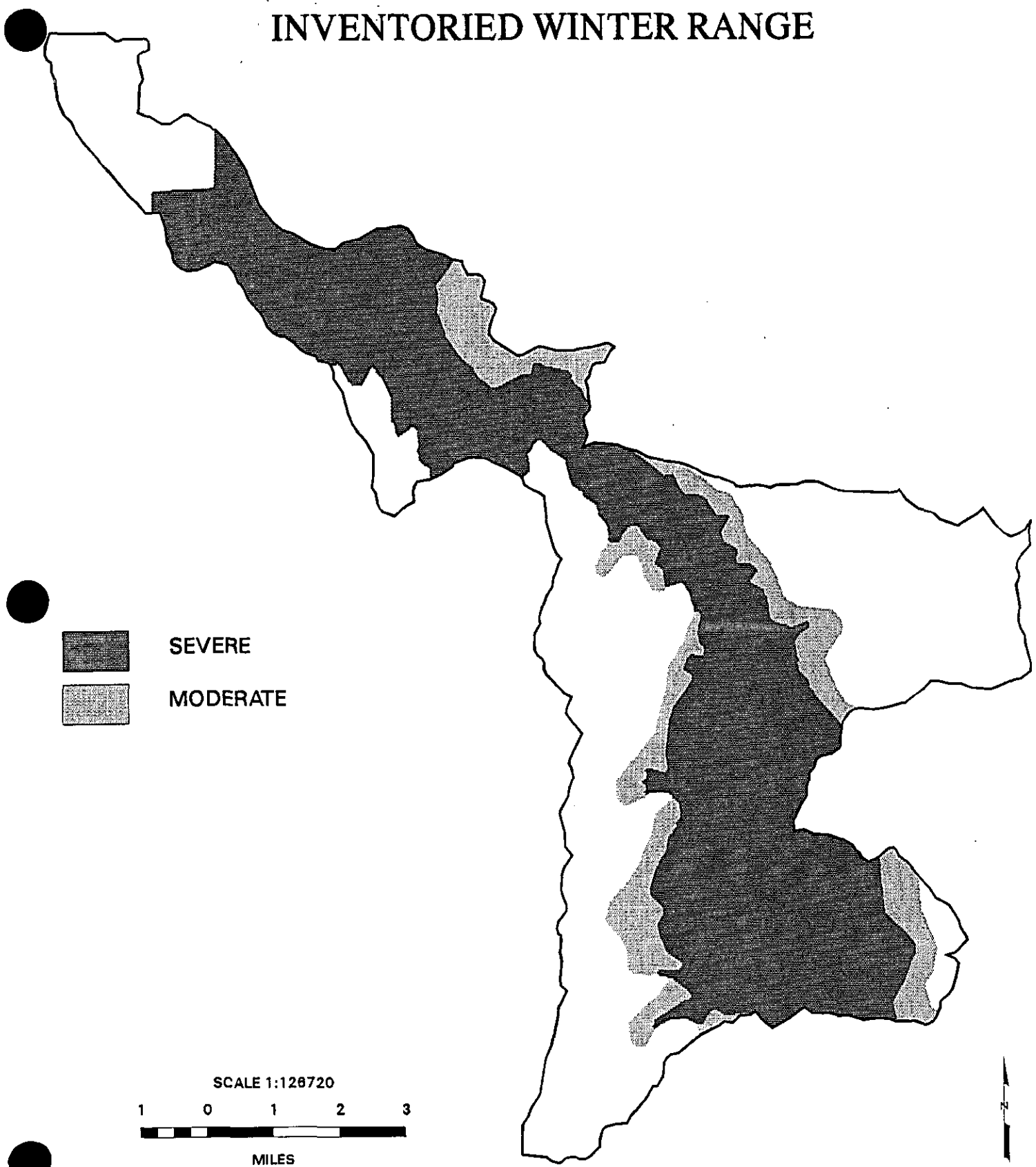
Eighty percent of the trans radio-collared elk remained in the Clackamas river drainage and we recruited into existing native herds.
Native herd home ranges varied from 1,975 to 17,840 acres in size. Winter ranges varied from 1,519 to 10,621 acres in size.
Overall mortality rate from December 1987 to October 1992 was 61% on radio collared elk. Unknown mortality accounted for 35%, poaching for 14%, stress/starvation 6% and legal harvest/predation for 6%. Many of the unknown mortalities were suspected poaching. Also, there has been 4 poaching locations identified within the Lower Clackamas River corridor.
Forage seeded areas received high use by elk herds.
Elk exhibited a close association with riparian habitat in areas of low road density and gentle terrain.
In areas of high road density, movement of several miles a day by herds is not uncommon, and seems to be the norm.
Elk responded readily to road closures in their home range by utilizing the habitat more frequently and moving less frequently.
Optimal thermal cover was utilized more often by higher elevation herds than low elevation herds (USDA et.al., 1992).
The Lower Clackamas River watershed encompasses 4 herds; The Sandstone herd, Ripplebrook herd, Tag Creek herd and the Fish Creek herd. Moreover, there have been 16 possible calving

LOWER CLACKAMAS WATERSHED
LATE SERAL INTERIOR HABITAT



MAP 2-4

LOWER CLACKAMAS WATERSHED
INVENTORIED WINTER RANGE

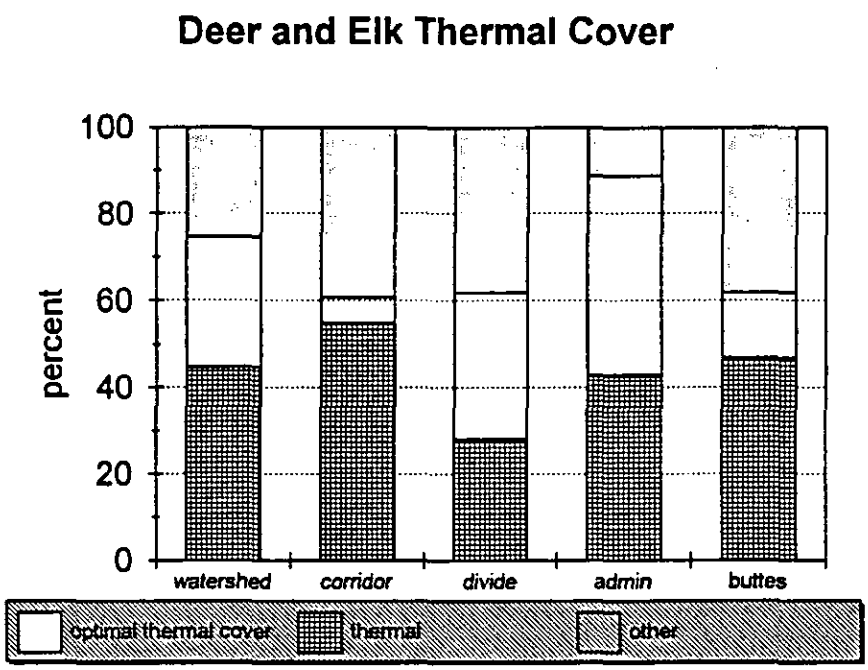


MAP 2-5

areas identified within the Lower Clackamas River watershed.
The Mt. Hood National Forest Plan professes optimal cover and thermal cover habitat components for deer and elk (measured at the area analysis level, i.e. approximately 5000 acres) should be maintained as followed:

On inventoried west side cascade deer and elk winter range 20% should be optimal cover 20% should be thermal cover.
On west side cascade deer and elk summer range 20% should be optimal cover and 10% should be thermal cover (USDA, 1990).
The current condition within the Lower Clackamas River watershed for deer and elk is : 45% optimal thermal cover and 30% thermal cover (Figure 2-10). These figures exceed forest plan standards and guidelines. Also, the watershed has been divided into 4 subwatersheds:
The Corridor contains 55% optimal thermal cover and 6% thermal cover. The Corridor does not meet the 20% forest plan standard and guideline for thermal cover.
The Divide contains 28% optimal thermal cover and 34% thermal cover. The Divide meets forest plan standards and guidelines.
Admin contains 43% optimal thermal cover and 46% thermal cover. Admin meets forest plan standards and guidelines.
The Buttes contains 47% optimal thermal cover an 15% thermal cover. The Buttes do no meet forest plan standards and guidelines for thermal cover.

Figure 2-10. Big Game Habitat.



The Mt. Hood National Forest Plan asserts that within the roaded portions of the forest, by year 2000, roads open to motorized vehicle traffic should be reduced to not exceed 2.0 miles per square mile within inventoried deer and elk winter range and 2.5 miles per square mile outside of inventoried deer and elk winter range. Currently the Lower Clackamas River watershed road density is at 3.1 miles per square miles, which is 0.6 miles per square miles over forest plan objectives. Furthermore, the Lower Clackamas River subwatersheds are also on average a 3.1 miles per square miles. The Buttes, the Divide and Admin. subwatersheds are not within deer and elk inventoried severe and normal winter range therefore forest plan standards for road densities are projected at 2.5 miles per square mile by year 2000. The Corridor subwatersheds are primarily within inventoried normal and severe winter range. Currently the Corridors road density is at 3.0 miles per square miles. Yet the 3.0 miles per square miles is 1.0 miles per square miles above the projected forest goal of 2.0 miles per square miles by the year 2000.

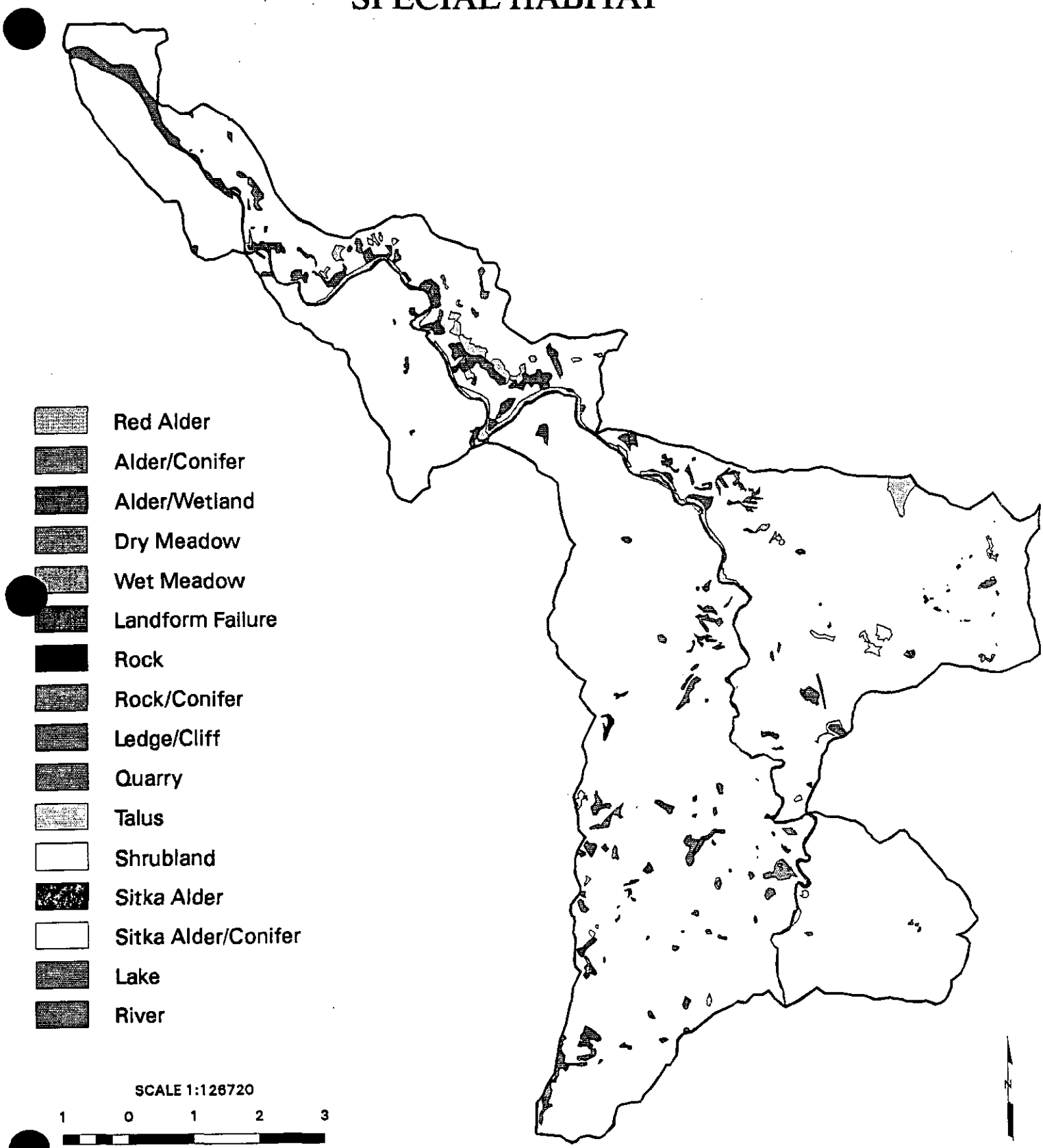
Special Habitats

Special habitats are those which provide a unique niche for species associated with them. These species may not be dependent on these habitats but they use them as primary breeding and / or non - breeding habitat. Table 2-4 lists special habitats information. A map of known special habitats within the Lower Clackamas River watershed can be found on Map 2-6.

At present, approximately 3356 acres of special habitats exist within the watershed. It appears that rock areas with scattered conifers is the dominant special habitat in the drainage (1009). The red alder habitat is the least dominant special habitat (13 acres).

The Wards Meadows area provides a unique habitat in that it contains a complex of open water with surrounding shrubs and grasses. Compositions such as this have the ability to support a diverse array of species. Examples of species known to occur in the area are beaver, Northwestern salamander, and pine marten. Several species thought to occur within the Lower Clackamas River watersheds special habitats warrant additional consideration / protection through documents such as the ROD, federal law, and / or the Mt. Hood Land Management Plan. Such species include, but are not limited to, bald eagle, red - legged frogs, pine marten, and townsends big - eared bat; additional information on these species may be found in the threatened, endangered, and sensitive species portion of this document.

LOWER CLACKAMAS WATERSHED
SPECIAL HABITAT



MAP 2-6

Table 2-4. Special Habitats.

Special Habitat	Eco-Classes	Total Acres
Alder	HACO,HA SWZO,HAMO	164
Moist Meadow	MW	172
Rock Areas	NRCO,NR,NRL2	1341
Lake/Pond	WL	333
Shrubland	SW	47
Hardwood Forest	HX	520
Landform Failure	NL	36

Eco Class Description:
HACO- Alder/Conifer
HA- Red Alder
SWZO- Sitka Alder
SWCO- Sitka Alder/Conifer
HAMO- Alder Wetlands
MW- Wet Meadow
NRCO- Rock Areas/Conifer
NR- Rock
NRL2- Ledge/Cliff
WL- Lake/Pond
SW- Shrubland
HX- Hardwood Forest
NL- Landform Failure

Soils

Soil Map Materials of the Watershed

The Mt. Hood Soil Resource Inventory (Howes, 1978) accurately displays the extent and distribution of soil types within the boundaries of the Lower Clackamas Watershed Analysis area. The Soil Resource Inventory (SRI) for the area is available as a current mapping layer in the Clackamas River Ranger District's computerized Geographic Information Systems (GIS), or as text and aerial photograph format in a notebook. Soils data from these sources are readily accessible and useful for project level or watershed level planning purposes.

Soil Types in the Watershed

There are a wide variety of soil types in the Lower Clackamas Watershed Analysis area. This is attributed to the variety of geologic conditions, landforms, elevations, vegetation types, slope positions, and aspects that are represented. Such variability contributes to a wide range of soil characteristics, some of which deserve special considerations for land management and use.

Soil types in the SRI are divided into 4 broad categories. Numeric attributes are assigned to them based on the differences between those categories. The first category of soils are assigned either single or double digit numeric attributes and are referred to as, "miscellaneous land types". They are comprised of an array of surface or soil features that are limited in extent or variable in composition and range from wet meadows to rock outcrops. They exist on a variety of landforms, slope positions, and elevations. All of them could be considered "sensitive" and have serious limitations concerning forest management. There are 5,768 acres of these land types distributed across the watershed.

Soils formed from pyroclastic deposits or loess, such as ash flows, ash-fall, or lahars, are designated one hundred level numeric attributes (100 series). They may occupy steep or gentle slopes and exist on a variety of aspects and slope positions. Generally, these soil types are comparatively deep and productive, having good topsoil and organic components. They are usually highly erosive and often associated with slope instability. Earthflow landforms are comprised of these soils. In this watershed, they are distributed over 14,312 acres of the southern half, primarily below 3,000'.

Soils forming on igneous rock formations such as basalt and andesite lavas, are designated two hundred level numeric attributes (200 series). In this watershed these soil types occupy steep (>30%), and often unstable slopes and narrow benches, below 2,000' in the main river corridor. Comparatively they exhibit low productivity, are very rocky, shallow in depth (<35"), are highly erosive, and low in organic and topsoil components. There are 7,128 acres of these soil types in the watershed.

Soils with three hundred level numeric attributes (300 series) have formed in glacial deposits. These soil types primarily exist on the upper benches, plateaus, and side slopes of the middle and lower reaches of the river corridor above 500' elevations. They exhibit moderate to low productivity, are usually rocky, and moderately erosive. There are 12,269 acres of these kinds of soil types in the watershed.

Overall Soil Productivity

Soil productivity in the watershed, as measured by site class, is predominantly moderate to high. The relatively higher productive soil types are the 100 series soil types found on earthflow landforms, they are generally considered "sensitive".

Approximately 11,042 acres of soil types in the drainage exhibit low relative productivity. They are potentially screen 4 (Determination of Land Not Suitable for Timber Production, Daoust et al, 1984) soil types. This means that natural regeneration of these soil types may not adequately stock a young stand (USFS, R-6 stocking standards) within 5 years after complete removal of an overstory stand by human or natural causes. Most of these soil types are very shallow, rocky, and cold. They exist on steep side slopes and ridgetops that are interspersed with talus and rubble, primarily within the steep side slopes of the main river corridor and at higher elevations above 3,000' in the watershed.

Soil Productivity Ratings (as measured by d. fir site class)

Low = site class <4, Moderate = site class 3-4, High = site class >3

Low	Low to Mod.	Mod.	Mod. to High
11,042 ac	6,860 ac	9,611 ac	12,472 ac

Soil Erosion Potentials

Erosion potential of soils in the watershed is predominantly high. This is attributed to the abundance of soil types derived from pyroclastic and igneous parent materials (100 & 200 series soil types) that are either readily broken down by weathering processes or occur on steep slopes (>30%). Yet many of these very erosive soil types exist on slopes less than 30%, they can be found on portions of earthflow landforms that have gentle relief. Vegetation is key in providing protective cover for highly erosive soils. The Mt. Hood LRMP (Land and Resource Mgmt. Plan) specifies target protective ground cover percentages for erosive soil types in an effort to safeguard them from accelerated erosion that could affect forest productivity, water quality, and aquatic habitat.

Soil Erosion Potentials:

Low	Moderate	High
9,547 ac	7,975 ac	21,976 ac

The condition of soil resources in the watershed has not been assessed. It is known that forest management activities ranging from timber harvest to recreational development have affected soil resources in certain areas to some degree. But to what extent is unknown and can be considered an information gap in this watershed analysis effort.

Sensitive Soil Types

Sensitive soils are those which have inherent properties (physical, biological, and chemical characteristics) that make them susceptible to detrimental soil impacts such as, but not limited to, compaction, accelerated erosion, and displacement. These disturbances have the potential to directly decrease forest productivity. The importance of identifying sensitive soil types is to alert forest managers where to exercise additional caution when implementing management activities on them.

Soil types considered sensitive, along with the characteristics which make them so, are listed in the attached tables. Two-thirds (30,049 ac.) of the watershed area is mantled with sensitive soil types. They are widely distributed throughout the watershed, existing on a variety of landforms, slopes, and elevations.

A predominance of sensitive soil types exist on earthflow landforms found on the east side of Fish Ck Divide. They are soils derived form pyroclastic parent materials (100 series). The remainder of sensitive soil types generally occurring along the steep slopes of the main river corridor, are derived from igneous parent material (200 series). Sensitive soils derived from glacial deposits (300 series) found on upper benches and higher elevation side slopes above 3,000' make up the remaining portion of sensitive soil types in the watershed.

Land management activities on sensitive soil types should strive to limit detrimental soil impacts. Standards and Guidelines from the Mt. Hood LRMP and Best Management Practices (BMP's) for all activities on sensitive soils should be identified prior to project implementation to prevent and minimize negative impacts to site productivity (direct effects), water resources (indirect effects), and existing detrimental soil conditions (cumulative effects).

Geology

Landform Types

The landforms have been delineated on the basis of their susceptibility to landsliding. Each landform type reflects a unique combination of geologic units, slope gradient, and drainage density. The dominant slope forming processes vary from landform type to landform type.

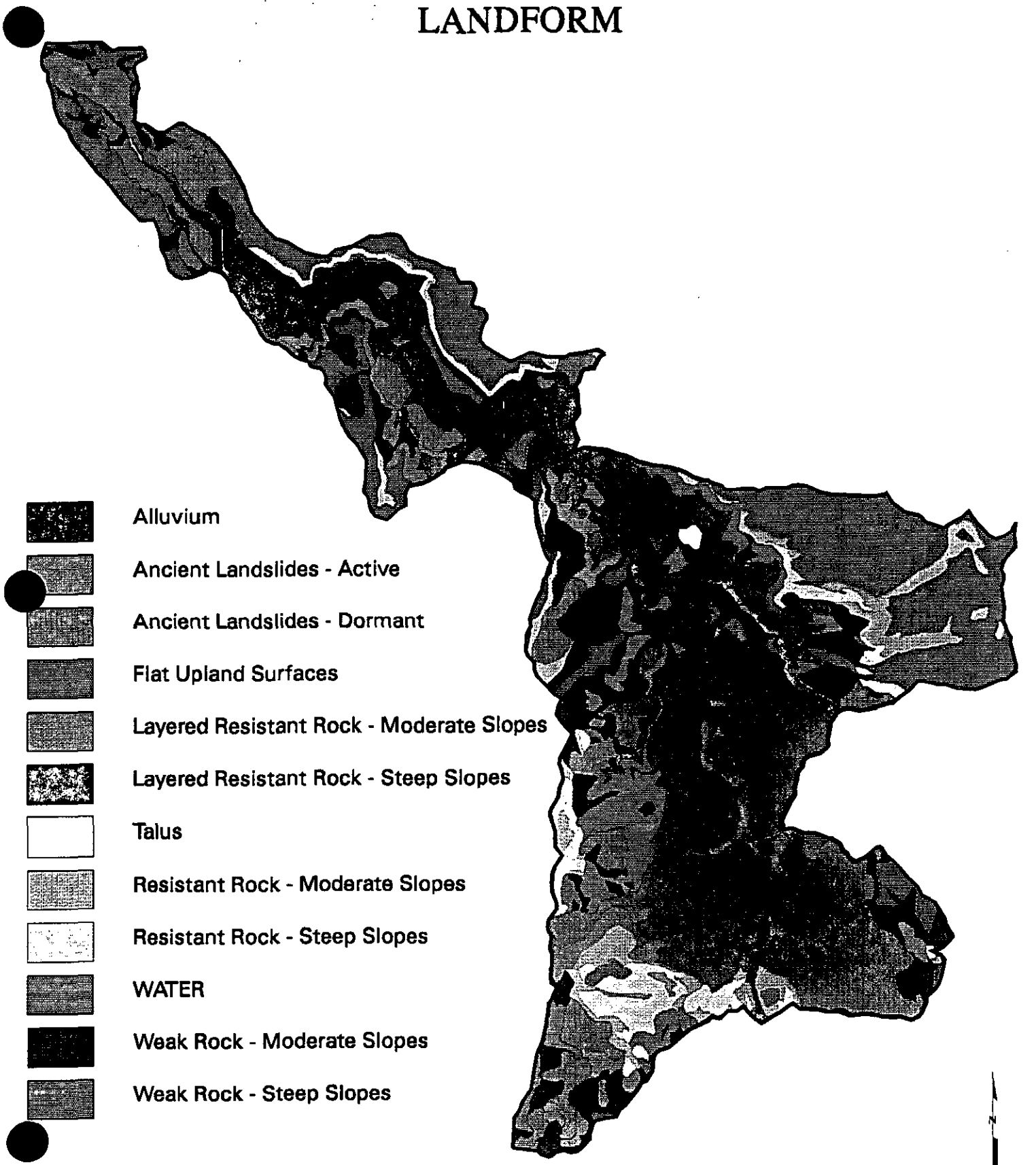
Table 2-5 lists the 11 landform types with their associated geologic units, the relative hazard rating, range of slope angles, and dominant mass-wasting processes. The landforms are displayed on Map 2-7.

Table 2-5. Relative Hazard Rating for Management Activities Triggering Sediment-Delivering Landslides.

Landform Type	Geologic Units	Hazard	Slope	Dominant Processes
Ancient Landslides--Active	Qls	XH	10-70	Slumps, EF, DS, DF
Weak Rock--Steep Slopes	Tr, Tbc	H	50+	DS, DF, Slumps
Layered Resistant Rock	Tcr	H	50+	DF, DS
Ancient Landslides Dormant	Qls	M-H	0-70	Slumps, EF, DS, DF
Resistant Rock-Steep Slopes	Titc, Tn, Qti, QTb, Qb, Tiha	M	50+	DF, DS, Rockfall
Weak Rock--Moderate Slopes	Tr, Tbc	M	20-50	DS, DF, Slumps, EF
Layered Resistant Rock-- Moderate Slopes	Tcr	M	20-50	DS, DF
Resistant Rock-- Moderate Slopes	Titc, Tn, Qti, QTb, Qb, Tiha	L	20-50	DS, DF
Talus	Qta	L	40-70	Rockfall, DS
Flat Upland Surfaces	QTb, Tn, Tr, Qb	VL	0-20	Weathering
Alluvial Flood Plain	Qal	VL	0-10	Streambank Failure

* Abbreviations: DS = debris slide, DF = debris flow, EF = earthflow, XH = extremely high, H = high, M = moderate, L = low, VL = very low

LOWER CLACKAMAS WATERSHED
LANDFORM



MAP 2-7

Additional descriptions of the landform types:

Ancient Landslides - Active (ALA): large ancient landslides or earthflows that have moved recently; evidenced by freshness of surface features as documented in the Geotech project files. Most types of management activities are likely to reactivate or accelerate movement on these landforms.

Weak Rock - Steep Slopes (WRSS): generally horizontal-lying layers of easily-erodible pyroclastic materials with enough thin, resistant lava flows to hold up the steep (>50%) slopes. Changes in permeability at the contacts between the different layers often result in springs or shallow groundwater tables. Altering the groundwater conditions in these areas can trigger debris slides, debris flows, and slumps. This landform unit is highly dissected.

Layered Resistant Rock - Steep Slopes (LRRSS): generally horizontal-lying layers of resistant lava flows separated by layers of weak pyroclastic materials. Permeability contrasts similar to that in the WRSS landform type increase the susceptibilty to landsliding at those contacts. Slopes are greater than 50%. Drainage are short and steep.

Ancient Landslides - Dormant (ALD): large ancient landslides or earthflows that are not known to have moved recently. These features may have been initiated thousands of years ago by extremely large earthquakes. Portions of these features have probably moved since then as a result of other large earthquakes or extreme climatic events. The present risk is for reactivating portions of these ancient landslides. Portions of the ancient landslides may in fact be active, but have not yet been identified as such.

Resistant Rock - Steep Slopes (RRSS): large igneous intrusions near Trout Creek underlie the steep (>50%) slopes in those areas. This landform type does not contain the layered bedrock common to much of the western portion of the watershed so permeability contrasts are not as pronounced. Also included are the steeper edges of the ridge-capping lava flows near the watershed boundary.

Weak Rock - Moderate Slopes (WRMS): similar to the WRSS landform type except for the lower slope angle (20-50%). Landslide susceptibility is also less.

Layered Resistant Rock - Moderate Slopes (LRRMS): similar to the LRRSS landform type except for the slope angle (20-50%). Landslide susceptibility is also less. Some of this landform type is probably ancient landslide deposits that have not been correctly identified yet.

Resistant Rock - Moderate Slopes (RRMS): similar to the RRSS landform type except for the slope angle (20-50%). Landslide susceptibility is also less.

Talus (T): angular loose rock that has accumulated down slope from outcrops of generally resistant bedrock as a result of rock fall and small debris slides. Mapped as a landform type in only two places in the watershed.

Flat Upland Surfaces (FUS): low angle ridgetops and midslope benches often underlain by resistant ridge-capping lava flows. Very poorly dissected.

Alluvium (A): very flat, fluvial depositional landforms. Includes glacial outwash, ancient flood deposits, and recent alluvium. Some glacial outwash deposits and ancient flood deposits have formed terraces located hundreds of feet above the present valley bottom.

The landform type map was constructed using existing bedrock and surficial geology mapping, slope angle, and drainage density. Hammond and others (1982) was the primary source for the bedrock and surficial geology. Slope angles were obtained using the Mt. Hood's digital elevation model. The relative activity of ancient landslides was determined using past landslide mapping by geotech personnel, and by personal field experience with many of the landslides.

The accuracy of these map sources has a direct bearing on the accuracy of the landform map; it can only be as good as they are. In particular, the geology maps are of crucial importance. Fortunately, although the geology mapping was conducted at a smaller scale than that at which the landform map was produced, our experiences with both maps suggest they are consistent, accurate, and reliable.

The key assumption and interpretation step in producing the landform type map involves the grouping of particular geologic units into simplified units based on their susceptibility to mechanical and chemical processes.

Another assumption involves assigning adjectives such as "Steep" or "Moderate" to a group of slope angles in order to highlight their propensity for landsliding. The breaks between slope classes are somewhat arbitrary, and there is no evidence to suggest that landslide frequency abruptly declines immediately upon moving from a higher to lower slope class.

Landslide Risk Ratings

The mass-wasting hazard map 2-7 highlights those landform types that have a moderate to high, high, and extremely high relative hazard rating for management activities to trigger a sediment-delivering landslide.

The relative hazard ratings are based on two major factors: (1) susceptibility of the landform type to mass-wasting events and (2) the likelihood of sediment from the mass-wasting event reaching a defined channel. No historical landslide inventory was attempted for this watershed due to time constraints. Information from historical landslide inventories completed on portions of two adjoining watersheds (Fish Creek and Upper Clackamas) with similar landform types was extrapolated into this watershed and used to assign the relative hazard rating.

A relative hazard rating of high (for example) for a landform type does not mean that the entire landform has an equally high probability of delivering mass-wasting produced sediment to a defined channel as a result of a management activity. Rather, it means there are more potentially unstable areas or a more efficient sediment delivery system or some greater combination of these two factors

within that landform type compared to other landform types with lower hazard ratings. Within any landform type there will be some areas with a very low relative hazard for sediment-delivering landslides and other areas with an extremely high relative hazard for sediment-delivering landslides. The high hazard areas will be identified during the planning phase of individual projects.

The relative hazard ratings for the landform types that were designated during this watershed analysis are different from the earthflow risk ratings (high, moderate, low) in the Land and Resource Management Plan (Forest Plan) for the Mt. Hood National Forest. The earthflow risk rating system incorporates other factors besides sediment delivery when assigning a rating to a particular earthflow, unlike this analysis' hazard rating system. Since earthflows are a type of landslide, the high, moderate, and low risk earthflows mapped for the Forest Plan are included within the Ancient Landslide landform mapped for this watershed analysis. Additional landslides that are probably not true earthflows are also part of the Ancient Landslide landform. The mapping completed during this watershed analysis does not replace the earthflow mapping that is part of the Forest Plan. The B8 standards and guidelines from the Forest Plan are not extended to any new areas as a result of mapping completed for the watershed analysis. Boundary discrepancies between the two mapping exercises should be resolved with field-based mapping.

Additional High Geologic Hazard Areas

There are certain combinations of geologic factors which result in a locally higher landslide risk than that indicated by the relative risk rating assigned to the various landform type polygons. These tend to be too narrow or small to be plotted accurately on the landform type map and need to be identified during project level planning. Some of these are listed below.

1. The major slope break at the outside edge of the FUS landform type. This creates a sudden change in the groundwater table and can create unstable conditions.

2. The contact between WRSS and LRRSS. Changes in permeability at this contact result in unstable conditions

3. The contact between WRSS and RRSS. Changes in permeability at this contact also result in unstable conditions.

4. The toes of ALD. The toes of these ancient landslides may be the sites of small landslides.

5. Locally steep portions of ALD. These areas could be old secondary scarp features within the larger landslide mass (unstable) or they could be the sides of large blocks of detached bedrock (not as unstable).

6. Along the margins of dikes or intrusions. The heat from these igneous rocks has probably altered and weakened the surrounding rock and increased the landslide risk there.

7. Along faults. Changes in groundwater conditions and rock strength in fault zones result

in increased landslide risk there.

8. Along the interbeds in LRRSS. Between the lava flows of the LRRSS and LRRMS landform types are sedimentary accumulations of tuff and lahar deposits known as interbeds. Permeability changes at these interbeds result in potentially unstable slopes. One of the interbeds is regionally prominent and is known as the Vantage interbed. So many landslides have occurred near this interbed that a topographic bench has developed along part of its extent. The "Vantage Bench" is easily seen on topographic maps. Near Big Cliff the bench is at 1200 feet elevation; near Big Eddy, 1600 feet; near the mouth of Fish Creek, 1800 feet; near Three Lynx, 2800 feet. The Vantage Bench is an indicator of past landslide activity and of the potential for more landslides.

In terms of the Forest Plan, all the locations listed above are "high geologic hazard areas" requiring a geologic analysis during project planning (FW-012).

Aquatic Conditions

Fisheries

In the mainstem Clackamas River, between North Fork Reservoir and the confluence with the Collawash River, cold water species such as salmon, whitefish and sculpins dominate the fish communities. Native anadromous salmonid species include spring chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), and steelhead trout (*O.mykiss*) (Map 2-8). Rainbow trout (*O. mykiss*) and cutthroat trout (*O. clarki*), and whitefish (*Prosopium williamsoni*) are native resident salmonids. Historically, bull trout (*Salvelinus confluentus*) inhabited these waters, but there have been no scientific verification of this species in the area despite efforts to locate any remaining individuals. Non-salmonid fishes that inhabit this reach are found in Table 2-6.

Table 2-5. Non-salmonid fishes of the Lower Clackamas River

Common Name	Scientific Name
longnose dace	*Rhinicthys cataractae*
sculpin sp.	*Cottus sp.*
mountain sucker	*Catostomus platyrhynchus*
Pacific lamprey	*Entosphenus tridentatus*

Abundance of Pacific salmon has been adversely affected by dams, over-harvest, hatchery practices and habitat degradation. Faraday Diversion Dam (formerly Cazadero Dam) was built in 1904 and River Mill Dam was built in 1912. Fishways were built, but it was a common practice at the time to install egg collection racks which blocked salmon runs so that as many fish as possible could be taken for artificial propagation. Due to the difficulties in installing and maintaining the racks during high water some fish were allowed to pass upstream and spawn. In 1917, the fish ladder at Faraday dam was washed out and was not rebuilt until 1939; the upper river was not seeded during this period (ODFW 1992).

A number of different stocks of the Pacific salmon have been introduced since the turn of the century. These introduced stocks include Willamette strain spring chinook salmon, early run coho salmon, Big Creek and Eagle Creek strains of winter steelhead, Skamania/Foster origin summer steelhead, and different races of cutthroat and rainbow trout (ODFW 1992).

There are almost forty miles of anadromous-fish habitat in the lower Clackamas watershed and 76% of it is in the Clackamas River. North Fork Dam is the point AT which all anadromous fish are recorded as they pass. PGE (Portland General Electric) has kept records of all downstream and upstream migrants since 1959. These data show a trend of decline in numbers of winter steelhead, spring chinook, and late-run coho (ODFW 1992, USDA Forest Service 1995).

The mainstem Clackamas River acts primarily as a transportation corridor. There is some rearing of

juvenile coho, chinook, and steelhead in the margins, but better habitat exists for them higher upstream or in tributaries where flows are more moderate and habitat more suitable. The area immediately above North Fork Reservoir is one of the most heavily used by spawning coho and chinook, especially upstream of "The Narrows" (area constrained by a canyon between RM 45.5 and 46.5 on the mainstem). Every year many spawning salmon are seen from road 46 where Tag and Tar Creeks enter the Clackamas River. There is a salmon overlook about 1/4 mile north of Riverside Campground on road 46 for the public to view the spawning salmon.

The 1991 Clackamas River Survey reports a high incidence of superimposition on redds by chinook. This indicates lack of spawning habitat. Fishes that build redds over existing redds may ruin the eggs already laid. Surveyors noted few juvenile coho in the river during their snorkel observations during the summer of 1991. This reinforces the idea that juveniles generally rear in safer areas such as backwater ponds and tributaries where the flows are more moderate, the habitat more diverse and where the woody debris hasn't been washed out of the system. Juveniles are often observed among rootwads and log complexes (Beyer 1992).

The late-run coho salmon in the Clackamas River is considered the last remaining viable wild coho population in the Columbia Basin (Nehlsen et al., 1991). The late-run coho return to the river from October through January and spawn in February and March. From 1962 to 1979, thousands of non-native coho were introduced to the Clackamas River and have become naturalized (Cramer and Cramer, 1994). These coho are termed "early-run" because they begin returning to the Clackamas River in August and spawn in November. Cramer and Merritt (1992) conducted a study to locate spawning sites for native late-run coho above the North Fork dam. Ninety-six wild fish were tagged with radio transmitters between 1988 and 1991. Of these 96, 80.2% spawned in the mainstem between RM 33.5 and 50.3 (below "The Narrows"). Spawning in the North Fork Clackamas River and Fish Creek accounted for an additional 8.3% and 10.4% of spawning respectively. Only 5 of the 96 coho spawned above RM 50.3.

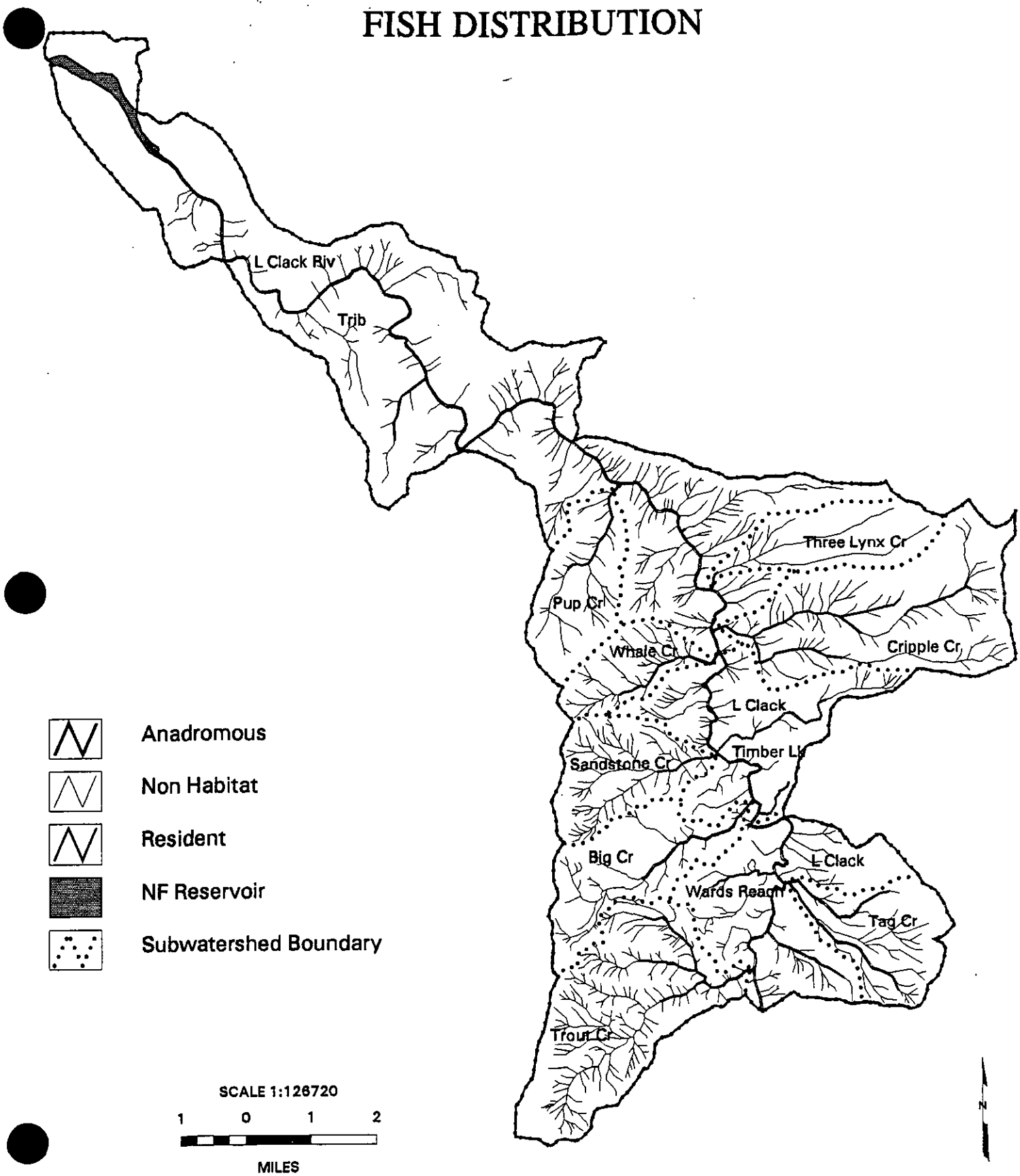
The Columbia River gillnet fishery has selected against the earlier portion of the native run. The fishery harvested about 85-95% of the late run in the 1970's. This gillnet fishery ran late-September to November essentially eliminating that portion of the wild Clackamas coho. Cramer and Merritt confirm a fishery principle that fish who come upstream earlier tend to travel furthest upstream. They reported that the fish they tagged earlier in the run did travel furthest upstream. What is left is the later portion of the run, which tend to spawn further downstream than the early fish, hence the skewed distribution of spawning coho in the lower river (Cramer and Merritt, 1992).

Anadromous fish have been blocked in the past (1920's through the 1950's) by poor water quality in the lower Willamette River during summer low flows. Fish migrating during the summer months may have died due to pollution and low dissolved oxygen. Since the 1960's the water quality has improved and is not longer an impediment (Cramer and Cramer 1994).

Fish Distribution in the Watershed

In 1994, an effort was made to map the upper limit of fish distribution in the Estacada and Clackamas Ranger Districts and report whether fish were limited due to a natural or man-made barriers, or lack of base flow (Baker et al., 1994). Salmonids were the focus of this project, but sculpins were noted when found. Map 2-8 shows the results of this work and Table 2-6 lists streams and fish distribution miles in the lower Clackamas River Watershed. Surveyors verified 8 natural barriers in this analysis area, and a 12-foot waterfall on Dugan Creek is presumed to be a barrier.

LOWER CLACKAMAS WATERSHED
FISH DISTRIBUTION



MAP 2-8

Table 2-6. Streams and Fish Distribution within the Lower Clackamas Watershed

Stream	Stream Survey (Y/N)	Fish Dist. Verified (Y/N)	Fish Distribution (miles)			Total Length (miles)
			Anadromous	Resident	Non-Fish	
Big Ck.	Y	N	2.2	2.2	2.2	4.4
Bull Ck.	N	N	0	2.3	1.0	3.3
Cat Ck.	Y	N	0	0	1.4	1.4
Clackamas River	Y	Y	25.6	25.6	0	25.6
Cripple Creek	N	N	0	3.8	1.8	5.6
Deer Creek	Y	Y	0	0	1.0	1.0
Dinner Creek	Y	Y	0	0	2.7	2.7
Dugan Creek	Y	N	0	1.3	0.5	1.8
Helion Creek	N	N	0	1.1	0.7	1.8
Mag Creek	Y	N	2.1	2.6	0.1	2.7
Monte Creek	N	N	0	0	0.4	0.4
Moore Creek	N	N	0	0	1.6	1.6
Murphy Creek	N	N	0	0	0.4	0.4
Pup Creek	N	N	0	1.8	1.2	3.0
Rod Creek	Y	Y	0	1.2	0.9	2.1
Sandstone Creek	Y	Y	0.1	0.9	1.6	2.6
So. Fk. Cripple Creek	N	N	0	1.8	2.6	4.4
Tag Creek	N	N	1.4	1.9	0.2	2.1
Tar Creek	N	N	0.9	1.4	0.2	1.6
Three Lynx Creek	Y	Y	0.2	0.2	2.9	3.1
Trout Creek	Y	Y	0.6	1.7	2.5	4.2
Whale Creek	Y	Y	0.6	0.6	2.1	2.7
Unnamed Creeks	N	N	0	3.2	213.9	217.1
Total Miles			33.7	53.6	241.9	295.6

Habitat Information

Streams within this watershed analysis area do not function uniformly. Three Lynx, Deer and Dinner, and the upper portions of Cripple and South Fork Cripple Creeks are deeply incised. In the upper reaches of these streams, there is an erosion platform that has a gentle gradient. Further downstream is a geologic difference and the gradient increases. These streams, from the geologic stratification to the mouth, are steep and substrate tends to be the pool forming hydrologic control due to the geology.

At least 50% of the lengths of Tar, Tag, Mag, Bull, Big and Dugan Creeks flow through earthflow zones (Map 2-7). The lowermost part of Sandstone, Cripple, and South Fork Cripple Creeks are, to a lesser extent (15-20%), in earth flow zones. Earthflow landforms are areas where lands are active in mass movement. In this watershed area they consist of weathered pyroclastic material. This material tends to weather quickly, its composition is high in clay, the soil holds large quantities of water, it is fertile, and is unstable. Streams flowing through earthflows have a large floodplain relative to the channel's width, the substrate is high in silt, stream banks are not well defined, pools are poorly formed, readily filling in after scouring, and there are more alders and underlying vegetation, such as grasses and skunk cabbage near the banks. Streams in earthflow zones have different characteristics than streams in a steep, rock landform, such as lower gradient and velocity, thus less scouring potential, the water has less flushing potential and tends to deposit more sediment in the channel, and pool formation is the result of woody debris rather than substrate.

Trout, Rod, and Whale plus the upper portions of the intermediate earthflow group are in an area where the dominant landform is the volcanic uplift along the Fish Creek Divide. The earthflow occurs in the lower portion of the valley near the banks of the Clackamas River (RM 48.5-56.3). This volcanic uplift region has intrusive rock and erodible pyroclastic material. The canyon that Trout Creek cuts through (RM 1.7-2.1) is characteristic of this type of geology where the river has cut through the pyroclastic tuff, but not through the more resistant intrusive rock, leaving a gorge.

Tributaries are important features of this watershed as they provide habitat for resident trout and rearing areas for juvenile anadromous fish, refuge from the mainstem during storms, and spawning grounds for anadromous fish, usually near the mouths.

All of the streams surveyed that are watersheds of the Clackamas River have had some human impact (timber harvest, road building, dispersed campgrounds) which have been known to degrade fish habitat.

The Mount Hood National Forest has developed a Land and Resource Management Plan (LRMP) that contains standards that describe desired future conditions for aquatic habitat parameters in the forest. The LRMP for pool frequency pertains to primary pools (pools greater than three feet deep). The LRMP standards FW-090 and FW-091 states that streams with less than 3% gradient should have at least one primary pool every 5 to 7 channel widths, and streams with greater than 3% gradient should have at least one primary pool every three channel widths. In this report the minimum of one primary pool every 7 channel widths was used. The LRMP standard for woody debris (FW-095)

states that there should be at least 106 pieces of small and large woody debris per mile. Large woody (LWD) debris is defined as a log at least 36 inches in diameter and 50 feet in length. Small woody debris (SWD) is a log with a diameter 24 to 36 inches in diameter and 50 feet in length. An obscure detail to this standard alludes that 80% of these 106 pieces/mile should be in the SWD category, while the remaining 20% should be LWD.

The Columbia Basin Pacific Anadromous Fish Habitat Policy and Implementation Guide (PIG) is another guideline used by the Forest Service. For LWD the PIG requires 80 pieces per mile. The PIG also sets a standard for pools of all depths (called total pools in this document) based on the average wetted width of the channel (See PIG for standards).

In the 1995 Dinner Creek Survey, it is reported that, "..less than 1% of all streams surveyed on the forest to date have met the woody debris standards." Fisheries personnel at the Clackamas River Ranger District have put together a data matrix for habitat parameters in "wilderness reaches" to provide a comparison for a range of natural variability. The data are from stream surveys done in roadless areas with little effects from timber harvest or roads. Information from these surveys reflect historical conditions. The unmanaged stream information serves as a baseline to compare conditions in managed areas. In general, these wilderness streams do not meet LRMP standards (Shively and Baker, in progress). This suggests LRMP standards should be revised.

Twelve stream surveys have been done in the lower Clackamas River watershed (Table 2-7.). Table 2-7 includes information on pool and woody debris frequency, stream width, and substrate. Pools and woody debris are important considerations in fisheries because these habitat characteristics provide cover, holding areas during low-flow periods, resting areas from high-velocity current, and wood acts as media for some aquatic macroinvertebrates, which are food sources for fish. For a more complete summary of the stream surveys see Appendix.

In the lower Clackamas River watershed, 42.7 miles of stream have been surveyed. Four out of the 12 streams surveyed (woody debris in reaches averaged) met the LRMP standard for woody debris (Rod, Three Lynx, Trout, and Whale Creeks). Dugan and Sandstone Creeks were 17.3% and 12.5% below the LRMP standard for large and small woody debris per mile. The four other creeks surveyed that could be directly compared to the LRMP for woody debris averaged 76.6% below the standard. In the mainstem Clackamas River, only LWD/mile was recorded and it was very sparse (>0.1/mi). The 1991 Clackamas River Survey explained that woody debris is transported out of the system due to the high streamflows. Ten out of the 38 reaches surveyed in the lower Clackamas watershed met the PIG standard for total pools per mile and four out of 38 reaches met the LRMP standard for primary pools per mile.

Lakes, Pond, Wetlands

Six named lakes and an additional seven unnamed lakes greater than 1 acre are located in the lower Clackamas River Watershed. The named lakes are: Surprise, Timber, Cripple Creek, Frog (the reservoir to Three Lynx), and High Lakes, and Ripplebrook Pond. Timber Lake was surveyed in 1975 in Lakes of Oregon. Timber Lake, a 14-acre impoundment, was constructed originally for log

storage and has since been incorporated as part of the Timber Lake Job Corps complex. The failing spillway gate on the dam was replaced in 1978 by untreated wooden planks (4 inches by 8 to 12 inches), which were becoming rotten by the 1990's. For fear of these planks bursting and causing damage to the dam itself, they were removed in 1993 lowering the potential level of the lake by seven feet. Timber Lake operates a tertiary wastewater treatment plant. The polishing pond is adjacent to road 46 near Timber Lake. Effluent is held in the pond from May 1 to November 1 (Adams, 1996). Timber Lake is stocked with legal-sized rainbow trout during the summer by ODFW. Cutthroat were stocked in the past, which there are now a naturalized population. There are 266 acres of wetlands in the watershed.

Table 2-7. Stream surveyed done by the Mt. Hood National Forest in watershed analysis area with associated LRMP and PIG standards.

Stream	# reaches	length surveyed	avg. wetted width (ft)	Woody Debris		Total Pools		Primary Pools	
				L+SWD /mi	LRMP std	Total Pools /mi	PIG std[3]	Primary Pools/mi	LRMP std[3]
Big Ck.	12[1]	4.0 mi	7.6	10.6	106/mi	51.4	1/10	4.7	0/10
Cat Ck.	1	0.5 mi	na	na	106/mi	na	na	na	na
Clackamas R.	5	22.2 mi	95.0	>0.1[2]	106/mi	12.4	1/5	12.4	3/5
Deer Ck.	1	0.7 mi	9.0	38.3	106/mi	15	0/1	0	0/1
Dinner Ck.	3	0.7 mi	8.6	29.0	106/mi	52.5	0/3	0	0/3
Dugan Ck.	3	1.7 mi	7.0	87.7	106/mi	55	2/3	1.1	0/3
Mag Ck.	1	0.5 mi	5.0	na	106/mi	111	2/2	na	na
Rod Ck.	3	0.9 mi	9.3	216.7	106/mi	100	2/3	2.4	0/3
Sandstone Ck.	2	2.0 mi	10.6	97.2	106/mi	22	0/2	7.5	0/2
Sandstone Tribs.	3	1.4 mi	8.2	21.3	106/mi	11.1	0/3	3.0	0/3
Three Lynx Ck.	2	1.5 mi	19.7	136.5	106/mi	10	2/2	4.0	0/2
Trout Ck.	3	4.1 mi	14.0	114.7	106/mi	55.7	0/3	26.7	1/3
Whale Ck.	1	2.5 mi	10.0	132	106/mi	36	0/1	0.8	0/1

[1]reaches 7 and 9 omitted since they are wetlands with undefinable channels.
[2]this value (>0.1) is for LWD/mi only. PIG standard for LWD/mi are 80 pieces/mi.
[3]number of reaches that meet LRMP or PIG standards / number of reaches surveyed.

Fisheries Work in the Watershed Analysis Area

Fishery biologists from Oregon Department of Fish and Wildlife (ODFW), Portland General Electric Co. (PGE), and the U.S. Forest Service (USFS) have collaborated in the past on projects in this watershed under the name, Clackamas River Working Group. Past projects have included: a summer steelhead radio tracking study where spawning locations were identified (1994 and 1995) and PIT (passive integrative transponder) tagging of juveniles captured via smolt traps to determine rearing ecology (1994-present). During the summer of 1995 and spring of 1996 a smolt trap has operated in the mainstem Clackamas River, just below the confluence with the South Fork of the Clackamas River. Juvenile fish are tagged and released. As the juveniles grow to smolts and migrate downstream, a device that detects the PIT tag as they pass through North Fork dam records the time of migration. This information helps determine where juveniles rear and how long they stay. After feeding in the ocean, these fish will migrate upstream and again be detected at the dam. Other smolt-trap locations in the Clackamas River Basin that are outside this watershed analysis area are: the mainstem Clackamas River near the confluence with Switch Creek, Oak Grove Fork, and Fish Creek. Fish tagged in these upper traps may be caught in the lower trap (weighted and measured again) or caught again in the same trap if they go upstream after being caught the first time. This is a method to track juvenile fish and learn about where they rear and how long they stay. A point of interest in the basin is how much time juveniles spend in the North Fork Reservoir before going through the hydro-complex. If fish are recorded at the trap near the South Fork and again recorded at the dam, then the time spent in the reservoir can be inferred.

Hydrology

Streamflow

Streamflow information for Lower Clackamas is very limited.

The most well documented flood event in the recent past was the 1964 flood. This flood approached the estimated 100 year frequency in the Clackamas drainage. Since 1964 the most recent major flood was in February 1996. Flood frequency numbers were not finalized at the time of this publication, but the most recent estimates were of a 50 to 100 year frequency on the Clackamas drainage. Instantaneous peak flow at the gauging station on the Clackamas near Estacada was 86,900 cfs in 1964 and 80,000 cfs (> 100 year frequency) in February 1996. The gauging station on the Clackamas at Three Lynx was 46,800 cfs (50 year frequency) in February 1996. This recent event has likely triggered many channel changes and sediment input. Damages and changes have not yet been documented. An update of stream surveys and other baseline monitoring will be critical in determining changes in the Clackamas River stream system following this large flood event.

Peakflow events occur during the rainy season, following a rapid and substantial depletion of the snowpack during a prolonged rain-on-snow period in the "transient snow zone". The Lower Clackamas River transient snow zone is estimated to occur between 1500 feet and 4000 feet elevation (Christner and Harr, 1982). These elevations may vary locally; however, local verification of the transient snow zone for Lower Clackamas River was not available. The lower portion of the watershed is not in the transient zone, but the majority of the upper portions of the Lower Clackamas watershed are within the transient snow zone.

Created openings from clearcuts, roads, fires and windthrow areas are areas that show increased snow accumulation. During rain-on-snow events runoff from these created openings is more rapid. The rapid runoff from these areas increases the magnitude of peakflows and may scour, downcut or widen the stream channel.

The Mt. Hood Forest Plan employed an analysis tool to assess hydrologic recovery, referred to as the aggregate recovery percentage (ARP) methodology (USDA,1990). The ARP model examines the effect of harvested openings and roads on hydrologic recovery. Since the Lower Clackamas watershed is a "collector" watershed, the ARP values are for the subwatersheds of the Lower Clackamas watershed. They are as follows.

Table 2-8. ARP Values.

Subwatershed	ARP
Pup Creek	77
Three Lynx	93
Whale Creek	80
Big Creek	78
Sandstone Creek	89
Trout Creek	76
Cripple Creek	87
Tag Creek	82

The Mt. Hood National Forest Land and Resource Management Plan identified an ARP value "threshold" of 65% for the Lower Clackamas watershed. This means that at least 65% of the watershed should be in a hydrologic recovered condition (defined as coniferous forest with at least 70% crown closure and an average diameter of at least 8 Inches). While no absolute thresholds exist in the real world, subwatersheds with lower ARP values are at a greater risk for damaging peakflows. The ARP % for the subwatersheds range from 76% for Trout Creek to 93% for Three Lynx. None of the ARP % are below the Forest Plan threshold. Since the flood damage from the February storm was limited in this watershed it appears that the watershed is in a hydrologic recovered condition.

Stream Temperature

Stream temperatures are affected by direct solar radiation which depends on the quality and quantity of shade, vegetative and/or topography. Natural disturbances and human activities have the potential to influence stream temperature by altering vegetation and channel form. Stream temperatures are directly related to the health and productivity of fish and other aquatic organisms. Water temperatures in salmonid streams vary daily, seasonally, and spatially.

Temperature data using continuous recorders were taken in 1994 for some of the subwatersheds and along the main Clackamas. Summer stream temperatures were during the months of July through September for most of the sites, however in some cases there is missing data for part of the month of July, during a time stream temperatures were elevated. The seven day maximum stream temperatures did not exceed the upper range of natural variability for the Clackamas River 14.5 - 20.0 C (REAP, USDA, 1993) for all the subwatersheds in 1994. The state water quality standard of 17.8 C was exceeded at the Clackamas above South Fork and is at the standard on the Clackamas above Fish Creek (see table below). The temperatures are well below the biological threshold for salmonids (20 degrees C to 23 degrees C).

Table 2-8. Stream Temperatures.

Subwatershed	Avg. Max. 7 Day Stream Temperature 1994
Clack R. above S. Fork	18.8
Clack R. above Fish Crk.	17.8
Whale Crk.*	15.6
Trout Crk.	17.1
Sandstone Crk.	13.6
Big Crk.*	13.5
Three Lynx*	10.9

* Analysis of avg. max.7 day temperatures was based on partial data set.

Key Points and Findings

Several items stand out as important findings when present conditions are analyzed for their contribution to habitat needs associated with riparian, aquatic, terrestrial and special habitats, and geologic and hydrologic conditions. They are:

Vegetation

In general, conditions within the watershed are within the range of natural variability. This is especially unusual in the Clackamas River sub-basin for late seral stands.

The vegetation pattern in the watershed is more fragmented than it was historically.

Conditions are above the range of natural variability for early seral conditions. These stands provide opportunities for forest products.

In the Late Successional Reserve/Corridor analysis area there are optimal conditions for big game. Vegetation patterns meet requirements for hiding, forage, and thermal cover.

Overall, from a vegetation standpoint, it is a stable watershed. Windthrow, disease and fire are minor contributors to vegetation patterns.

Wildlife

There is an overall lack of survey information in the Late Successional Reserve/Corridor.

Bald eagle nesting and roosting habitat is suitable in the Corridor.

Road densities exceed Mt. Hood Forest Plan standards.

Soils

Erosion potential is predominately high.

Soils susceptible to detrimental impacts mantle two-thirds of the watershed. These soil types are found predominantly in the East Divide area.

Geology

Eight landform areas are high geologic hazard areas, requiring additional geologic analysis during project planning.

This watershed is one of the five most geologically unstable watersheds on the Mt. Hood National

Forest.

Fisheries

Spawning areas for late-run coho are important.

Winter steelhead, proposed for Federal listing as threatened, occur in the watershed.

Overall, aquatic habitat conditions do not meet Mt. Hood National Forest standards and guidelines.

Hydrology

No "ARP" values are below Mt. Hood National Forest standards and guidelines.

HUMAN USES

Which critical components are key to the balance of human use and management of infrastructure while protecting and managing resources?

Methodology to address the key question

This question is answered by addressing the following topics:

*Identification of key components of human use and infrastructure, and
*Identification of natural resources impacted by human use

Key Components of Human Use and Infrastructure

This question was identified because of the concentrated use by humans in the Lower Clackamas River watershed. Use falls into two broad categories-those associated with developed sites such as campgrounds and developed facilities, and those occurring throughout the watershed, in a dispersed fashion.

There are general concerns about impacts of human use with natural resources such as wildlife, fisheries and water quality. This chapter discusses those concerns by displaying key components of human use and infrastructure in table 3-1, human use and dispersed recreation in table 3-2, displaying natural resources impacted by human use, and a summary of where the conflict occurs.

Table 3-1 Key Components of Human Use and Infrastructure

Facility	Uses	Comments	Species Habitat	biodiversity
Roadways	primary, secondary, bridges, closed	includes hard and soft closures	**	*
Three Lynx & Frog Lake	transmission lines, facilities (housing & management)	power production	**	**
Timber Lake Job Corp	management, housing, Timber Lake		**	**
Transmission Lines	PGE, Indian Henry Campground		*	*
Ripplebrook Area	Ranger Station, Heliport, Oak Grove housing		**	**
Ripplebrook Wetlands			*	*
Construction and Maintenance Shop	administrative	future use under review	**	**
Memaloose Scaling Station			**	**
Indian Henry	Campground, Shop and RV Dump Site		**	**
Other Developed Camping Sites	Memaloose, Fish Creek, Roaring River	not all sites listed	**	**

One * means compatible, Two ** means not compatible.

Table 3-2 Human Use and Dispersed Recreation

Human Use	Habitat for Species	Bio - Diversity
Clackmas River instream activities -kayaking, rafting, fishing, canoeing	**	*
Streamside activities-photography, driving for pleasure, hiking, walking, biking	**	*
River access-boat access sites	*	*
Special Use Permits-white water events, commercial guiding, marathon race, bicycling and bicycling events	*	*
Day Use - picnicking, wildlife viewing	*	*
General Activities-target shooting, illegal activities, garbage dumping , off-highway vehicles, equestrian	**	**
Gathering of Special Forest Products - Christmas trees, boughs, beargrass, fiddleheads, mushrooms, transplants, firewood	product specific	product specific

One * means compatible, Two ** means not compatible.

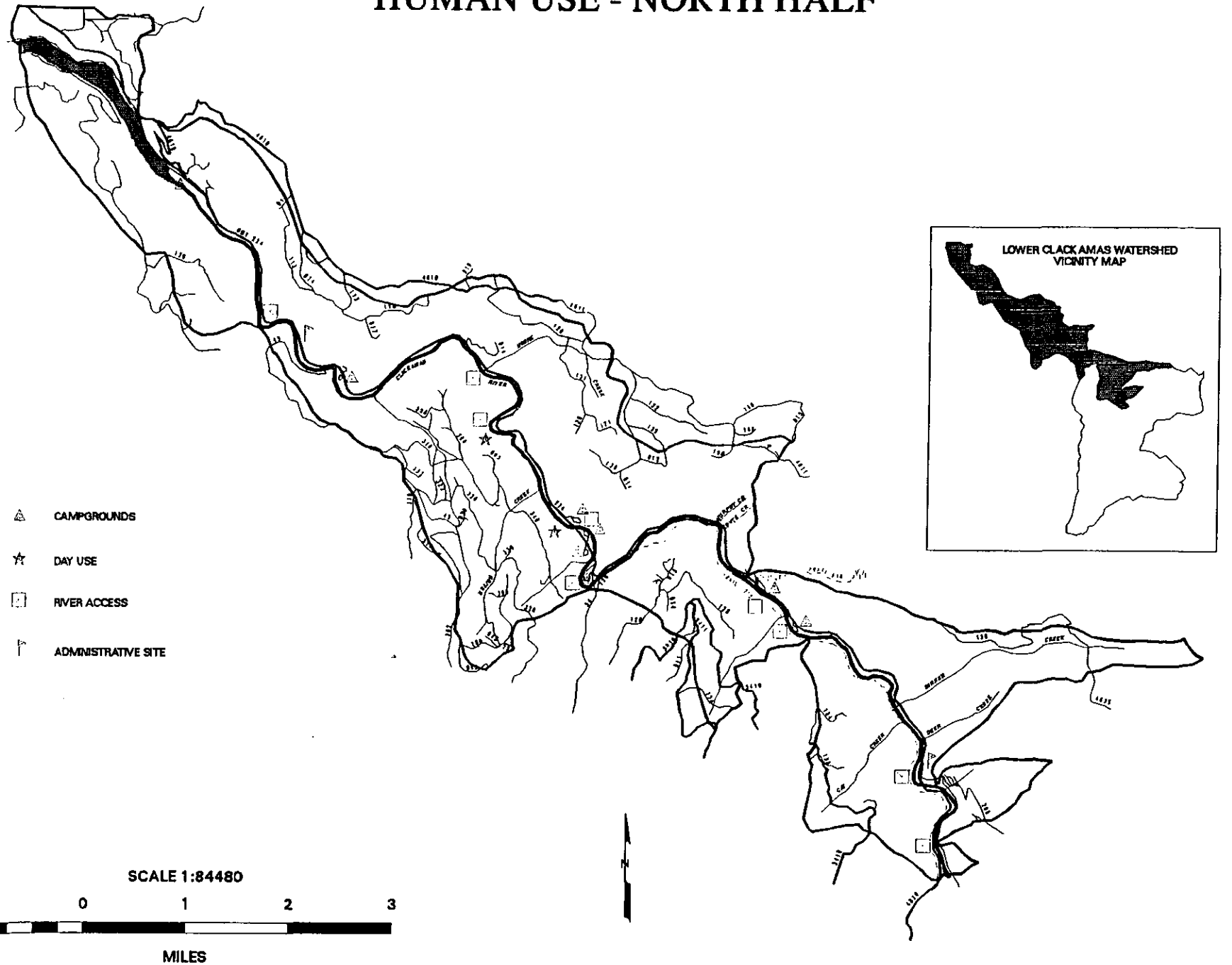
The Lower Clackamas Watershed provides the setting for a wide range of recreational activities and experiences, administrative facilities, and human development of natural resources (Map 3-1 and Map 3-2).

Recreational use varies from developed sites along the Clackamas River with access provided by Oregon State Highway #224 and Forest Service Road #46 to semi-primitive motorized and non-motorized dispersed sites in outlying areas with access provided by Forest Service roads and trails. Many of the watershed recreational uses are cited as the most popular forest activities recognized in the Mt. Hood National Forest Management Plan. Visitor days recorded for the highest use of Forest's resources included: 1) Driving for Pleasure; 2) Camping; 3) Viewing Scenery; and 4) Gathering Forest Products. Hiking/Walking and Fishing were fifth and sixth on the list.

One of the primary recreation opportunities in the watershed is the Clackamas River. Activities that are centered on this body of water include: fishing, whitewater rafting, kayaking, canoeing, water surfing, wildlife viewing, and special water related events. Associated activities include developed and dispersed camping, hiking, horseback riding, bicycling, jogging, wildlife/scenery viewing, and photography. Highway #224 and adjacent river trail system provide easy access to the river.

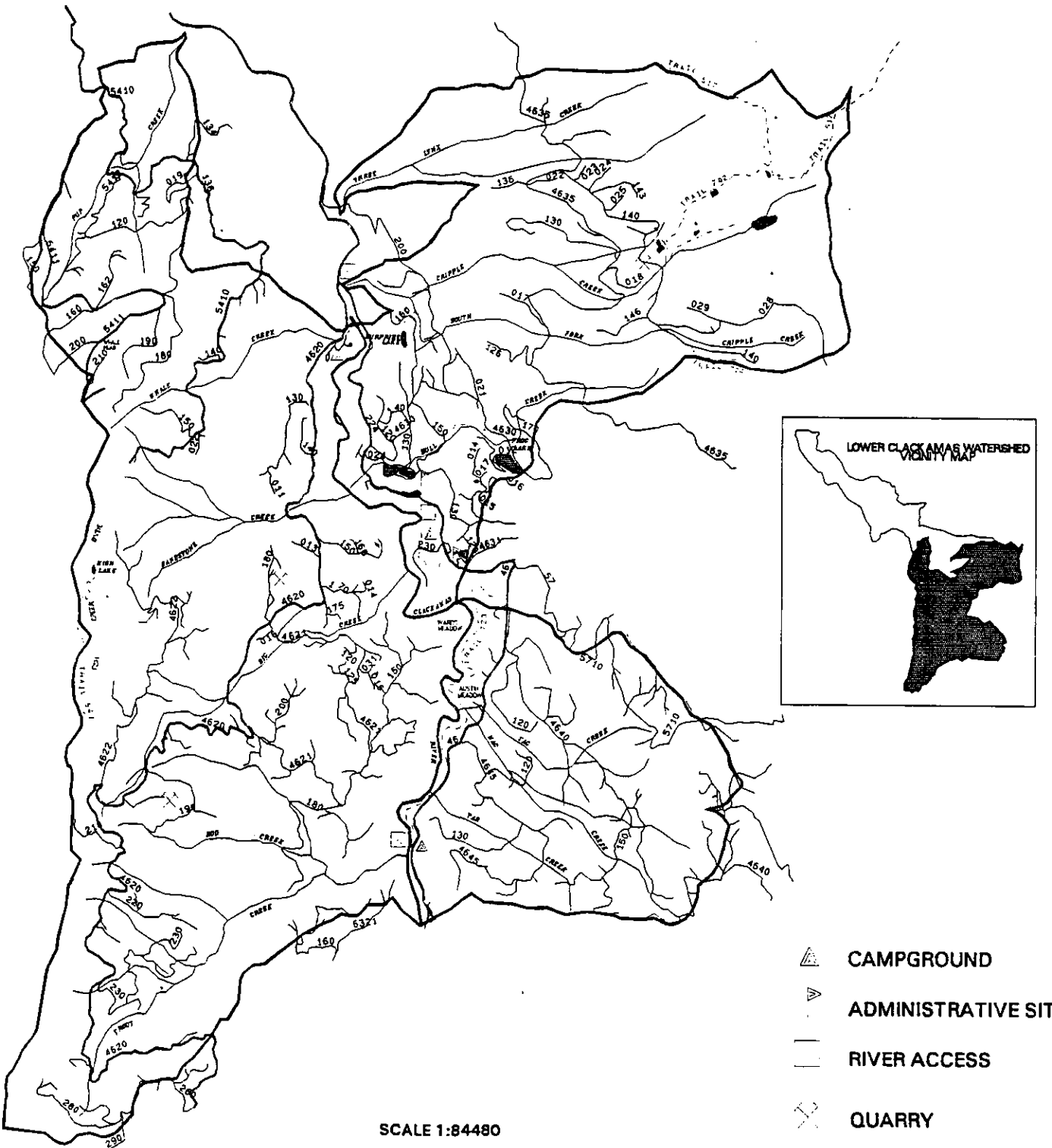
Recreation activities in the lower Clackamas drainage have economic impact on the town of Estacada. Special recreation events such as the Clackamas River Canyon Marathon which is a Boston qualifier, Annual Best Dam Run and Walk 10K, Bob's Hole Rodeo/Kayaking, annual free

LOWER CLACKAMAS WATERSHED
HUMAN USE - NORTH HALF



MAP 3-1

LOWER CLACKAMAS WATERSHED
HUMAN USE - SOUTH HALF



MAP 2-2

fishing day and clinic, and the Whitewater Festival bring national and international visitors to the area. Facilities in the town are utilized by event participants for associated activities and general services.

The road system for the areas surrounding the Clackamas River provides access to a variety of recreation opportunities. Activities include hunting, target shooting, fishing, gathering of special products, and camping. The number of public created dispersed camp sites increases on a yearly basis. Choice of these sites is often general user preference not to be in a developed campground. The sites of dispersed camping often change with season of the year and related activities (e.g. whitewater boating, hunting, gathering).

Gathering of forest products is productive in the Lower Clackamas Watershed area. Products include but are not limited to firewood, cedar, Christmas trees, boughs, mushrooms, bear grass, transplants, fiddlehead, and other forest greens. Limitations exist in the Late Successional Reserve portion of the watershed.

Driving for pleasure on Highway #224 through the Clackamas River Corridor is enhanced by the scenery provided by the west slope of the Cascade Mountains. This highway is a section of the Clackamas-Breitenbush Scenic Byway. Featured are dense, lush conifer forests dominated by mature Douglas-fir and western red cedar, riparian flats with groves of cottonwood and red alder, beaches of river-rounded cobbles, rocky openings on south facing bluffs, and huge volumes of water cascading through narrow canyons. The Clackamas River is mostly natural appearing, but a combination of highway construction, power lines, recreation development, and timber harvests have altered the scenery to some extent.

Use of the watershed is impacted by close proximity to the Portland Metropolitan Area. This watershed is less that an hour's drive from this urban center. Of the 154 forests in the National Forest system, the Mt. Hood National Forest is one of the eleven forests identified by the Forest Service as meeting the urban forest characteristics of being located within 50 miles of populations greater than one million people. This is commonly referred to as an "urban forest". The Clackamas River is one of two major drainages on the Mt. Hood National Forest that meet this criteria. This close proximity encourages not only recreational use, it provides a low monitored, remote setting for urban crime. Illegal disposal of varying types of materials occurs in the watershed. Users seeking areas for illegal activities utilize the remoteness of this easily accessed watershed.

Development along the river corridor includes National Forest and Portland General Electric facilities and housing developments. National Forest administrative locations include: Timber Lake Job Corps Center, Ripplebrook Ranger Station, Lazy Bend Construction and Maintenance Shop, and Indian Henry storage garage. PGE facilities include the Three Lynx hydro-power plant, administrative facilities, residence quarters, and a cleared right-of-way with steel transmission towers that carry Three Lynx generated electricity down along the river to the Portland metro area.

Overall levels of visitation to the watershed, prior to flood closures of Spring of 1996, can be

inferred through traffic counts. According to monitoring done in 1994 and compared with 1990, traffic counts have shown minor changes for Highway #224 along the Clackamas River (see Appendix to Reference ODOT 1990/1994 statistical information).

Due to the presence of late successional reserves located in the watershed and the diverse character, the watershed has been delineated into the following areas: Corridor, Administrative Unit, East Divide and Butte. To best describe human use in the "Corridor" delineation, the area has been further divided into the following two areas: river corridor and back country areas. Information specific to each delineation is found in the Appendix of this document.

Impacts and Conflicts from Human Use

As outlined in Key Question #1, wildlife and fisheries use in the Lower Clackamas watershed is abundant and diverse. The Clackamas River and its tributaries provide essential habitat for numerous wildlife species. Recreational disturbance to wildlife and fisheries has traditionally been viewed as most detrimental during the breeding season. Disturbance outside of the animals breeding season may have equally severe effects. The consequences of disturbance during these two periods in an animals annual cycle are quite different; however, disturbance outside of the breeding season may affect the individual's productivity; disturbance outside of the breeding season may affect the individual's energy balance and, therefore its survival (Knight, 1995).

The primary wildlife concerns on the Clackamas River are bald eagles and peregrine falcons, because the Clackamas River has been identified as a recovery area for these species. The harlequin duck is present throughout the river corridor and is therefore a concern as well. The highest recreational use traditionally along the Clackamas River usually occurs between May and October. The Clackamas River corridor is the ideal setting for a number of outdoor sporting events, for example; kayaking, rafting, fishing, canoeing, commercial guiding, horseback riding and organized river events.

Each of the above mentioned activities could potentially impact the harlequin duck both directly and indirectly. Direct impacts to the duck could come from disturbance which would be associated with noise and the proximity of any organized river event to nesting and rearing harlequins or foraging harlequins as well. The impacts of disturbance are not consistent throughout the breeding season; the period of greatest sensitivity to disturbance occurs during nest building and incubation. In addition, if parents are disturbed from their nests, and are reluctant to return, predators may visit nests and consume eggs or young. Outside of the breeding season, animals are not restrained to a nest or den site, and young are less dependent on their parents. Wildlife, however, can still be disturbed in a way that potentially reduces energy acquisition (i.e. foraging) or increases energy expenditure (i.e. fleeing) (Knight, 1995).

Clackamas River water sports will continue and are projected to grow in interest over the years. The long term survival of the harlequin duck will come with education of the public. Informing the publics which use the Clackamas River what to look for in the preservation of wildlife habitat

without losing the recreational experience is key to the ducks existence.

The bald eagle and peregrine falcon have potential habitat within the Lower Clackamas River watershed; however no existing sites are present at this time. It appears the likelihood of the bald eagle and peregrine falcon taking up residency within the Lower Clackamas River watershed is very low.

The Mt. Hood Forest Plan has identified three A 13 management areas (bald eagle habitat management areas) within the Lower Clackamas River watershed. The two management areas along the Lower Clackamas River could be changed as forest plan land allocations. The LSR designation throughout the watershed furnishes enough protection of the two forest plan land allocation (A-13) areas to provide for the possibility of bald eagle presence now and in the future. However, if eagles do in the future occupy these sites or any others along the Lower Clackamas River corridor a management plan should be prepared to ensure the eagles presence. The bald eagle is very sensitive to disturbances, specifically human induced disturbances. Frequent human intrusions renders bald eagle habitat undesirable. The third bald eagle management area is associated with the Frog Lake area. The Frog Lake area can be controlled and managed for bald eagles. Also, human intrusion can be shifted at Frog Lake so essential habitat characteristics can be maintained and unaltered. The Frog Lake bald eagle management area should remain as a forest plan land allocation. A bald eagle management plan should be developed for this site.

Dispersed camping within the Lower Clackamas River watershed continues to grow. The areas most likely to be impacted by this increase are: Whale Creek, Trout Creek, Sandstone Creek, Pup Creek, Big Creek and the Lower Clackamas River Wards Reach. The Divide area (subwatersheds: Sandstone Creek, Pup Creek, Whale Creek, Trout Creek, Big Creek and the Lower Clackamas River Wards Reach) is a high use area for deer and elk. Known calving areas exist in this area and are highly used by deer and elk. This area is also essential winter range for deer and elk. Ungulates may habituate to predictable events such as highway traffic, which they learn is not dangerous. Nonetheless, dogs and humans away from roads and trails are unpredictable, and ungulates do not habituate to these disturbances (Knight, 1995). Dispersed camping within subwatersheds primarily will be associated with secondary roads and occasional camping use behind road closures. In fact, roads often are used by animals for foraging, bedding, and as travel lanes. Regular on going use of roads for forest management activities seems to be less disruptive than the pattern of intermitted use associated with hunting, wildlife viewing and other recreational activities (USDA, 1985). Furthermore, dispersed camping may alter the use of habitat by many animals. When trails and campsites are developed, habitat can be drastically altered. Discarded human food waste provide different sources of food for animals, affecting their population structure. As people intrude into an area, the effects on animals can result in altered behavior, increased stress, or changes in productivity and diet.

The maintenance of habitat availability within the Lower Clackamas River near Wards Meadow and Sandstone Creek subwatersheds will be critical for deer, elk and mt. lions. These three animals are highly sensitive to human disturbance. Moreover, year round use within these two watersheds could have devastating impacts to the Divide deer and elk herds and increase

interactions between the public and mountain lions. It will be essential to increase the road closure rate within the Lower Clackamas River near Wards Meadow subwatershed and Sandstone Creek. The implementation of forest plan standards for road densities within normal and severe winter range should be accelerated within these identified subwatersheds. Particular attention should be paid to the Lower Clackamas River Wards Reach subwatershed. Until permanent closures can be implemented seasonal closures should be maintained and expanded to completely shut off this area during winter and spring.

The use of off-road motorcycles and quads on level 2 roads throughout the forest is not in itself an issue. However, the noise level of these vehicles is much louder than standard vehicles. Adverse levels of noise might cause wild animals to become irritable affecting feed intake, social interactions, or parenting. All these effects might eventually result in population declines. Even if populations were unaffected, genetically determined differences in susceptibility might exert subtle selection that eventually could affect fitness.

Areas where dispersed camping occurs may be displacing ducks, birds and bats. These species are primarily associated with riparian zones. Dispersed camping changes soil characteristics which adversely affects the establishment of plants and reduces structural diversity. Species composition and vegetation structure change because species and growth forms differ in their ability to tolerate recreational disturbance (Knight, 1995). The loss of vegetational structure within riparian zones reduces the overall habitat characteristics for waterfowl and bats. Bats will be impacted from the loss of roosting habitat from firewood collection as well.

LATE SUCCESSIONAL RESERVE

What is the comparability of the Late Successional Reserve with current and projected human use?

Late-Successional Reserves represent a network of existing old-growth forests. They retain their natural processes, such as fire, to function. The reserves are designed to serve a number of purposes. First, they provide distribution, quantity, and quality of old-growth forest habitat sufficient to avoid foreclosure of future management options. Second, they provide habitat for populations of species that are associated with late-successional forest. Third, they will help ensure that late-successional species diversity will be conserved (USDA, 1994). The expectations of the Mt. Hood National Forest Plan, as amended by the Northwest Forest Plan/ROD is that watersheds associated with LSR's are to provide for the northern spotted owl's habitat and dispersal among surrounding LSRs..

The Lower Clackamas River watershed contains approximately 23,296 acres of dispersal habitat. Dispersal in animals can be defined as the relatively permanent movement of individuals from one location to another. Usually dispersal is the movement of juveniles from their natal area to a site where they eventually settle to breed. Regular migratory movement of birds between breeding and nonbreeding areas is not dispersal. Although habitat destruction is probably the main reason for breeding adults to disperse in search of another breeding area, other factors may also induce adult dispersal. Successful dispersal is an essential feature of a conservation strategy; without it, decreased individuals in the breeding population will not be replaced by recruits among dispersing juveniles and displaced adults, and the population will decline to extinction (USDA, 1990). Fifty four percent of the Lower Clackamas River watershed is within effective dispersal habitat for the spotted owl. The ability of juvenile and relocating adult owls to disperse within the watershed is not hindered by the lack of valid habitat. The amount of dispersal habitat available currently within the watershed is within established perimeters. However, there are two quarter townships, 186 and 176, which are below the established perimeters for dispersal habitat. These areas have been heavily fragmented by timber management.

The Lower Clackamas River watershed encompasses LSR 207. LSR 207 contains 105,792 acres. Of this, 103,897 acres are US Forest Service owned; 98,434 of the 103,897 acres are considered nesting, roosting and foraging habitat. Within LSR 207 there are 46 owl activity centers, of the 46 owl activity centers 9 are resident singles, and 37 are established pairs (per. comm. D. Pengeroth, 1996). Fifty seven percent of LSR 207 is considered nesting, roosting and foraging habitat. Descriptions of past spotted owl population levels at the basin, sub-basin, and watershed scales are not available and projections of future populations are difficult; available population is limited to current conditions and is further limited by incomplete survey data throughout the basin, sub-basin and watersheds.

The Lower Clackamas River watershed is between the Salmon-Huckleberry Wilderness/Roaring River LSR complex and the Bull of the Woods/Collawash LSR complex. LSR 207 provides enough acreage for a combination of 34 northern spotted owl pairs and resident singles. The Lower Clackamas River watershed contains 43,255 acres, of this 21,087 acres are within LSR

207. The Lower Clackamas River watershed has enough acreage to support a combination of 37 pairs or residents singles. The 21,087 acres of LSR 207 within the Lower Clackamas River watershed can support a combination of 18 pairs or resident singles. The Lower Clackamas, River watershed currently supports a combination of 13 pairs or resident singles. Of those 13, two are resident singles and the remainder (11) are pairs. The 11 pairs and two resident singles are presently using 22,188 acres of available habitat. Fifty one percent of the Lower Clackamas watershed is suitable nesting habitat for the spotted owl. The 21,087 acres of LSR 207 represented within the Lower Clackamas watershed equates to 20% of LSR 207. However, 48% of the Lower Clackamas River watershed is within LSR 207.

The Lower Clackamas River sub-watersheds; Three Lynx Creek and Cripple Creek, 6,423 acres, are completely within the DCAs boundaries. Furthermore, the Lower Clackamas River watershed contains a large portion of a Fish and Wildlife designated critical habitat unit (OR- 10). Critical habitats are specific areas within the geographical area occupied by a species at the time of listing on which are found those physical or biological features (1) essential to the conservation of the species; (2) which may require special management considerations or protection; and (3) specific areas outside the area occupied by the species upon a determination that such areas are essential to its conservation (USDI, 1992). CHU OR - 10 embraces 75,033 acres of which 47,704 acres are nesting, roosting and foraging (NRF) habitat and 27,329 acres have been identified as other than NRF habitat. The Lower Clackamas River watershed contains approximately 25,488 acres (34%) of CHU OR - 10. In addition, CHU OR - 10 is 59% of the Lower Clackamas River watershed.

The Northwest Plan provides direction for management of LSR's. Table 4-1 lists activities likely to occur in the Lower Clackamas River watershed portion of LSR number 207 and initial comparability with LSR objectives.

Table 4.1 Compatibility of Activities with LSR objectives

Activity	Compatibility (High, Medium, Low)	Comments
Campground Maintenance	High	must meet Riparian Reserve standards and guidelines
Campground Development	Low	
Trail Maintenance	High	
Fire Suppression and Prevention	High	fire management plan needs to be developed during LSR assessment
Special Forest Products	Medium	case by case assesment, commercial mushroom harvest greatest impact
Road Construction	Low	
Road Maintenance	Medium	hazard tree removal along rights-of- way permitted
Road Decommissioning	High	
Silvicultural Activities	High	used to create or promote late successional forests

LANDSCAPE ANALYSIS AND DESIGN

The Landscape Analysis and Design (LAD) process unites forest planning with the principles of landscape ecology and emphasizes the conscious design of vegetation patterns in the landscape based upon management objectives. The premise of the LAD process is that different landscape structures in the watershed can be arranged spatially according to the management direction of the landscape within the parameters of the watershed's physical and biological potential. Information about the LAD process is described in detail in the publication *Forest Landscape Analysis and Design* by Diaz and Apostol, 1992. The goal of using the LAD process in the Lower Clackamas Watershed Analysis is to synthesis current management direction from the Northwest Forest Plan, BLM Resource Management Plan, and the Mt. Hood Forest Plan , with the site specific analysis and recommendations from the watershed analysis to form a spatial plan of vegetation patterns and forest structures. See Chapter 1, Table 1-3 and Table 1-4 for information about allocations and management direction.

The LAD process for the Lower Clackamas watershed included a comprehensive review of land allocations and the creation of a Conceptual Design (Map 5-1) which graphically displays the forest structure and vegetation patterns. The legend for map 5-1 is displayed on Table 5-1. The main issues in the watershed which were the foundation for the Conceptual Design included potentially unstable landforms, scenic viewshed, deer and elk herds, and timber production. Of particular importance in this watershed is the Late-Successional Reserve, the Riparian Reserves and the watersheds linkage to the larger surrounding landscape.

Table 5-1 Conceptual Landscape Design Key

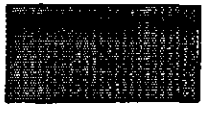
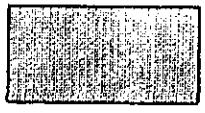
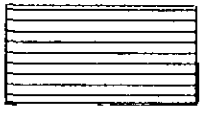
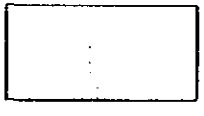
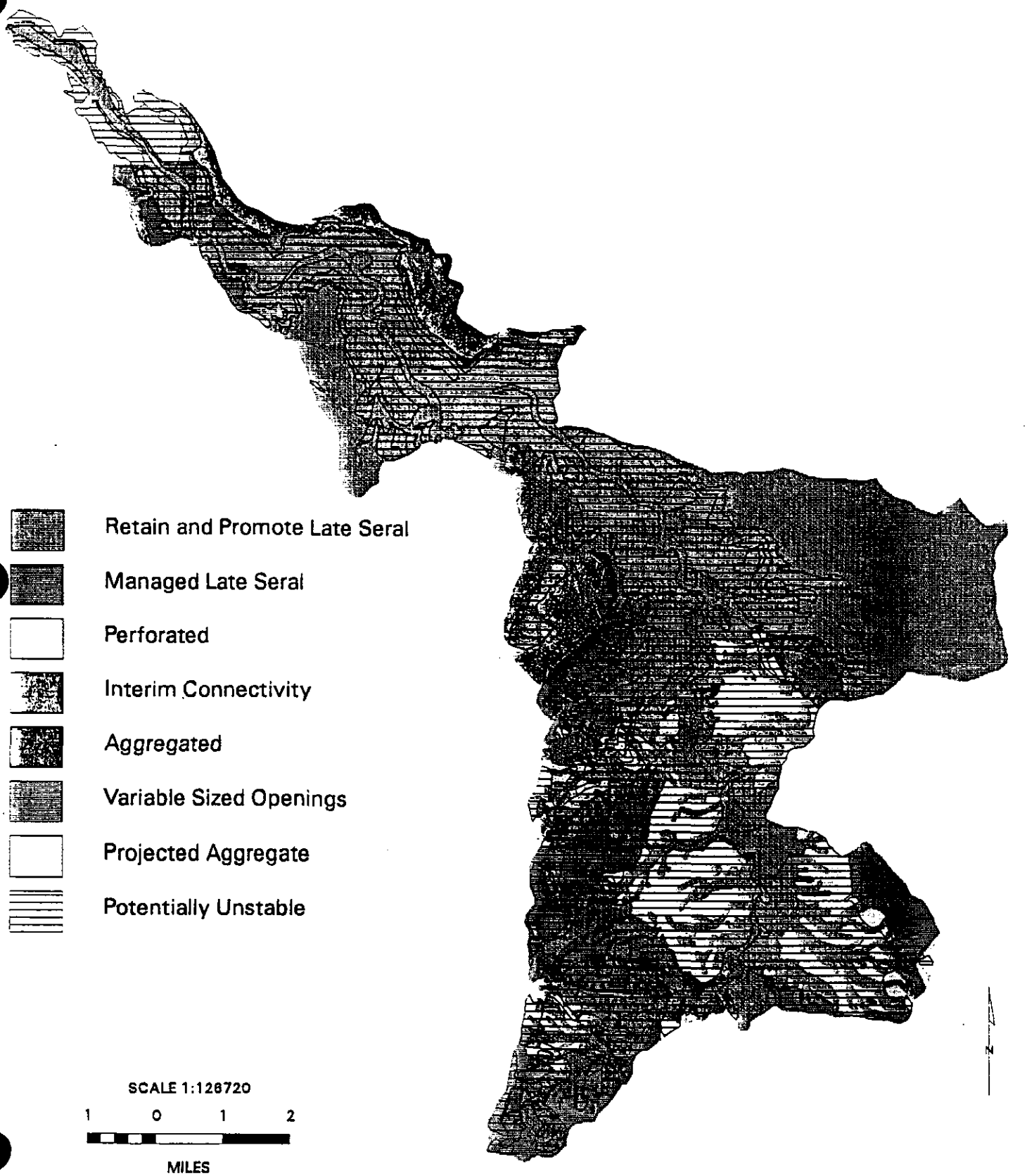
Pattern Type	***Objectives***	***Includes***	***Management Direction***
Retain and Promote Late Seral 	* Aquatic habitat Protection * Late seral terrestrial connectivity	* LSR * Riparian Reserves * A-4 * A-9 * A-13 * LSR on BLM land * Ancient Landslides-Active	* Thin plantations and natural stands to accelerate production of large trees. * Reduce risk from fire, insects, and disease. * Release young conifers in Riparian Reserves.
Managed Late Seral 	*Scenery resource management	* All B-2 allocation outside LSR and Riparian Reserves except areas identified for interim connectivity.	* Foreground: Closed canopy late seral forest with small gaps $\leq$1 acre and site specific natural appearing openings to enhance views or highlight features. * Middleground and background: Closed canopy forest with irregularly shaped openings $\leq$5 acres which reflect the landform. * Reshape existing rectangular units in middleground and background as possible.
Interim Connectivity 	* Retain connected mature forest dispersal habitat until LSR and Riparian Reserves function as planned.	* Large blocks of interior late seral habitat outside and Riparian Reserve. * Late seral connections to neighboring watersheds.	* Limited timber production. * $\leq$ 2 acre openings * $\geq$ 60% canopy closure * $\geq$ 40% canopy closure in plantations.

Table 5-1 Conceptual Landscape Design Key

Pattern Type	Objectives	Includes	Management Direction
Variable Sized Openings 	*Minimize mass wasting and erosion * Timber production.	* Upper Trout Creek in the southern part of the watershed on C-1 land allocations.	* Thin for variable canopy. * Create irregular openings of variable size and spacing.
Small Perforations (2 - 5 acres) 	* Minimize mass wasting and erosion. *Create forage for deer and elk.	* B-8 allocation. * Deer and elk winter range.	* Size and distribution of openings to vary according to site specific characteristics.
Aggregated 	* Timber production * Deer and elk forage.	* C-1 allocation on FS and BLM land near South Fork, LaDee Flats, and north of Fish Creek Mtn.	* Create large patches of early and mid seral habitat ranging from 0 - 120 years old. * Develop narrow range of age classes ranging from 0-30 years old within patch. *Fit patches to landform.
Potentially Unstable Land 	* Minimize mass wasting and erosion. * Landform stability. * Timber production.	* weak rock/steep slopes * intermediate rock/steep slopes, * resistant rock/steep slopes *Ancient Landslides Dormant	* Opening size and location determined after field verification.
Projected Aggregated 	* Timber production	Private land	* Large patches of early and mid seral habitat but without the structural components required under ROD * 100' riparian buffers on anadromous fish bearing streams. * 50' buffers on all other streams

LOWER CLACKAMAS WATERSHED

CONCEPTUAL LANDSCAPE DESIGN



MAP 5-1

RECOMMENDATIONS

The recommendations presented in this chapter are set in the context of the Northwest Forest Plan and Mt. Hood National Forest Plan. All recommendations either fall within this existing direction or recommend amendments to these planning documents. These recommendations can be used to help guide development of site specific projects, including timber sales, restoration, access and travel management planning and biodiversity enhancement.

This chapter is organized by a series of topics. They are:

* Pine Marten/Pileated Woodpecker B-5 areas
* Riparian Reserves
* Social Trends
* Monitoring
* Management Planning
* Access and Travel Management/Transportation System
* Foreman Hill road project
* Dispersed Camping Closure along Highway 224
* Potential Sale Quantity

Pine Marten/Pileated Woodpecker B-5 Areas

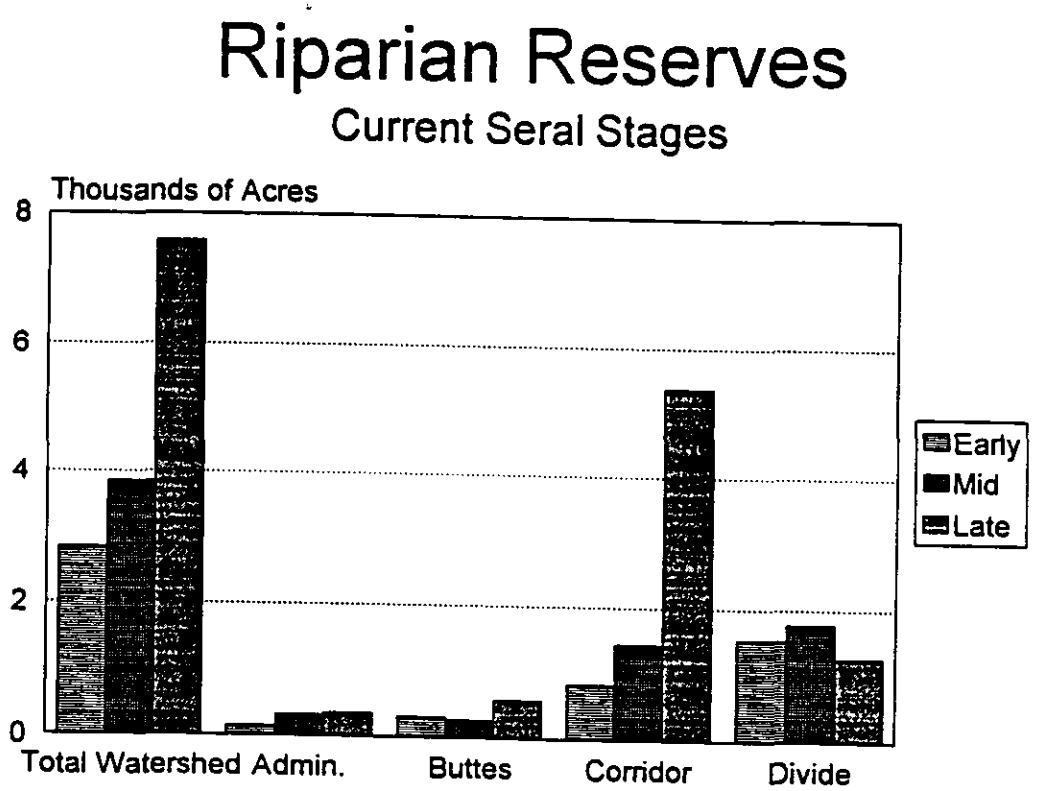
Mt. Hood National Forest Land Allocation; B-5 Pileated Woodpecker/Pine Marten Habitat Area.

The B-5 areas were originally allocated based on available habitat and distribution of habitat to assure connectivity across the range of pileated woodpecker and pine marten. Currently the Lower Clackamas River watershed contains 6 B5 habitat areas. The habitat requirement for these areas is mature or old growth forest conditions which are contiguous. LSR 207 contains 4 of the 6 B5 habitat areas identified within the Lower Clackamas River watershed. Moreover, the structural characteristics of the LSR are conducive to B5 habitat area management objectives. The maintenance of a forest land allocation is not necessary for those B5 habitat areas within the LSR boundaries. Also the Rod Creek B5 habitat area is not required due to the connectivity of the Lower Clackamas River watershed to other watersheds and to its self. The other contributing factor is the extensive riparian reserve network in the southern half of the watershed. However the Lower Clackamas River watershed team recommends that the First Creek and Sandstone B5 habitat area remain in effect in an interim status. Thus the First Creek/Sandstone B5 habitat area will provide a needed link between the Fish Creek watershed and the Lower Clackamas River Watershed upland species.

Riparian Reserves

Riparian reserves are specified for five categories of streams or water bodies (includes unstable and potentially unstable lands) in the ROD. The distances specified as site potential tree heights were the riparian reserve widths designated for Lower Clackamas River Watershed with some additions. The site potential tree height used in this watershed is 208 feet, the average maximum tree height for Douglas fir species from Mt. Hood's Ecology data. Site potential tree heights can be refined during project level planning. In addition we recommend expanding the riparian reserve network to include high risk and slide areas (Map 6-1).

Figure 6-1. Riparian Reserve Seral Stages.



Social Trends

Population

The area including the Clackamas River is the most heavily populated region in the state. Counties in this area include Clackamas, Multnomah and Washington. Clackamas County population estimate, July 1, 1995 was 308,600. Percentage of change from 1990 to 1995 was 10.7%. Multnomah County population estimate, July 1, 1995 was 626,500. Percentage of change from 1990 to 1995 was 7.3%. Washington County population estimate, July 1, 1995 was 370,000. Percentage of change from 1990 to 1995 was 18.8%. Population estimates by age for Clackamas County show the people aged 40-44 and 45-49 to have the highest population.

Traffic Counts

Oregon Department of Transportation vehicle count reports for Highway #224 show an increase at MP 30.82 (LaDee Road) from 2,650 ADT to 2,700, MP 39.33 (Fish Creek) from 1,350 to 1,400 and MP 45.83 (Cripple Creek Bridge) from 1,350 to 1400. Decrease shown at MP 44.67 (Pipe line road) 1,150 to 1100 and MP 49.40 (Ripplebrook Ranger Station) 1,150 to 1100. The decreases are thought to correlate with decrease in logging activity in adjoining areas (ODOT Highway Counts for 1990 and 1994). Average Daily Traffic showed increases for the period of 1987 to 1990 (see Appendix).

General Recreation User Characteristics

The National Forest users are more urban, are often two-income families, and are taking more short vacations away from the stress of the city where they live. Nearby National Forests are attractive answers to their needs (Tom Lennon, FS Recreation & Tourism Program Manager, Washington Office).

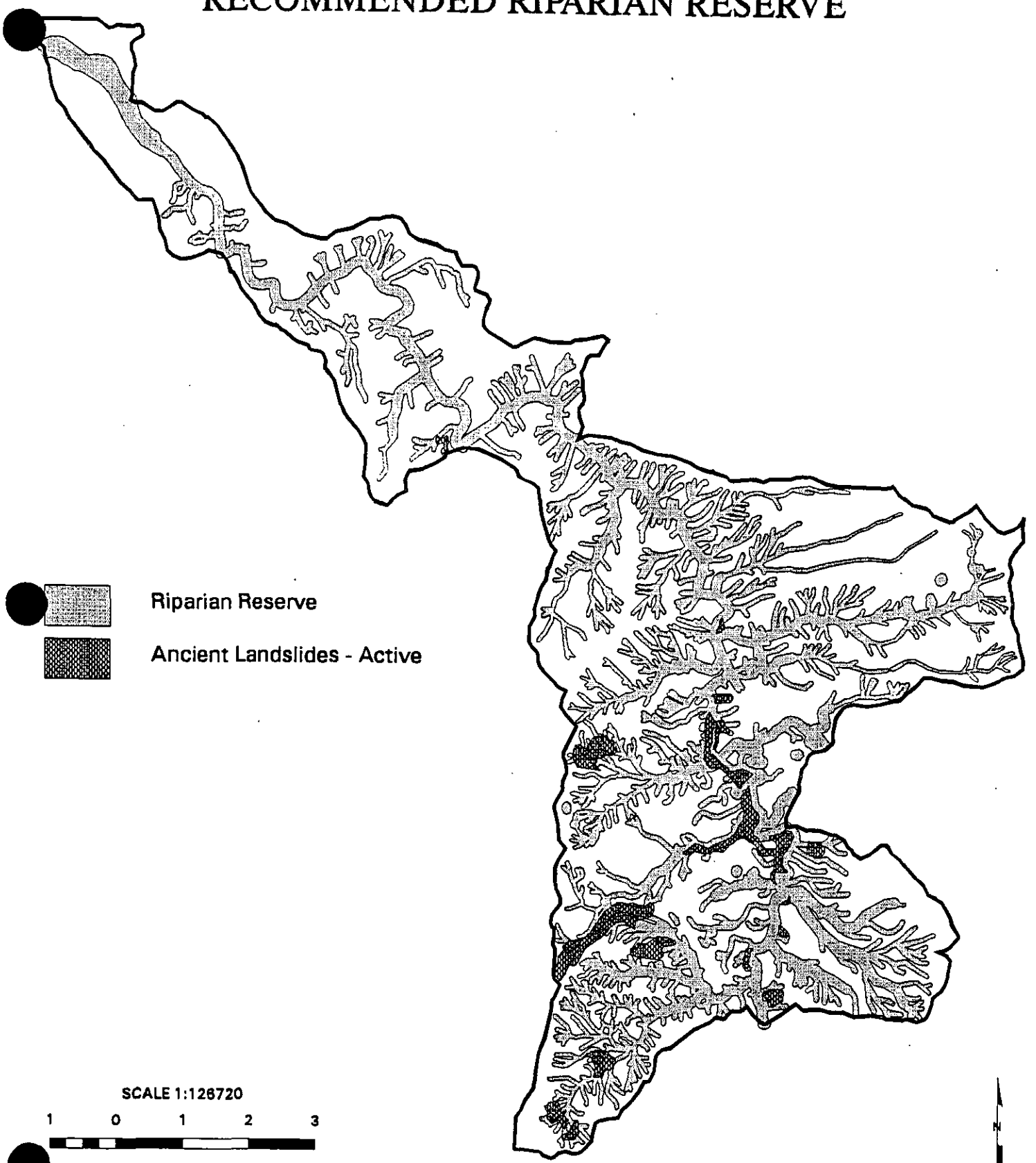
Boater Characteristics on the Clackamas River

In terms of particular conditions which draw boaters to the Clackamas, river levels were identified by 96% of kayakers and 80% of rafters as the most important factor in their decisions to visit the Clackamas. Flow levels in the 2000-4000 cfs range were identified by 70% of all boaters as creating the best boating conditions. 85% of all boaters indicated that they check river flows before leaving for the Clackamas. Weather conditions influenced 30% of rafters, and 23% of kayakers indicated the same.

During the study period, 80% of boaters came for the day and did not stay overnight. Three-quarters of boaters in the survey reported boating on the study section only on weekends, just over 6% said they came only on weekdays and 20% reported that they boat both weekends and weekdays.

Water temperature of the Clackamas River effects river recreation. Short-term measurements

LOWER CLACKAMAS WATERSHED
RECOMMENDED RIPARIAN RESERVE



MAP 6-1

taken on the river near Three Lynx and above the South Fork indicate that daily temperatures range from 41 degrees to 62 degrees during the months of March through September. Cold water limits the attraction of the river to avid water sportsmen not the playful warm water recreationists.

Boaters place great value on the accessibility of the Clackamas, given that other popular rivers require more elaborate planning and permit procedures for a trip. Within the next three to five years as allocation systems on surrounding river restrict use, additional use would be expected to come to the Clackamas River.

Community Direction

Chamber of Commerce mission is to "Promote a positive image of our community's economic benefits, livability and recreational resources and further strengthen the economy by supporting local business and government. Accomplishment of this mission could mean additional use of the Clackamas River through wider knowledge of the benefits of the river area for activities. New proposals such as the proposal to select Estacada to be the portal for the West Cascades Exploration route, will bring additional recreationists to the area.

Monitoring, Inventory Needs, Data Gaps

Monitoring, as described in the Federal Agency Guide for Ecosystem Analysis, is used to evaluate environmental change. The Lower Clackamas River watershed analysis has displayed key processes and factors that are either unique or important. The following Table 6-1 shows monitoring priorities are based on the value of data for better understanding processes, and/or potential to show significant early changes of land management activities.

Table 6-1. Monitoring.

Resource Area	Goal or Area	Objective
Recreation	viewshed vegetation pattern	monitor scenic quality in the wild and scenic river corridor
	dispersed camping sites	changes in location, trends, seasonal movement, impacts to vegetation
	Clackamas River use	as adjacent rivers implement lottery systems monitor local impacts
	outfitter guide survey	obtain information to determine number of outfitter guides and begin NEPA
Hydrology	lakes and ponds	impacts of human use
Wildlife	Late-successional Reserve	owl , red tree voles, fishers, wolverines
	species presence	bald eagle, peregrine, waterfowl, amphibians
	Late-successional Reserve habitat	determine levels of down woody debris and snags
Fisheries	fish distribution and habitat use	continue cooperative fisheries program

Management Planning Recommendations

* Retain Frog Lake bald eagle management area.

* Remove the other two bald eagle management areas.

* Use additional temporary toilets during high use weekends.

* Review Mt. Hood Forest Plan standards and guidelines for stream habitat conditions.

* Maintain forest health by treating early- and mid-seral stands.

* Finish the Clackamas River carrying capacity study by surveying physical and biological conditions.

* Identify ways to discourage additional weekend boating use on the river.

* Review Wild and Scenic River implementation plan. Review Appendix F for appropriateness of projects and potential for an Environmental Assessment amendment.

* Continue with implementation of facilities site plan, i.e. closing Lazy Bend.

Table 6-2. Road Decommissioning Opportunities.

Road #	Priority	Reason(s) for Decommission	Recommended Rx
4500-048	low	- LSR - high sediment producer	- terminally obliterate entire length - implement after commercial thinning entry
4500-340	very high	- LSR - Riparian Reserve - unstable slopes	- terminally obliterate ASAP - last 0.2 mi - from last stream crossing to end of road
4620-240	mod-high	- Riparian Reserve - unstable slopes - high sediment producer	- terminally obliterate last 0.6 miles - from spur intersection to end of road
4621	mod-high	- Riparian Reserve - unstable slopes - high sediment producer	- terminally obliterate - 2 sections to obliteration a. from Big Ck rehab site NE to rd entry b. from Big Ck rehab site E to 011 spur
4621-140	moderate	- LSR - Riparian Reserve - Wild & Scenic corridor - critical elk habitat - existing access blockaded w/berm, prevents access for stream crossing culvert maintenance	- terminally obliterate entire length
4622-115	high	- Riparian Reserve - unstable slopes - high sediment producer	- terminally obliterate entire length
4635-017	moderate	- LSR - unstable slopes - high sediment producer	- terminally obliterate entire length
4635-020	low-mod	- LSR - unstable slopes	- terminally obliterate entire length
5410	mod-high	- unstable slopes	- terminally obliterate last 0.5 mi.
5410-013	low	- LSR	- terminally obliterate entire length - may be overgrown already
5410-014	low	- LSR	- terminally obliterate entire length - may be overgrown already
5410-020	low	- LSR	- terminally obliterate entire length - may be overgrown already

Table 6-2 Continue. Road Decommissioning Opportunities.

Road #	Priority	Reason(s) for Decommission	Recommended Rx
5410-021	low-mod	- LSR - Riparian Reserve - unstable slopes	- terminally obliterate entire length - may be overgrown already
5410-022	low	- LSR	- terminally obliterate entire length - may be overgrown already
5410-120	low-mod	- LSR - Riparian Reserve - unstable slopes - existing road (5410) upslope can access same stands	- terminally obliterate entire length
5410-134	mod-high	- LSR - Riparian Reserve - unstable slopes	- stabilize and stormproof - leave open or temp closure
5410-136	mod-high	- LSR - Riparian Reserve - unstable slopes	- stabilize and stormproof - leave open or temp closure
5410-150	moderate	- unstable slopes - high sed. producer	- stabilize and stormproof - leave open or temp closure
spur 014 (Hwy 224)	mod-high	- LSR - Riparian Reserve - Wild & Scenic corridor	- terminally obliterate entire length - entry starts from pit between Big Eddy and Lazy Bend on Hwy 224 @ MP 36

Headwater Restoration

Location: Road 4620 @ intersection with 190 & 200 spurs

Problem: Headwaters of Dugan Ck were diverted by construction of road 4620. Headwaters now drain into Big Ck., causing massive gully erosion. The diverted flows have been scouring new channels into soft, highly erosive earthflow soils.

Potential Solutions: 1) Restore diverted flows back to original drainage system of Dugan Ck. by installing a culvert under road 4620, redirecting flow back into the historic channel. 2) Stabilize the gullies that the diverted stream is now flowing through, maintaining that discharges into Big Ck.

Roads to Remain Open

Lower Clackamas River WS ATM Proposal for Closures, also, Roads which have been identified

to remain open based on administrative need. For specific levels of use and maintenance proposed for these roads see the district ATM. Roads not identified on the following list which are within the Lower Clackamas River Watershed, to date these roads have not been identified for any proposed action.

Roads Identified to Remain Open:

4620		4630	-150	5410	
4621			-014 (from 013	5412	
4622			to 140 jct.)	5412	-120
4630			-160 (to the quarry)	5411	
4620	-190		-025	5411	-200
	-220		-027		-180
	-230		-210		-190
	-280		-200		-170
	-180	4635			-210
	-300	4635	-140 (to 702 trail		-120
	-310		jct.)	5710	
4621	-180	4640		6321	
	-150	4640	-120 (to 135 jct.)	6321	-160
	-160	4600			
	-200	4610			
4622	-120	4610	-113		
	-130	4500			
	-140	4500	-340		
			-320		
			-280		

Table 6-2. Proposed Wildlife Road Closures.

Concerns	Roads
Deer and Elk	4621-220, -200,-210,-029,-028,-027,-190,-024,-170,-020,-015,-014,-011,-013,-120,-014,-125,-031,-018, 4620-170, -014,-175,-174
Peregrine Falcons	6321-160
Deer and Elk Poaching	4630-031, -140,-120,-030

Table 6-3. Proposed Obliterations and Seeding for Wildlife.

Concerns	Roads
Deer and Elk	4621-160, -019,-017,-140, -162 4621 from the 140 spur junction to the 4620 junction. 4620-150, -160 4621-180 (from 4621 junction to the end of the road).
Bald Eagle Habitat area	4630-160 (from the quarry to the end of the road).

Foreman Hill Road Project

During the floods in February 1996 a major failure occurred on Highway 224 near milepost 47. As a result, approximately ½ mile of road slid partially or completely off the hillside. The road is currently closed. A project has been proposed to relocate this section of the road upslope and rebuild on more stable ground. 20 acres of Late Successional Reserve (LSR) habitat will be lost and one acre of wetland habitat will be impacted.

This project will impact both LSR habitat and Riparian Reserves. It is recommended the project proceed because:

1) Highway 224 is the major access route in the Clackamas River drainage. The current closure has resulted in economic loss and hardship for local residents and visitors.

2) Highway 224 is identified as Forest Service level 4 which is critical for access and will continue to be open.

3) Site specific investigation by a geologist is recommended before road location to identify unstable areas. The proposed road location will be on more stable ground, reducing risk of long-term failure (such as occurred in February).

4) The proposed road will meet objectives of the Wild and Scenic River plan (maintain access) and the Scenic Byway.

It is understood habitat will be lost. The failure of the road is considered catastrophic and regaining direct access into the Clackamas River basin is the highest priority.

Dispersed Camping Closure on Highway 224

Currently there is a special order closure for camping between Highway 224 and the Clackamas River from the National Forest boundary to Three Lynx. We recommend during the current Highway 224 repair closure, a temporary non-compliance order to allow dispersed camping in these areas be initiated.

Probable Sale Quantity

Timber commodity outputs in the Lower Clack are expected to continue for the next 4 decades, primarily in the form of commercial thinning and other intermediate harvest of mid seral stands within the LSR, Matrix and Riparian Reserves. After the fourth decade, it is estimated that many of the mid seral stands in the LSR and Riparian Reserves will have reached the definition of late seral stands and will not contribute to future timber commodity outputs.

Decades 0-4

The Lower Clackamas watershed has approximately 13000 acres of mid seral stands within the LSR, Matrix and Riparian Reserves. If during the first four decades, these stands were commercially thinned every 20 years to maintain forest health, encourage growth and late seral structure, then 650 acres/year would be treated. At 2.0MBF/ac, the first entry could yield 1.3MMBF/year. The second entry of these stands during the third and fourth decade could yield 7.0MBF/ac or 4.6MMBF/year.

Decades 5 and beyond

The lower clack watershed contains approximately 4100 acres of Matrix outside of Riparian Reserves that may contribute to a sustainable probable sale quantity. (Harvest volumes from the LSR and Riparian Reserves are not a component of probable sale quantity). This translates to about 45 acres of regeneration harvest at 1.8MMBF per year or about 200 acres of thinning per year.

None of the above calculations reflect other likely resource constraints that may limit acres actually available for treatment such as geologic unsuitability, visual objectives, owl activity centers or financial feasibility. Nor do they take into consideration stand specific conditions such as understocking due to insects, disease, previous heavy thinnings, low site potential or logging feasibility.

PARTICIPANTS

Participants

The following individuals gave their time and effort to make this report possible:

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