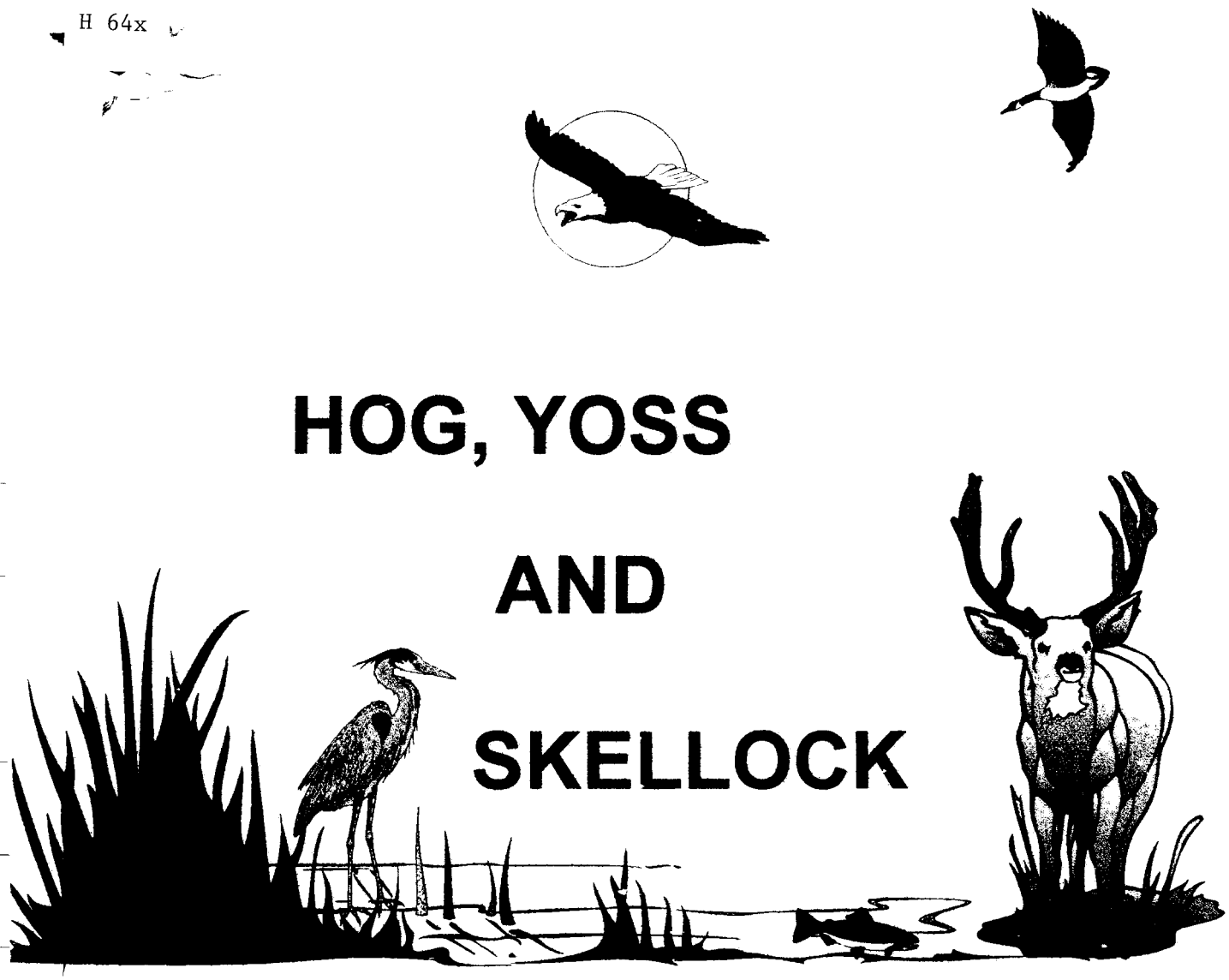
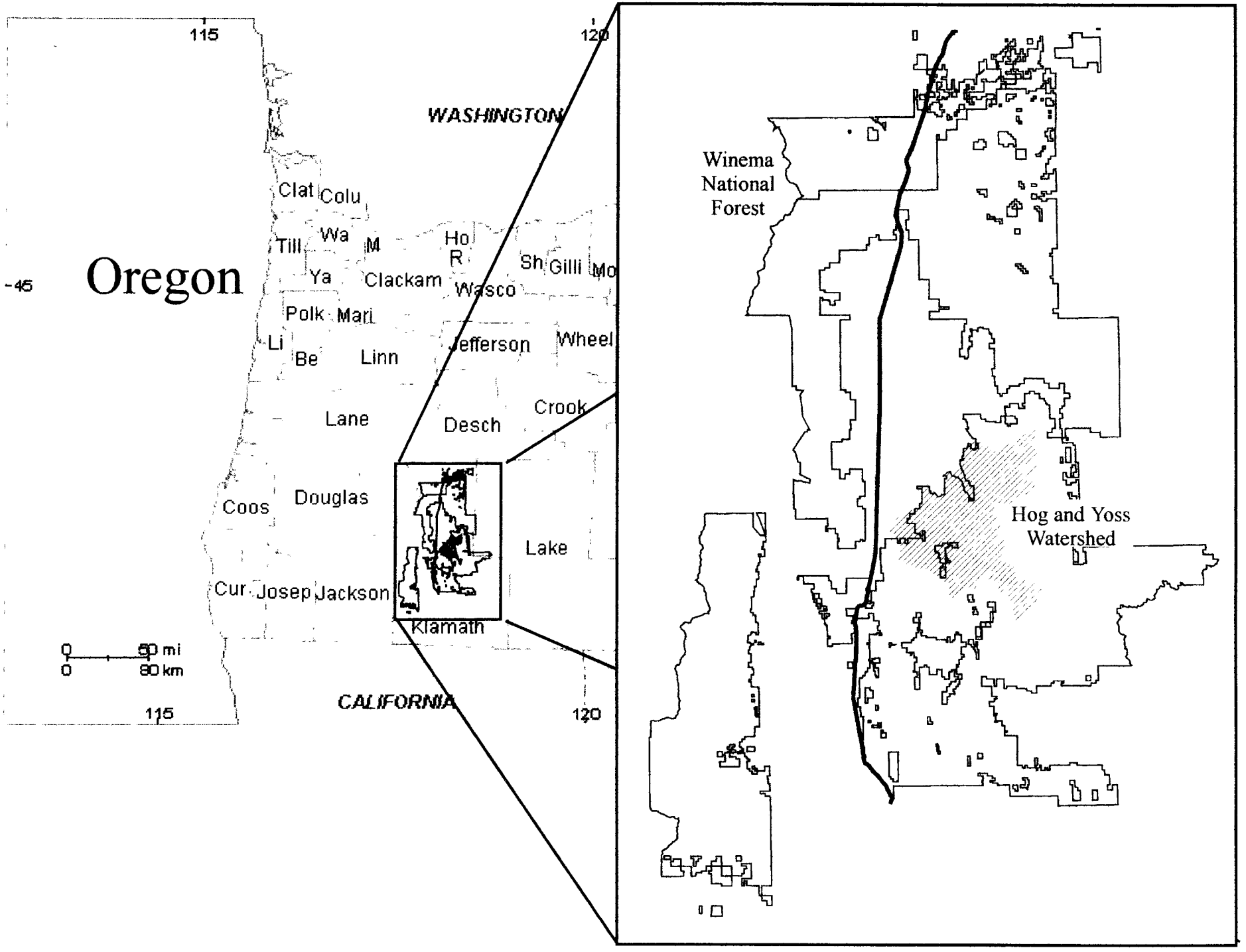


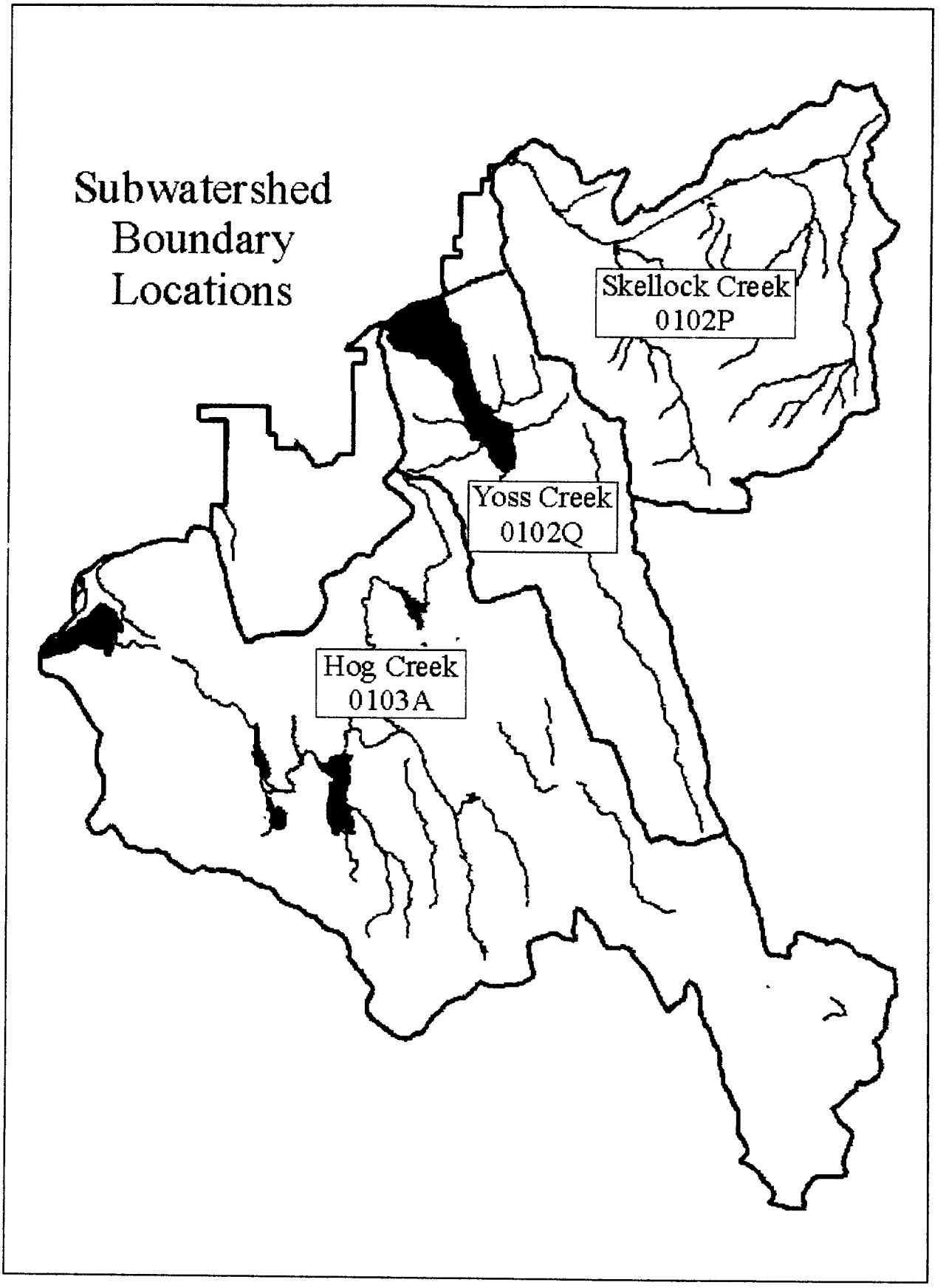
HOG, YOSS AND SKELLOCK

AN ASSESSMENT OF THE FORM, FUNCTION, AND CONDITION OF THE HOG CREEK, YOSS CREEK AND SKELLOCK DRAW SUBWATERSHEDS

Chiloquin Ranger District **Winema National Forest**

February, 1996




Subwatershed
Boundary
Locations
Skellock Creek
0102P
Yoss Creek
0102Q
Hog Creek
0103A

WATERSHED ANALYSIS TEAM

The following persons were assigned the task of gathering available information, researching local knowledge of the watersheds through local publics, and evaluating conditions on-site. Together, as a team, they have worked to assimilate the information necessary to prepare this report.

Ken Van Zee, S.O. Ecosystem Mgt.	Team Leader, Writer/Editor
Mike McNeil, S.O. Ecosystem Mgt.	Hydrology, Geology, Climate
Susan Puddy, Chiloquin R.D.	Silviculture, Vegetation
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Tim Sexton, Chiloquin R.D.	Fire, Ecology
Elizabeth Williams, Chemult R.D.	GIS/Database Mgt.
Elizabeth Budy, S.O. Archaeology	History, Human Uses
Susan Mattenburger S.O., Water Resources	Hydrology
Bradley Kerr, S.O., Ecosystem Mgt.	Fish Biology
Barry Kolar, Chiloquin R.D.	Soils, Hydrology
Treg Christopher, Chiloquin R.D.	Botany

Special thanks to the following individuals for their assistance, input or technical knowledge. Their contributions helped make this report possible.

Kent Russell, Chiloquin District Ranger, for developing issues, and his unending moral support.
Jack Sheehan, S.O. EM Staff, for his divine leadership, and staying out of the way.
Rex Appleby, Chiloquin R.D., for his input, technical skills, and ever positive attitude.
Steve Trulove, Chiloquin R.D., for helping with GIS work.
Tuffy Eggsman, Chiloquin R.D., ditto.
Lorena Corzatt and Crew, S.O. Forest Hydrologist, for stream survey work.

There are no doubt some that I forgot, but thanks to all that helped.

TABLE OF CONTENTS

I. INTRODUCTION

The intent of this assessment is to provide a general description of ecosystem structure, processes, and functions occurring within the Hog, Yoss and Skellock Watersheds. The analysis area includes 86,402 acres of Winema National Forest land, 5,932 acres of private land, and 1,590 acres of State Forest land, for a total of 93,924 acres. Understanding the past, present, and possible future of the vegetation, riparian communities, wildlife, and other ecosystem components will help identify the potential, and limitations, of the watersheds involved in this analysis.

This assessment is a blend of current scientific knowledge, information gathered during on-site visits, interviews with local publics familiar with the area, and a review of existing records and documents . New inventories and surveys to fill gaps in existing information will be added to future versions as they become available.

This is not a decision document. It will neither resolve issues, nor provide answers to specific policy questions. This document is prepared to provide a foundation for project level analysis and support the line officer in decision making.

The Chiloquin District Ranger requested that the assessment team focus on the following issues:

A. Stream channels, soil productivity, and basic hydrologic functions have changed from the reference era conditions in the Hog, Yoss and Skellock drainages.

B. Fire exclusion, grazing, timber harvest, road and railroad construction and other management activities have changed the biological and physical characteristics of the landscape from the reference condition.

C. The current risk of stand replacement events from wildfire, insects and disease appears to be increasing.

D. Vast portions of the watershed have experienced potential soil compacting activities.

The team then developed key questions to assist in addressing the issues identified above. Key questions are numbered and in bold type.

In order for the assessment team to portray the condition, function and processes of the watersheds, two time frames were selected: Pre-1875, and current. These time frames were selected because after 1875 Euro-americans initiated activities within the watershed which changed the conditions, and thereby the functions and processes.

II. OVERVIEW

History and Human Uses

The Hog, Yoss, and Skellock watershed lies wholly within the former Klamath Indian Reservation. In 1864 the Klamath Treaty was signed by the Klamath, Modoc, and Northern Paiute Yahooskins. These are three distinct groups, although the Klamath and Modoc spoke dialects of the same language. The treaty, which was signed again by the chiefs in 1869, and ratified by Congress and signed into law in 1870, set aside one million acres as a reservation (Stern 1966:42). Members of the Klamath Tribes were granted exclusive rights to hunt, fish, gather and trap within the reserved area, and they were to be protected there against trespass by any unauthorized non-Indians.

The terms of the treaty relegated the Klamath Tribes from a state of sovereign independence to a status under the government of the United States, and more directly, under the supervision of an Agent. A program of extensive change was initiated, one designed to make tribal members into farmers and ranchers by American standards. Their children were educated in schools, and they were encouraged to use the services of a physician. "The terms of the payment make it probable that both parties to the treaty thought the Indians would be able to maintain self-sufficiency by the end of twenty years" (Stern 1966:42).

The General Allotment (or Dawes) Act of 1887 was intended to individualize Indians by giving them citizenship and assigning them private tracts (160 acres), to be held in trust by the United States for at least 25 years. The Klamath Reservation was considered best suited to stock raising, and the Klamath Marsh was one of the best areas for putting up hay and raising stock.

Individual family allotments were located in bottom lands along streams in the vicinity of the pre-reservation winter villages. Klamath Marsh was the most densely populated area, with winter villages located all along the south and east edges (Spier 1930). Families who maintained wocus (water lily seed) gathering camps along the marsh were allotted lands here (Stern 1966). Hence, the continuity of traditional culture was maintained into the historic reservation era through the maintenance of family allotments at the marsh. Today, the lands around Klamath Marsh provide an important cultural and spiritual focus for Klamath Indian peoples. Special concern is centered on protection of ancestral villages and burial grounds.

The allotment policy, however, did not provide sufficient lands to sustain families as farmers or stockmen, and the leasing of individual allotments to non-Indians became common practice. For example, one tribal member contracted with two different stockmen to give exclusive pasture to 300 head of cattle on his tract at Klamath Marsh, at one dollar per head per season (Stern 1966:142). By 1903, payments from leases comprised 30% of total estimated personal income (with $8,220 distributed among some 90-100 allottees) (Stern 1966:143). The leasing policy, however, made regulation of stock difficult to impossible, especially on adjacent communal tribal lands. It is likely that unregulated stock initiated many watershed problems we see today.

Leasing was soon replaced by a movement to sell the allotted lands. The original 160 acres per family were minimal for self sufficiency, and so the leasing, but when divided among numerous heirs, the tracts often became "dead allotments" which did not produce anything (Stern 1966:144). This encouraged the rapid transfer to patents in fee simple and resulted in land sales to non-Indians. By

1924, practically all fee patents had been sold. Of the 1,624 allotments issued, totaling 247,515 acres, 1,130 allotments amounting to 133,000 acres remained in August 1954. By October 1957, 630 tracts remained, totaling 73,681 acres (Stern 1966:145). However, the impetus toward self-sufficiency based on farming and stock raising had been supplanted much earlier with the opening of the reservation to commercial timber harvest after 1910.

When the Southern Pacific Railroad reached Klamath Falls in 1909 and moved north to Kirk in 1911, the reservation timber was opened to commercial markets (Tonsfeldt 1987). Cutting on allotted lands began in 1911. In 1913, the first tribal timber was sold. Superintendent Edson Watson proposed the exploitation of tribal timber, arguing that it would provide work for the Indians. He recommended that the reservation timber be cut on a sustained yield basis in fifty to one hundred year rotations. He advocated large sales of stumpage, as involving lower administration costs, and considered small concerns unreliable (Annual Narrative Report 1914:8, 11-13; cited in Stern 1966:152).

The Hog & Yoss watershed includes portions of five timber management units, all of which were logged as individual timber sales during the reservation era. A conservative estimate indicates 500 MMBF was harvested within the watershed, with the largest volume (375 MMBF) from the Calimus Marsh Unit, cut between 1922 and 1937. Railroad logging was the prevalent method used to access and transport timber over most of the watershed before 1935. The eastern portion of the watershed, harvested in the 1940's and 1950's, used trucks to haul the timber. A total of 213 miles of railroad grade have been recorded in the watershed; 70% of which have been converted to modern roads. This represents about 60% of the total number of railroad miles estimated to have once traversed the watershed. Although of historic interest, railroad grades often created watershed problems and may pose difficulties for certain watershed restoration projects.

Bureau of Indian Affairs Timber Sales (1921-1954)

BIA Unit/ Sale	Dates of Harvest	Estimated Volume	Volume Harvested	P.Pine Price	Lumber Company
Solomon Butte	1921-1928	100 MMBF	123,317,820	5.56	Shaw-Bertram (50% in watershed)
Calimus Marsh	1922-1937	400 MMBF	375,225,220	5.08	Williamson Rv/Forest (100% in watershed)
Skellock Draw	1945-1946	?	23,598,320	7.35	Pelican Bay (100% in watershed)
Wildhorse No. 1	1948-1952	88 MMBF	?	27.76	Klamath L and Box (50% in watershed)
Wildhorse No. 2A	1952-1954	?	?	?	?

Klamath Indian participation in the growing timber industry, however, was minor. At no time did more than a handful hold jobs in woods, camp or mill (Stern 1966:152). Individuals received per capita payments from the timber sales. In 1926, these amounted to $500 annually; in 1930, $700 annually (Stern 1966:153).

Access to these funds gave tribal members a considerable measure of economic independence. A family of four in 1926 received $2000 in timber receipts, which was ample for their needs, and provided some emancipation from Agency surveillance.

In 1953 a policy was designed, under House Concurrent Resolution 108 (USDA-FS 1995:15), to terminate federal relationship with Indian Tribes. The Klamath Tribes were included with several groups chosen for the "termination experiment," with the Klamath Termination Act of 1954. By 1961, tribal lands were sold, special federal programs were discontinued, state legislative jurisdiction was authorized (except for hunting and fishing rights which, were not terminated), and tribal sovereignty was ended (USDA-FS 1995:16).

The termination policy was based on the concept that the Klamath had achieved a necessary level of self-sufficiency. However, this sufficiency was based on a land base containing rich timber resources. The termination of the 861,000 acre reservation, along with federal recognition of tribal status, resulted in severe social and economic problems (Hanes 1995:A-13). Considered one of the wealthiest tribes in 1920, by 1989 unemployment was 46% (compared to 8.5% statewide) and average life expectancy was 39 years.

In 1961 the Winema National Forest, which included most of the former Klamath Indian Reservation lands, was created. Under Forest management, lands were opened to non-Indian hunting, fishing, and recreation. Hunting and fishing remain important focuses for public land use in the watershed.

The Klamath Tribes were restored as a federally recognized tribe in 1986, but reservation lands were not. With the restoration of the Tribes, focus has turned to defining the government-to-government relationship with the Forest Service and to commenting on projects that may affect game herds and fish populations. Treaty rights to hunt and fish were retained on former reservation lands, and this was reaffirmed in 1981 by the Kimball vs. Callahan decision. Issues concerning hunting and fishing rights and proper habitat maintenance often arises during NEPA scoping for Winema National Forest projects.

Portions of the Lamm Mainline Railroad, which served as common carrier for a number of lumber companies between 1929 and 1948, is an important historic site considered eligible for the National Register of Historic Places. There is considerable public interest in railroad logging history, but the Lamm Railroad's location in the bottom of Skellock Draw poses potential difficulties for future watershed restoration projects.

Current human uses in the watershed center around hunting, fishing, dispersed recreation, and wood cutting. Maintenance of deer herds for hunting is of concern to tribal members as well as other hunters who use the area.

The Klamath Tribes retain treaty rights to hunt and fish year round; deer and elk are the primary capture species. The Tribes also collect wocus (water lily) seeds in Klamath Marsh and have strong

cultural values associated with heritage sites located around the marsh.

Sustained timber production is valued by the logging community, both for its social and economic importance to the local economy. Local ranchers use the area for cattle grazing in summer months. Maintenance of a "natural appearing" forest is valued by most local residents.

Topography

The Hog, Yoss, and Skellock analysis area includes elevations ranging from 4,500 feet in the lowest reaches of the Hog Creek drainage where it joins the Williamson River to more than 6,600 feet at the summit of Calimus Butte in the head waters of Hog Creek. However, this significant range of elevation does not reflect the true character of the analysis area. More than 77% of the study area lies below 5,000 feet in elevation; 22% between 5,000 and 6,000 feet; and less than 1% above 6,000 feet. The land slopes within the study area are predominantly less that 10%. Only 33% of the area has slopes of 10% or greater. The Yoss Creek drainage is slightly steeper on average with 46% of its area having slopes of 10% or greater; still, only 7% has slopes greater than 30%. The steeper slopes are associated with relatively low ridge system dividing low gradient valleys.

The slope aspect within Hog and Yoss Creek drainages is almost evenly divided between north & east and south & west facing slopes. This is controlled by a series of low parallel, north/south trending ridges. Skellock draw is composed of predominately (64%) north & east facing slopes and does not show the ridging pattern.

Geology

The geology of the analysis area is predominantly volcanic in origin. Nearly 60% of the area is composed of basalt flows of the Pleistocene and Pliocene eras. In the lower Hog Creek drainage and Skellock Draw the basaltic parent material has been buried by deep deposits of Mazama pumice and ash. The higher points in the study area (around the headwaters of Hog Creek and the divide between Hog and Yoss Creeks) are generally volcanic vents and concentrations of ejecta material such as cinders. The remainder of the area is composed of sedimentary material that is both older and younger than the basalt flows forming the dominant parent material. These sediments include lake deposits located at the mouth of the three primary drainages in the study area.

The parent materials in the area have been fractured by several north/south trending faults in the Hog and Yoss systems and east/west faults in the Skellock system. These faults control the orientation of the ridging in the study area.

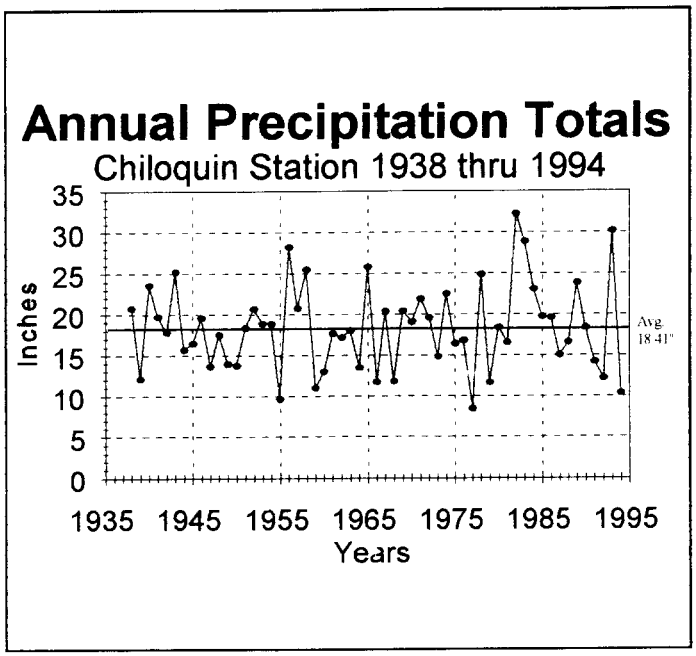
All of the parent materials have been covered by a mantle of pumice and ash from Mt. Mazama with the only exposures located in infrequent canyon section of stream channels and along the more prominent ridge tops.

Climate

The Chiloquin Weather Station, located 13 miles southwest of the study area, is the closest long term station available to indicate annual precipitation amounts. Although the station is approximately 400 feet lower in elevation, the precipitation amounts appear to be similar when compared to the amounts

recorded by the Taylor Butte station since 1978.

Precipitation generally comes in the form of snow in the months of November through March, with the snow melt season being February through June. The Chiloquin Station data shows an averaged annual precipitation of 18.4 inches over the last 57 years. The important factor displayed in the data is not the amount of precipitation, but the variability from year to year. It is common for precipitation to vary by 10 to 20 inches from one year to the next. It is also not uncommon for four to six consecutive years to be significantly above or below the average.



Soils

The study area is predominantly composed of three basic soil groups: "A", soils formed in deep pumice and ash deposits from Mt. Mazama; "B", soils formed in pumice and ash over a buried residual soil; and "G" , soils formed in sediments accumulated in the valleys and low spots of the study area.

The "A" type soils cover 64% of the study area. This is basically all the land except the valley bottoms and ridge tops. These soils have low natural fertility, are deep enough to exclude plant roots from reaching the pre-Mazama soils, are excessively drained, have rapid infiltration rates, low detrimental compaction potential, low erosion rates (due to high infiltration rates and gentle topography), and produce sand size sediments when eroded. Overland flow of snow melt or even winter rain is very unlikely in these soils. Even runoff from natural surfaced roads is minimal. Interception of groundwater flows by road cuts is also very rare and is generally only in wet spring and seep areas. Some localized overland flow is possible during intense summer storms when the dry soils have significantly lowered infiltration rates. Snow melt, after wetting the upper soil horizon, moves rapidly through the remainder of the profile into the water table or to the parent material interface.

The "B" type soils cover 21% of the study area. This is primarily along the ridges and side slopes of the study area. These soils have low natural fertility, are shallow enough to allow the deepest rooted native plants to reach the pre-Mazama soils, are excessively drained, have rapid infiltration rates, low detrimental compaction potential, low to moderate erosion rates, and produce sand size sediments when eroded. Overland flow from snow melt or winter rains is not a frequent event in these soils, but is possible where the residual soil is relatively near the surface (20 inches or less). Some localized overland flow is possible during intense summer storms when the dry soils have significantly lowered infiltration rates. Snow melt, after wetting the upper soil horizon, moves rapidly through the remainder of the pumice to the residual soil interface, then along this interface to the water table. In the areas where "B" soils are shallowest, it is possible for road cuts to intercept groundwater flows along the pumice/residual soil interface. This intercepted groundwater is most likely to become groundwater again over a short distance of flow in the road ditch.

The "G" type soils cover 15% of the study area. These soils form the meadow and valley bottoms of the area. They have low to moderate natural fertility, are deep enough to exclude plant roots from reaching the pre-Mazama soils, are poorly drained, have rapid infiltration rates, moderate detrimental compaction potential, moderate potential for gully erosion, and produce sand and silt size sediments when eroded. Although these soils have high infiltration rates, due to their slope position (valley bottoms), they maintain high water tables. These are the locations where long term intermittent or perennial flows are likely to occur. These are also the soils that are likely to respond to heavy use with gullying and down cutting of existing stream channels. Overland flow is a common sight during spring snow melt or heavy rainfall events. Road cuts often intercept groundwater which occasionally flows on the surface for considerable distances before returning to the groundwater system.

Streams

The stream channel systems in the Hog, Yoss, and Skellock drainages are discontinuous in nature. Well defined channel segments are broken by low gradient grass meadow sections without well defined channels. Except for the high snow melt period, water moves through these low gradient meadow sections as groundwater. The low gradient of the systems and the high infiltration rates of the soils favor intermittent over perennial stream types.

USGS 7 1/2 min. quad maps show 114 miles of total stream system in the three drainages. This equals a stream density of sightly over 1 mile per square mile of land area. This is a relatively low value and reflects the groundwater nature of these systems. The USGS photo interpreted stream mapping is generally overestimates the actual amount of defined stream channel.

Field observations in the three drainage systems indicate that a significant portion of existing defined channels are relatively recent (since the reference era) features. This is especially true in the low gradient meadow section. Much of the channel system in the lower half of Hog Creek consists of man-made irrigation ditches. The Skellock Draw channels have been heavily modified by the construction of the Lamm Railroad grade. In addition to these dramatic cases, each drainage has examples of channel developed after road fills drained by a culvert were placed across existing meadows.

In the reference era, the stream channels in the study area were likely associated with long term springs and the Klamath Marsh. The channels in the low gradient meadow segments were most likely "E" type channels with narrow, relatively deep cross sections, and high sinuosity. Abundant deep rooted bank vegetation such as willow and sedge would have been key to the stability of these channels. Channels in the steeper gradient canyon section would likely have been of the "B" type. These channels would tend to be shallower and wider than the "E" type, and of higher gradients and lower sinuosity. Stability of these systems will also depend to some degree on deep rooted vegetation, but they often have rocky bottoms which maintain stability through a broader range of vegetation conditions.

Vegetation

The vegetation ranges from wet riparian marsh types at the edge of Klamath Marsh, to mixed conifer stands growing between 5-6000 feet elevation. Calimus Butte, at 6600 feet, is the highest point in the area. Klamath Marsh is the dominant lowland feature. Relatively abundant vegetation types are listed below.

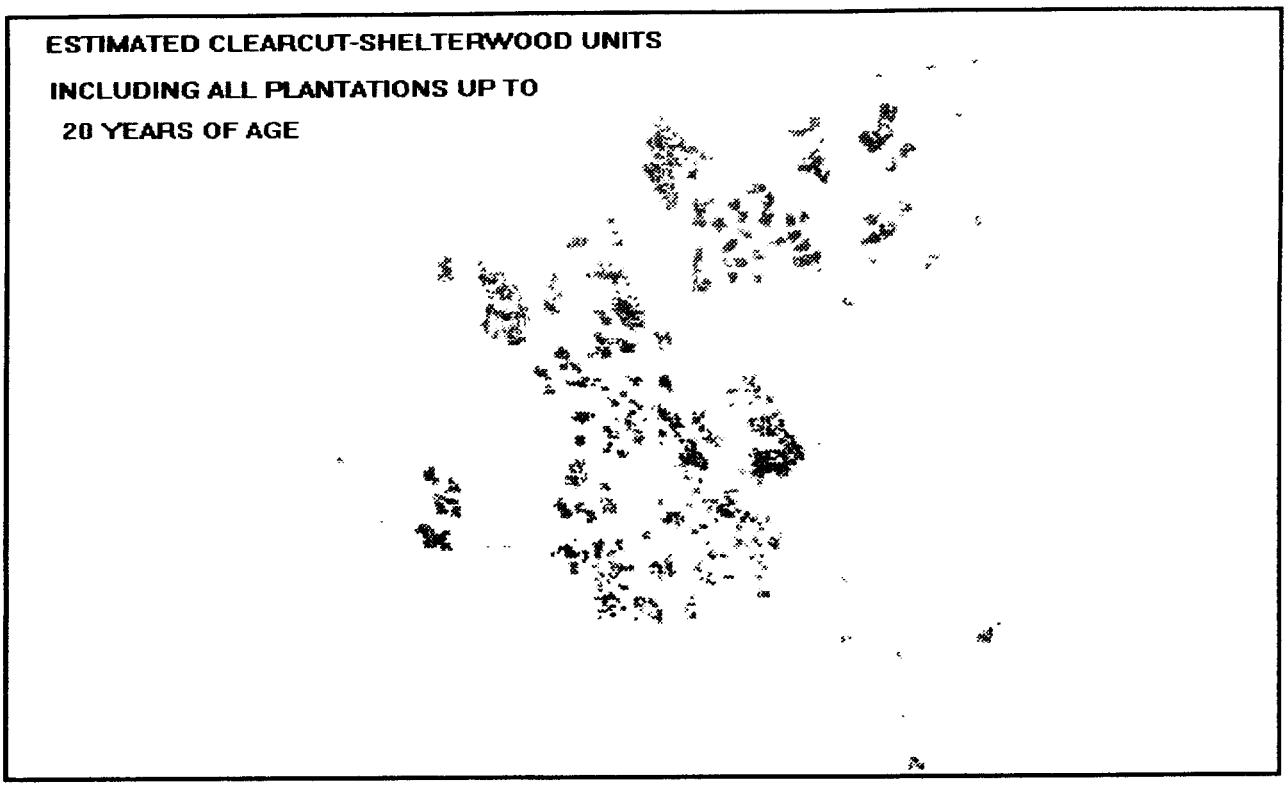
Plant Communities from Ecoclass layer	Acres
Unclassified	9772
Lodgepole/Needlegrass Basin	4188
Lodgepole Bearberry	2858
Lodgepole-PP/Bitterbrush/Needlegrass	16544
Lodgepole/Bitterbrush/Sedge	932
Ponderosa Pine/Bitterbrush/Fescue	250
Ponderosa Pine-LP/Bitterbrush/Needlegrass	50968
Mixed Conifer/Snowbrush/Manzanita	6012
Dry Bluegrass/Wheatgrass Meadow	224
Wet Sedge Meadow	180
Low Sagebrush/Idaho Fescue	844

Species From PMR Data	Acres
Grass	6818
Lodgepole pine	22014
LP-PP	1646
Ponderosa Pine	40548
Mixed Conifer	17454
Rock sparsely vegetated	1046
Shrub	3986
Water	504
Moist Bluegrass Meadow	740
Non-Commercial Rocky	38
Sagebrush/Bluegrass	468

Description From PMR data	Acres
Grass	6818
Rock, Sparsely Vegetated	1046
Shrub 15-25%	144
Shrub 26-40%	1042
Shrub 41-55%	1836
Shrub 56-70%	876
Shrub 71-100%	88
Tree Crown Closure 11-25%	9058
Tree Crown Closure 26-40%	36622
Tree Crown Closure 41-55%	25884
Tree Crown Closure 56-70%	7588
Tree Crown Closure 71-100%	2512
Water	504

Meadow vegetation reflects the impacts and goals of forage production for cattle grazing. Kentucky bluegrass is often the dominant species. It has successfully invaded sites once occupied by tufted hairgrass, Cusick bluegrass, willow, widefruit sedge, Baltic rush, prairie junegrass and others. These sites may be potential habitat for Silene nuda ssp. insectivora (Catchfly) and Calochortus longebarbatus (Long-Haired Star-Tulip). Shrub types are generally found on the fringe of ponderosa sites where soil moisture is inadequate for conifer growth.

Most conifer stands are in either a plantation or heavily stocked, multi-size condition. This is a result of several fires, and clearcut or seed tree type sales which occurred in the 1980's. An accurate GIS layer of these units is being developed. A very rough estimate of plantation acres from Pacific Meridian Resources (PMR) and stand records indicates approximately 5% of the area in this condition.



Approximate distribution of plantations within Analysis Area

The PMR data above shows 9,000 acres in 11-25% Tree Crown Closure. However, due to the small pixel size of PMR data, this class picks up many landings and skid trails in that class. Young plantations, such as House Timber Sale, may account for some of the Grass/Shrub acres shown. Plantations were planted to ponderosa or lodgepole pine or a combination, and are mostly 5-12 years old. White fir is naturally reseeding into higher elevation units. Some of these plantations have been precommercially thinned and many others are currently candidates for thinning. Recently logging began on Yoss Timber Sale, an uneven-aged management type harvest. Otherwise, no recent stocking level control entries have occurred in the rest of the stands, resulting in a heavily stocked condition.

Neither the Plant Community nor PMR data sets are highly accurate. However, even these data sets indicate an increase of approximately 10,000 acres in white fir type throughout the area. The Plant Community layer generally predates the PMR Data by about 10 years, although portions have been updated.

Lodgepole stands generally average 80 years of age. Pure lodgepole types generally have either not been harvested or have been clearcut/seed tree harvested. Lodgepole/ponderosa pine ecotones may have received partial cut treatments in the past. Bark beetle mortality has been occurring for the past decade with most stands sustaining 10-50% cumulative mortality to date. The mortality has most often occurred in small clumps, over multiple years, rather than heavy mortality occurring in any one year. Higher rates of mortality are occurring in wetter than in drier lodgepole types. Natural regeneration is reestablishing lodgepole in the mortality pockets, producing a clumpy, multi-age stand type.

Ponderosa stands are multi-size/multi-age. Most stands have a thick understory component which is

controlling stand growth. These stands have all had multiple logging entries from 1922 on. While all non-plantation stands contain trees of all size classes, past harvest has impacted the size composition. Currently, these types of stands are receiving less mortality than stands on most of the district. Some stands have very few large trees and these may be of a relatively younger age class.

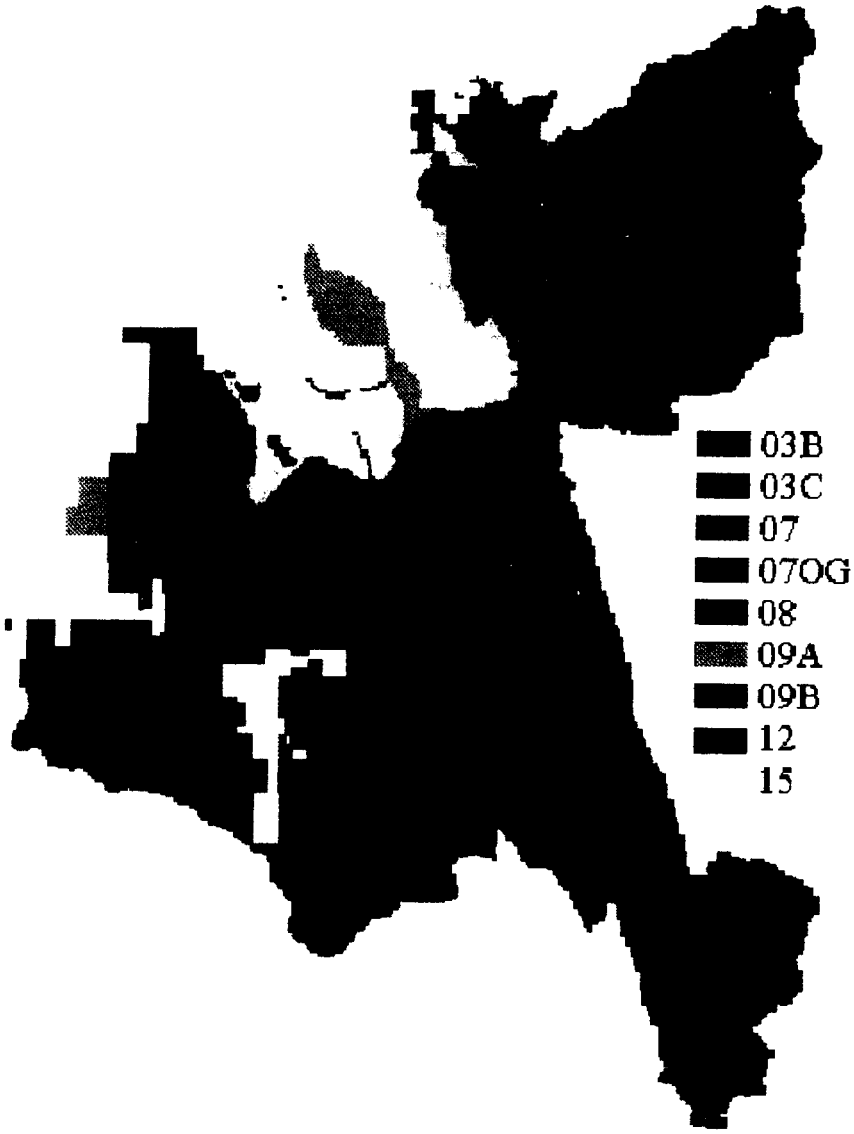
Mixed conifer stands are multi-sized/multi-aged and may contain components of ponderosa, sugar and lodgepole pine as well as white fir, or they may be pure white fir stands. There are 15,416 acres of inventoried old growth in this area. These stands are receiving heavy mortality, especially in the sugar pine and fir component.

Management Areas

The Winema National Forest Land and Resource Management Plan identifies nine management areas within the Hog, Yoss and Skellock Watershed Analysis Area. They are as follows:

Management Area 03B - Scenic Management, Foreground Partial Retention
Management Area 03C - Scenic Management, Middleground Partial Retention
Management Area 07 - Old-Growth Ecosystems
Management Area 07OG - Inventoried Old Growth
Management Area 08 - Riparian Areas
Management Area 09A - Bald Eagle Nest Sites and Recovery Sites
Management Area 09B - Bald Eagle Replacement Habitat
Management Area 12 - Timber Production
Management Area 15 - Upper Williamson

The map below shows the location of Management Areas within the analysis boundaries. For a more detailed description of the Areas, see Appendix A, Management Areas.



Hog, Yoss and Skellock Management Areas

III. ISSUES AND KEY QUESTIONS

A. Stream channels, soil productivity, and basic hydrologic function have changed from the reference era conditions in the Hog, Yoss and Skellock drainages.

1. What specific changes have occurred in stream channels, soil productivity and hydrologic function in the Hog, Yoss and Skellock Analysis Area? How and where have the road and railroad systems extended the natural stream system?

Hydrologic Function

The basic hydrologic cycle for Hog Creek, Yoss Creek and Skellock Draw includes precipitation in the form of snow, spring snow melt, infiltration into the shallow groundwater table, and migration of groundwater into the larger Klamath Marsh and Williamson River systems. Each of the three drainages experience intermittent flows of surface water in discontinuous channels segments during the spring and early summer. Hog and Yoss Creeks also have generally short spring fed segments of perennial stream channels. It is believed this basic cycle was the same in the reference era.

Changes have occurred in the systems' ability to retain surface water into the late summer months, reducing any potential for perennial surface flows. Beaver activity, higher water levels in the Klamath Marsh, and sinuous channels with well vegetated banks may have supported perennial flow in the lower reaches of these drainages during higher precipitation periods in the reference era.

Precipitation amounts in the study area are erratic, commonly varying 10 to 20 inches from year to year, often including periods of two or more years where precipitation is either well above or below the average. This weather pattern is the primary driver of the hydrologic system. It is likely that even with the high levels of beaver activity, high marsh levels, and good channel conditions of the reference era, a drought period of sufficient length and severity has occurred to cause long term perennial segments of stream channels to go dry. The exception to this may have been segments fed by long term, consistent spring flows, such as those in portions of the Hog and Yoss Systems. This variability in precipitation may preclude aquatic species at times, but there is a high probability of habitat re-invasion during wetter periods

Channel Morphology

All three drainages have segments of channel restricted by both roads and historic railroad grades. The effects of these restrictions are generally localized to the area of the road crossing. The restrictions effect both surface and groundwater movement. The effect on surface flow is to either dam it up or concentrate the flow through a culvert. The concentrated flow often results in the forming of a new channel above and below the culvert location. Groundwater effects are very localized in the pumice sediments of these three drainages and do not appear to be significant.

The lower 1/3 of Hog Creek and all of the Wilson Flat area has been heavily diverted and channelized to drain wet areas and irrigate pasture lands for domestic livestock. This activity has straightened the natural channel system, changing the routing of surface water and some portion of the groundwater, resulting in lower water retention in this portion of the drainage. Again, this may affect the length of

time that surface flows are present.

In Skellock Draw, the construction of the Lamm Railroad in 1929 captured much of the natural surface drainage system. The drag-line construction technique also captured a minor amount of the groundwater and placed it in an open ditch. These changes have increased the efficiency with which water is moved off site, potentially reducing the length of time that surface flows are present. This effect has been reduced to some extent by breaches in the railroad grade which allow surface flows to access the natural channel in some reaches.

The high infiltration rates of the pumice soils and sediments generally eliminate the possibility of roads and railroad grades acting as extensions to the natural stream channel system. Places where existing surface flows have been captured by the road or railroad grade structure, and those locations where concentrated surface flows associated with culverts have cut new channels, are the only examples. These are only minor occurrences in the study area. The railroad grade in Skellock Draw is the most dramatic example.

Soil Productivity

Fire suppression effects

The primary effect of extended fire suppression is that more plants are allowed to grow and stay in place for longer periods of time, locking nutrients in plants, and preventing them from cycling through the system at more frequent intervals. It allows changes in plant community structure which favor more conifers and upland brush in areas that would be more dominated by hardwoods, grasses, sedges, and forbs. This in turn affects breakdown of litter layers (needles vs. deciduous leaves). Conifer litter stays in place longer, resulting in longer nutrient cycling periods.

Another effect is that wildfires, and subsequent fires in the same area, ignite more large dead and down materials (1000 hour fuels) because of increased stocking levels and litter layers. This can affect productivity (by scorching soils), carbon cycling (more loss above and below ground level), and can increase volatization of nitrogen and phosphorus.

Roads that were used for harvesting timber remain active for longer periods of time due to the need to prevent large fire occurrences, eliminating some acres from production.

Potential timber harvest effects

Removal of biomass from the area (long rotations have less effect than short rotations). Biomass removal affects long term nutrient cycling. During the late 1970's thru the mid 1980's, most of the harvest regimes were for shorter rotations in both the ponderosa and lodgepole pine communities. This is most evident in the acres treated with overstory removals or clearcuts, since these areas are now plantations less than 20 years of age.

Acres of land removed from production of grass, forbs, and brush and reduced soil productivity because of roads, skid trails, and landings needed for timber harvesting. Although there is some reduction in tree production due to roads, it is probably not significant. Average miles of open road in the analysis area generally ranges between 3 to 7 miles per section. This equates to approximately six to thirteen

acres per section, or somewhere between 871 to 1885 acres (1-2% of the analysis area). Calculations are based on 15 foot right-of-way, and 93,000 acres in the analysis area.

Exposure of bare mineral soil from harvest activities, which allows drying of site and loss of organic layer, disrupting both long and short term nutrient cycling. These effects can be, and usually are, minimized with winter harvest.

Potential displacement, mixing of soil horizons, and compaction from harvest and post harvest activities. This can influence the nitrogen, phosphorus, and carbon cycles, leading to long-term nutrient deficiencies by changing the soil structure, increasing bulk densities, and disrupting or removing the thin organic layer. Most of the soils in the analysis area have very low nitrogen and phosphorus components to begin with.

Pile burning in some areas causes soil temperatures to exceed 200 degrees centigrade, causing loss of productivity in these areas. Heat from slash pile burning when reaching the above temperature effectively volatizes nitrogen and removes carbon up to 12 inches below ground surface. Also, the soil structure changes which reduces the nutrient holding capacity of the soil.

Roads that cross riparian areas may detrimentally alter stream channels and movement of water through the systems, resulting in reduced soil productivity or complete soil loss in these areas. Hog Creek, Yoss Creek, Skellock Draw, Meadow Creek, and Clover Creek all show examples of this at both past and current crossings.

2. Have the timing and duration of peak flows changed detrimentally in the Hog, Yoss and Skellock drainages since the reference era?

There is no data available to quantify changes in timing and duration of peak flows in the analysis area. Without some reasonable way to quantify change, determination of detrimental effects is only speculation. However, loss of sinuosity, channelization of surface flows, entrenchment of natural channels, and removal of beaver from the lower reaches of these drainages will tend to reduce water retention, increase peak flows, and reduce their duration. The streams in the analysis watersheds have access to less of their historic floodplains, thus they are unable to store as much run-off in the aquifer. Therefore, run-off tends to happen earlier, with shorter duration, because the portion that normally would be stored is now released with the bulk of the run-off. Moving the same volume of water over a shorter duration requires higher rates of flow, resulting in deeper entrenchment. Whether these changes have had a detrimental effect on hydrologic function is not clear. Hog Creek and Skellock Draw with their significant alterations to the lower channel reaches will have the largest relative effect of the three drainage systems.

One of the major effectors in the Hog, Yoss, and Skellock systems has been the lowering of the Klamath Marsh level to benefit agricultural use. This has likely effected both amount and duration of peak flows, as well as the potential for perennial flows in the lower reaches of these systems. This effect is long term and largely irreversible, unless the Marsh elevation is returned to historic levels.

Consequences of shorter duration, higher volume peak flows include the following:

- By shortening high flow periods, the window of opportunity for migration of terrestrially challenged aquatic species is shortened. This window may be further shortened by velocity blocks that develop in constricted channels, effectively blocking upstream migration. Examples of this include road crossings and culverts. This shortened period of potential migration time may minimize or eliminate species from colonizing residual perennial habitat located higher in the watersheds. Lack of colonization results in habitat with less species diversity than those with longer periods of access to downstream watersheds.

- Perennial stream reaches are shorter than during the reference period. Due to channelization and channel incision, the streams do not have as much access to their floodplains, causing desaturation. Surface flow continues over saturated streambeds and attenuates over unsaturated streambeds. This effect dries out downstream ends of perennial reaches and reduces historic aquatic habitat.

- Higher peak flows will further erode and incise stream channels in reaches with sufficient slope. This further decreases access to their floodplains, which in turn exacerbates the situation by further shortening and intensifying peak flows. The channel scouring caused by incision also reduces organic sediments in the streambed and eliminates resting cover, both of which decrease biological productivity of the habitat.

- Beyond the requirements of the watersheds in this analysis area is the need to store water for the Klamath Basin below. The watersheds analyzed here currently provide only a portion of their potential historic groundwater storage capacity which is important to the Klamath Basin as a whole. If the analysis area's storage volume increases, aquatic habitat will improve within the area, as well as downstream.

3. Has the extent of coverage of riparian hardwood species declined since the reference period?

Extent of Riparian Types and Descriptions

Composition of riparian vegetation is determined by many factors, but especially soil type, soil moisture, water table, period of inundation, etc. The importance to vegetation is how a channel affects these characteristics, not the presence or absence of a channel. The exception is marsh/pond and immediate streambank vegetation. Therefore, there is a poor relationship between stream classification and vegetation type. Many acres classified as riparian are not associated with stream channels, but are areas of high water tables and/or spring inundation. These areas generally support riparian vegetation of a moist or dry type, but there are always exceptions. Changes in riparian types are best addressed in the following categories:

Standing/pooled water

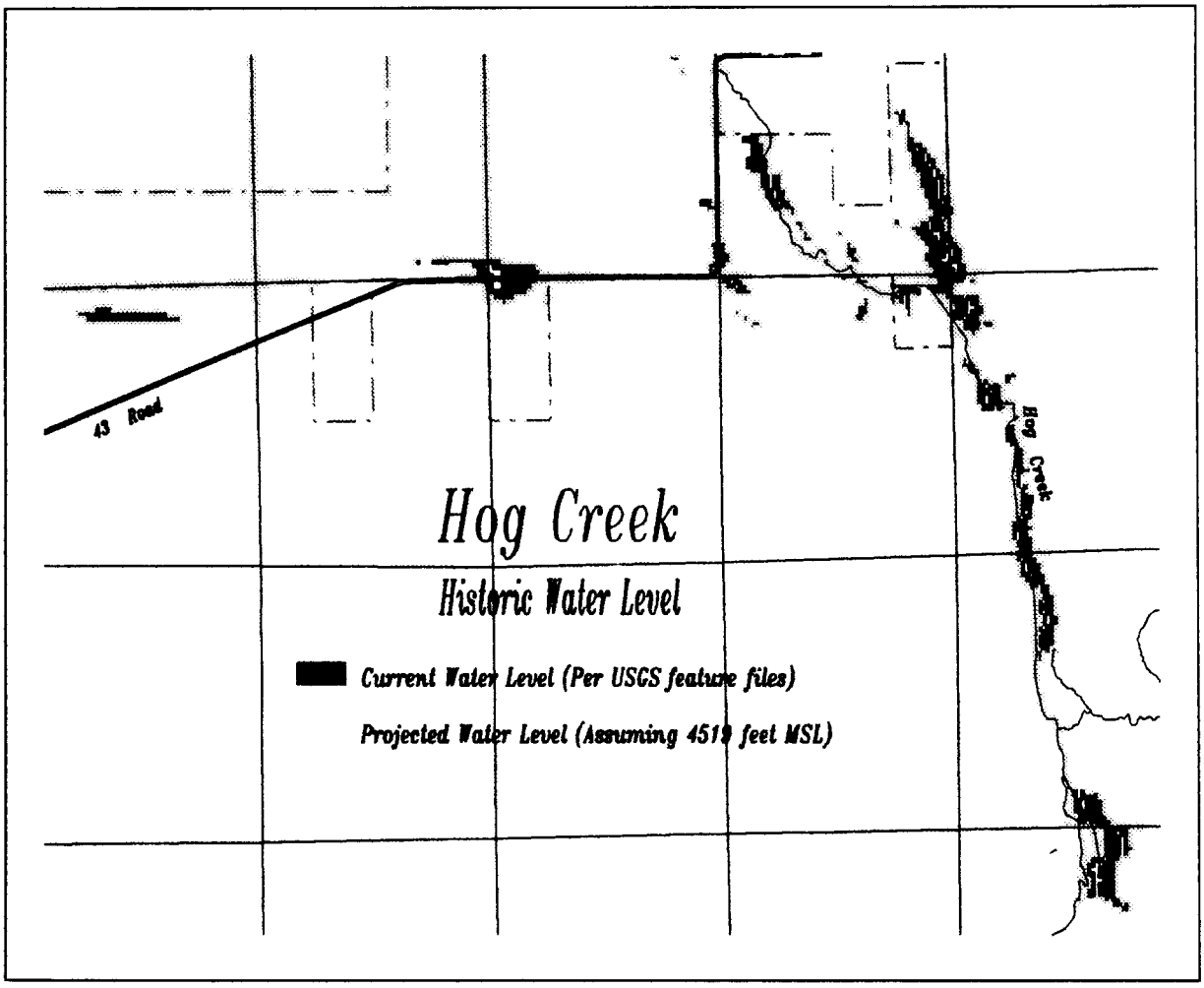
These areas were/are associated with the edge of the marsh and ponding generally associated with beaver dams. Changes to hardwood species are secondary to lowering of the water table or soil moisture regime. Other vegetation types are more impacted.

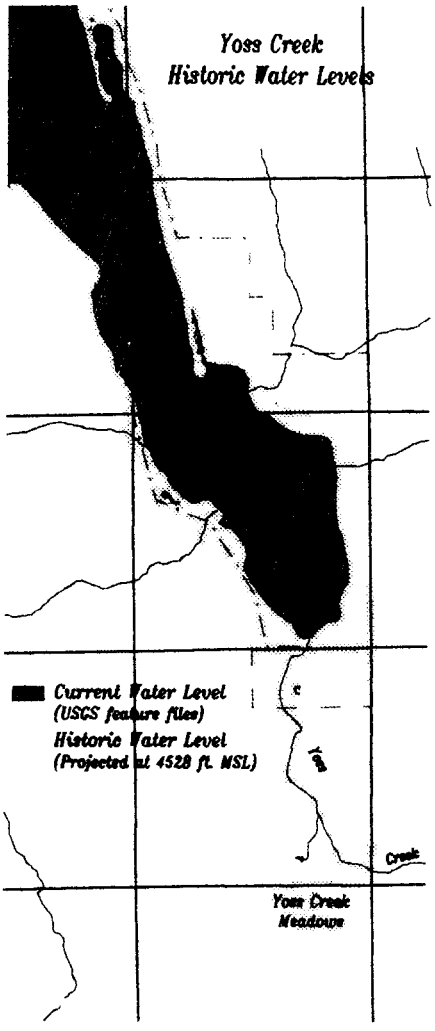
Klamath Marsh

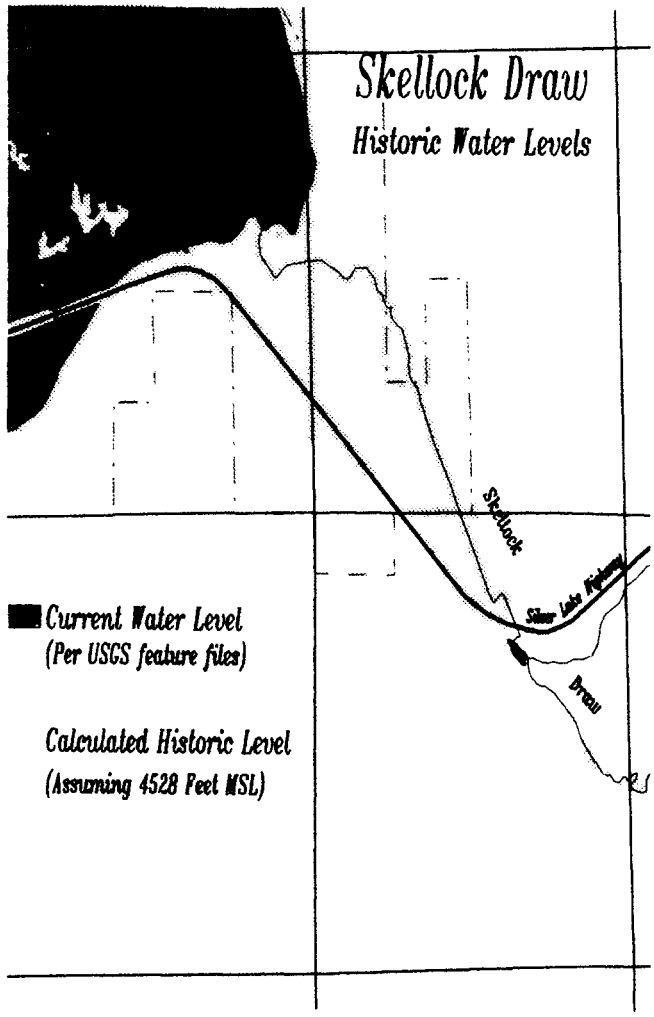
Cruise maps from the 1920's show elevation of water in the marsh was approximately 4518 feet. The Kirk reef was blown around 1908 to lower the water level of the marsh. The actual height of this reef is not known. Estimates range from 5-10 feet, which would have raised the marsh accordingly. Projecting the elevation of the marsh at approximately 4528 feet would result in:

- Increased shoreline, increasing quantity of water edge habitat and associated vegetation
- Extending the edge of the marsh, increasing wetting into portions of Wilson and Whitehorse flats
- Enlarging the Hog Creek marsh areas (Solomon Flat would be inundated well inside the Forest boundary)
- Wocus and Little Wocus Bays being larger
- Yoss Creek Meadow might have been marsh, and marsh may have extended another ½ mile or so into Skellock draw.

The following 3 maps project historic water levels in Hog, Yoss, and Skellock Creeks before the lowering of Klamath Marsh.







Management of the former marsh lands since 1908 has resulted in various draining/flooding activities which have discriminated against longer-lived species with limited habitat ranges, favoring annuals, short-lived perennials and establishment of non-native species.

Ponds, generally the result of beaver dams, may have carried the elevation of standing water farther upstream than the marsh level alone would dictate. Beaver dams would also provide more season-long pools of water than are currently present, and slow sediment transport.

The effects of decreased marsh and ponds on vegetation are that less aquatic emergents or species dependent on saturated soils would be present, for example, tules (frequently mentioned in historical accounts), Baltic rush, Nevada rush, inflated sedge, bladderworts, pondweeds, buckbean and orange arnica, bluejoint and slimstem reedgrass, beaked sedge, widefruit sedge and creeping spikerush.

Riparian Types

Extent of these riparian types are either topographically controlled (draws with surface or subsurface flows), or water controlled (springs, high water tables in perched basins, etc). Changes in riparian vegetation occur due to the following factors:

- Lowering of "site potential" water table hydraulically (channel downcutting draining system)
- Drying of soil within rooting depth and potential lowering of the functional water table
- Reduction in soil moisture by vegetation growth (in this area most commonly caused by lodgepole stands)
- Surface compaction resulting in runoff and less soil water holding capacity, which can result in loss of some vegetation needing surface water. This may affect some meadow areas as a result of grazing.

Reference era condition

Vegetation was always dynamic, and probably had a wide range of variation. In these types there would have been a wide range of conditions, and no one description would be appropriate, except for the time that condition was present. Vegetation at the immediate streambank edge, if present, was probably more stable. The rest of the riparian area would vary more widely.

Hardwoods (predominantly black cottonwood and aspen in association with willow) would compose 10-50% of the tree/shrub component in riparian areas and immediately upslope. Willow would dominate the channel edge and wettest portions of the site, perhaps in association with vegetation described under the Marsh/pond section. Areas between hardwoods would be variously occupied with grass, forbs and lodgepole "scrub". The 1920's cruise inventoried much lodgepole growing on the flats outside of the forest boundary, but very little within the forest boundary. This lodgepole is often described as small and clumpy, although moderate volumes of poles were recorded in some areas.

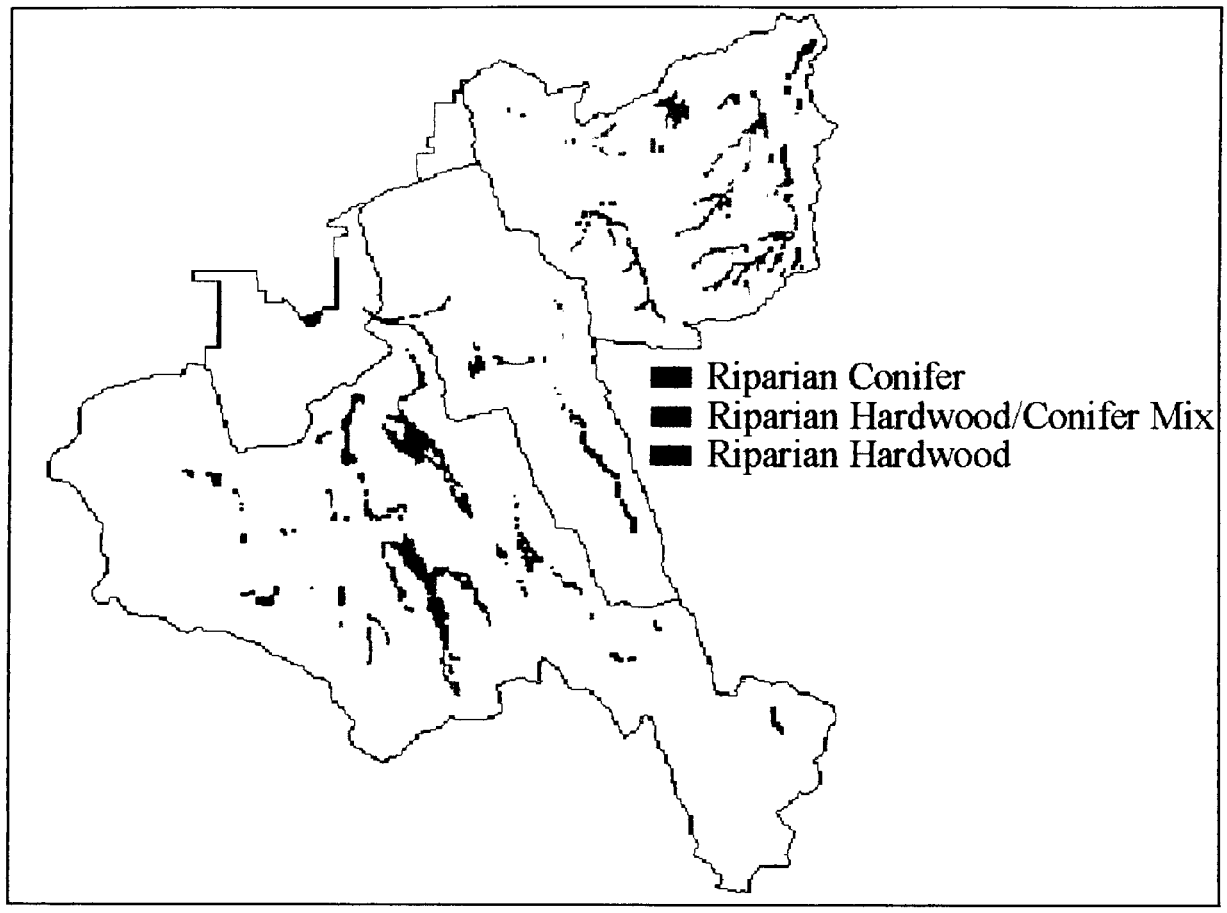
Anecdotal reference is found to "willow and lodgepole regen", but references are not found to lodgepole stands of the same type. It is possible that willow was out-competing the lodgepole and dominating the site. This historic riparian type does not currently exist and a known classification does not exist. With the exception of the lodgepole component, it is probably most similar to, and would be found on sites now classified as:

CL-M3-14 LP/ Douglas Spiraea/widefruit sedge
CL-M3-11 LP/Bog Blueberry/Forb
SW-11-13 Willow/Widefruit sedge
HQ-C1-12 Aspen-LP/bearberry
HC-G1-11 Black cottonwood/widefruit sedge (identified only at Prairie Farm, Sisters RD)
MM-29-13 Widefruit sedge

Current condition

Riparian types are generally in one of two conditions:

- A lodgepole pine stand (basically a lodgepole/forb type). This condition occurs more often in the upper 2/3 of a stream, and may continue above the end of the channel. Less intense grazing may be a partial factor in developing this condition. High stocking levels of lodgepole have a drying effect on the site and the large amount of lodgepole seed production assures maintaining these sites in a lodgepole dominated condition. Most of these types are in a mature lodgepole stand with mortality occurring in pockets. 10-50% of the lodgepole have died and have been replaced by lodgepole.



Hog, Yoss and Skellock riparian areas containing trees, showing tree classifications

Without multiple major disturbance activities these sites will remain in lodgepole. If only one or possibly two disturbance events (fire or mechanical) occur, lodgepole will continue to regenerate due to the existing seedbank. Since lodgepole can only reproduce from seed, and rarely reaches sexual maturity before 20 years, multiple disturbance events will discriminate against lodgepole (and to a lesser degree bitterbrush, if present) and favor annuals, rhizomatous, perennials and any plant which produces seed at a period less than the disturbance interval.

☞ A meadow type, with some willow and minor or major lodgepole encroachment slowly occurring. Most willows appear to be in the later seral stages, mature, decadent and/or being overgrown with lodgepole. There are some areas with young willows present that are maintaining themselves.

Predicted future condition

Future conditions depend mostly on what kind and pattern of disturbance events occur on the site. For the areas that are in lodgepole, without major disturbance the lodgepole is expected to continue dying slowly (5-10% of remaining stand per year). The small dead patches are quickly regenerated with lodgepole seedlings in the several thousand per acre range. Fuel accumulation is increasing due to the dead material which generally falls within 10 years after death. A wildfire will eventually burn these stands. As more large surface fuels accumulate, the potential for soil damage increases, especially since these soils are generally of higher clay content. After the first fire, lodgepole pine will naturally regenerate at a very high rate, again several thousand seedlings per acre. These sites may or may not be resistant to fire for a short or long period of time, depending on the intensity of the burn. Young, pure lodgepole stands just don't burn well. To alter the continued lodgepole dominance of these sites, multiple, intensive ground disturbing events (within probably 5 years) will be necessary to reduce the amount of lodgepole seed in the seedbank, and allow establishment of other species.

Lodgepole pine's regeneration strategy is to produce very high numbers of seedlings, without any self limiting mechanisms such as ponderosa pine has. This is the strategy of a species with low numbers and distribution, that is trying to maintain itself. This also supports the contention that it was here in very small numbers historically. One example is the lack of serotiny in our lodgepole. Serotiny is a mechanism to ensure reproduction after a hot fire. Conversely, it also limits reproduction until the occurrence of a hot fire. This is a very effective self-limiting population mechanism that lodgepole in this area does not have. Fire frequency apparently was the only population limiting mechanism for lodgepole in this area.

In the types which are currently still considered meadow, some degree of lodgepole encroachment will continue. There will continue to be areas where willow/aspen are losing vigor due to age and lack of reproduction. Grazing pressure may keep some areas in grasses and select against the more palatable grasses. Cows don't seem to eat lodgepole but they do trample them. Long term prognosis for these types is similar to the lodgepole dominated stands. However, the difference is that they would be easier types in which to restore hardwood vegetation. This is because the seedbank is not yet heavily populated with lodgepole seed.

4. What is the relationship of upland vegetation stocking to water yield?

Historical Upland Stocking and Water Use

By type and rooting depth

A basic principle of vegetation management is that an acre can produce X amount, but that amount can be apportioned many ways. Historical conifer stocking levels were much lower than current, yet contemporary references consistently refer to slow growth rates and evidence of release. This indicates strong intertree or tree/shrub/grass competition. The growing space of historical stands apparently had less apportioned to conifers and more to hardwoods/brush/forbs/grass. The chart below shows a range of conifer stocking levels which might be found on the same site. Comparing the highest and lowest values indicates the amount of growing space that is available to non-conifer vegetation. In historic stands this could be ½ to 3/4 of the stand growth potential.

	1993 M&M EXAM, DEMO UNEVEN-AGED AREA	CURRENT UNEVEN-AGED HARVEST PRESCRIPTION	CURRENT STANDS	REFERENCE STAND 5 MBF	REFERENCE STAND 10 MBF
BASAL AREA	80	60-80	60-200+	28	50
TREES/AC	232	75-150 +	100-400+	7 58	15 15
STAND DENSITY INDEX	140 SDI IS A MORE ACCURATE MEASURE BETWEEN DIFFERING STAND TYPES	70-120	100-400	35	70
NOTES	MORE HIGHLY STOCKED NEXT TO ROAD	IF STAND IS NOT PRECOMMERCIALLY THINNED, VALUES CAN BE MUCH HIGHER		REFERENCE STAND COMPUTATION BASED ON ARBITRARILY SELECTED 26" DBH, 4 LOG TREE.	

Grasses are often underestimated as competitors and users of water/nutrients. 85% of the mass of a grass plant may be below ground as an extensive root system. For example, a four month old cereal rye plant, grown in a laboratory, had 387 miles of root hairs.

In cold soils grasses begin root growth before conifers. This probably occurs in the analysis area. There are several consequences of this relationship. Grasses will establish first and out compete conifer seedlings on a disturbed site. Grasses and brush effectively limit late-spring/early-summer growth of conifers, which is their major above ground growing period. In field trials where bitterbrush was removed (in plantations), Idaho fescue invaded and reduced the growth of conifer seedlings more than the bitterbrush had. One grass plant within a three foot radius of a seedling may be fatal to the seedling. Grass roots go deeper faster than brush or conifers. Annuals generally emerge after the first fall rain and their roots grow much of the winter. Many ponderosa germinants appear the first season or two after a fire, but few survive to maturity. Idaho fescue has demonstrated allelopathy to ponderosa pine seedlings and can reduce ponderosa pine radicle elongation by 60%. Brush seedlings emerge before conifers, therefore a hierarchy exists which strongly affects stand composition and season and depth of water use.

Short fire frequency would favor grasses over woody species which emerge quickly after fire, and annuals and perennials with hardy root crowns not susceptible to fire. Frequent fires would discriminate against species susceptible to fire and species which do not develop sexual maturity in a time period less than the average fire frequency. Frequent fires would also favor species which propagate via windborne seed or other transport methods.

Streamflow modeling done in Arizona using a water yield model based on the Baker-Kooner model shows a stand stocked at 1867 levels had 17 sq. ft. BA/AC and produced 6.9" of water yield, in 1987 it had 154 sq. ft. BA/AC and produced 5.1". Unfortunately the reference to this study is very brief and contains little supporting information, but the circumstances are similar to this area.

Summary

- Grass has a major root system below ground (within 1-3 feet of the surface), uses more water early in season and less to none late in season.

- Lodgepole pine and brush have major root systems below ground (within 1- 4 feet of surface). On "A" soils, rooting depth may not exceed 12". Uses more water early in season and continues using what water is available later in season.

- Ponderosa pine generally have a two level root system. One system is similar to LP and brush types, another is connected by a tap root going deeper into the soil, seeking more fertile levels, especially the residual soil. Generally, ponderosa use all the available water from early spring to late fall.

By season of use

The historic stand type, with a higher proportion of grasses, would use all the water it could in the early spring growing period, and probably used slightly more in mid-winter to support root growth. In most years grass growth stops in early summer and there would be a reduction in water use during that time. Also grass root depth is generally shallow, a foot or so depending on species, soils, etc.. Conifer roots will go as deep as water and nutrients are available, and ponderosa pine will send a tap root as deep as necessary to be beneficial to the tree (not negative benefit of energy required to pump water up). Ponderosa pine routinely develops a tap root that goes past the "sterile" horizons of pumice soil in search of residual soil and the moisture and nutrients associated with it. As a result, ponderosa pine can tap deep soil water and perhaps subsurface flow that grass/brush and generally lodgepole pine cannot. Ponderosa has more potential to dry the system than the grass/forb/brush component. Ponderosa will pull water, if it is available, throughout the summer period, though not as much as during late-spring/early-summer.

Current Upland Stocking and Water Use

Current upland stocking is generally at the highest conifer stocking level described in section 1. Because of the extremely high proportion of conifer roots, much deeper water use has resulted, additionally depleting subsurface flow throughout the growing season. Grass dominated sites dry the soil earlier in the growing season than conifer dominated sites.

It is assumed that vegetation in the analysis area watersheds has increased since fire suppression activities began in the early 1900's. Increased vegetation increases water consumed in the evapotranspiration cycle and reduces the amount of water available in late season stream flows. Can the removal of upslope vegetation increase late season stream flows?

The effect of upland vegetation on a streamflow is difficult to precisely quantify. Experiments have been conducted and summarized on watershed response to the effects of timber harvest. Inferences can be drawn to site specific areas by careful consideration of unique characteristics of the area.

Evapotranspiration is reduced in the short run (5-20 years) due to removal of vegetation in a watershed. Increases in flows are positively correlated with precipitation, so greatest increases are in the wettest years. The increase is insignificant in dry years or from summer precipitation, as those waters are

retained on site. Studies suggest two-thirds of precipitation is lost through evapotranspiration. The remaining one-third enters the system through both groundwater and surface flow.

"Process studies suggest that thinning young lodgepole pine stands in Colorado and Wyoming significantly reduces winter interception loss. Soil moisture studies in lodgepole pine stands that range in basal area from 32 sq. ft. to 180 sq. ft. per acre, show that soil water depletion (and evapotranspiration loss) is reduced and water available for streamflow is increased in direct proportions to the basal area reduced. The effect of basal area reductions on soil water depletion is eliminated in dry years" (Troendle, C. A. 1986).

Research indicates that a 35% water increase occurs in 100% vegetation removal and a 0% increase in 10% vegetation removal, with a linear fit between the two points (Troendle 1987).

Other processes affected by vegetation removal, that also affect the hydrologic systems, are the distribution and melt of snow. As a result of interception loss, deposition of snow increases, as does water availability to streamflow. Increased solar radiation on snowpack accelerates snowmelt, causing the rising limb of the hydrograph during low to mid-level flows (generally in April and May) to occur earlier in the year.

Along with possible ground water loss due to evapotranspiration, consideration should also be given to the effect of timber stand densities on the portion of the snow pack that enters ground water reserves. Solar radiation and wind evaporate the snow pack and affect melt rates. Dense timber canopies can trap and evaporate snow before it reaches the ground. Absence of timber allows snow to reach the ground, but no protection from the sun is possible on southerly facing slopes and flat areas, which are common in the analysis area. Lack of shade protection in the spring may melt snow faster than soils can efficiently absorb the moisture. This effect would tend to increase springtime runoff flows at the expense of residual flow during the rest of the year. Lack of timber also exposes snow pack to increased wind action which sublimates snow into the atmosphere. Some level of timber stocking will maximize groundwater capture of snow melt. Experimentation with timber stocking rates may prove valuable when dealing with areas where groundwater storage is important.

Soil water depletion that occurs during the growing season is reduced due to lower evapotranspiration rates. Stored water moves through the root zone and enters the groundwater table. Routing of the water toward the stream is complex. More water would remain locally, keeping the soil moister for a longer period, supporting a higher density of underbrush. Other water will recharge ground water supplies. The Klamath Basin has a significant moisture deficit, especially in the summer months.

The following natural evapotranspiration reducing conditions specific to the analysis area watersheds alter the quantity of water entering the streams:

- Soils of the drainage are extremely porous, with high infiltration rates.
- The watershed's low topographic gradient slows the transport of water.
- Greatest water savings occur on North facing slopes, this watershed is generally south facing. Hog and Yoss Creeks are precipitation driven. Precipitation in the watershed can be characterized as low, although precipitation is variable from year to year with the range being 10 to 40 inches. An increase in streamflow from reduced evapotranspiration rates would not exist in most years due to the low levels of annual precipitation.

Research in glacial parent material in the Colorado Rockies indicates that the removal of 30+% of the vegetative cover from a drainage may result in earlier peak flows, slightly larger peaks, and a slightly larger (5-10%) overall flow volume. Although it is expected that Hog, Yoss and Skellock will generally respond in a similar manner, differences in parent materials and channel morphology may result in significant differences in the magnitude of the effect.

Reduced retention of water in the systems due to loss of sinuosity, channelization, entrenchment, and removal of beaver will likely negate any potential gains from the manipulation of vegetation within the study area.

One area where personal experience indicates removal of vegetation may be beneficial to flows is springs. Springs seem to frequently respond to fire events with increased flows. This potential gain is transitory unless vegetation is actively maintained at the reduced levels. This benefit depends on our ability to identify the recharge area for the spring in question.

5. Are livestock operations affecting water quality?

Historic Livestock Use

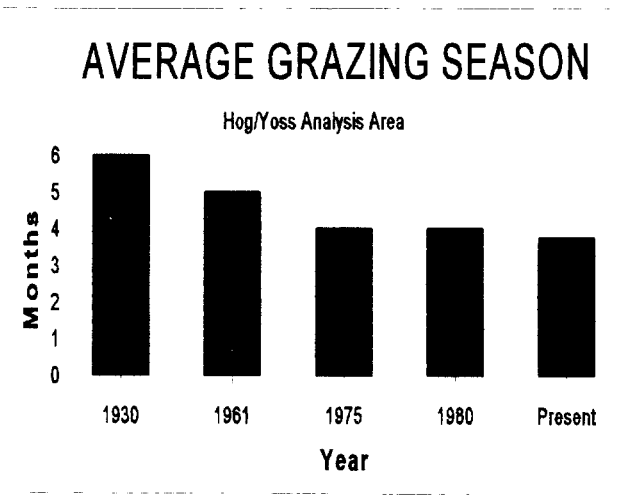
The effects of livestock grazing on water quality are generally limited to surface water. Personal observations indicate the major current effect on surface water in Hog, Yoss and Skellock drainages is localized at stock ponds and isolated water holes in existing stream channels during the late summer. The effect on these confined water sources can be quite dramatic with animal waste, lack of bank vegetation, and concentrations of other organic debris. The concentration of pollutants in the water holes increase as the volume of water in the hole is reduced. Although these water sources are exposed groundwater, the effect of any pollution in the limited number of water holes on the large groundwater resource is insignificant. Most pollutants will be filtered out by the soil and sediment particles and the remainder will be highly diluted over a short flow distance.

1948 photo of east Hog Creek

Some effects of decades of heavy livestock use are still observable in the study area. Deep rooted riparian vegetation such as willow and sedge have been replaced by shallow rooted pasture grasses, reducing stream bank stability. Stream banks have been broken down, widening natural channels and increasing sediment yields. Frequently used trails have, in some cases, been converted by erosion into active channels. These latent effects have likely increased surface water temperatures during the summer season and increased the sediment load, possibly affecting water chemistry.

Siemons Creek, 1979. Note the lack of riparian vegetation along streambank.

Historically, livestock use was season long, and on some private lands, year long. Typically, most of this area has been grazed by sheep. The effects from past grazing activities on water quality is very hard to quantify unless water was previously sampled and then re-sampled (no water samples were taken within analysis area). All stream systems in the analysis area are either intermittent or discontinuous in nature, which means that in most cases water does not flow year-long in these systems. Therefore, very little emphasis has been placed on water quality in the analysis area.



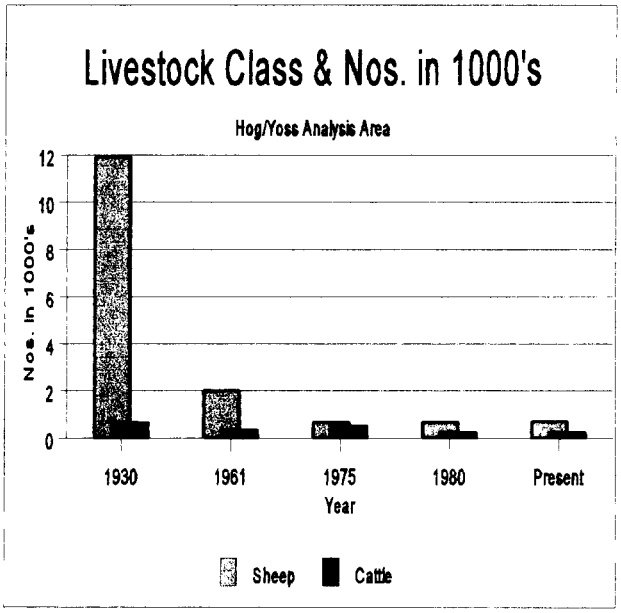
The most obvious effects are when stream shade along with filtering vegetation is removed, either by livestock grazing or grazing management activities. Water temperature and sediment increase, which reduces the oxygen level, making the water less usable by cold-water dependent life forms.

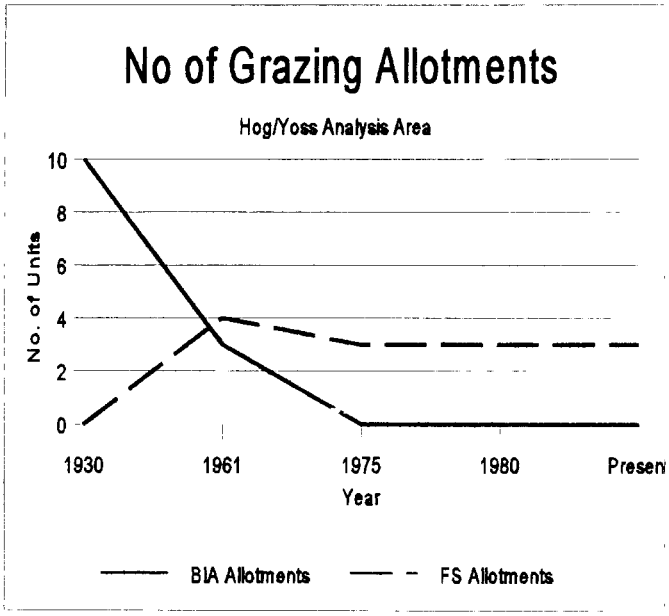
Another effect on water quality from livestock management activities has been diversion of water on private lands, which has reduced flows and negatively affected the vegetation above. Concentrated

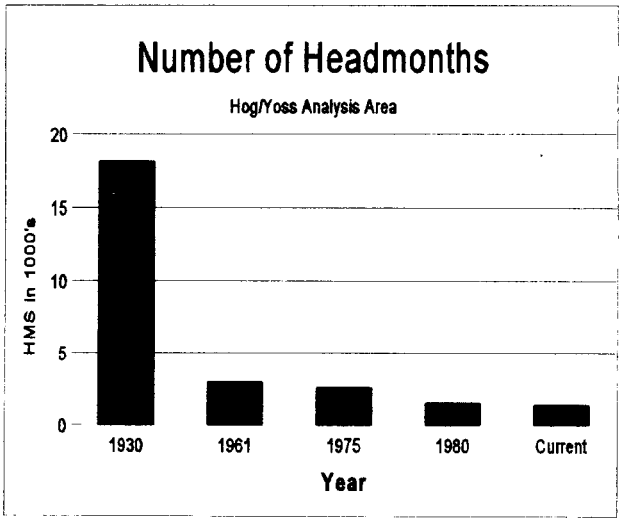
livestock use in some areas along creeks or live water sources may have increased nitrogen and phosphorus levels. Added inputs of nitrogen and phosphorus can tie up more oxygen in these areas, plus increase negative effects from the additional inputs of these elements. This can render those areas uninhabitable by the cold-water life forms mentioned above. Grazing, combined with riparian road crossings, has helped create the down-cut channels where surface water has ponded through late summer. This generally has been the only water available for livestock and big game. The water quality in these areas is not suitable habitat for the reasons stated above.

Grazing on Public Lands

Although not as severe as historical use, some effects may still be present in the Hog Creek area, but until additional sampling of the perennial portions of creeks and live water sources is conducted, we cannot quantify the effects from this management activity. In most cases, present livestock use is being managed so as not to remove streamside vegetation to the point where effects on water temperature and







oxygen levels are detrimental. Or, if an area is grazed heavily one year, it is given a rest period for at least one grazing season. The graphs on this page show the decrease in livestock use of the analysis area.

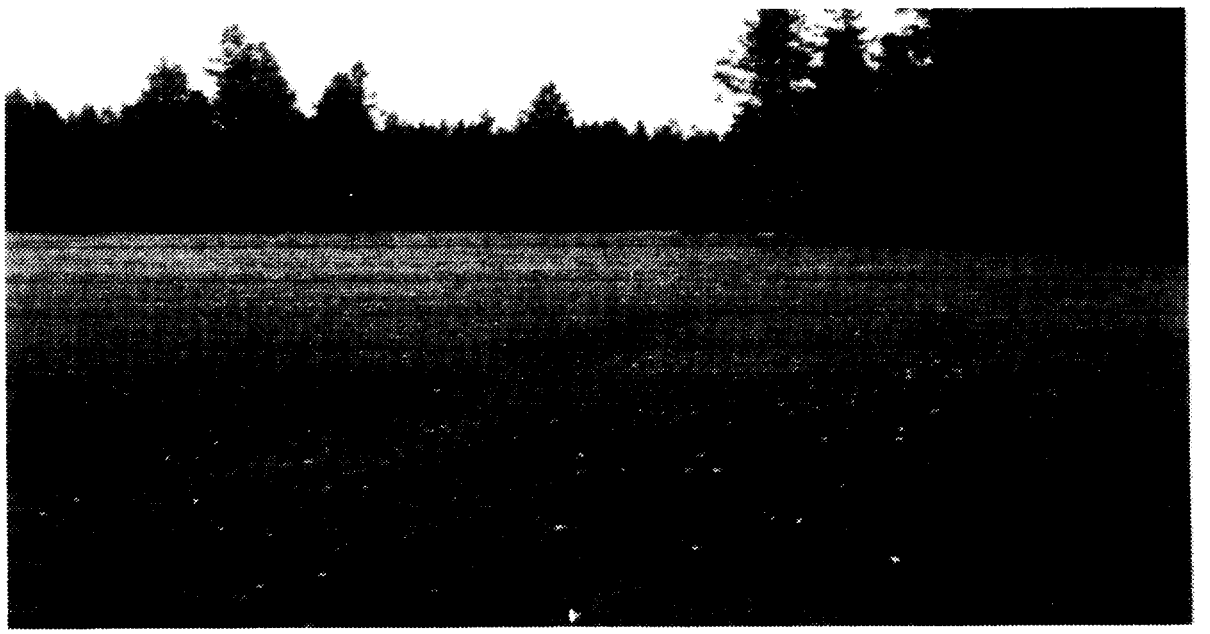
Grazing on Private Lands

In most cases, grazing has been conducted from the time vegetation greens up until either feed or water runs out, or climatic conditions force livestock operators to move their livestock to winter feeding areas. This is fairly obvious by the stubble height

left and the short growth form that forage vegetation attains. There is also a lack of hardwoods, or deep rooted sedges and grasses. These conditions are readily observable along the 43 road in T32S, R8E, Sec 27, where the road crosses private land.

1979 photo of Wilson Flats showing effects of drought and heavy grazing pressure.

Some private land grazing practices appear to be changing in the Hog Creek area. It appears that livestock operators are starting to remove livestock earlier, or reducing livestock numbers, leaving more vegetation upon removal from the area. This effect is readily observable at the 4526 road crossing of Hog Creek.



1982 photo of Wilson Flats before livestock turnout; above normal precipitation.

Again, water quality data is not available as far as is known. In addition to the grazing effects, there have been drainage ditches constructed to dry out the wetter pastures, and the main channels of creeks have been ditched and diverted. This has happened primarily in the Wilson Flat and Ray Ranch (prior to public ownership) on Hog Creek, Siemons Creek, and Applegate Creek. This area is located at T32S, R8E, Sections 21, 27, 28, 34, 35, 36, and T33S, R8E, Secs 1, 2, 12. Most of the ditches were constructed during the BIA Administration, and were abandoned by the 1950's. Some of these ditches were reconstructed in the early 1970's.

1963 Photo of Hog Creek drainage showing natural channelizaton.

B. Fire exclusion, grazing, timber harvest, road and railroad construction and other management activities have changed the biological and physical characteristics of the landscape from the reference condition.

1. How have vegetative conditions changed since the reference era?

Exclusion of fire from these three drainages has not had a significant impact on the basic hydrologic function. The additional vegetation that has come to occupy the uplands and riparian lands may have increased the amount of precipitation that is intercepted by the plants and evaporated into the atmosphere. Also, the additional vegetation likely transpires a larger percentage of available soil moisture, requiring more of the annual precipitation to be dedicated to the recharge of soil moisture than the groundwater table. These effects in combination may have some impact on the amount of groundwater in the system. The effect on groundwater would be most pronounced in years with below normal precipitation. In these years, the percentage of the precipitation that is dedicated to the recharge of soil moisture is higher, with less infiltration making it to the ground water.

Grazing has, over time, aided in the removal of deep rooted vegetation such as willow and sedge from the riparian systems. This change tends to lower the stability of the easily eroded pumice channel banks. In the most heavily and frequently grazed areas, bank erosion, channel entrenchment, and loss of channel sinuosity has resulted. In the Hog, Yoss, and Skellock drainages observed examples of this change in condition appear to have been caused by grazing activities occurring 20 or more years in the past. Where there has been no grazing in recent years, revegetation with non-native grasses has occurred, however the deep rooted vegetation needed for channel bank stabilization has generally not reestablished.

The effects of timber harvest activities over the past 70 years on hydrologic function can be placed in two categories: cutting and yarding; and construction, use, and maintenance of the transportation system. The cutting and yarding activities' effects are limited to direct impact of past poor logging practices (yarding down, across, or parallel to existing riparian and channel systems). Observations in the Hog, Yoss, and Skellock drainages do not indicate detrimental effects from widespread soil compaction or channelization of run-off due to logging practices.

Roads and railroad grades, constructed primarily to transport harvested timber, generally have a more frequent direct effect on hydrologic function. Roads that cross riparian areas and stream channels funnel surface flows through culverts, restricting water movement to one small portion of the valley bottom. Often these concentrated flows down-cut existing channels both up and downstream from the culverts. In cases where a channel did not exist before the road construction, flows concentrated by the culverts have resulted in development of an actively eroding channel. Every riparian system in Hog, Yoss, and Skellock watersheds has been impacted.

Another less common example is the location of roads and railroad grades in ephemeral channels, or immediately adjacent to intermittent or perennial channels. In these cases surface flows are restricted to a narrow path, and the natural adjustment of the channel to disturbances is no longer possible. This results in channels with lower sinuosity, which become entrenched, with actively eroding channel banks.

Ranchers and farmers on private lands have, in the case of the Hog Creek drainage, diverted and channelized surface flows to drain wet areas and irrigate pasture lands. This has interrupted the natural recharge of groundwater and increased the efficiency of moving surface flows off site, thus reducing the potential for perennial flows.

Characterization of Reference Era Vegetative Conditions

Major plant associations:

The major plant associations that were present in the reference era are still present today. The main difference between present associations and the reference era, is that the associations historically developed under a fire regime that favored some plants more than others (ex. Ponderosa, aspen, willow associations responded positively to fire whereas lodgepole, white fir, bitterbrush were not as extensive as they are today). Another difference between reference era meadow associations and present associations is the introduction of non-native grasses (Kentucky bluegrass) and forbs (dutch clover). Ponderosa pine stands were more open-grown and consisted of older trees with little understory development due to active fire regimes. Shrubs and young trees had much lower densities. Basin lodgepole stands were more open, and wet lodgepole associations were more confined to cold, wet drainages. Mixed conifer stands were kept to higher elevations of Solomon Butte and Applegate butte, due to the frequent fire occurrences. According to old land survey documents, the willow and aspen associations were more extensive than they are today. Reference era characteristics are summarized below:

- Reduced mixed conifer (likely less than 5% of the area)
- Reduced lodgepole pine (likely less than 10% of the area...most of the lodgepole pine-bitterbrush-needlegrass was ponderosa pine-bitterbrush-needlegrass)
- Where lodgepole was the dominant tree species, it was present in lesser amounts, lodgepole stands were typically 10-20 mature trees per acre with lots of shrubs and grass in the understory.
- Increased ponderosa pine (likely over 75% of the area)
- Increased meadow

Characterization of Current Vegetative Conditions

Major plant associations

As stated above, the major plant associations have not changed. The current conifer associations generally are more densely stocked, and due to timber harvesting combined with fire suppression, contain more understory vegetation (both young conifers and bitterbrush) and less grass. The mixed conifer associations have expanded their range on Solomon Butte and Applegate Butte. Aspen and willow associations occupy less area than during the reference era. Results of Proper Functioning Condition (PFC) information collected show that many of the willow stands appear to be fading out due to old age (50+ years). In addition, conifers have encroached into some areas that were at one time occupied more by willow and/or aspen. Wet meadow associations are still present, but due to past management activities occupy less space. Moist and dry meadows have been slowly and progressively moving into areas that were once tufted hairgrass and/or sedge dominated. *For a complete listing and map of the functional condition of streams examined in the Analysis Area, see Appendix B.*

Willow and aspen are present in greatly reduced amounts. Scouler's willow (an upland species) is represented by fewer numbers and is mostly very old. Scouler's willow is a valuable wildlife forage when the plants are young (less than 30 years). Most individual plants in this watershed exhibit reduced vigor and very poor forage opportunities due to old age.

Management Activities that Brought About the Changes

Management activities that brought about the changes to the riparian plant associations have primarily been agricultural development (pasture lands, water diversion), fire suppression , and road construction associated with timber harvest. Major lowering of the water table in this analysis area and the upper Williamson area probably occurred at the time that the Kirk reef was lowered, about 1908. The introduction of exotic grasses and forbs probably started when the native people were forced to change from food gatherers to farmers and ranchers. Private acquisitions and agricultural development of Indian allotments in and adjacent to the analysis area also contributed to the influx of exotic species. Fire suppression activities allowed more conifers and understory brush to become established.

Selective timber harvesting reduced ponderosa pine stocking, and coupled with fire exclusion, allowed lodgepole pine to expand into areas previously dominated by ponderosa pine.

2. Has biodiversity, as reflected by the variety of plant association/seral stage combinations and their distribution, been reduced as a result of higher conifer/brush stocking levels?

Reference era plant associations were primarily composed of species adapted to recurring fire regimes. There were more older ponderosa pine stands with very little young conifer and upland brush (bitterbrush) stocking underneath. This was primarily due to the fire cycles which tended to remove most understory vegetation. The understory vegetation was primarily composed of dryland grasses and forbs that could respond favorably to fire. The lodgepole pine associations occupied cold air drainages, basins, and riparian areas, as they do today. During the reference era, lodgepole was probably more open-grown in the basins. Lodgepole associations in the drainages and wetter areas came in fairly thick, but with the fire regime in the adjacent ponderosa pine stands, it expanded and retreated with fire occurrence. Lodgepole probably did not attain the old growth character prevalent today, as a result of fire suppression activities over the last 70 years. It was probably more in the early to mid seral stages across the landscape. The willow and aspen communities probably occupied more areas and tended to be favored by fire occurrence. Mixed conifer or pine-associated communities tended to have less fir, and occupied less area than they do today. Reference era mixed-conifer associations were probably more restricted to north and northeast slopes of Applegate Butte and Solomon Butte. These reference era stands contained a relatively small fir component and would be dominated by ponderosa pine and sugar pine. Currently white fir has extended its range down slope, and onto southern slopes. The primary reasons for this are that timber harvesting has selectively removed the ponderosa pine due to its higher commercial value, and fire suppression has kept fire out of areas that were subjected to a frequent fire regime.

With the advent of fire suppression, timber harvest management, and associated activities, the structure and composition of the pine type changed. Many or all of the larger pine were removed. Regeneration of pine and white fir developed into heavily stocked pole and small tree components. These activities also tended to encourage longer term expansion of non-fire tolerant plants such as bitterbrush,

lodgepole, and white fir into areas they normally did not occupy for long periods of time. The effects of these plants on biodiversity has changed the components of the plant associations, (less grass and forbs, less willow and aspen) which in turn has changed the distribution of wildlife species and their use of these communities. Fewer hardwood-obligate neotropical birds and larger big game populations (1950's increase in deer, present increase in elk populations) are common examples. The changing of open-grown ponderosa pine to mid to older aged pine with heavier stocking of young conifers and brush, has made less of the total water supplied to the analysis area available to riparian communities. This has changed some plant species composition and tended to increase the moist and dry riparian communities, and decrease the wet riparian communities within meadow and drainage systems. The overall riparian bands within the analysis area do not appear to have decreased significantly in total acreage, since they tend to be governed by soil type as well as water. The quality of the riparian plant species has decreased since the reference era. Increased conifer stocking combined with grazing management activities has reduced the range of the aspen and willow communities. This, along with the change in timber stand structure, is probably the most significant change in the analysis area.

3. What are the effects to the hydrologic function of Hog, Yoss and Skellock drainages from encroachment of conifers and upland brush into the riparian areas?

The basic hydrologic functions of precipitation, infiltration, groundwater recharge, and intermittent stream flow are not significantly effected by the encroachment of conifers and upland brush into the riparian areas. This encroachment is a symptom of other changes, such as exclusion of the vegetation stimulation properties of natural fire, drought, exposed mineral soil from intense grazing activities, and the localized lowering of groundwater tables from incised stream channels. Encroachment may have some minor effect on the local water balance by increasing the portion of annual precipitation committed to evapotranspiration. This may locally intensify drought conditions on competing vegetation and may reduce groundwater recharge. This local effect is very small compared with the overall effect of the drought itself.

4. What indicators/parameters exist in Hog, Yoss and Skellock drainages of downward trends in the biological and physical characteristics of these landscapes?

Biological Indicators

Plantation situations

Most effects of soil compaction are visible in plantations. There are relatively few plantations over five years of age in the area, and most show no negative indicators.

In soil compaction studies, reference is often made to changes in conifer growth rates and characteristics. These characteristics, found on sites with identified detrimental compaction, include good early reproduction and growth, generally in the five year range, then slowing growth and stunted, non-symmetrical development and limited root development.

In the analysis area these characteristics are rare. Portions of the Lamm units (plantations approximately ten years of age), have seedlings exhibiting stunted, deformed growth (interestingly this is not much different from the form exhibited by seedlings of "off-site" stock that was always blamed on the seed source rather than any site condition, such as soil compaction). The Lamm units are not off-site stock, so either a planting problem, frost damage, or soil compaction is highly suspect. There is reduced height growth present in areas of the Yoss creek plantations. Most or all of this is due to localized high populations of white pine butterfly and multiple-year top damage that has resulted. Using plantation evidence as an indicator shows less than 1% of the area in a potentially detrimental soil compaction condition.

"Wild" or second growth stands

Most acres in the area have been logged multiple times. No indication of loss of growth or deformity is present. Conversely, stand productivity appears to be increasing.

Stocking levels

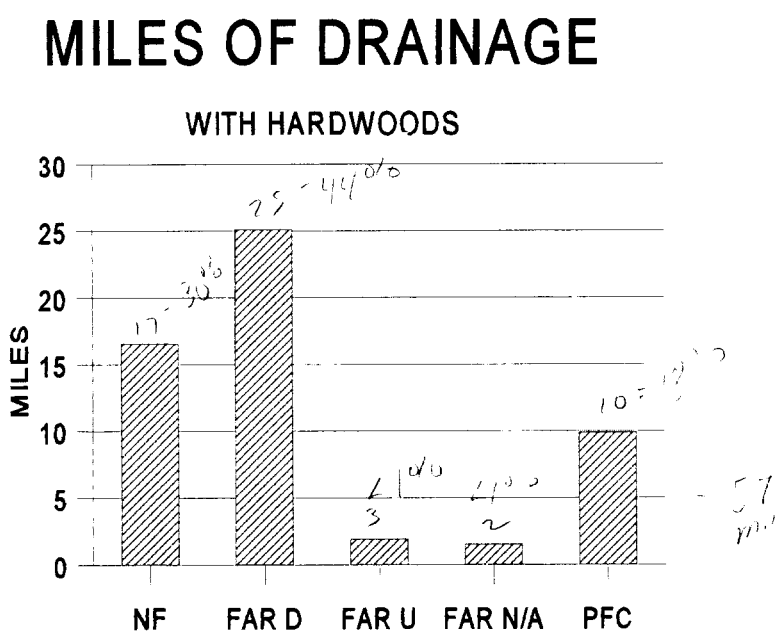
Stocking levels and growth rates are higher than at any time since logging began. Many factors affect growth, some which may mask effects of a specific condition such as moderate soil compaction. However, stocking levels and growth rates, with the exception of the areas discussed, cannot be used to confirm detrimental compaction.

Hardwoods/brush

Along most drainages within the analysis area most willows appear to be in the later seral stages (overmature, decadent), and/or being overgrown with lodgepole. The graph at right shows the approximate miles of drainage in each functional condition, as defined by protocol established by the B.L.M..

LEGEND

NF ---------Non-Functional
FAR D-----Functional At Risk, Down Trend
FAR U ----Functional At Risk, Up Trend
FAR N/A- Functional At Risk, Trend Not Apparent
PFC---------Proper Functioning Condition



One of the reasons most of the trends are downward is the deteriorating condition of the hardwoods. There are some areas with young willows present that are maintaining themselves. There are some areas that have young willows that are being browsed by livestock and wildlife (Corral Springs), and some areas that have not been used by livestock, but are being utilized by elk (Meadow Creek).

Physical Indicators

- ☹ Channelization caused by roads/vehicular traffic
- ☹ Presence of active headcuts
- ☹ Side bank and side slope erosion
- ☹ Presence of increaser/invader vegetative species
- ☹ Encroachment of conifers in meadows
- ☹ Loss or drying of riparian zones
- ☹ Soil compaction from past logging activities

5. How has private land management within Hog, Yoss and Skellock affected the streams and their adjacent riparian areas?

Private Agricultural Practices

Livestock grazing/pasture management

Agricultural practices have affected these watersheds in several ways, which cumulatively have impacted the aquatic systems and their associated riparian zones. Impacts have been from several sources, including:

- ☞ Channelizing meadows to increase grazing areas, diverting water for irrigation.
- ☞ Dewatering of Klamath Marsh.
- ☞ Diverting water for irrigation
- ☞ Removal of woody riparian vegetation.
- ☞ Removal of beaver from the watersheds.
- ☞ Changes in species composition of herbaceous riparian vegetation
- ☞ Livestock grazing and pasture management

The primary agricultural activity in and adjacent to the analysis area is the summer pasturing of livestock (cattle). During the early development of the private lands some areas were used for growing hay, as well as for pasturing livestock. It is felt that after the late 1950's, the practice of growing hay was significantly reduced on most of the private lands.

There does not appear to be any recognizable pasture rotation system established on the private lands within most of the analysis area. The primary method of pasturing livestock was that as soon as feed and weather conditions permitted, livestock were turned out. When conditions dictated (either lack of feed or inclement weather), the livestock were removed from the area. This practice does not appear to have changed significantly. The permittee who controls most of the private ground on Hog Creek brings livestock onto private lands just prior to turn-out time on public lands, moves them to public lands when the permit allows, then returns them to private lands after public lands close.

Most of the livestock grazing activity is taking place downstream of the current perennial reaches, therefore impact could potentially be more severe. In situations where livestock are allowed to concentrate in perennial stream reaches, aquatic fauna are threatened by habitat destruction as well as erosion of water quality. In addition to reduced flows, higher temperatures and reduction of cover due

to channel and riparian destruction, livestock can increase organic loads in streams by spending extended periods of rest time there. Via defecation and urination in and along stream channels, bacteria such as fecal coliforms rise in concentration. The effect of increased bacterial loading amplifies the temperature increase by reducing the maximum lethal temperature of the aquatic fauna. As the stream warms, more species are lost (compared with clean water) due to the additional stress incurred by the immune system's attempt to protect from infection, due to the higher concentrations of bacteria.

Actual livestock grazing does not appear to have caused severe channel incision on these watersheds as would be expected in watersheds with greater geographical relief. Most of the habitat degradation appears to have been caused by land reclamation activities such as channeling and beaver removal, which causes dewatering, and subsequent defoliating of riparian zones.

It is difficult to differentiate sources of riparian vegetation destruction between land reclamation activity and direct impact of livestock. However, it is well documented that livestock trampling can and does prevent reestablishment of riparian vegetation. The cumulative impact to the environment from these two sources has been large-scale. Modification of grazing practices will probably improve riparian vegetation condition and the stream habitat, but reversing the greater effects of channelization will be slower.

Diversions, ditches

It appears that most of the ditches on private lands were established during the early development of the area, probably during the 1920's or 1930's. Most of the ditches were abandoned by the mid-1950's, but some were re-established in Hog Creek and White House Flat during the 1970's. The primary function of most ditches has been to drain excess water from the wetter pastures and/or divert water to drier sections for mid to late summer irrigation.

Timber Harvest

Timber harvest has occurred on most private lands within the analysis area, and is still occurring due to the current shortage of timber. Timber harvest activities have taken place in and adjacent to most meadow areas. Constraints on these practices have been significantly less than on adjacent public lands.

Complete removal of overstory conifers along meadow edges may detrimentally reduce the conifer component, removing needed shade for cool-season grasses in transitional zones between the meadow and drier upland communities (desertification). This effect can change a moist meadow community to a dry meadow or upland conifer/brush community, and may increase compaction in these areas, resulting in reduced rooting zones and plant growth.

The debate of whether overstocked forests reduce water supplies continues, but regardless of this factor there appears to be sufficient water supplies in strategic reaches of these streams to support aquatic species, given the availability of proper habitat. The stream's ability to recharge its entire aquifer could have a much greater impact on perennial flow than overstocked forests. Streamflow reduction from timber overstocking would have the same effects as other causes, except that it may function higher in the watershed, and have more impact on water flow from springs that provide water to most of the isolated stretches of perennial streams. Impact to the perennial flow zones has the most direct effect on isolated aquatic fauna populations. Reduction of flow here reduces environmental buffering from

severe drought. Reduction of flow also reduces wetted habitat and the added population that would provide a larger brood stock to improve genetic variation within these isolated populations. The direct impact of conifer overstocking to stream desiccation warrants further study.

Subdivisions and Housing Developments

Subdividing of some adjacent lands has occurred, but development has not been extensive. This is primarily due to the weather conditions (short growing seasons, and very dry/dusty summers) in this area. There are a few more residences adjacent to the analysis area, but not enough to make a significant impact.

Subdividing lands has led to increased water consumption and further modification of conifer and meadow communities, but the associated impacts are still considerably less than the past and present effects of grazing and timber harvest.

Cumulative Effects

Habitat modification

Fauna

The cumulative effect of agricultural practices has reduced water storage in the local aquifer, which in turn degrades perennial stream reaches to intermittent or ephemeral classifications. These watersheds historically maintained streams which supported beaver and healthy riparian vegetation. These two ecological components strongly indicate a perennial system. Given the shade, cover, and habitat provided by healthy riparian zones and beaver ponds, these streams would support many of the native aquatic fauna of the Williamson River drainage, including Redband Trout. Even though evidence strongly suggests isolated populations of trout existed in these watersheds during the reference era, occupation may not have been continuous. Eventually these small isolated populations could succumb to temporary elimination due to such factors as severe drought, loss of habitat, or inbreeding. In these cases a periodic aquatic connection to Klamath Marsh would be necessary to either repopulate the system or provide genetic outcrossing necessary to sustain the viability of the isolated populations.

Considering the anecdotal history of Klamath Marsh, it seems very possible that spring runoff water can periodically rise to levels necessary to flood the lower portions of these streams. This may allow access by Williamson River and Klamath Marsh aquatic fauna, particularly spawning runs of Redband Trout (See Historic Water Level maps on pp. 16,17). According to Rod Johnson (personal communication), during spring and early summers in the 1970's, he caught Redband Trout from natural channels of Klamath Marsh between the Silver Lake highway and the Kirk area. This information indicates trout were present in areas of the watershed that, during times of peak run-off, would allow their access to analysis area streams. Hydrographs from the Williamson River gauge at Kirk show that monthly flow quantities for March and April, 1956 to 1958, were approximately twice the average flow measured during the 1970's, and approximately 50% greater than the high average of the bimodal distribution of the 1970's. This indicates an increased potential for connectivity in at least two of the forty years of data analyzed (1954-1994).

Local history indicates an active land reclamation program of riparian defoliation and beaver removal since the reference era. Much of this program was aimed at the meadows lower in the watersheds. Presently these areas contain few or no natural channels through them. Channels may have originally existed here, but by removing channel stabilizing riparian vegetation, there remains very little integrity in meadow soils. When water comes down out of an established channel, then runs over an area of low integrity, its energy is dissipated, thus losing its focus and ability to maintain a single channel. Beaver also assisted in the maintenance of these channels.

Wind action works with the dispersed hydraulic energy of undefined channels in pumice soils to eventually fill in and eliminate the channel. This interaction may have eliminated channels in several meadow areas, particularly in Yoss Creek. Water diversion projects may have effected the same net result in the Wilson Flats section of Hog Creek.

Aquatic access to Klamath Marsh and the upper Williamson River would be more frequent if continuous defined channels existed throughout the analysis area watersheds.

Following are the most significant cumulative effects of habitat modification:

- Reduction of the potential for periodic aquatic connection to the Williamson River
- Elimination of habitat, particularly beaver constructed habitat
- Reduction of perennial stream length

There are existing isolated areas of perennial streams that could support Redband Trout, especially in Hog Creek. What appears to be lacking are sufficient pools to provide rearing space and cover to sustain the fish. Most likely this habitat was historically provided by beaver ponds. Hankin and Reeves Level II stream surveys on perennial reaches of the analysis watersheds would quantify habitat and further characterize habitat needs. These surveys have not yet been undertaken, but are listed in the recommendations section of this document.

Local habitat rehabilitation, via improving aquifer levels, will improve habitat for fauna that has terrestrial access. Aquatically obligated fauna require aquifer and habitat improvement throughout the system, to the lowest point of the access path, which in this case is Klamath Marsh. Therefore, to provide the periodic aquatic access that allowed these watersheds to be populated by aquatic fauna from the Williamson River, each of the marshes in each of the systems needs to be brought to historic levels of saturation. This includes Klamath Marsh. With these marsh systems at saturation levels prior to spring run-off, the high spring flows are better able to connect the systems, rather than compensate for the deficit in the aquifer.

Flora

The effects of livestock pasturing and ditching have significantly altered the hardwood community which provides shade, filtering, and bank stabilization along Hog Creek. Introduction of non-native grasses has also changed the riparian plant community. Some of these introduced species have shallower root systems, which are not as effective in stabilizing banks and filtering water systems. Most of the remanent hardwood communities on private lands are mature and/or decadent.

Rehabilitation reconstruction

Future habitat reconstruction efforts need to consider that habitat modifications have played interdependent roles. The Trout and other aquatic species require suitable habitat, most likely provided in large part by beaver. Beaver require hardwood vegetation for feed and to create structures (dams). Hardwood riparian vegetation require access to moist soils, which is provided by a healthy aquifer. The aquifer requires hydraulic control points high enough to allow the stream access to its flood plain, in order to provide periodic connectivity to the Williamson River via Klamath Marsh, and perennial flows to historically perennial stream reaches.

Besides channelization, anecdotal history indicates there was a reef on the Williamson River near Kirk, that was removed in approximately 1908 to dry out Klamath Marsh. It is probable that resaturating the marsh, via eliminating ditches and restoring the reef, will benefit the watersheds analyzed here. However, consideration should be given to the impact of a water deficit that would be incurred downstream in the Klamath Basin during the period required to resaturate the marsh. If the Kirk reef had most of its effect on surface runoff of the marsh, and did not affect the hydraulic control of the groundwater, then water flow from springs in the lower Williamson River would not be harmed and may actually be augmented due to greater infiltration of surface waters into Klamath Marsh.

6. What are the impacts to the watershed of maintaining current vs. reference era vegetation stocking levels?

Current Stand Conditions

Impacts related to fire hazard

Fire hazard within the watershed is associated with litter accumulations and ladder fuels. Due to cold winters and dry summers, litter deposition in the watershed proceeds more rapidly than decomposition, resulting in a net increase in dead fuels each year. Litter fuels within the watershed are represented most commonly by Ponderosa pine needles and branchwood. Ladder fuels are represented mostly by bitterbrush and young tree reproduction. As bitterbrush plants age they become more flammable, due to the amount of dead branches on the plant. Dead branch material increases significantly after plants are 20 years old. The average age of bitterbrush within the watershed is over 40 years. A volatile combination of fuels exists in much of the watershed where pine needle litter is suspended in decadent bitterbrush plants. This can increase flame lengths as much as ten-fold over those in either fuel type alone. Needle-draped old age bitterbrush is the most significant fire hazard within the watershed and is the primary potential driver of stand-replacement type fires. This fuel occupies over half of the acres within the watershed.

There has been little impact to the watershed by actual fire suppression, rehabilitation and restoration activities, due to the small percentage of the watershed that has burned. As wildfire sizes grow, suppression impacts will become greater. These will be associated primarily with soil compaction caused by dozer line construction, and phosphate-based retardant pollution that may accidentally enter waterways. Potential rehabilitation and restoration impacts include those associated with timber salvage (soil compaction that may reduce productivity, microclimate changes that may shift successional pathways), and introduction of exotic species associated with soil stabilization techniques

(hay bales and grass seeding).

Although there are notable exceptions, most of the forest stands throughout the watershed are overstocked. That is, there are more trees (and understory shrubs) than the ecosystems can sustain. Competition for sunlight, moisture and nutrients limit growth and vigor making individual trees and shrubs more susceptible to insect and disease mortality.

Currently, there are active insect mortality centers in mixed conifer stands on the northeast slopes of Solomon, Applegate, and Calimus Butte. In addition to the mixed conifer mortality, there are mortality centers in riparian lodgepole stringers scattered throughout the analysis area. Without reductions in stand densities, these mortality centers will expand and eventually reach epidemic levels.

The mortality associated with competition, insects, and disease predispose areas to stand-replacement wildfire. As dead trees fall to the ground, the fuel load and depth increase dramatically. Currently, there are only small areas with dead and down. However, within 10 years most of the current standing dead within the watershed will fall to the ground, greatly increasing wildfire hazard in those areas.

Without stand density reduction, continued mortality will add additional standing dead as the current standing dead begins to fall to the surface. Wildfires occurring in areas with heavy dead and down fuel loadings will cause much greater damage to the soil and potentially reduce post-fire productivity. This is due to the increased heat pulse duration associated with burnout of large fuels such as tree boles.

Those areas within the watershed that have been harvested or precommercially thinned recently (within the last twenty years) are experiencing much less mortality and have much lower fire hazard.

Prescribed burning impacts

About 12,000 acres (fifteen percent of the watershed) have been prescribed burned within the last twenty years. These individual areas are relatively safe from stand-replacement level wildfires, however the acres are scattered throughout the watershed, providing little landscape level hazard reduction. In order to make a substantial reduction in stand-replacement fire potential, reduced hazard areas should be at least 1/4 mile wide and extend across the watershed. This is due to spot fire production associated with high intensity wildfire.

Until about 1990, most of the prescribed burning was machine pile burning. The piling likely adversely affected soil productivity in some places through compaction and displacement. The burning adversely affected soil productivity (in the areas immediately under the piles) through the physical (increased bulk density and decreased organic layer), chemical (decreased cation exchange capacity and reduced nutrient content), and biological (at least short-term decreased microbial populations) impairments associated with the long-duration heat of a pile burn. The intense heat effects associated with pile burning generally affect less than one percent of a piled and burned unit. Compaction and displacement may cover a much greater portion of a project area; in some cases as much as fifty percent of a treatment unit is affected.

Since 1990, most of the burning has been broadcast underburning or "jackpot" burning, which imparts to the soil a much lower heat flux for a much shorter period of time, and has none of the negative effects to the soil associated with machine pile burning.

Impacts related to insects and disease.

Competition induced stress

Most stands are at high risk now, or will be within ten years. Highly stocked stands are excellent habitat for almost every insect and disease problem these species are susceptible to (Pandora moth appears to be a noteworthy exception. Pandora moth used to be an active defoliator, although not necessarily causing mortality. It appears that Pandora moth is not active in areas of dense canopies or where soil is covered with deep litter.). If the habitat is present the pathogen will come, the only question is when and which one. Most likely candidates are:

- ☹ *Mountain and Western Bark Beetle* - These are always present in endemic levels, and have a cyclical major epidemic cycle of 50-80 years. Current stand conditions may invalidate the cyclic pattern. The last major epidemic occurred 1915-1935. Currently larger and older sugar and ponderosa pine are dying, in part from bark beetles. Western and Mountain Bark Beetle generally can only successfully colonize and kill trees greater than 8" DBH, the limiting factor being cambium thickness.

- ☹ *Ips pini* - These are present in endemic levels and, in the past, have not been a major agent of mortality. Ips attack smaller diameter (2-8" DBH) pines. Mortality from Ips is occurring in very small pockets. Current slash retention policies will support Ips populations, as they use green slash to overwinter. With the large amount of small pine, an Ips epidemic is likely. Ips can colonize trees with thin cambium layers, especially if they are weakened by environmental effects such as drought.

- ☹ *Root Rots* - Several species of root rot are present in the soils of probably all acres in the area. Currently most dramatic root rot mortality is seen in large sugar pine. It is probably the major predisposition to death, with bark beetles operating as opportunists.

Whatever agent(s) become more active first will determine the rate of mortality and the portion/species of stand killed. High levels of mortality can reasonably be expected. The greater Basin area was estimated to have lost 100 MMBF per year to mortality for many years during the 1920's Bark Beetle Epidemic. Stands were reported to incur mortality up to 60%. These figures came from a much lower growing stock base, and when 100-200 MMBF per year was harvested. Next time mortality will be much higher if an epidemic builds and runs its complete course. With the current fire hazard level that's probably not possible, so actually the insect and disease discussion is relatively unimportant at a landscape level, due to the potential for stand replacement fires. Where the insect and disease discussion is important is for the stands which escape burning, and especially in considering stand cultural treatments to maintain those stands.

Exotic diseases

With increasing imports, despite the best precautions, the risk from exotic diseases increases. Their consequences are anyone's guess. Most diseases which currently attack the stands present in H,Y&S have evolved in a predator/prey type relationship over a very long time. Since these insects and diseases need their prey, they never totally eradicate them. Exotic diseases have not developed limiting mechanisms to protect their prey base.

Linkage between insect-disease mortality and fire hazard increase

There is a synergistic effect between insects and fire in high stress stands. Most mortality in pines is caused by bark beetles. Bark beetles reproduce in the cambium layer of low vigor live trees or recently dead trees. Bark beetles are attracted to burned areas, where they will find many recently killed trees suitable for reproduction. This increases beetle population levels, which may then attack adjacent live trees. This causes more mortality, which if not removed, becomes fuel for future fires. In white fir there is less of a link. Surface fires may reduce/deepen activity of root rot pathogens.

Silvicultural impacts

Only the Ponderosa pine type is discussed here. In this area there is essentially no "white fir" type if referencing historical types. The lodgepole type is split between wet and dry types. The wet types are basically lodgepole domination of riparian types discussed earlier. The dry lodgepole type is a much more complex situation. The historic condition of dry lodgepole is contradictory and unclear. Essentially none of those acres were in lodgepole over 4" DBH in 1920. These sites may have been a highly varying type with small lodgepole patches, some scattered pine, and mostly a grass/brush type or dry ponderosa pine savannah. In any of these conditions these stands would not be managed as a timber production area, so are not discussed further.

Ponderosa pine type, including current mixed conifer

Harvest activity and frequency - Under the "current condition" description, there are actually a wide range of activity types and they change rapidly. However, there are still many common elements seen in most current activities:

- Relatively light cuts (although they may appear heavy when compared to surrounding stands), which maintain a fully stocked stand, under intertree competition of conifers. These prescriptions do not improve tree vigor in the long term and may not reduce the risk of stand replacement wildfire.

- Heavy cuts, clear cuts or seed trees, which are then planted or designed for natural regeneration of high numbers of trees which soon develop to a fully stocked or overstocked stand.

Both of these harvests utilize silvicultural activities which are designed for a high maintenance, intensive forestry regime dependent upon regular stand tending. Entries occur approximately every 20 years, and have potential for a high degree of site disturbance due to the large number of stems removed or destroyed in each entry. Each entry generally consists of three activities; harvest, planting or thinning, and fuels treatment. While these are intensive operations, they often do not open up the site enough to allow activities such as underburning or subsoiling. More slash is left untreated. A high degree of silvicultural activities and fire protection is necessary to sustain these conditions. Fire suppression activities will continue to be intensive, with large amounts of cat line construction needed, air support often needed to hold lines, and frequent occurrence of large stand replacement fires.

Reference Era Stand Conditions

Ponderosa pine historic range

To date, implementation of prescriptions to emulate qualities of reference era type stands have not occurred on an operational basis, so many of the "hows" are open to speculation. A common element of this type of stand prescription would be to develop stands that function more at an individual tree level, rather than on a stand level. This requires developing a stocking level which allows for population limiting mechanisms other than timber harvest, stand replacement wildfire, or insect events. Potential population limiting mechanisms include:

1906 photo showing reference era stand conditions.

- Establishment of non-conifer competition (grass/forbs/shrubs/hardwoods) which is more able to adjust to fluctuations in water and nutrient availability than conifers. This is to buffer direct intertree competition.

- Development of a stand structure which allows the return of a more frequent surface fire interval. This is to utilize fire to reduce the amount of conifer regeneration in the stand, and allow the potential for occasional stocking reduction of larger trees.

Harvest activities would be used along with fire to maintain this stand structure. Harvests might remove 10-30 trees per acre and would be a much less intensive activity than current harvests and related activities. The removal of fewer trees per acre and the lack of thinning and fuels treatment would greatly reduce many of the potential problems with current harvest entries. Skidding activities would be very minimal, negating the risk of compaction and mechanical disturbance to the site. No mechanical thinning or fuels treatment activities would be needed, as an underburn would meet those needs. Planting might very rarely be done to meet specific objectives. Small cover patches or very light (50 trees per acre?) underplanting might be done for wildlife cover, or to insure a minimum conifer stocking level or species mix. Fire suppression would still be necessary, but probably would not require cat lines or retardant support. Fires could be controlled by burning out from the nearest road or handline or natural break. Stand replacement fires should be non-existent in the ponderosa type.

Transition Stand Conditions

While the idea of managing reference era stand conditions may have a certain appeal, there are many associated problems. To start with, you probably can't get there from here, at least not across a large landscape, in a human lifespan.

The scale of activities needed to make a transition from current to reference era stands across a landscape in enormous. Just in this small analysis area there are approximately 60,000 acres of highly overstocked stands. To culture them in a manner to develop a reference stand type would often require removal of 100-500 stems per acre. Many of these stems are of non-commercial or chip material size. There is only so much demand for chips, and smoke management objectives limit burning. The transition activities would be more intensive than current harvest activities, although there would also be more opportunities for improvement activities such as subsoiling.

Some stands still have a large tree component not that different from the reference era stands, and could theoretically be converted immediately to a stand with at least some of the structural characteristics of reference stands. However, large tree mortality is occurring now, so options for this treatment are ending.

Many objectives preclude harvest of large amounts of acres in a short time frame.

Current Stand conditions after wildfire.

C. The current risk of stand replacement events from wildfire, insects and disease appears to be increasing.

1. How do the current and reference era risks of stand replacement events differ in terms of frequency and susceptibility?

Ponderosa pine plant communities were relatively immune to stand-replacement type wildfire due to the frequency of low intensity fires. Wildfires burned the watershed on an average of every 5 to 15 years. These low intensity fires prevented buildup of fuels so that each individual fire burned with very low intensity, rarely torching out more than a few trees at a time.

Lodgepole pine plant communities experienced fire less frequently due to the short-needle, compact surface litter layer, and lesser amounts of litter produced in the early stages of growth. These fires had a range of intensities from very low to stand-replacement levels, and likely burned these communities every 20 to 50 years.

Mixed conifer plant communities experienced stand-replacement wildfires of 20 to 100 acres on a frequency that would cover the entire area every 100 to 300 years. Stand-replacement intensities were minimized by surface fires that killed few trees on an average of every 20 to 30 years. As the interval between surface fires increased, more torching and crowning occurred. When many years (more than 50) elapsed after a low intensity surface fire, stand-replacement wildfire followed.

Current fire intensities in ponderosa pine are quite high due to the accumulation of dead and down litter and the increased amount of understory vegetation (primarily bitterbrush). Without aggressive initial attack most fire starts would have the potential for substantial stand-replacement acreage.

Lodgepole pine communities are starting to die off due to old age and overstocking. As large amounts of heavy fuels accumulate at the surface, stand-replacement fire potential increases. Those stands that are less than 40 years old generally have not accumulated enough litter to drive a stand-replacement type fire. Where needle-draped bitterbrush occurs or large woody debris has accumulated, stand-replacement type fires may occur.

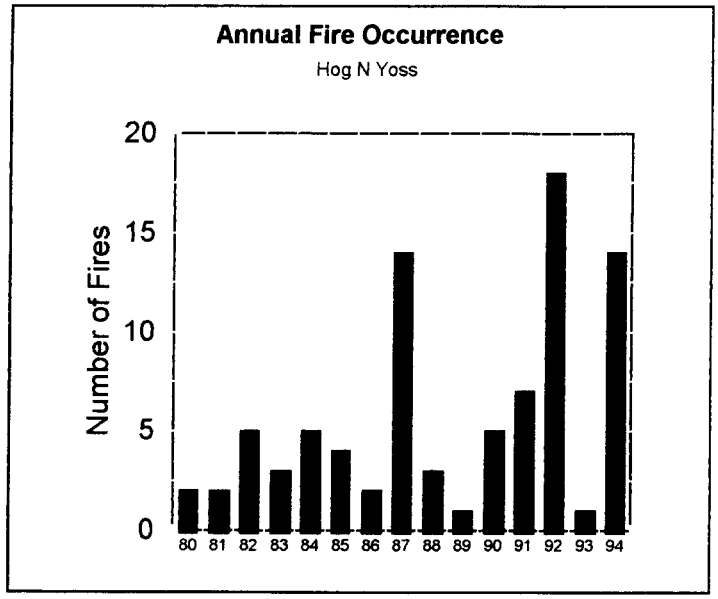
All mixed conifer stands that have not been thinned are now predisposed to stand-replacement type wildfire. This is primarily due to ladder fuels of shrubs and young trees.

Human-caused fire occurrence fluctuates for many reasons. We should assume, however, that occurrence rates will remain the same or increase (if forest visitor/user numbers increase). Currently, the watershed experiences about one human-caused fire per year.

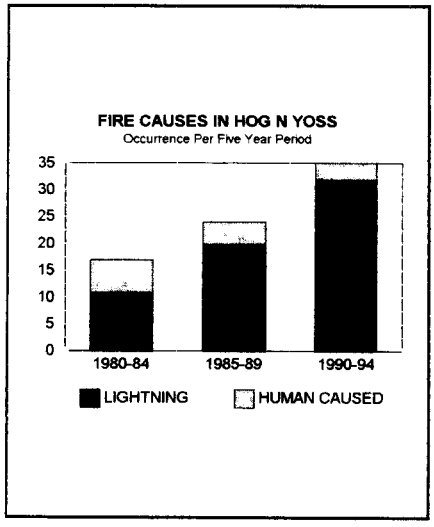
There is evidence that suggests that while numbers of downstrikes likely have not changed, their probability of starting fires has increased. Total lightning-caused fires in the watershed have increased during the last fifteen years from approximately two fires per year to over six. The likely reason is that fuel accumulations provide more continuous receptive fuels so that each downstrike has a greater chance of hitting fuels that will ignite and continue burning. The lightning storm of June 1994 is a good example. Only 10-12 downstrikes caused 8 fires, one of which grew to over 140 acres (Cole Fire).

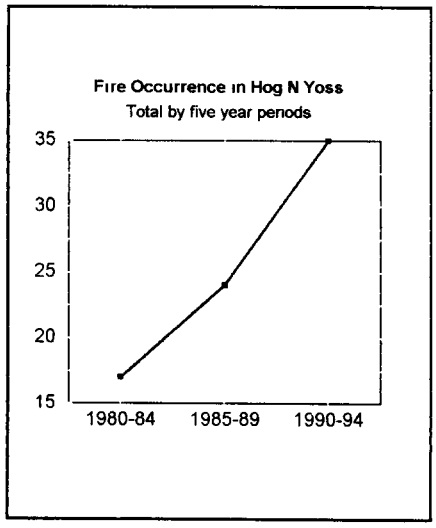
Annual acreage burned within the watershed has increased from 2 acres per year to over 50 in the last fifteen years. Percentage of these acres in high severity burns has risen from 25% to over 90% during this time period.

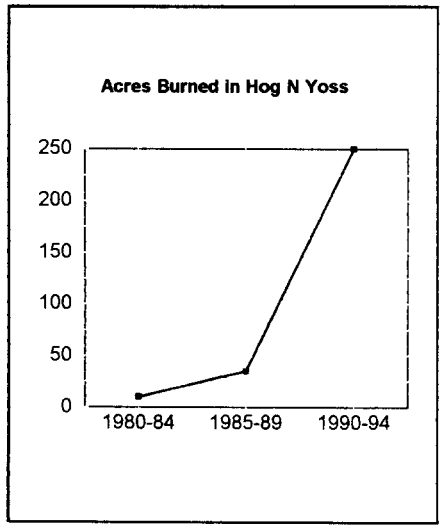
During the past fifteen years (1980 - 1994) there have been 86 wildfires within the Hog, Yoss and Skellock watershed analysis area. Fire occurrences average 5.7 each year, but has varied from eighteen in 1992 to only one in 1989 and 1993.



Although total human-caused fires have decreased, total fire occurrence and acreage burned within the area have increased over the past fifteen years.



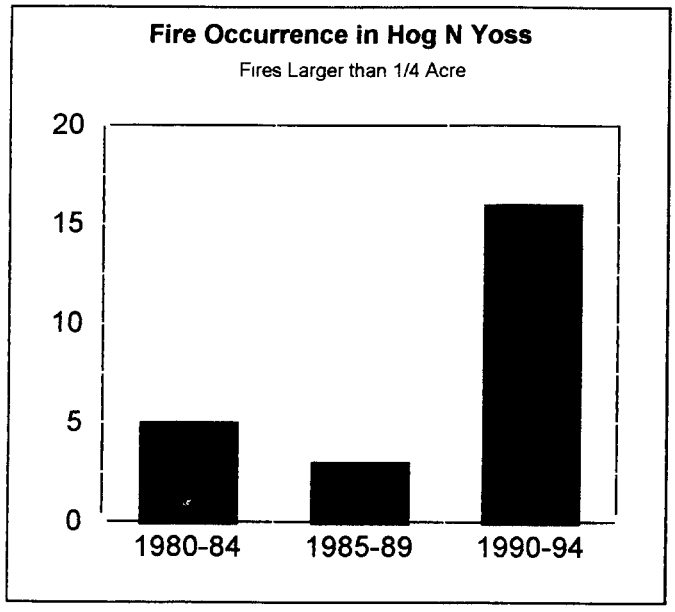




The increase in lightning-caused fires is likely associated with an increase in fuels throughout the area. As fuels accumulate, they become more continuous. A lightning fire that may previously have burned out an island of fuel and then gone out, may now continue burning to a size that requires suppression action. In addition, the accumulation of needle-drape in bitterbrush has likely contributed to lightning

strike fire-starting efficiency. Fuel arrangements allowing more oxygen mixing have been correlated with greater lightning fire occurrence.

Fire sizes have also increased during the last fifteen years for much the same reasons as the increase in occurrence. Fuels are more continuous in general, and more prevalent ladder fuels contribute to more torching and crowning.



2. What actions or events would lead to a reduced risk of stand replacement events?

Fuel management through harvest, mechanical manipulation, and prescribed fire can reduce the current hazard and associated stand replacement fire potential. It is likely that any one of these methods by itself cannot solve the problem. Combinations of these treatments can provide real solutions to the wildfire hazard.

Reducing conifer stocking, to open the overstory canopy (particularly in lodgepole pine) and eliminate much of the understory ladder fuels, will greatly reduce high intensity wildfire potential.

Much of the shrub component is old and decadent with needle-drape. Prescribed fire can be used to reduce the continuity of shrubs (especially those directly under mature trees).

Reduction in overall site stocking (both conifer and shrub) will make moisture more available to the remaining plants. This will increase average live fuel moisture content during fire season and reduce crown fire potential.

Insects and diseases prosper when trees have low vigor. Overstocked stands reduce vigor through competition for moisture and nutrients, resulting in reduced resistance to insect and disease attacks. Conifer thinning and/or prescribed fire can increase tree vigor, limiting the effects to the ecosystems of insects and disease. Insofar as possible, thinning operations should focus on understory trees when the overstory is still capable of height growth. Wider spacing of trees not only increases resistance to insects and disease, but also reduces ladder fuels that can drive a surface fire into the crowns and result in a stand replacement event.

3. Are stand replacement events necessarily undesirable, if not, in what situations would they be beneficial?

Stand replacement events are not necessarily undesirable. Small sized (10-100 acres) events provide structural diversity across the landscape. Currently, the watershed has many early seral units scattered across the ponderosa pine, dry lodgepole pine, and mixed conifer plant communities. Additional early seral units may not contribute to landscape diversity in these communities, especially in the ponderosa pine and mixed conifer communities.

Some of the other plant communities need stand-replacement events to persist. Aspen is a good example of a species that needs stand-replacement wildfire to regenerate. Currently, stands of aspen within the watershed are declining in vigor and extent. In many areas lodgepole pine has invaded aspen stands and is gradually replacing the aspen. Without a stand-replacement level fire, the aspen will soon fade out entirely. Many of the other riparian and meadow plants are also being replaced by lodgepole pine and need stand-replacement events to allow them to survive.

Conversion of lodgepole pine to aspen and willow communities will return important ecosystem components to riparian areas. Consequently, stand-replacement events may be desirable when size of event, timing (seasonality), and juxtaposition to other burned areas is managed.

Timing, size, and spacing of these events should be well planned to ensure desired objectives are achieved. Tree removal, followed by application of fire, should be considered as a preferred method to restore these plant communities. While fire alone can accomplish a change in structure and species, repeated fire is necessary to ensure lodgepole pine competition is reduced. Repeated fire where large fuels (greater than 3 inches in diameter) exist at the surface can reduce soil productivity through volatilization of much of the site nutrients, reduce the ability to hold nutrients (cation exchange capacity), and cause changes in soil microbial populations.

Stand replacement events in ponderosa pine can cause fundamental changes to those ecosystems, especially where exposure to extremes of cold in the winter and heat in the summer exist. Frost pocket areas may favor lodgepole pine or other more cold-hardy species over ponderosa pine. Dry, south-facing slopes may favor shrubs or other drought and heat-resistant species over ponderosa pine. In these cases, it may take centuries for ponderosa pine to recapture the sites following stand-replacement events. Repeated, expensive silvicultural treatments may be necessary if we wish to speed up the process.

Small stand-replacement events occurred in mixed conifer stands during the reference era. These events provided structural diversity contributing to overall biodiversity. Mixed conifer stands within the watershed are limited to the northeast slopes of Solomon, Applegate, and Calimus Buttes. Because the total acreage of these communities is small (about 6,000 acres or about 7% of the watershed), additional stand-replacement events in mixed conifer should be planned carefully. Care should be taken to manage these stands to avoid unplanned stand-replacement events.

D. Vast portions of the watershed have experienced potential soil compacting activities.

1. To what extent and degree has compaction occurred? What areas are showing detrimental effects of the compaction?

In order to address the issue of soil conditions with regard to compaction, a soil monitoring program has been established. Soil monitoring was conducted in accordance with guidelines set forth in the USDA Forest Service Manual entitled *"Guidelines for Sampling Some Physical Conditions of Surface Soils"*. This program is geared toward determining the percentage of detrimental compaction over a given area. Detrimental compaction is defined by the regional standard of 20% compaction over 20% of a given area on pumice and ash soils.

The Hog, Yoss and Skellock analysis area is composed of a variety of soil groups, landtypes, and complexes. The Soil Resource Inventory (SRI) for this area lists the Detrimental Compaction Hazard as low, moderate, or high for each of the soil groups and landtypes. In establishing the soil monitoring program, sample sites selected were either heavily impacted by past timber harvest activities or were listed by the SRI as having soils that are more susceptible to compaction. These areas were sampled at the request of the District and are not necessarily representative of the Analysis Area as a whole. Although all sites were heavily impacted by past logging activities, there were control samples taken from non-compacted soils within or adjacent to each of the sites.

Soil monitoring results concluded that four of the seven areas selected exceed the regional standard of 20% for detrimental compaction. The degree of detrimental compaction ranges from 42% to 79% on these sites. Results also confirm that the greatest degree of compaction is found on those soils listed by the SRI as being highly or even moderately susceptible. However, examination of sample results indicates that landtype, rather than soil group, has a greater impact in determining how a particular soil will respond to the effects of compaction activities. Specifically, soils with landtypes 1-3 tend to be more dramatically affected.

It should be noted that some of the soils that tested as being detrimentally compacted are listed as having a low susceptibility. Others are highly susceptible and did not exceed the regional standard. Several points have been made in an attempt to explain why this occurs. One possible explanation is that because of lower susceptibility ratings on certain soils, management practices with regard to timber harvest and grazing activities have been more lenient in the past.

Another explanation is that the lower susceptibility soils generally have lower undisturbed bulk densities, therefore less of an increase in the bulk density of these soils is required to achieve the 20% standard. The more susceptible soils generally have slightly higher undisturbed bulk densities and require a greater increase in density to achieve the 20% standard.

It may be assumed that other areas within H,Y&S that possess the same soil types as those sampled and have undergone similar management activities may produce like results with regard to compaction.

The sites sampled were requested by the District, and have received intensive potential soil compacting treatments. They intentionally do not represent the analysis area as a whole. Control samples of undisturbed soils were taken within or adjacent to each site.

SOIL COMPACTION MONITORING DATA SUMMARY

	Camp TS Unit 2	Yoss Crk II Unit 2	Yoss Crk II Unit 8	LammTS (8-10)	House (8,47)	House Unit 34	House (54-56)
Soil Type	A2 A4	A4 B6 B4	A2	A2A4 A4B4	A2 G2	G2 A6	G2
Acres	241	146	186	73	107	48	25
Samples Tested	193	197	200	187	97	199	97
Samples Required	84	67	128	66	76	81	66
Sample Mean Db	.68	.69	.68	.77	.68	.63	.68
Controls Mean Db	.63	.60	.57	.60	.64	.61	.63
Sample Mean (-) Control Mean	.05	.09	.11	.17	.04	.02	.05
Control Mean (+) 20% (UUL)	.76	.72	.69	.72	.73	.74	.76
# Samples in excess of (UUL)	27	82	102	147	27	10	15
% Detrim. Compact	13.71%	41.62%	51.00%	78.60%	27.84%	5.00%	15.46%

SOIL COMPACTION CHART LEGEND

Land types 1,2,3 = Are generally associated with valley bottoms, soils are generally loamy. For complete description of land types see Soil Inventory Resource for the Winema National Forest.
Db = Bulk Density
UUL = Undisturbed Upper Limit (Control Sample)

The levels of compaction indicated by some of the sampled units may send up a red flag, however it is not clearly evident how, if, or to what degree these levels of compaction affect vegetative growth on the pumice and ash soils. Also, it is unlikely and has not been visually evidenced that compaction of these soils leads to excessive run-off or soil erosion. This is probably due to naturally high infiltration rates.

The soil monitoring program did fall short in sampling the meadow communities of H,Y&S. There is a legitimate concern over the condition of soils within these areas, both due to their histories of intense grazing and the fact that they exhibit the most dramatic effects of soil erosion.

The main problem involved in sampling the meadow communities was in establishing a means of comparison or "control". It has not been possible to locate an undisturbed area within H,Y&S to represent the natural state of these soils. Most of the meadow sites in the analysis area are landtype 2, which the SRI estimates as having an undisturbed bulk density of .7 - 1.0g/cc. Samples taken from these areas produced mean bulk densities well below even the lower undisturbed limit of .7g/cc. These results probably are not truly representative of the soils in these areas and another method of sampling needs to be found.

In any case, it is felt that further study is needed to determine the exact effects of compaction on the unique properties of the pumice and ash soils common to H&Y and whether the 20% figure established to identify detrimental compaction actually indicates a level of compaction that adversely effects soil processes. See Appendix C for a map of harvest areas on "A2" (most susceptible) soils.

2. Which soils within the watershed are most susceptible to compaction and which are least susceptible?

Soil Groups, Complexes, Landtypes w/Moderate or Higher Compaction Rating

A Group	B Group	D Group	G Group	Soil Complexes	Landtypes
A2	B2	D1	2G3	A6G2	2
	B3		G2	C2D1	15
			G3	D1H4	16

Soils Least Susceptible to Compaction in Hog/Yoss Analysis Area

A Group	B Group	C Group	D Group	H Group	Soil Complexes	Landtypes
A1	B1	C1-4	D4-5	H1-3	B4H6	20
A4-5	B4-5			H5-6	A5B5	21
A8-15	B7-8				A4B4	
A17-19						

Soils most susceptible to compaction

Soils least susceptible to compaction

IV. MANAGEMENT RECOMMENDATIONS

Klamath Marsh

It is assumed, that the lowering of the Klamath Marsh level around the turn of the century has had a major effect on the hydrologic function of drainages that terminate in the Marsh or the Williamson River between the Marsh and Kirk. The lowering of the Marsh has directly affected Hog Creek, Yoss Creek, and Skellock Draw by reducing or eliminating the connectivity of surface flows between the main Williamson River and these tributaries. The lower marsh level increases the groundwater gradient between the lower reaches of these systems and the Marsh, which reduces the time period that surface flows are present in these segment of channel.

If cooperation of all land owners and management agencies can be obtained, a study should be undertaken to identify which effects of the Marsh lowering can and should be reversed.

Stream Restoration

Stream restoration activities in the study area should center around two areas of change since the reference era; changes in channel morphology, and changes in riparian vegetation. In many cases, current channels have been down-cut and straightened from their natural condition. In some cases, channels have been created where no channel existed during the reference era. In many riparian areas vegetation has reverted from deep rooted plants such as willow and sedge, to shallow rooted plants such as bluegrass, lowering the natural stability of stream banks.

Limited field observations indicate:

Skellock Draw should be evaluated in detail to identify the effect of the Lamm Railroad grade on the hydrologic function of this system. This investigation could result in a proposal to mitigate the effects of the grade. Any proposal will need to be coordinated with the Natural Register proposal for the grade itself.

The entrenched channel of Meadow Creek, between Skellock Draw and Forest Road 49, should be evaluated for opportunities to return it to a properly functioning condition.

The entrenched channel of Meadow Creek, immediately up and down stream from Forest Road 4990, should be evaluated for opportunities to return it to a properly functioning condition.

Hog Creek, from its intersection with the Williamson River to Wilson Flat, should be evaluated for opportunities to redirect surface flows from the existing irrigation and drainage ditches, back to the natural channel system.

Existing channels in the study should be evaluated for the opportunity to reestablish native deep-rooted plants (willow, sedge, etc.) in the riparian zones, to enhance channel bank stability.

The reader is referred to the Functional Condition Chart (Appendix C). The chart lists different reaches of drainages and intermittent systems by Township, Range, and Section. Each reach has been evaluated as to whether it was properly functioning, functioning at risk, or non-functional. The risk factors for each stream reach are briefly summarized in the last column. This list is by no means complete, but will give the project planners a place to start in developing restoration projects, such as modifying road crossings, or eliminating those not needed, planting preferred riparian plants, stabilizing headcuts, or constructing new channels, prescribed burns, etc.

Other potential projects that should be explored are those that involve adjacent landowners, both public and private. Although the Forest Service does not have the authority to work on private lands, there are two agencies that can assist in projects involving both private and public lands; i.e, the Ecosystem Restoration Office located in the Bureau of Reclamation office in Klamath Falls, and the National Conservation Resource Agency (former SCS), who, also, has an office in Klamath Falls. Other groups that may assist in projects are Ducks Unlimited, and the Rocky Mountain Elk Foundation. The Hog and Yoss Analysis Area may have a high potential for involvement by these two groups, since it is next to the Upper Klamath Marsh, and elk populations appear to be increasing in the general area.

Road and Railroad Grades

All channels and meadows in the study area have existing Forest Roads that either cross or run parallel to these critical areas. Each of these roads should be evaluated to identify specific effects on hydrologic function. Each road determined to be significantly hindering proper function should be evaluated for mitigation opportunities. In addition to Forest System Roads, every meadow observed in the area had wheel tracks created by vehicles accessing firewood or hunting camps. Each of these cases should be evaluated to determine their specific effect on local hydrologic function. Again, locations identified as significantly hindering proper function should be evaluated for mitigation opportunities.

In general, all road access to riparian lands should be evaluated for its need in the transportation system. Any road found to be not necessary should be considered for closure at the minimum or obliteration if possible. An actual road density of two miles per square mile or less is recommended.

Fish

Perform appropriate stream surveys and aquatic fauna sampling.

Improve water storage in local aquifers by returning sinuosity to natural channels and eliminating artificial channels.

Replace any breaches of hydraulic control points in the system, especially the Kirk reef.

Manipulate grazing activity such that riparian vegetation can be successfully reintroduced.

Replace exotic grasses in riparian zones with native grass and sedge communities.

When appropriate, reintroduce beaver to the system; where this is not feasible, mimic their effects in the system with structures.

Experiment with timber stand densities in localized watersheds associated with perennial springs, to assess timber stocking levels on spring water yields.

Prescribed Fire

Apply prescribed fire in riparian areas that are infested with lodgepole pine to convert dominant overstory species back to aspen and willow and increase diversity in understory shrubs, forbs, and grasses.

Reduce wildfire hazard in the upland areas through prescribed fire. Underburn prescriptions should kill much of the understory shrub-tree component while maintaining large, old trees and leaving a portion of the duff layer.

Remove most of the conifers less than 14" DBH so that:

The majority of the remaining trees, except small seedlings, can survive an average fire with minor mortality.

Conifer stocking does not fully occupy the site and more resiliant vegetation; grasses, forbs, brush, provide a buffer for droughty conditions.

Ponderosa pine regain dominance over the area and fir is restricted to a minor component on only the highest and wettest sites.

Remove most of the lodgepole from the area and encourage replacement by grasses and forbs on drier sites, and riparian hardwood vegetation on wetter sites.

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APPENDIX

A

Management Area 3 - Scenic Management

Goal

Management Area 3 is designed to maintain and create visually appealing scenery that represents the landscape character of the Forest. Emphasis is on areas viewed from selected travelways, use areas, and bodies of water.

Description

This management area may be applied to lands visible for a distance up to 5 miles from selected travelways, bodies of water, or public use areas. These areas are classified as retention or partial retention based on the Visual Management System, as explained in "National Forest Landscape Management," Vol. 2, Agriculture Handbook Number 462. Retention and partial retention are further subdivided into distance zones. Standards and guidelines differ for each distance zone and focus more intensively on activities that are viewed at close range.

Desired Future Condition

The desired future condition is a forested environment. This environment includes a mix of native coniferous trees and shrubs. periodically interspersed with natural meadows and flats, talus slopes, rock outcrops, and rimrock. Size classes range from seedlings to large diameter trees; a multicanopied, vegetative appearance occurs in appropriate scale with the viewing distance. Where they naturally exist, deciduous trees such as aspen and cottonwood are perpetuated for autumn color. Management activities repeat form, line, color, and texture that are common within the characteristic landscape.

Standards and Guidelines

Specific standards and guidelines that apply to all management intensities of this management area are stated in this subsection.

Recreation

1. The area shall be managed to provide a semiprimitive or roaded natural recreation opportunity setting.

2. Recreation facilities may be placed in this management area, provided they are designed to achieve the visual quality objectives.

3. Viewshed guides shall be prepared to provide project-level direction for Forest Plan implementation. These guides shall provide guidance regarding the following elements: large trees, distinctive bark, spring and fall color, variety of tree species, shrubs and ground covers, emphasis on special landscape features, vista creation, rotation of view openings, and rehabilitation needs.

4. Because of existing negative visual elements like skid roads, activity residues, or cable corridors, landscapes or portions of landscapes not meeting visual quality objectives should be rehabilitated with consideration for the resource values present.

5. Enhancement of selected areas or views may be conducted through vegetative manipulation, landform alteration, or inclusion of structural elements when needed to achieve objectives of the management area.

Range

1. Structural and nonstructural range improvements shall be constructed of native materials or designed to blend with the landscape.

Timber

1. Timber harvest shall be programmed.

2. A mix of naturally occurring species should be maintained in regenerated harvest units in pine associated and mixed conifer working groups with emphasis on ponderosa pine, Douglas-fir, and sugar pine.

3. Aspen, ponderosa pine, and white fir should be emphasized where they occur in predominantly lodgepole stands. Presence of ponderosa pine in ecotones should be maintained.

4. Screening vegetation should be perpetuated for areas such as rock quarries, road cut and fill slopes, utility ways, structures, or unhealed harvest areas.

5. Created openings shall be shaped to appear natural in the landscape.

6. Size of timber harvest units should be in scale with the surrounding landscape character, considering distance from viewer and dispersion needs to achieve desired variety.

7. Clumps or islands of vegetation/leave trees within natural-shaped clearcut units may be retained to reduce contrast of visual elements.

8. Individual tree selection, group selection, or combinations of both shall be used to achieve the desired future condition in ponderosa pine and pine associated species.

9. In ponderosa pine and pine associated species where uneven-aged management is applied, from 30 percent to 35 percent of an area shall be considered for treatment at any one time, and treatments shall be dispersed over the total area. All lands should be entered, as needed, on a 20- to 30-year cutting cycle.

10. Management of armillaria root rot in mixed conifer and mountain pine beetle in lodgepole pine should focus on long-term diversity and visual quality achievement. Consideration should be given to short-term mitigation such as design of harvest units (which includes maintenance of vegetated clumps). Some natural mortality also should be accepted until stand conversion can be implemented over time.

Minerals and Energy

1. New salable mineral material sources should not be developed.

2. Existing mineral material sources should not be expanded into scenic areas.

3. Existing mineral material sources shall be analyzed for short-term mitigations to achieve scenic objectives and long-term rehabilitation measures. Partial rehabilitation of a material source should be considered when that part no longer is of use for development.

4. Reasonable access for the exploration and/or development of locatable and leasable minerals shall be allowed but shall be highly controlled to protect scenic values.

5. Except for road access, surface occupancy should not be allowed.

Lands

1. Landownership classification group 3 applies to this management area. Disposal of lands should occur only if lands of equal or higher scenic quality shall be acquired.

2. Special-use permits shall be permitted for structures that existed before designation of lands to scenic emphasis. Rehabilitation should be emphasized for any structures that do not blend with the landscape.

3. New special uses may be permitted when they are consistent with the management objectives and are justified through an environmental analysis.

4. This management area is an avoidance area for new transportation and utility corridors.

Facilities

1. Roads, parking lots, and other necessary facilities shall be designed to flow with the typical lines and slopes in the landscape and/or shall be screened by natural vegetation.

2. Closed roads should appear natural with large logs and boulders partially buried to blend with the area and should be tilled and revegetated with trees, shrubs and grasses, as appropriate to the location.

Management Intensities

The following management intensities may be applied.

Management Area 3A
Scenic Management, Foreground Retention

Goal

The primary emphasis for this intensity is to retain the natural-appearing condition of the foreground areas. The retention visual quality objective means that activities may only repeat whatever form, line, color, and texture are frequently found in the characteristic landscape. Changes in their qualities--such as size, amount, intensity, direction, and pattern--may not be evident.

Description

This management intensity is applied to lands visible for distances up to .25 mile from selected travelways, bodies of water, or public use areas. This area focuses on the detail in the landscape; the detail includes individual tree shape, color, size, species mix, and related vegetation like shrubs and grasses. Vegetation may be manipulated to achieve desired character through enhancing large diameter trees, opening a vista to provide an attractive view, or creating a small space to encourage new growth of desired vegetation.

Desired Future Condition

The desired future condition is the same as the areawide condition. In addition, large tree character is emphasized and maintained perpetually in the foreground area through retaining groupings of large-diameter trees and by having large trees sometimes scattered individually among other tree size classes. To achieve diversity, small openings with natural-appearing edges may be created. Overall, trees with distinctive bark and tree form characteristics, including occasional character snags, are very evident. Natural-appearing forms, colors, and textures dominate to create a high quality scenic condition.

Intensity-Specific Standards and Guidelines

The following standards and guidelines apply to the foreground retention intensity of the scenic management area.

Scenic

1. Evidence of management activities from projects that produce slash (tree harvest) or charred bark (underburning) will not be noticeable one year after the work has been completed.

Timber

1. Large tree character will be perpetually retained in the foreground retention area in all species, except lodgepole pine, through maintaining three to five large diameter trees (between 30 inches and 36 inches DBH) on the average per acre. These should be distributed in groupings for greatest visual effect. Some areas may have high numbers of large diameter trees, and other areas may have fewer small clumps. Openings may or may not have mature large-diameter trees; if not, more trees will be retained on other acres to maintain the three-to-five-trees-per-acre average in the foreground overall.

2. In ponderosa pine and pine associated areas where uneven-aged management will prevail, the objective is to achieve a healthy, multiaged forest with timber stands that contain a variety of tree sizes up to 36 inches DBH following harvest. At least three canopy levels or size classes are present within each stand.

3. For even-aged and group selection management, the long-term objective is to achieve the mix of tree size classes shown in table 4-22.

4. Stumps, if visible, shall be cut to approximately 6 inches or less in height on the uphill side of the stump.

5. Thinning units should be irregularly marked (vary the density of leave trees) in the immediate foreground to break up the viewing distance and to provide diversity.

6. Landings, decks, major skid roads, temporary roads, and slash piles shall be located to utilize vegetative or landform screening opportunities. These should be located away from critical line-of-sight viewing areas.

Protection

1. Fire suppression efforts in the immediate foreground should use low-impact methods. If heavy equipment is needed on high-intensity fires, rehabilitation may be needed to mitigate the effect on the visual resource.

2. Harvest residues resulting from management activities should not be evident after residues treatment.

TABLE 4-22
Scenic Foreground Retention Tree Size Class Objectives
Even-Aged and Group Selection Management Strategies

Working Group	DBH (Inches)	Percent of Area in DBH Class
Ponderosa Pine, or Pine Associated, or and Mixed Conifer	30-36 22-30 16-22 9-16 0-9	20 20 20 20 20
Lodgepole Pine	9+ 5-9 0-5	50 25 25

Table 4-23 summarizes the critical elements necessary to achieve the retention visual quality level in foreground.

TABLE 4-23
Scenic Foreground Retention Standards by Working Group

Critical Element	Ponderosa Pine (Uneven)	Pine Associated (Uneven)	Mixed Conifer (Even-aged)	Lodgepole(1) Pine (Even-aged)
Target diameter for mature portion of the stand (inches)	36	36	34	-(2)
Maximum created openings size (acres)(3)	2	2	3	8
Maximum area in created openings in any one decade (percent)	4	4	4	-
Maximum area in created openings at one time (percent)	8	8	8	-
Linear feet of created opening along road frontage/decade/mile of road	300	300	200	-
Target stand appearance	Open, park-like, mature groups of trees with deeply furrowed, yellow-colored bark within a mix of varying age classes.	Mature trees in tight, dense groups of various species and ages.	Mature trees in tight, dense groups of various species and ages.	Even-aged, mature groups of trees within a mosaic of varying ages.

(1)The mountain pine beetle infestation has resulted in relaxed operating standards to achieve the visual quality objective in the long term.
(2)In lodgepole pine, rotation age (80 years), not diameter, is the controlling factor.
(3)For visual management purposes, a created opening is no longer considered to be an opening when the vegetation within it reaches an average of 20 feet in height and (for foreground retention purposes) may include from three to five large-diameter trees per acre.

Management Area 3B
Scenic Management, Foreground Partial Retention

Goal

The goal is to provide attractive scenery that is slightly altered from a natural condition as viewed in the foreground. Activities may repeat or introduce form, line, color, or texture common or uncommon to the characteristic landscape, but changes in their qualities of size, amount, intensity, direction, and pattern must remain visually subordinate to the visual strength of the characteristic landscape.

Description

This management intensity may be applied to lands visible for distances up to .25 mile from selected travelways, bodies of water, or public use areas. This area focuses on the detail in the landscape: individual tree shape, color, size, species mix, and related vegetation like shrubs and grasses. Vegetation may be manipulated to achieve desired character through enhancing large diameter trees, opening a vista to provide an attractive view, or creating a small space to encourage new growth of desired vegetation.

Desired Future Condition

The desired future condition is the same as the areawide condition. In addition, large tree character is emphasized and maintained perpetually in the foreground in all species, except lodgepole pine, through retaining large-diameter trees in groupings and by having large trees sometimes scattered individually among other tree size classes. To achieve diversity, small openings with natural-appearing edges may be created. Overall, trees with distinctive bark and tree form characteristics, including occasional character snags, are very evident. Management activities may be noticeable, but they remain subordinate to the natural landscape character.

Intensity-Specific Standards and Guidelines

The following standards and guidelines apply to the foreground partial retention intensity of the scenic management area.

Scenic

1. Evidence of management activities from projects that produce slash (tree harvest) or charred bark (underburning) should not be noticeable from two to three years after the work has been completed.

Timber

1. Large tree character will be retained in the foreground area in all species, except lodgepole pine, through maintaining three to five large diameter trees (between 24 inches and 30 inches DBH) on the average per acre. These should be distributed in groupings for greatest visual effect. Some areas may have high numbers of large diameter trees, and other areas may have fewer small clumps. Openings may or may not have mature large diameter trees; if not, more trees will be retained on other acres to maintain the three-to-five-trees-per-acre average in the foreground overall.

2. In ponderosa pine and pine associated areas where uneven-aged management will prevail, the objective is to achieve a healthy, multiaged forest with timber stands that contain a variety of size classes up to 30 inches DBH following harvest. At least three canopy levels or size classes are present within each stand.

3. For even-aged and group selection management, the long-term objective is to achieve the mix of tree size classes shown in table 4-24

4. Stumps, if visible, shall be cut to approximately 6 inches or less in height on the uphill side of the tree.

5. Thinning units should be irregularly marked (vary the density of leave trees) in the immediate foreground to break up the viewing distance and to provide diversity.

6. Landings, decks, major skid roads, temporary roads, and slash piles should be located to the rear of the stands to use vegetative or landform screening opportunities. These should be located away from critical line-of-sight viewing areas.

Protection

1. Harvest residues resulting from stand management activities may be evident but should blend, where possible, with the surrounding landscape characteristics.

2. Hand tools are the preferred method for fire suppression in the immediate foreground. Mitigation or rehabilitation measures may be necessary for high-intensity fires.

TABLE 4-24
Scenic Foreground Partial Retention Tree Size Class Objectives
Even-Aged and Group Selection Management Strategies

Working Group	DBH (Inches)	Percent of Area In DBH Class
Ponderosa Pine, or Pine Associated, or Mixed Conifer	24-30 18-24 12-18 6-12 0-6	20 20 20 20 20
Lodgepole Pine	9+ 5-9 0-5	50 25 25

Table 4-25 summarizes the critical elements necessary to achieve partial retention in the foreground.

TABLE 4-25
Scenic Foreground Partial Retention Standards by Working Group

Critical Element	Ponderosa Pine (Uneven)	Pine Associated (Uneven)	Mixed Conifer (Even-aged)	Lodgepole(1) Pine (Even-aged)
Target diameter (inches)	30	30	30	-(2)
Maximum created openings size (acres)(3)	2	2	5	10
Maximum area in created openings in any one decade (percent)	6	6	6	-
Maximum area in created openings at one time (percent)	12	12	12	-
Linear feet of created opening along road frontage/decade/mile of road	500	500	250	1,000
Target stand appearance	Open, park-like, mature groups of trees with deeply furrowed, yellow-colored bark within a mix of varying age classes.	Mature trees in tight, dense groups of various species and ages.	Mature trees in tight, dense groups of various species and ages.	Even-aged, mature groups of trees within a mosaic of varying age classes.

(1)The mountain pine beetle infestation has resulted in relaxed operating standards to achieve the visual quality objective in the long term.
(2)In lodgepole pine, rotation age (80 years) is the controlling factor.
(3)For visual management purposes, a created opening is no longer considered to be an opening when the vegetation within it reaches an average of 20 feet in height and (for foreground retention purposes) may include from three to five large-diameter trees per acre.

Management Area 3C
Scenic Management, Middleground Partial Retention

Goal

This management intensity provides attractive scenery that is slightly altered from a natural condition as viewed in the middleground. Activities may repeat or introduce form, line, color, or texture common or uncommon to the characteristic landscape. Changes in their qualities of size, amount, intensity, direction, and pattern must remain visually subordinate to the visual strength of the characteristic landscape.

Description

This management intensity may be applied to lands visible for distances of .25 mile to 5 miles from selected travelways, bodies of water, or public use areas. This area focuses on the texture and form in the landscape where groups or stands of trees are similar as a unit compared with others that differ in size, degree of texture (fine, medium, or coarse), or pattern. A continuous forest canopy is usual; variety is provided by the addition of natural openings, rimrock, or rock outcrops that are typical in the landscape.

Desired Future Condition

The desired future condition is similar to the areawide condition. In addition, masses of vegetation rather than individual trees are evident. Varying canopy levels with natural-appearing edges and careful perpetuation of forested ridgelines create a mosaic. Created openings imitate natural occurrences in the landscape, while the characteristic landscape is retained. Activities repeat form, line, color, or texture common to the characteristic landscape. Activities may introduce changes in form, line, color, or texture that are found infrequently or not at all in the characteristic landscape, but they must remain subordinate to the visual strength of the characteristic landscape.

Intensity-Specific Standards and Guidelines

The following standards and guidelines apply to the middleground partial retention intensity of the scenic management area.

Timber

1. For individual tree selection (uneven-aged management), the long-term objective is to achieve a healthy, multiaged forest with timber stands that contain a variety of size classes up to 24 inches DBH following harvest. At least three canopy levels or size classes are present within each stand.

2. For even-aged and group selection management, the long-term objective is to achieve the mix of tree size classes shown in table 4-26.

3. Even-aged management may be applied to achieve diversity where stands of different ages are located adjacent to each other. Uneven-aged management also may be applied when appropriate.

4. Landings, decks, and slash piles should use vegetative or landform screening opportunities. These should be located away from critical line-of-sight viewing areas.

TABLE 4-26
Scenic Middleground Partial Retention Tree Size Class Objectives
Even-Aged and Group Selection Management Strategies

Working Group	DBH (inches)	Percent of Middleground Area in DBH Class
Mixed Conifer or Pine Associated	16-18 12-16 8-12 4-8 0-4	20 20 20 20 20
Lodgepole Pine	9+ 6-9 2-6 0-3	25 25 25 25

Table 4-27 summarizes the critical elements necessary to achieve the partial retention visual quality objective in the middleground.

TABLE 4-27
Scenic Middleground Partial Retention Standards by Working Group

Critical Element	Ponderosa Pine (Uneven)	Pine Associated (Uneven)	Mixed Conifer (Even-aged)	Lodgepole(1) Pine (Even-aged)
Target diameter for mature stand component (inches)	24	24	18	-(2)
Average created openings size (acres)(3)	2	2	15	20
Maximum area in created openings in any one decade (percent)	8	8	8	-
Maximum area in created openings at one time (percent)	16	16	16	-

(1)The mountain pine beetle epidemic has resulted in relaxed operating standards to achieve the visual quality objective in the long term.
(2)In lodgepole pine, rotation age (80 years), not diameter, is the controlling factor.
(3)For visual management purposes, a created opening is no longer considered to be an opening when the vegetation within it reaches an average of 20 feet in height.

Management Area 7 - Old-Growth Ecosystems

Goal

Management Area 7 is designed to provide, maintain, and enhance existing mature and old-growth communities for associated wildlife species, mature successional stage diversity, preservation of natural gene pools, and aesthetic qualities.

Description

This management area may be applied to coniferous or deciduous vegetative communities that have been identified as, or have the potential to become, old-growth ecosystems based on the criteria developed by Hopkins (1989 draft).

Management indicator species that use old-growth communities are: northern spotted owl, pileated woodpecker, northern goshawk, three-toed woodpecker, and marten.

Desired Future Condition

The desired future condition is old-growth environments of mature and overmature communities of lodgepole pine, ponderosa pine, mixed conifer, ponderosa pine and associated species, and mountain hemlock/subalpine fir, as well as stands of cottonwood or aspen.

Following are descriptions and criteria for old-growth conifer stands by working group.

Characterization of Existing Lodgepole Pine Old-Growth Forests

Lodgepole pine typically does not maintain itself in an old-growth state on a given acre that is generally associated with other ecosystems found in this area. The old-growth state is present but tends to be very transitory on the landscape. As one area reaches old-growth state and then deteriorates, another area reaches old-growth state. Therefore, when considering the value of a lodgepole pine old-growth area, one must consider the larger view.

The following stand criteria must be used to evaluate old-growth lodgepole pine.

1. Overstory: It consists of at least 120 mature trees per acre (approximately 19 foot spacing) greater than 12 inches in diameter. There should be an adjacent younger stand with well-distributed trees greater than 7 inches diameter at breast height (DBH). Species composition in both stands is almost entirely lodgepole pine, and an occasional ponderosa pine may be present.

2. Other tree layers: Very little layering occurs in lodgepole pine old-growth stands. Small groups of younger trees may occur from past disturbances.

3. Snags: There should be a minimum of three snags per acre greater than 6 inches DBH.

4. Shrubs and herbs: Bitterbrush and manzanita make up the majority of the shrub cover that ranges in canopy closure from zero to 50 percent. Idaho fescue and needlegrass are generally the herbs present.

5. Woody material component: Large woody material ranges from zero to 30 logs greater than 6 inches in diameter (as measured at the large end) and over 8 feet long.

6. Natural openings: Natural openings generally will be less than 5 percent of the area.

7. Size: The area should be a minimum of 500 contiguous acres arranged to maximize internal integrity and should have elements of immature, mature, overmature, and decadent tree components. The immature elements should not occupy more than one half of the area. In addition, there should be an adjacent 250 acres of younger age classes that will provide future replacement to the above components.

Characterization of Existing Ponderosa Pine Old-Growth Forests

At least seven considerations regarding structure are found in old-growth ponderosa pine forests. These seven structural considerations apply to all major sites throughout the range of the ponderosa pine forests. The following conditions are for climatic climax, which differs from the historic open, park-like stands representing fire climax.

1. Overstory: The overstory consists of between 10 and 20 large ponderosa pine trees greater than 21 inches DBH per acre. Stocking of the large overstory trees may vary from five to 30 per acre. Smaller components in the stand will generally be less than 20 percent of the trees per acre of the large tree component.

2. Other tree layers: In addition to the large tree component, at least two additional layers will be recognizable (seedlings or saplings or poles).

3. Snags: There should be a minimum of three snags per acre greater than 14 inches DBH.

4. Shrub and herbs: Shrub canopy cover ranges from 20 percent to 40 percent and is associated with a variety of herbaceous plants such as grasses, sedges, and forbs. Canopy closure in the shrub components can vary from zero to 60 percent.

5. Woody material component: Large wood material ranges from three to six logs greater than 12 inches (as measured at the large end) and over 8 feet long. The variance found may be from zero to 10 logs per acre.

6. Natural openings: There may be small openings (up to one half acre) created by natural causes like beetle kill, windthrow, lightning, or wildfire.

7. Size: The size of the area should be no less than 200 contiguous acres arranged as to maximize internal integrity and should have elements of mature, overmature, and decadent tree components;

The following conditions are for fire climax ponderosa pine. These open park-like stands are of less value for wildlife then climatic climax ponderosa pine but have aesthetic value.

1. Overstory: The overstory consists of 4 or more large ponderosa pine trees greater than 30 inches DBH per acre. Smaller components are generally absent. This creates an open, park-like appearance in the stand.

2. Other tree layers: Other layers are generally absent. Incidental individual smaller sized trees may be present.

3. Snags: Snags may or may not be present. The role of snags may be fulfilled by dead tops in live trees.

4. Shrubs and herbs: Shrubs and herbs may be absent.

5. Woody material component: May be absent.

6. Natural openings: Openings created by beetle kill, windthrow, lightning, or wildfire may occur.

7. Size: The size of the area should be no less than 10 contiguous acres and must be adjacent to or an inclusion of climatic ponderosa pine or pine associated old growth stands.

Characterization of Existing Pine Associated Old-Growth Forests

The following conditions reflect climatic climax, which differs from historic stands greatly structured by regular wildfire, creating forests referred to as fire climax forests. This characterization describes those forests where ponderosa pine is a dominate life form.

1. Overstory: The overstory consists of between 30 and 40 large trees greater than 28 inches DBH. Species composition should be from 18 to 67 ponderosa pine per acre, zero to 12 white fir per acre, zero to 15 Douglas-fir per acre, and four to six other conifer species per acre.

2. Other tree layers: In addition to the large tree component, at least two additional layers will be recognizable (seedlings or saplings or poles).

3. Snags: There should be a minimum of six to 10 snags per acre greater than 14 inches DBH.

4. Shrubs and herbs: Shrub canopy cover ranges from 20 percent to 50 percent with a variety of herbaceous plants such as grasses, sedges, and forbs covering zero to 50 percent of the areas. The shrub component will be dominated by snowbrush, but manzanita, pinemat manzanita, and golden chinquapin will be present. In some stands, the brush cover may be as low as 2 percent.

5. Woody material component: Large woody material ranges from 12 to 14 logs greater than 12 inches (as measured at the small end) and over 8 feet long.

6. Natural openings: There may be small openings (up to one half acre) created by natural causes like beetle kill, windthrow, lightning, root rot, or wildfire.

7. Size: The size of the area should be no less than 350 acres and should be arranged as to maximize internal integrity and should have elements of mature, overmature, and decadent tree components.

Characterization of Existing Mixed Conifer Old-Growth Forests

This characterization reflects higher-elevation forests where a combination of white fir, Douglas-fir, and Shasta red fir assume dominance over other coniferous species.

1. Overstory: The overstory consists of 11 to 38 large trees greater than 27 inches DBH. Species composition should be from zero to 33 white fir per acre, zero to 22 Douglas-fir

per acre, zero to 38 Shasta red fir per acre, and less than nine other conifer species per acre.

2. Other tree layers: In addition to the large tree component, at least three additional layers will be recognizable (seedlings or saplings or poles).

3. Snags: There should be a minimum of six to 12 snags per acre greater than 14 inches DBH.

4. Shrubs and herbs: Shrub canopy cover ranges from 25 percent to 40 percent with mainly long-stolon sedge and a few native grasses. The shrub component will be dominated by snowberry, manzanita, or pinemat manzanita.

5. Woody material component: Large woody material ranges from 12 to 14 logs greater than 12 inches (as measured at the small end) and over 8 feet long.

6. Natural openings: There may be small openings (up to one half acre) created by natural causes like beetle kill, windthrow, lightning, root rot, or wildfire.

7. Size: The size of the area should be no less than 250 acres. It should be arranged as to maximize internal integrity and should have elements of mature, overmature, and decadent tree components.

The following priorities shall be followed in selecting areas to be managed as old-growth ecosystems.

1. Select areas meeting all of the criteria listed.

2. Select areas that have a total rating index of 42 or greater using the ecological significance matrices developed by Hopkins (1989 draft).

3. Select areas that do not have a rating of 42 or greater because of deficiencies in dead standing trees or dead down material but meet all other criteria for a 42 rating.

Management indicator species and their respective habitats are described below. Individual areas that could be utilized by more than one management indicator species are noted.

Northern Spotted Owl

The desired future condition is old-growth mixed conifer communities that provide the required habitats necessary for foraging and nesting of northern spotted owls. Contiguous core nesting areas are maintained within the surrounding forage areas. These areas are typified by varied species composition and stand structure diversity such as snags, umbrella crowns, down trees, natural cavities, and various height categories and crown closures. Nesting pileated woodpeckers and northern goshawks may be present.

Pileated Woodpecker

The desired future condition is multistoried mature and old-growth stands of mixed conifer, ponderosa pine, and ponderosa pine and associated species, as well as riparian areas of large cottonwood or aspen trees, that provide the preferred nesting and feeding habitats for pileated woodpeckers. Snags of appropriate species, size, and density are available, as well as dead and down woody material and heart rot. Snags for nesting and foraging are surrounded by mature or old-growth timber and are clumped in small patches throughout the nesting habitat. Nesting northern goshawks may be present.

Northern Goshawk

The desired future condition is mature and old-growth ecosystems available for nesting/foraging in the ponderosa pine, mixed conifer, ponderosa pine and associated species, and lodgepole pine plant communities. The characteristics of these communities include multistoried canopies comprised of mature tree crowns with subcanopies of shade-tolerant conifer species of various ages and heights. Included within the nesting/foraging areas are north-facing talus slopes or cliffs, water sources, and all downed logs potentially used as northern goshawk plucking/feeding sites.

Three-Toed Woodpecker

The desired future condition is selected vegetative communities of mature and old-growth lodgepole pine or mountain hemlock/subalpine fir stands. Trees used for nesting are standing dead trees, live trees with dead limbs, or live trees with rotted heartwood. In most cases, the limbs or trunks of these trees have maintained a hard outer shell. Trees infested with bark and wood-boring insects are available for foraging. Effects of fire, insect epidemic, blow down, or other die off are often visible. Nesting northern goshawks may be present.

Marten

The desired future condition is mature and old-growth mountain hemlock or high-elevation lodgepole pine ecosystems. These communities consist of multicanopied stands containing a high diversity of understory plant species. Special and unique habitat components include talus slopes, rock piles and crevices, cliffs and rims, snags, stumps, and dead and down woody material. Nesting northern goshawks and three-toed woodpeckers may be present.

Standards and Guidelines

There is only one management intensity for this management area. Specific standards and guidelines that apply to this management area/intensity are stated in this subsection.

Recreation

1. Provide a range or recreation opportunity settings except for Roaded Modified, Rural or Urban.

2. Developed recreation (for example, campgrounds and resorts) is not compatible with the goals of this management area, and shall not be allowed. Dispersed recreation developments shall be discouraged.

Scenic

1. Management activities shall meet the inventoried visual quality level of the specific areas.

Wildlife and Fish

1. Provide suitable mature and old-growth nesting and foraging habitat for at least the minimum required number of pairs of management indicator species (as determined by Regional Office direction). These minimum numbers are: nine pairs of northern spotted owls, 51 pairs of martens, 28 pairs of pileated woodpeckers, 87 pairs of northern goshawks, and 215 pairs of three-toed woodpeckers.

A. Northern spotted owl nesting area requirements are as follows.

1. A minimum of 1,500 acres of old-growth mixed conifer stands shall be provided for each pair of northern spotted owls.

2. Of the 1,500 acres, a 300-acre core area of contiguous old-growth habitat shall be designated as breeding habitat for northern spotted owl. The remaining 1,200 acres of old-growth habitat shall provide foraging habitat but does not need to be contiguous. Foraging habitat shall be located within 1.5 miles of the core area and shall consist of stands larger than 30 acres.

3. The distance between core areas shall be no greater than 6 miles. Clusters consisting of three or more spotted owl habitat areas (SOHAs) may be up to 12 miles apart.

4. Disturbing human activities within .5 mile of an active northern spotted owl nest site shall be discouraged or minimized from March 1 through September 30 (refer to forestwide standards and guidelines). Where the actual nest site has not been located, disturbance shall be discouraged or minimized within the 300-acre core area during the above-mentioned nesting period.

B. Pileated woodpecker area requirements are as follows.

1. A minimum of 300 acres of old-growth and/or mature mixed conifer, ponderosa pine and associated species, or ponderosa pine stands shall be provided as breeding and primary foraging habitat for one pair of pileated woodpeckers. These woodpeckers may also nest in large aspen or cottonwood trees associated with riparian areas.

2. Pileated woodpecker habitat should be contiguous where possible; otherwise, stands shall be at least 50 acres in size and not more than .25 mile apart.

3. Within the 300-acre primary breeding area, a minimum average of two hard snags per acre greater than 12 inches DBH shall be maintained as follows.

   a) Forty-two suitable nesting snags (hard) greater than 20 inches DBH shall be available within the 300-acre primary breeding area.

   b) Within the 300-acre breeding area, 558 hard snags greater than 12 inches DBH will be maintained.

4. An additional 300-acre feeding area shall be provided in adjacent management areas. Refer to forestwide standard and guideline X-X for specific direction.

5. Pileated woodpecker areas shall be dispersed throughout suitable habitat, not more than 5 miles apart from the center of one area to the center of another area.

6. Disturbing human activities within .25 mile of an active pileated woodpecker nest site shall be discouraged or minimized from March 1 through July 31 (refer to forestwide standards and guidelines).

C. Northern goshawk area requirements are as follows.

1. A minimum of 60 acres of contiguous old-growth and/or mature mixed conifer, ponderosa pine and associated species, ponderosa pine, and lodgepole pine

plant communities shall be provided as primary breeding and foraging habitat for one pair of northern goshawks.

2. Northern goshawk areas shall be dispersed throughout suitable habitat, not more than 5 miles apart from the center of one area to the center of another area.

3. Disturbing human activities within .25 mile of any active northern goshawk nest shall be discouraged or minimized from March 1 through August 31 (refer to forestwide standards and guidelines).

D. Three-toed woodpecker area requirements are as follows.

1. A minimum of 75 acres of contiguous old-growth and/or mature lodgepole pine or subalpine fir shall be provided as primary breeding and foraging habitat for one pair of three-toed woodpeckers.

2. Three-toed woodpecker areas shall be dispersed throughout suitable habitat, not more than 2.5 miles apart from the center of one area to the center of another area.

3. Within the 75-acre primary breeding area, a minimum average of two hard snags per acre greater than 10 inches DBH shall be maintained as follows:

a) Forty-five suitable nesting snags (hard) greater than 12 inches DBH shall be available within the 75-acre primary breeding area.

b) Within the 75-acre breeding area, 105 hard snags greater than 10 inches DBH shall be maintained.

4. Disturbing human activities within .25 mile of an active three-toed woodpecker nest site shall be discouraged or minimized from April 15 through July 15 (refer to forestwide standards and guidelines).

E. Marten area requirements are as follows.

1. A minimum of 160 acres of contiguous mature and/or old-growth mountain hemlock or high elevation lodgepole pine shall be provided as a territory for one breeding female. This also constitutes part of a territory for a breeding male; this territory covers several female territories.

2. Marten areas shall be dispersed throughout suitable habitat, not more than 3 miles apart measured center to center.

Timber

1. Timber harvest shall not be programmed.

2. Timber management techniques may be used to enhance low quality stands to greater potential.

Range

1. Old-growth ecosystems selected for management shall be protected from adverse impacts of livestock.

Minerals and Energy

1. New salable mineral material sources shall not be developed, and existing developments shall not be expanded into areas managed for old-growth values.

2. Reasonable access for the exploration and/or development of locatable and leasable minerals shall be allowed but shall be highly controlled to protect old-growth values.

3. Except for road access, surface occupancy should not be allowed.

4. Personal use or commercial firewood cutting permits shall not be issued for these areas.

Lands

1. Landownership classification group II applies to this management area. However, opportunities may become available where disposing of an existing old-growth stand may allow land acquisition in another area that would enhance the overall old-growth distribution.

2. This management area is an avoidance area for transportation and utility corridors.

Facilities

1. Road closures in specific areas and during specific periods shall be used to protect the resource.

2. New road and other facilities construction shall be avoided in this area.

Protection

1. Fire shall be suppressed in a manner which best retains old-growth ecosystem character.

Management Area 8 - Riparian Areas

Goal

Riparian area management is designed to protect soil, water, wetland, floodplain, wildlife, and fish resource values associated with riparian vegetative communities and adjacent drier ecosystems. Management emphasis is on water quality, deer fawning, wildlife habitat, and aquatic ecosystems. Existing conditions will be maintained or enhanced.

Description

This management area may be applied to lands that are characterized by streams, lakes, ponds, springs, and wetlands--including seeps, bogs, wet and moist meadows, and wet and moist conifer plant associations. It includes riparian ecosystems and transitional ecosystems as defined by "Riparian Zone Associations" (R6 Ecol TP-279-87, Kovalchik). Also included are nonriparian areas adjacent to streams, lakes, and wet meadows that must be carefully managed to protect riparian values.

Specific boundaries of this management area are identified during project level planning.

Desired Future Condition

The desired future condition is riparian vegetative communities containing openings and meadows interspersed with stands in various successional stages. These stands differ in age, species composition, density, and size. Riparian vegetation provides wildlife habitat and adequately protects floodplains, bank stability, and water quality. Few roads and other facilities are present within the riparian area.

Standards and Guidelines

Specific standards and guidelines that apply to all management intensities of this management area are stated in this subsection.

Throughout this set of standards and guidelines, the term "riparian area" is synonymous with the term "riparian zone" as used in the "Riparian Zone Association Guide for Area IV."

Recreation

1. The area shall be managed for a full range of recreation opportunity settings.

2. Primary recreation emphasis shall be placed in dispersed recreation.

3. The visual quality level shall be consistent with adjacent area objectives, and typically will be partial retention or better as a result of other riparian area standards and guidelines.

4. Recreation facilities placed in riparian areas shall be designed to protect riparian values.

Wildlife and Fish

1. Dead woody material and cavity-nester habitat shall be provided by managing dead trees at the 80 percent potential population level for cavity nesters (Thomas 1979) in forested areas. Green trees shall be managed for future replacements for dead trees.

2. New roads within 0.25 mile of a riparian area shall be located in a manner as to provide for greatest topographic and vegetative screening of the riparian area.

3. Wildlife habitat improvements may be permitted.

Range

1. Where a combination of high soil moisture and fine soil texture results in stream banks susceptible to early season trampling damage, grazing shall be delayed to a late season period (Clary and Webster 1989).

2. Where stream banks or channels are highly erodible, the stubble height at the end of the grazing period shall exceed 4 inches. Under extreme conditions, the area may need permanent protection or removal of grazing for long periods (Clary and Webster 1989).

3. Water developments for livestock or wildlife in riparian areas shall be designed to protect riparian values.

4. Salting areas shall be located on uplands outside of riparian areas.

5. Sheep bedding areas shall be located on uplands outside of riparian areas.

Soil and Water

1. Riparian area management objectives shall be described for a specific zone along a stream or wetland within the proposed project area. As a minimum, the following areas shall be evaluated during the preparation of the objectives:

   a) an area within 100 feet of the normal high water line of Class I, II, or III streams (for protection of water quality and wildlife habitat);
   b) an area within 25 feet on each side of Class IV streams;
   c) any timbered area within 200 feet of wet meadows (to provide wildlife hiding cover);
   d) the entire area of a wetland, including the farthest reaches of the riparian vegetative influence; and
   e) any seeps and springs.

2. The cumulative total area of detrimental soil conditions in riparian areas shall not exceed 10 percent of the total riparian acreage within an activity area. Detrimental soil conditions include compaction, displacement, puddling, and moderately or severely burned soil.

3. Fish habitat and riparian area improvement projects shall be permitted.

Timber

1. Timber harvest shall not be programmed within 100 feet of Class I and II streams and within 50 feet of Class III streams. In other riparian areas, timber harvest shall be programmed.

2. Stocking level control may be delayed if necessary to provide big game cover or habitat diversity.

3. Directional fell and yard away from all stream channels (classes I-IV) and wet areas. Logs yarded over streams shall be fully suspended where practicable.

4. Landings should not be located within riparian associations as defined by "Riparian Zone Associations" (R6 Ecol TP-279-87, Kovalchik).

5. Uneven-aged management in the ponderosa pine, pine associated, and mixed conifer working groups shall be designed to maintain healthy, multistoried stands that contain various size classes up to 36 inches DBH following harvest. The lodgepole pine working group shall receive a variety of silvicultural treatments to meet the management area objectives.

6. Existing stands of hardwood species should be protected or enhanced.

Minerals and Energy

1. New salable mineral material sources should not be developed, and existing developments should not be expanded into riparian areas.

2. Reasonable access for the exploration and/or development of locatable and leasable minerals shall be allowed but shall be be highly controlled to protect riparian values.

3. Except for road access, surface occupancy should not be allowed.

Lands

1. Landownership classification group III applies to this management area. Disposal of lands shall occur only if riparian lands of equal or higher quality shall be acquired.

Facilities

1. New road construction in riparian areas should be avoided. Where road construction is unavoidable, roads should cross riparian areas perpendicular to the landform. System and temporary roads should not be constructed through the length of a riparian area. System and temporary roads crossing a riparian area shall not alter stream or ground water flow characteristics to a degree that will adversely affect the riparian characteristics.

2. Existing roads within riparian areas should be evaluated for opportunities to reduce impacts on riparian values.

3. New water developments and reconstruction of developments for road dust abatement and fire control, for example, in riparian areas shall be designed to protect riparian values.

Protection

1. Wildfire suppression methods that minimize effects on the soil and on riparian ecosystems shall be used. High-impact methods shall be used only on fires that threaten human life and property and riparian resources.

Management Intensities

The following management intensities may be applied.

Management Area 8A
Riparian Areas Adjacent to Class I, II, and III Streams

Goal

This management intensity is designed to maintain or improve riparian areas associated with Class I, II, and III streams and with lakes. Management practices shall meet (as a minimum) the substantive State Best Management Practices (BMP) requirements and other considerations required by the National Forest Management Act (NFMA) and other authorities for the protection of the soil and water resources.

Description

This management intensity is applied to areas associated with Class I, II, and III streams and includes meadows and forested areas exhibiting riparian vegetation along these streams. At a minimum, it includes an area within 100 feet of either side of the normal high water level of the stream. Actual on-the-ground streamside riparian areas may be much greater than 100 feet, extending to the farthest reaches of the riparian vegetation influence. This management intensity also applies to land adjacent to lakes containing resident trout.

Desired Future Condition

The desired future condition includes:

1. A diversity of vegetative types ranging from open meadowlands to forested land to provide instream cover for fish, bank, and floodplain stability, and habitat for big game and nongame wildlife.

2. High standards of water quality in terms of temperature, turbidity, and bank stability for fisheries and recreational uses and to meet State water quality standards.

Intensity-Specific Standards and Guidelines

Recreation

1. Vehicles, including off-road vehicles, shall not be allowed in stream channels or on sensitive stream banks.

Wildlife and Fish

1. Water use during low water periods shall be limited to emergency fire suppression situations only.

2. Fish habitat improvements may be permitted but must be coordinated with range, watershed, and recreation resources, and the Oregon Department of Fish and Wildlife.

3. Shrubs and trees shall be managed to maintain at least 50 percent of the riparian area in hiding cover for big game.

4. Wildlife improvements encouraging streamside cover may be permitted.

5. Reservoirs may be planned for fisheries and other compatible uses where feasible.

Range

1. Livestock shall be managed so that no more than 5 percent of the stream banks in a stream reach (see glossary) exhibit degradation caused or perpetuated by livestock.

Timber

1. All logging slash/residue shall be removed from within the high water level. Large logs may be left or introduced as large woody debris.

2. Created openings, which may be necessary to treat lodgepole pine, shall not occur directly across a stream from an existing opening. Openings shall not encompass more than 600 feet of a stream length.

3. Selected hardwoods or conifer trees adjacent to the stream channel shall be retained.

Facilities

1. To provide for fish passage, arch culverts, bridges, or similar open bottom structures should be required on permanent road crossings on all Class I and II perennial streams.

Protection

1. Heavy equipment generally shall not be allowed in stream channels. Based on resource analysis, exceptions such as dry crossings or fords may be allowed upon approval of appropriate line officer or designated resource adviser.

2. Fuels shall be disposed of so that they will not reach stream courses. Slash piles shall not be located within the normal high-water flow area of either natural or created drainages.

3. Only low intensity fire should be prescribed within 100 feet horizontal distance on either side of Class I, II, or III stream channels.

Management Area 8B
Riparian Areas Adjacent to Class IV Streams

Goal

This management area is designed to minimize adverse downstream impacts on Class I, II, and III streams, to protect bank and channel stability of Class IV streams, to meet or exceed BMPs, and to provide quality habitat for nongame and big game wildlife species.

Description

This management intensity may be applied to Class IV streams. These are intermittent streams or segments not meeting criteria for Class I, II, or III streams and include streamside meadows and forested

areas exhibiting riparian vegetation. At a minimum, it shall include an area within 25 feet of the normal high-water level on either side of the stream.

Desired Future Condition

Provide a vegetative condition that shall protect stream banks from erosion and protect downstream values.

Provide cover and forage for big game and nongame wildlife.

Intensity-Specific Standards and Guidelines

Wildlife and Fish

1. Shrubs and trees shall be managed to maintain at least 50 percent of the riparian area in hiding cover for big game.

2. Provide cavity-nester habitat at the 80 percent potential population level with sufficient live replacement trees to meet future needs.

Range

1. Livestock shall be managed so that no more than 10 percent of stream bank exhibits degradation caused or perpetuated by livestock.

2. Livestock water developments shall be designed so that streamside degradation does not occur.

Timber

1. Activity-created debris shall be cleared from stream channels except for large woody material keyed into stream banks that contribute to water quality, and stream channel and bank stability.

2. Skid trails shall cross Class IV streams only at approved locations, shall cross perpendicular to the stream, and shall be designed to avoid altering the drainage characteristics of the stream.

Management Area 8C
Moist and Wet Meadows

Goal

This management intensity is designed to protect, maintain, or enhance moist and wet meadows and associated wildlife habitat. Maintain or improve meadow condition, and prevent gullying or dropped water tables. Reduce encroachment of conifers on existing meadows.

Description

This management intensity may be applied to moist and wet meadows, which are areas dominated by grasses, sedges or other grass-like vegetation and forbs associated with seasonal or continuous high

water tables. These areas are often flooded in the spring. These areas provide forage for big game and habitat for abundant nongame wildlife. These areas are an important component of forest diversity. This management intensity also includes a 200 feet wide perimeter of timber surrounding wet meadow areas, which is important hiding cover for wildlife.

Desired Future Condition

The desired future condition of moist and wet meadows is the maintenance of quality meadow condition and no encroachment by conifers and providing adequate forage for big game and livestock. Also desired is a lack of gullying or lowered water tables which drain the meadows.

Intensity-Specific Standards and Guidelines

Recreation

1. Vehicles, including off-road vehicles, should not be allowed in meadows during wet soil conditions.

Wildlife and Fish

1. At least 50 percent of the meadow edge should be managed to maintain hiding cover condition to provide high levels of use of the meadows.

2. Cover areas will be 10 acres in size and no less than 600 feet in width.

Range

1. Livestock will be controlled to maintain or improve vegetative condition of moist and wet meadows.

Protection

1. Prescribed fire may be used as a tool to limit conifer encroachment on moist and wet meadows but shall be done under conditions such that reduction of organic peaty deposits does not occur.

Management Area 8D
Moist and Wet Forested Riparian Areas
(Hardwood, Lodgepole, or Other Conifer)

Goal

Maintain or improve these riparian ecosystems to encourage wildlife habitat, fawning cover, forage, and hydrologic values.

Description

This management intensity applies to all moist or wet forested plant associations that exhibit riparian vegetative characteristics in the understory. These areas may be associated with springs, seeps, or

bogs; in areas where spring snow melt or seasonal rainfall is trapped in low gradient depressions with poor drainage; and in floodplains greater than 100 feet from stream channels.

These areas are especially important habitat for big game because of their proximity to water, succulent forage, cover value, and moist microclimate. They are particularly important for mule deer fawning and elk calving.

Desired Future Condition

The desired future condition is an area with structural vegetative diversity in which small openings (less than 20 acres) are interspersed with hardwood species and open-canopied stands and patches of conifer reproduction that provide big game hiding cover.

Intensity-Specific Standards and Guidelines:

Wildlife and Fish

1. Small openings may be created to provide grass and grass-like vegetative components for diversity and forage for big game.

2. Except in created openings, shrubs and trees shall be managed to maintain at least 50 percent of the riparian area in hiding cover for big game.

Timber

1. Intensity of harvest treatments and spatial distribution of cutting units shall ensure that hydrologic conditions are maintained or improved.

2. No more than 25 percent of the riparian area described shall be in created openings.

3. In environmental analysis before harvest activities, evaluate the potential of logging to temporarily convert wet lodgepole sites to wet meadows.

4. Heavy machinery shall not be permitted on wet or organic soils when there is a hazard of compaction.

Management Area 9 - Bald Eagle Habitat

Goal

Management Area 9 is designed to maintain, enhance, and provide nesting, foraging, and winter roosting habitat for bald eagles consistent with the Pacific States Bald Eagle Recovery Plan (1983) and Working Implementation Plan for the Bald Eagle Recovery in Oregon and Washington (January 1989).

Description

This management strategy may be applied to lands where there are nesting bald eagle pairs or winter roosting eagles or where potential habitat exists for additional nesting pairs or for winter roosting eagles. Nesting habitat generally occurs in overmature stands with large diameter, large-limbed, open-canopied trees within 1 mile of water. Major foraging areas are large bodies of water within 1 mile of nest trees. Bald eagles also forage in areas within nest sites and between nest sites and major foraging areas. Winter roosts occur in stands similar to those described for nesting, but may be located farther from major foraging areas.

Desired Future Condition

The desired future condition is an increase in the number of nesting bald eagles and maintenance of wintering populations of bald eagles on the Forest. The habitat will consist of a preponderance of multistoried stands of large diameter mixed conifer, ponderosa pine and associated species, and ponderosa pine. These stands provide bald eagle nesting habitat and communal winter roosting habitat. Ponderosa pine, Douglas-fir, and sugar pine are the major preferred tree species. The upper canopy level is comprised of large diameter trees with open upper crowns and large horizontal branches. Overstory trees and large snags provide perching habitat. Winter roosting areas are available in a relatively undisturbed condition. Major foraging areas are providing waterfowl habitat at high levels.

Standards and Guidelines

Specific standards and guidelines that apply to all management intensities of this management strategy are stated in this subsection.

Recreation

1. The area shall provide a range of recreation opportunity settings.

2. Developed recreation like campgrounds, summer homes, and resorts is not compatible with the goals of this management strategy. Existing developed sites will not be expanded, and increased use will be discouraged when monitoring identifies a potential conflict with bald eagle use. New sites will not be developed.

3. The forested environment created by bald eagle habitat management shall typically achieve no less than the partial retention visual quality level.

Wildlife and Fish

1. Except where dead trees are identified as safety hazards to humans, dead tree habitat will be maintained at above the 80 percent level of the 20-inch or greater DBH trees to

provide adequate bald eagle perch trees and to meet needs of cavity-dependent wildlife. For optimum bald eagle use, one large snag per acre should be left for perch trees.

2. Marshes and lakes within 2 miles of nest sites, perches, and roosts will be managed to provide waterfowl and fish prey for bald eagles. Fish and waterfowl numbers may be increased through habitat enhancement projects and cooperative efforts with Oregon Department of Fish and Wildlife and U.S. Fish and Wildlife Service.

Timber

1. Competing vegetation should be controlled or eliminated (at least within the crown drip line) to maintain nesting and winter roosting habitats and to lessen their susceptibility to insect attacks.

2. Vegetation management activities shall emphasize the development of large diameter trees of the preferred species into suitable bald eagle nest, perch, and roost trees.

Minerals and Energy

1. New salable mineral material sources should not be developed, and existing developments should not be expanded.

2. Reasonable access for the exploration and/or development of locatable and leasable minerals shall be allowed but shall be highly controlled to protect habitat values.

3. Except for road access, surface occupancy should not be allowed.

Lands

1. Landownership classification group II applies to this management strategy. Disposal of lands shall occur only if bald eagle habitat of equal or higher quality shall be acquired.

2. Electric distribution lines are acceptable to the extent that they will not preclude bald eagle access to and utilization of the management area and will prevent electrocution of bald eagles.

3. Most special uses are not compatible with the goals of this management strategy. Existing special uses shall not be expanded and additional special use permits shall be discouraged when monitoring identifies a potential conflict with bald eagle use.

Protection

1. Insect and disease outbreaks will be managed with a minimum of resource disturbance. Biological and silvicultural treatments will be emphasized.

   The use of toxic chemicals that adversely affect bald eagles will not be allowed. Such chemicals include DDT and other persistent organochlorine pesticides, PCB, mercury, and lead. Selected suppression methods should feature integrated pest management.

2. Protection of bald eagle nesting and winter roosting habitat from wildfire will have high priority for fire suppression.

3. If suppression efforts are within .5 mile of an active bald eagle nest during the nesting season, they shall be based on minimizing the disturbance time to bald eagles. Fire camps should be located at least 1 mile from active nests.

4. Prescribed fire may be used to reduce hazardous fuel accumulations. Burning prescriptions will be consistent with management strategy objectives.

Management Intensities

The following management intensities may be applied.

Management Area 9A
Bald Eagle Nest Sites and Recovery Sites

Goal

This management intensity is designed to maintain, enhance, and provide bald eagle nest sites. Some of these nest sites may also provide winter roosting habitat.

Description

This management intensity may be applied to lands where there are nesting bald eagle pairs or areas identified as bald eagle recovery nest sites.

Desired Future Condition

The desired future condition is multistoried stands of mixed conifer, ponderosa pine and associated species, and ponderosa pine that may provide bald eagle nesting habitat and communal winter roosting habitat. Ponderosa pine, Douglas-fir, and sugar pine are the major preferred tree species. The upper canopy level is comprised of large diameter trees with open upper crowns and large horizontal branches. A component of large trees also is not yet suitable as nest trees but along with large dead trees provides perching habitat. There may be an intermediate canopy level present that consists of immature trees of the desired species. An understory canopy level of seedlings, saplings, and pole-sized trees provides a visual barrier around nest trees, except within the crown drip line of nest and roost trees.

Nesting habitat will be provided for 32 pairs of bald eagles; this was determined to be the Winema National Forest share of habitat (Draft Pacific States Bald Eagle Recovery Plan 1983).

Intensity-Specific Standards and Guidelines

Wildlife and Fish

1. Nest site implementation guides shall be developed for each of the 32 nest sites by the end of the decade.

2. When a pair of bald eagles establishes a nest in a recovery nest site or any other site, that site will become an existing nest site.

3. Disturbing human activities within .5 mile of an active bald eagle nest site will be discouraged or minimized from January 1 through August 31.

4. If a pair of bald eagles chooses to establish a new nest in an area already receiving human use, the human activities occurring at that time should be evaluated for continuance.

5. Nest sites will be at least 125 acres. Nest site areas may vary from 125 acres to 620 acres; the size depends on such factors as topography, eagle use patterns, and proximity of existing land uses near the nest site.

6. There will be 20 percent to 40 percent crown closure of the upper canopy level.

Timber

1. Timber harvest shall not be programmed.

2. Multistoried stands within .25 mile of established nest trees shall be considered for uneven-aged management to maintain or to enhance bald eagle nesting habitat.

Facilities

1. Existing Forest Service roads within .5 mile of active nests should be closed during the January 1 to August 31 nesting season.

2. New road networks shall be designed to facilitate easy control of access during the bald eagle nesting/roosting seasons.

Minerals and Energy

1. New salable mineral material sources shall not be developed, and existing developments shall not be expanded.

2. Except for road access, surface occupancy shall not be allowed.

Management Area 9B
Bald Eagle Replacement Habitat

Goal

This management intensity is designed to develop and enhance replacement habitat for bald eagle nesting, roosting, and perching needs in the event of catastrophic loss of existing nesting, roosting, and perching habitat.

Description

This management intensity may be applied to lands adjacent to existing and recovery nest sites or to other potentially suitable nesting and roosting habitat.

Desired Future Condition

The desired future condition is multistoried stands of mixed conifer, ponderosa pine and associated species, and ponderosa pine that may provide bald eagle nesting habitat and communal winter roosting habitat. Ponderosa pine, Douglas-fir, and sugar pine are the major preferred tree species. The upper canopy level is comprised of large diameter trees with open upper crowns and large horizontal branches.

A component of large trees also is not yet suitable as nest trees. An intermediate canopy level of immature trees of the desired species may exist. An understory canopy level of seedlings, saplings, and pole-sized trees provides a visual barrier around potential nest trees.

Intensity-Specific Standards and Guidelines

Wildlife and Fish

1. When a pair of bald eagles establishes a nest in a replacement stand, that stand shall become an additional nest site and shall be managed according to the standards and guidelines for Management Area 9A.

2. Replacement stands shall be developed and managed to occur on at least 50 percent of each contiguous 40-acre tract to ensure uniform distribution of habitat throughout the management area.

3. The upper canopy level of a replacement stand shall contain five to 10 trees per acre that exhibit the following characteristics:

   a) Have large open upper crowns and large horizontal branches;
   b) Are in the group of preferred tree species; and
   c) Are a minimum of 36 inches DBH and an average of 42 inches DBH or larger.

   The upper canopy levels of a nest site also will have five to 15 trees per acre that have the following characteristics: have the potential to develop open upper crowns and large horizontal branches, are in the group of preferred tree species, and are a minimum of 24 inches DBH and an average of 28 inches DBH.

4. There will be 20 percent to 40 percent overstory crown closure in nest sites.

Timber

1. Timber harvest will be programmed.

Management Area 9C
Bald Eagle Winter Roosting Habitat

Goal

This management intensity is designed to maintain and enhance communal winter roosting habitat for bald eagles.

Description

This management intensity shall be applied to lands where communal roosting by bald eagles occurs.

Desired Future Condition

The desired future condition is stands of Douglas-fir and ponderosa pine with two or more canopy levels. The upper canopy level is comprised of large diameter trees with open upper crowns and large horizontal branches. The understory canopy level is comprised of seedlings and saplings.

Intensity-Specific Standards and Guidelines

Wildlife and Fish

1. Bald eagle winter roosting habitat shall be identified and managed to maintain or enhance the existing characteristics. A minimum buffer of .25 mile around identified roost trees will be established. This buffer delineates the exterior boundary of the roosting habitat.

2. Disturbing human activities (including snowmobile use) within .5 mile of an active bald eagle winter roost shall be discouraged or minimized from November 1 through March 31.

3. Provide eight to 16 open-crowned, large limbed Douglas-fir and ponderosa pine trees per acre that are a minimum of 20 inches DBH.

4. Maintain or provide at least one dead tree greater than 30 inches DBH with a height greater than 75 feet per acre for diurnal perching.

Timber

1. Timber harvest shall not be programmed.

Minerals and Energy

1. New salable mineral material sources shall not be developed, and existing developments shall not be expanded.

2. Except for road access, surface occupancy shall not be allowed.

Management Area 12 - Timber Production

Goal

Management Area 12 is designed to produce a high level of growth and timber production with considerations for economic efficiency and resource protection.

Description

This management area is applied to lands that are predominately forested and capable of high levels of timber production.

This management area has a primary focus on the production of wood products, but also provides a variety of dispersed recreation opportunities, wildlife habitat, and forage for domestic livestock.

Desired Future Condition

The desired future condition is a mosaic of healthy stands capable of sustaining high levels of timber production. Such stands typically are comprised of trees that are growing rapidly and have well-developed crown ratios and low levels of mortality.

Standards and Guidelines

Specific standards and guidelines that apply to all management intensities of this management area are stated in this subsection.

Recreation

1. The area shall be managed to provide roaded natural or roaded modified Recreation Opportunity Spectrum settings.

2. A variety of dispersed recreation activities shall be permitted.

Scenic

1. Management activities shall meet or exceed the maximum modification visual quality level.

Timber

1. Timber harvest shall be programmed.

2. A variety of diameter classes up to 24 inches DBH will remain after harvest in all stands treated with uneven-aged silvicultural systems. Uneven-aged management is not planned for use in the lodgepole pine or mixed conifer working groups in this management area.

3. Stocking levels may be varied to meet other resource requirements as long as 90 percent of the cubic foot timber growth potential is maintained.

Lands

1. Landownership classification group 3 applies to this management area.

Wildlife and Fish

The following guidelines provide direction associated with the salvage of the dead and dying lodgepole pine. The guidelines only apply to the treatment of lodgepole pine stands in Management Area 12; the stands either are affected, or are expected to be affected, by the mountain pine beetle epidemic. The guidelines only apply during the life of the epidemic and during the accelerated salvage of the lodgepole pine.

1. At least 30 percent of implementation areas in lodgepole stands will be managed to provide deer hiding areas. Generally, at least 70 percent of an implementation unit will be within 600 feet of cover. Hiding cover must meet the definition for hiding cover or either of the following set of conditions:

   a) Five acres or larger, fully stocked stands that average at least 6 feet tall and that have not been thinned for 15 years; or

   b) Residual clumps of one-half acre or larger, fully stocked stands within units with advanced regeneration (trees including "whips" up to 7-inch DBH) and at least 12 greater than 7-inch DBH trees per acre remaining after harvest. Residual dead and down material will be left in the units to achieve fuel loadings of Photo Series identifiers 2-LP-3-PC and 2-PP-4-PC (Maxwell and Ward 1976). Photo Series identifiers 1-LP-3-CC and 3-PP-4-PC are at the upper limit of acceptability and would require treatment. Clumps should be located away from roads.

   Hiding areas may not meet the definition of hiding cover developed for the Blue Mountains (Thomas 1979). Similarly, although some thermal cover will be provided, the crown closure of the hiding areas will not meet the requirements in Thomas (1979).

2. Hiding area guidelines will be applied over entire implementation units and will consider only those areas capable of providing hiding areas.

3. Units meeting the requirements of Wildlife and Fish Guideline 1b will be retained in harvest units, where needed, to connect deer travel corridors, to break up large openings, or to mitigate for cover deficiencies in other portions of implementation units.

4. Spot treatment of fuels may be needed to break continuity and treat pockets of heavy accumulation.

5. Advanced regeneration and green trees should be left to reduce view distances from roads.

6. In planning projects, the following areas or treatments could contribute to achieving the desired cover conditions:

   a) Management requirement areas, riparian areas, and management areas not associated with timber management;

b) Timber types other than mature lodgepole pine where treatment can be delayed;

c) General forest areas that are unsuited for harvest but meet the hiding needs in Wildlife and Fish Guidelines 1a or 1b;

d) Existing harvest units or portions of the units that meet or will meet the hiding requirements in Wildlife and Fish Guidelines 1a and 1b within the contract period (in these areas, precommercial thinning may need to be delayed); and

e) Partially treated stands in a proposed timber sale that will still provide hiding conditions meeting the requirements of Wildlife and Fish Guidelines 1a and 1b.

7. To achieve greater age-class diversity in the future, residual stands should be retained where the option exists; foregoing "whip" cutting is necessary.

8. Reductions in open-road density may be used to offset reductions in hiding cover to achieve habitat effectiveness objectives for implementation units.

9. Arrangement of cover areas into corridors is a preferred condition that will be achieved where possible, but will not prohibit accomplishment of timber management objectives. If necessary, the integrity of corridors will be maintained by connecting cover areas with units meeting the requirements in Wildlife and Fish Guideline 1b.

Management Area 15 - Upper Williamson

Goal

Management Area 15 provides a natural-appearing forest setting for dispersed recreation activities and special wildlife habitats.

Description

This management area applies to the historical Klamath Tribe use areas along the Upper Williamson River and along the Klamath Forest Marsh.

Desired Future Condition

The desired future condition is a slightly altered forest environment, including a mix of native coniferous and deciduous trees and shrubs. There is a generally uniform appearing forested environment with a variety of age classes throughout the ponderosa pine working group. Cutting units will dominate in the lodgepole pine working group.

Standards and Guidelines

Recreation

1. The area shall be managed to provide a roaded natural to roaded modified recreation opportunity setting.

2. Special use permits may be permitted for traditional tribal camping over extended periods.

3. Low-key interpretative facilities may be provided in special wildlife and historic areas, particularly around the Klamath Forest Marsh.

Scenic

1. Scenic management activities shall generally achieve the foreground partial retention visual quality level. However, the foreground of the Williamson River will generally achieve the retention visual quality level.

2. Evidence of management activities (such as tree removal and slash disposal) along roads will not be visible three years after the work is completed.

Wildlife and Fish

1. The portions of this management area along the edge of the Klamath Marsh shall be managed to produce larger diameter (36 inches DBH or greater), open-canopied, long-limbed ponderosa pine and Douglas-fir for replacement bald eagle nesting habitat.

2. Fish and waterfowl habitat improvement will be emphasized in riparian areas adjacent to this management area.

Timber

1. Timber harvest shall be programmed.

2. Uneven-aged management systems shall be used in the ponderosa pine and pine associated working groups. A variety of sizes up to 30 inches DBH will remain after harvest, except in areas of foreground retention and eagle replacement where a 36-inch DBH size class shall remain after harvest.

3. Uneven-aged management silvicultural systems may be used to manage the lodgepole pine working group if it is deemed optimal during project-level planning. A variety of size classes up to 12 inches DBH will be retained after an uneven-aged harvest entry.

4. Stocking levels may be varied to meet other resource needs.

Lands

1. Landownership classification group 2 applies to this management area. Acquisition of private lands should be directed at obtaining fish and wildlife habitat and access for the recreating public. The Forest shall also consider acquisition of less than fee title to meet landownership objectives.

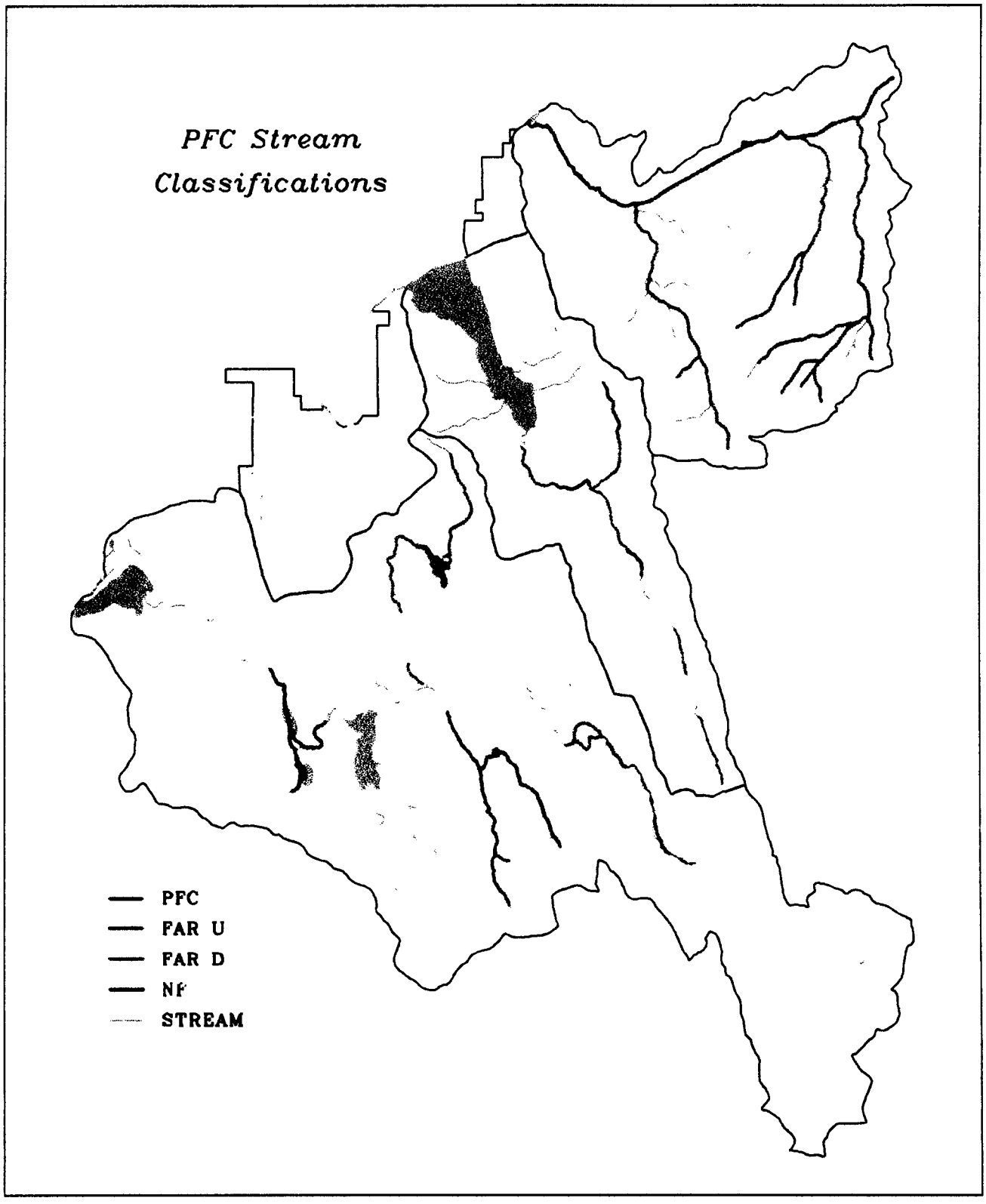
2. This is an avoidance area for new transportation and utility corridors.

Protection

1. In areas along roads, wood residues from stand management activities may be present in low levels, such as an occasional large down log and scattered branches that appear natural. Slash should be piled and burned in areas of low visibility, and low impact methods should be used. Uprooted stumps are not desirable, and should be removed unless they are blended to appear natural in the landscape.

APPENDIX

B



Functional condition of streams examined in Hog, Yoss and Skellock Watersheds. Only discontinuous and major intermittent streams were examined. Calls were not made on private lands, resulting in the breaks in calls seen on the map.

FUNCTIONAL CONDITION OF STREAMS EXAMINED

IN H&Y ANALYSIS AREA

Legal	Reach	Periodicity	Condition	Risks
		Skellock Draw		
T31SR9ES14/15	MR1	INT	NF	A,C,E,F,H
T31SR9/10E	MR2	INT	NF	A,C,E,F,H
		Corral Springs		
T31SR9ES23-26	T7AR1	INT/PER	FAR D	A,B,C,E,F
T31SR9ES25/36	T7AR2	INT	FAR D	A,C,E,F,H
T31SR9ES36	T36BR1	INT	FAR D	A,B,C,F,G
		Clover Creek		
T31SR10ES8,9,16	T31AR1	INT	FAR D	A,E,F
T31SR10ES16/20/21	T31AR2	INT	FAR U	A,C,E,F
T31SR10ES20,21	T31AR3	INT	FAR D	A,B,E
T31SR10ES20,29	T29AR1	INT	FAR D	A,E,F
		Meadow Creek		
T31SR10ES9/16/21	T6AR1	INT	FAR U	E,F,H,I
T31SR10ES21/28	T6AR2	INT	NF	A,B,C,E,F,I
T31SR10ES28	T6AR3	INT	PFC	
T31SR10ES31-33	T6AR4	INT/PER	FAR D	A,E,F
T31SR10ES32/33	T5AR1	INT	FAR D	A,E
T32SR10ES4/32	T4AR1	INT	FAR D	A,E,F
T31SR10ES33/34	T33CR1	INT	FAR D	A,C,E,F
		Hog Creek		
T32SR8ES27	MR2	INT/PER	NF	A,E,H
T32SR8ES34	MR3	INT/PER	NF	A,C,E,H
T32/33SR8ES2/35	MR4	INT/PER	NF	A,E,H
T33SR9ES5/8/16/21	MR6	INT/PER	PFC	
T33SR9ES16	T16AR1	PER	FAR D	A,B
T33SR8ES2/11	T11AR1	INT	NF	A,F,H
T33SR8ES2/11	T11BR1	INT	NF	A,C,F,H
T33SR8ES2	T2AR1	INT	NF	A,C,F,H
T33SR9ES7/18/19	T19AR2	PER	FAR N/A	A,D,H
T33SR9ES5/6/8/17	T17AR1	PER	PFC	
T33SR9ES4/5/9/15	T15AR1	INT	NF	A,G,E

T33SR9ES3	T3AR1	PER	FAR N/A	H
T33SR9ES2/11/13/14	T13AR1	INT/PER	FAR D	A,E,F
T32SR9ES31	T31AR1	INT	FAR D	A,E
T32SR9ES7/8/17/20	T7AR1	INT	FAR D	A,E
T32SR9ES19/20	T7AR2	INT	FAR D	A,E
T32SR90ES18/19/30	T7AR3	INT	FAR D	A,F,G

Yoss Creek

T32SR9ES9	MR1	INT	FAR D	A,E
T32SR9ES9/10	MR2	INT	FAR D	E,H
T32SR9ES10/15	MR3	PER	PFC	
T32SR9ES14/23	MR4	PER	FAR U	
T32SR9ES23	MR5	INT	PFC	
T32SR9ES25/36	MR7	INT	FAR D	B,E
T33SR9ES7	MR9	INT	PFC	
T32SR9ES10/11	T2AR1	INT	FAR N/A	A
T32SR9ES11	T2AR2	INT	FAR D	A,H
T32SR9ES11/12	T2AR3	INT	PFC	

REACH DESIGNATION: e. g. T11BR2DRI

T11 - Tributary with headwaters in section 11
B - Indicates this is the second tributary originating in section 11
R2 - Reach number two in upstream direction from confluence of next larger tributary
D - Definable (D) channel as opposed to an Undefined (U) channel
R - Indicates an in-channel Riparian (R) plant community as opposed to a Non-riparian (N) plant community
I - Intermittent (I) as opposed to Ephemeral (E) or Perennial (P)

FUNCTIONAL CONDITION

PFC - Proper Functioning condition
FAR - Functional At Risk
FAR U - FAR, Upward Trend
FAR D - FAR, Downward Trend
NA - Trend Not Apparent
NF - Non-Functional

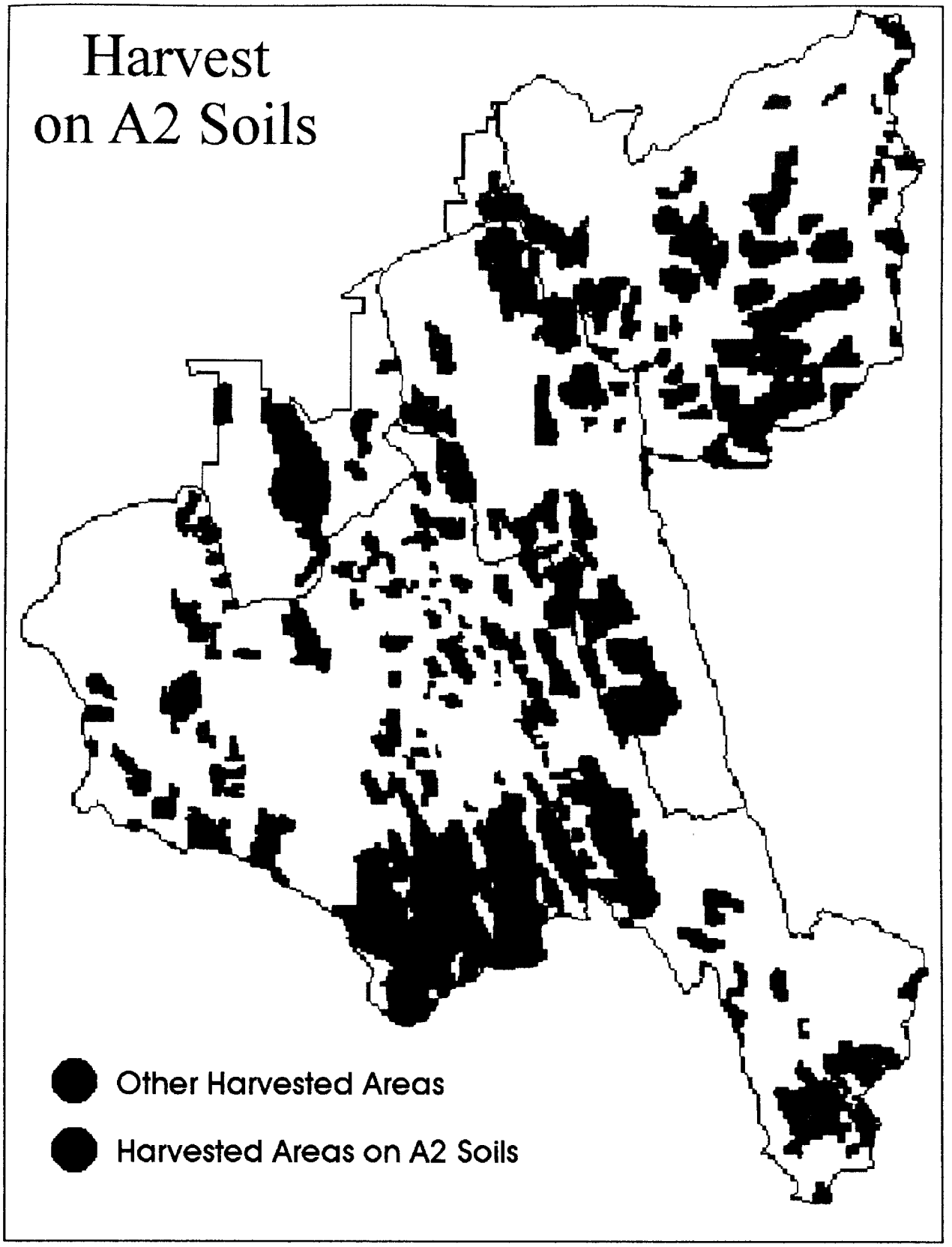
AT-RISK FACTORS COMMONLY ENCOUNTERED

A Roads/Vehicular Traffic
B Presence of Active Headcuts
C Side bank erosion
D Side slope erosion
E Increaser/Invader vegetative species/Encroachment
F Loss or Drying of Riparian Zone
G Past Logging Activity
H Manmade Diversions/Channelization
I Mixed effects from past Erosion Control Structures

This inventory was conducted using the interdisciplinary method prescribed in the handbooks "Process for Assessing Proper Functioning Condition, TR 1737-9 1993", and "Process for Assessing Proper Functioning Condition for Lentic Riparian-Wetland Areas, TR 1737-11 1994". These processes were developed by the Bureau of Land Management, Department of the Interior. The inventory was conducted to provide a preliminary assessment of the functioning condition of discontinuous and intermittent streams and drainages within H&Y. Other reaches may be added to this list at a later date.

APPENDIX

C



The Red polygons show areas that the District should monitor before implementing projects due to these areas potential of currently exceeding regional guidelines on soil compaction.