SOUTH OF SPRAGUE WATERSHED ANALYSIS

CHILOQUIN RANGER DISTRICT
WINEMA NATIONAL FOREST
KLAMATH COUNTY, OREGON
SEPTEMBER 1995

SOUTH OF SPRAGUE WATERSHED ANALYSIS

Table of Contents

Table of Contents (cont.)

APPENDICES

SOUTH OF SPRAGUE (SOS) WATERSHED ANALYSIS

I. INTRODUCTION

The intent of this assessment is to provide a general description of ecosystem structure, process, and function occurring within the watersheds of the SOS analysis area. 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 (Appendix A, Bibliography) New inventories and surveys to fill gaps in existing information are not part of this analysis effort.

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 concerns

1. How have streams, soil and hydrologic function changed from the reference era? What has caused these changes? What are the effects of these changes?

2. How have fire exclusion, grazing, timber harvest, road construction, railroad construction and other management activities changed the biological and physical elements of the landscape from the reference condition?

3. What are the current and reference era risks of stand replacement events from fire, insects, or disease?

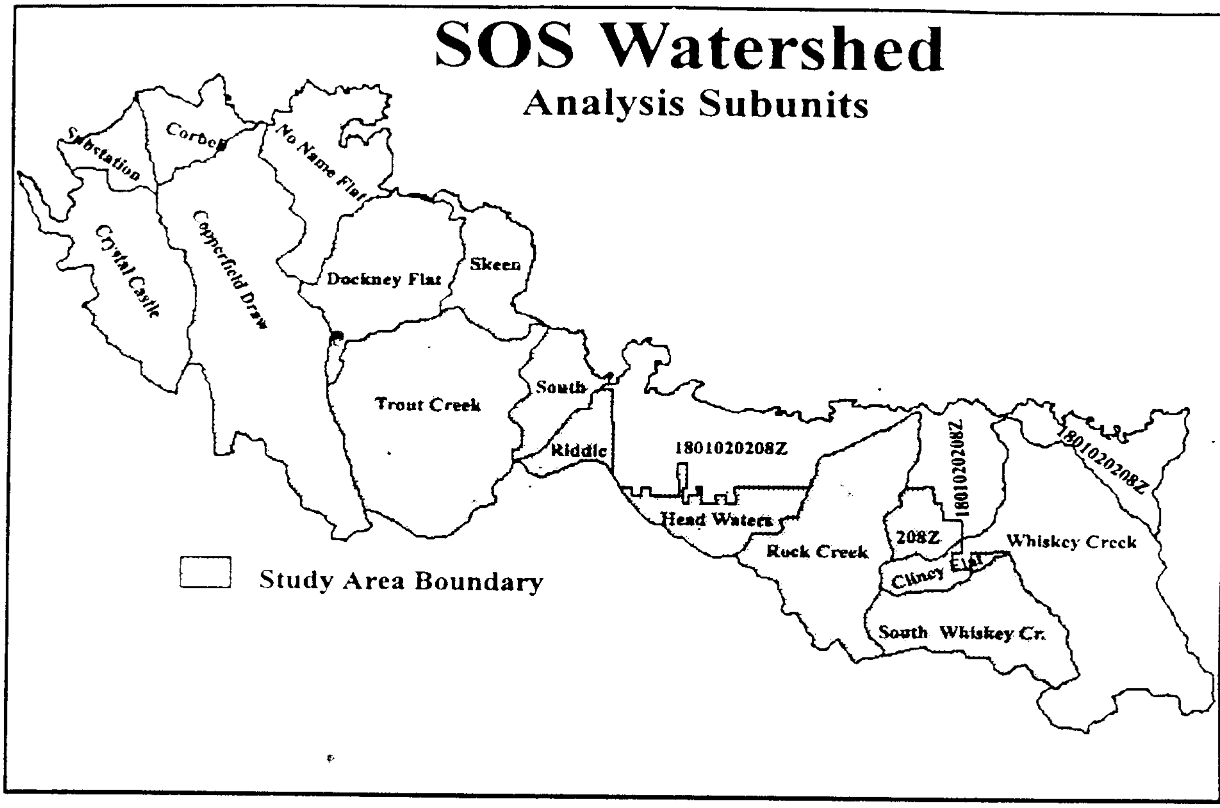
4. What is the relationship between management activities and TE&S habitat? How has habitat been altered by management activities?

5. Has soil compaction increased and what impact has this had on vegetation?

6. Has soil productivity increased or decreased since the reference period? What impact has this had on vegetation?

7. How does the impact of maintaining high stocking levels in conifer stands differ from the impact of maintaining historic stocking levels in those stands?

In order for the assessment team to portray the current processes, function, and condition for the watersheds, two time frames were selected: Pre-1900, and current. 1900 was selected because this was about the time when post-European contact activities began to most affect change across the landscape; as opposed to natural or indigenous population activities.



II. OVERVIEW

To aid in site-specific discussions, the study area boundary is divided into fifteen subdivisions identified in the map above. From west to east they are: Crystal Castle, Substation, Corbell, Copperfield, No Name Flat, Dockney Flat, Trout Creek, Skeen, South, Riddle, Headwaters, Rock Creek, 208Z, Cliney Flat, and South Whiskey. The study area boundary for SOS (108,239 acres) does not include the bulk of the private lands between the Winema National Forest boundary and the Sprague River, due to the lack of data available on these lands and time constraints precluding further research.

The hydrologic assessment portion of the study (148,103 acres) includes all lands south of and within the Sprague River Watershed between the Williamson and Sycan Rivers. The assessment encompasses 15% of the Sprague River drainage. Five units identified on the Winema GIS watershed layer are included: The main Sprague River (1801020208Z), Whiskey Creek (1801020208B), Trout Creek (1801020208E), Dockney Flat (1801020208H), and Copperfield Draw (1801020208I). The inclusion of the Whiskey Creek and 208Z subdivisions in the hydrologic assessment, although outside the study area, was deemed necessary to understand the hydologic function of the total system and evaluate the National Forest's role in stream restoration.

Total acreage involved in SOS study area: 108,239 acres.

- Winema National Forest: 86,634 acres (80% of study area).
- Private ownership: 18,137 acres (17% of study area).
- Fremont National Forest: 3,192 acres (2.75% of study area).
- BLM and State ownership: 276 acres (.25% of study area)

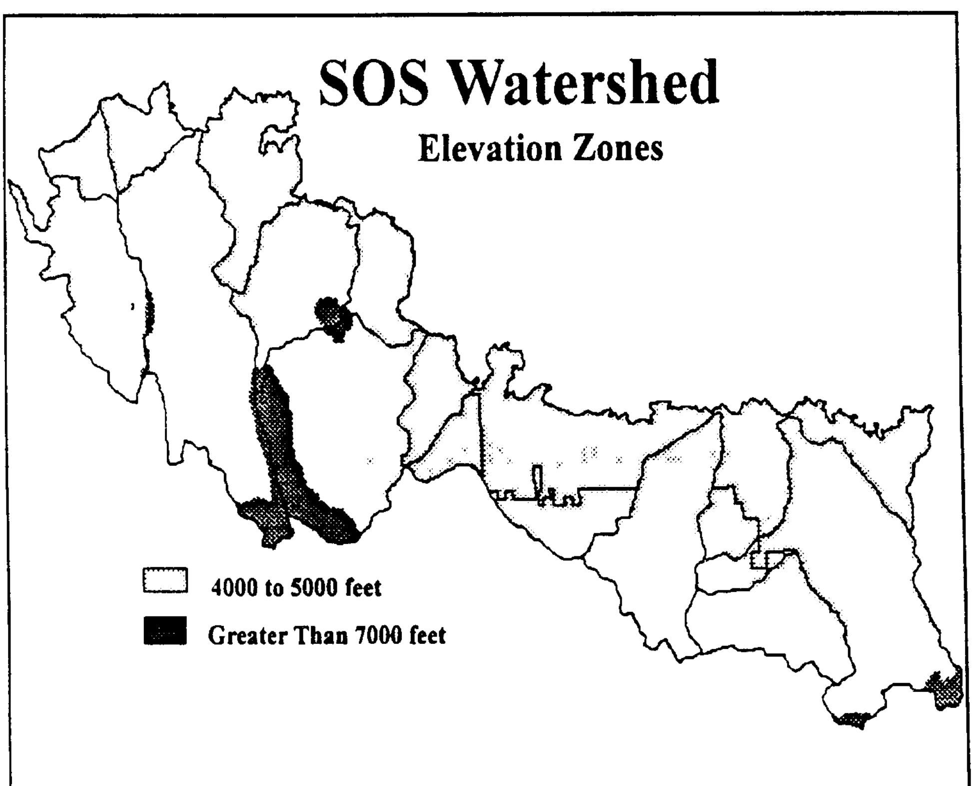
Additions to study area for hydrologic assessment 39,864 acres

- Private lands 33,386 acres
- Fremont National Forest 6,308 acres
- State lands 167 acres
- Winema National Forest 3 acres

Geology

The SOS area is dominated by volcanic parent materials extruded through and onto lake bottom sediments of the Pliocene era. The western portion of the study area includes the major eruptive centers of Edgewood Mtn., Swan Lake Mtn., Swan Lake Point, and Saddle Mtn. Lower elevations near the Sprague River contain more recent shallow basalt flows and lake sediments, with small inclusions of recent alluvial sediments in the valley bottoms. The east half has one major eruptive center, Yainax Butte. Much of the remaining area is shallow (20 to 30 feet) basalt flows over lake sediments. The area near the Sprague River is predominantly Pliocene lake sediments, and recent alluvial sediments from the Holocene period

The entire analysis area is influenced by many northwest tending fault lines. These control much of the area's topography, and have a major influence on surface and sub-surface hydrology. Interpretation of mid-level and deep aquifer flow extent and direction is very difficult, due to significant bedrock modification by the extensive fault systems.

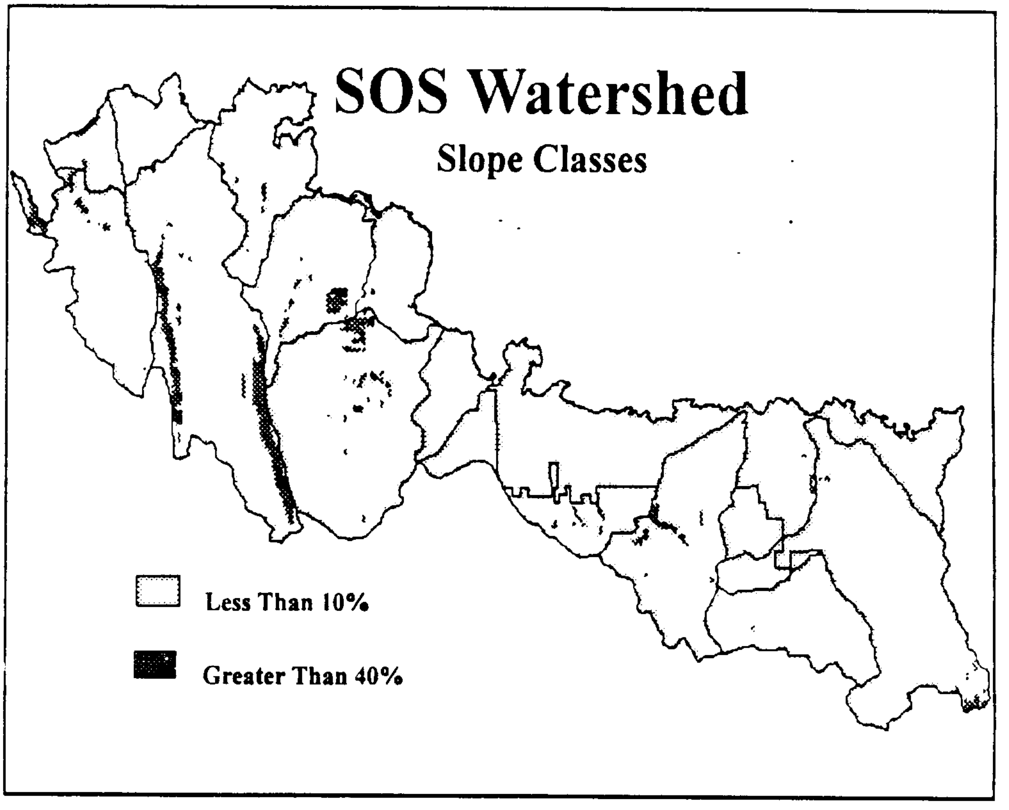


Elevation Ranges and the amount of the study area occupied are

4,170 (Mouth of Sprague River) to 5,000 feet - 67%

5,001 to 6,000 feet - 28%

6,001 to 7,000 feet - 5% (The bulk of these lands occur on Swan Lake Mountain and along Ya Whee Plateau Rim, essentially forming the southern boundary of the study area.)



Ground slopes vary from 0% to over 70%. Slopes over 40% occupy only 2% of the area. The steeper slopes are associated with the area's prominent geologic features (Chiloquin Ridge, Ya Whee Rim, Saddle Mtn., Swan Lake Mtn., Swan Lake Point, Yainax Butte). Nearly 67% of SOS has slopes less than 10%.

The dominant aspects are North (38%), and east (31%). Only 8% of the area contains South facing slopes. This orientation limits solar gain and maintains snow pack later into the spring, directly affecting the timing of stream flows.

Climate

Climate is characterized by warm dry summers and moderately cold wet winters. Annual precipitation averages from 15 to 30 inches per year, occurring mostly as snow in the months of November through February. Widely scattered summer thunderstorms also occur throughout the area annually. Summer temperatures reach as high as 105° F, and winter lows have dropped to minus 24° F. Average daily temperatures range from 29° F in January to 68° in July. Records show a low total annual precipitation value of 8.49 inches in 1977 and a high of 32.3 inches in 1982. The average for a 56 year period of record is 18.41 inches. Substantial variation in total precipitation and its timing from year to year is the norm, but the average over a ten year period is generally within 2 to 3 inches of the average.

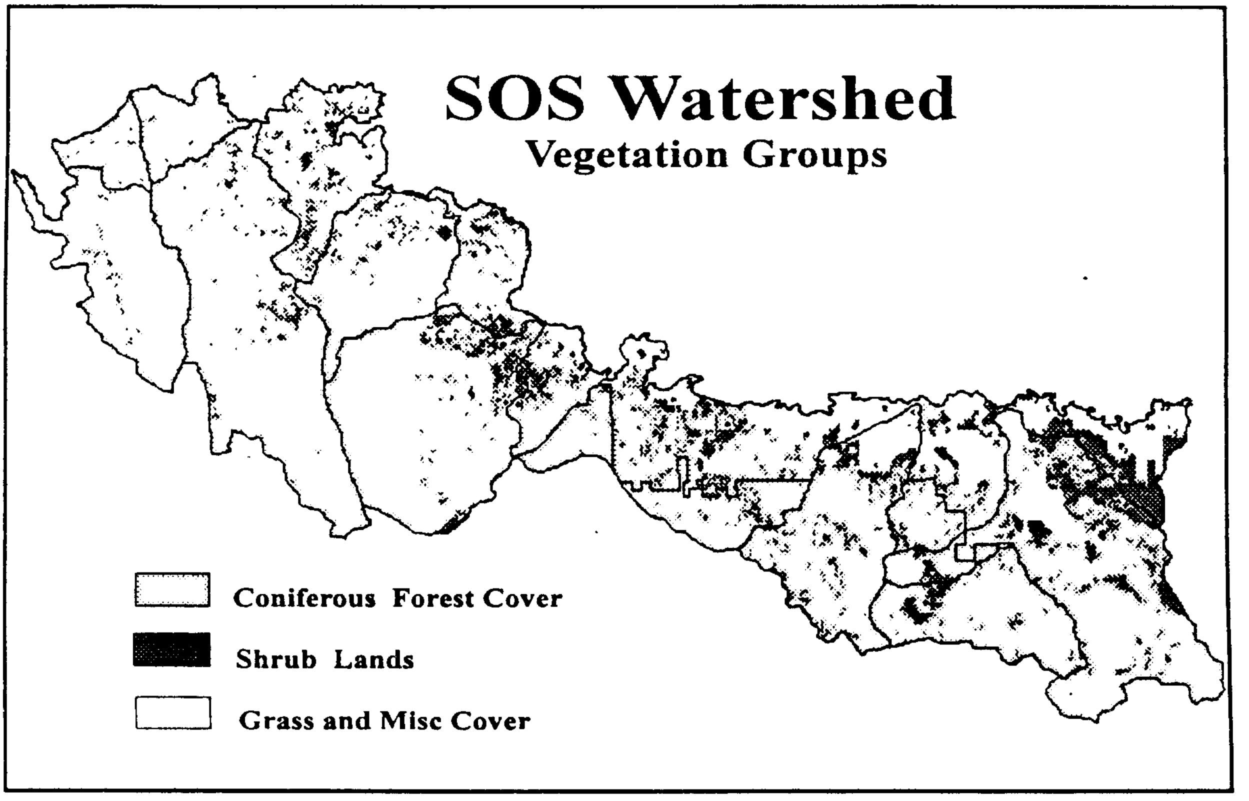
Area streams are fed by snow melt in the spring months and by ground water in the summer months. Much of the stream system is intermittent and goes dry in mid summer. The rate and timing of snow melt is extremely variable from year to year and is dependent on daily temperatures and warm rain storms during the melt season. Trout Creek is the only perennial stream which feeds the Sprague River in SOS

The soil survey identified 6% of the area as being Scab Rock Flats These areas are scattered throughout the study area, located primarily where the the shrub and grass vegetation groups occur. They have moderate infiltration rates in the A soil horizon (10 to 20 inches) and then very slow permeability below this level This tends to make the surface soil easy to saturate during spring snow melt. Overland flow of snow melt, as well as lateral flow through the soil profile, is common. This flow is easily intercepted and redirected by roads and other areas where the soil profile is exposed.

Vegetation

Nearly 75% of theNational Forest lands within SOS are predominately coniferous forested, approximately one third of this area has greater than 40% crown coverage. Over 16% is grassy meadows, and an additional 9% is in shrub covered or sparsely vegetated.

The GIS data base identifies approximately 5% of the study area as riparian; 56% coniferous cover (24% with a crown cover greater than 40%); 28% grassy meadow; and 16% shrub dominated or sparsely vegetated.



III. ISSUES AND KEY QUESTIONS

1. How have streams, soil and hydrologic function changed from the reference era? What has caused these changes? What are the effects of these changes? .

A. Have changes occurred in the streams, soil and hydrologic function in the South of Sprague Watershed Analysis area?

Streams - Long term grazing, timber harvest, and railroad grade and road construction over the past 70 to 100 years have all impacted the stream systems of SOS. Grazing has modified the amount and species of riparian vegetation along portions of most, if not all streams. Stream banks have been broken down by cattle and sheep in the past Railroad grades have channelized, displaced and dammed many of the streams at some time in their history. Roads have intensified this effect over time, and there are currently 3.25 miles of road maintained for regular use per square mile. Streams presently reflect these changes through loss of sinuosity, segments of downcut channels, unvegetated or under-vegetated and actively eroding banks, and areas where the normal flood plain has been abandoned and a new channel is forming.

Soils - Over the past century grazing, timber harvest, and construction of a transportation system have influenced the soils of SOS. Grazing, concentrated on meadow lands, has subjected these lands to repeated compaction since the 1850's (some areas received year-round livestock use). Repeated logging has occurred on virtually all of the forested areas. Tractor logging has subjected soils to various levels of compaction (skid trails being the most intense) and displacement of the surface layers. Transportation system construction maximizes compaction and disruption of the soil profile and discourages any recovery of basic soil function. Between 1% and 2% of the area is directly committed to the transportation system. Compaction reduces pore space, water holding capacity, infiltration rates, and (possibly) the basic productivity of the soil. The SOS area needs a survey on soils conditions in order to quantify these effects.

Hydrologic Function - The primary observable change in the hydrologic function in SOS is the effect of the road system on the delivery of precipitation to the stream system. The normal routing of precipitation is from snow melt into the soil profile to and along the interface between the A and B horizons, or into the ground water table, then into the valley bottoms and the stream system as spring runoff or base flows. The road system interferes with this process. Road cuts intercept both overland and sub-surface flows along the A and B horizon interface, and route the flows into a ditch, efficiently delivering the water as surface flow to the stream channel system. This change in hydrologic function tends to reduce the delivery time of snow melt to the stream channel from days (or weeks), to minutes or hours. The results are: An increase in peak channel flows; a reduction in the duration of flows; intermittent systems drying up earlier in the year; and perennial systems changing to intermittent.

Changes in stream channel morphology , such as loss of sinuosity, tend to move water through the channel system more rapidly, reducing water retention in the channel. This causes the channel to dry earlier in the year. These effects have not been quantified in SOS.

Road location and construction have caused water to be captured and moved off site rapidly, reducing its availability for on site use by flora and fauna. The GIS data base shows that 50% of the total road system is located within 1/4 mile of the stream system. Field observations in the spring of 1995 indicate that the road system functions as an extension of the stream system for at least this distance, effectively doubling the length of the natural stream system.

B. Is water leaving the watershed entering proposed critical habitat at higher temperatures than during the reference era?

This question is difficult to answer, as we have no water temperature data from the reference period to compare with current data We can, however, make the following assumption based on current observations and knowledge

The only perennial system present in SOS is Trout Creek, though Rock Creek does have some reaches with perennial flow. All other systems within the study area are intermittent. During the summer, when higher temperatures would translate into high stream temperatures, most SOS channels are dry. The systems are also generally diverted for agricultural use starting in early summer, and would not reach the Sprague during the period when temperatures are on the rise. Summer months flow in the Sprague River ranges between 200 and 500 CFS. The potential contributions from SOS in this same period of time would be less than 10 CFS, most likely in the range of 1-2 CFS. This volume would not significantly alter the temperatures in the Sprague River.

The amount of water reaching the Sprague River during the summer months has been greatly reduced due to changes that have occurred to the stream channels (entrenchment, widening, shallowing , removal of bank vegetation, diversion). This reduction has eliminated any cooling effect (however small) these waters may have had on the Sprague River's lower reaches. Whether any of the present intermittent streams were previously perennial is not known, but it is possible that Rock Creek was, prior to the channel's manipulation to accomodate agricultural development. If many of the intermittent systems were at one time perennial, it is possible that they had a larger cooling effect on the Sprague, but quantifying this effect is not possible with current information.

C. Have past federal actions (BIA or Forest Service) contributed, or will proposed actions contribute, to excess sediment and/or nutrients to proposed critical habitat in the Sprague River System?

The SOS assessment represents only 15% of the total Sprague River watershed system. Although the streams in SOS all have degraded segments that are currently yielding more sediment than stable systems would, they are not unique in the Sprague River system. The contribution of SOS to the current sediment load of the Sprague River is not likely to be out of proportion to its relative land area. The question of whether the sediment produced on federal lands reaches the Sprague River system is not easily addressed. In the case of Butler Creek and Crystal Castle Springs, sediment has easy access to the main river channel. Sediment delivery through most other channels is not easy to quantify, as the material passes through agricultural lands and is diverted into irrigation systems before it reaches the Sprague. This is most evident in the Rock and Whiskey Creek systems. Seasonal stream flows and channel material are capable of transporting sediments, particularly, but not limited to, the silt-to-small-gravel size material. If this material reaches the Sprague, it could easily be transported further downstream due to the much higher flows in the Sprague River.

Past federal actions have contributed to current stream channel conditions, producing quantities of sediment greater than that estimated prior to development. Limited visits to the watersheds have found no unusually large sedimentary depositions in SOS stream channels, leading us to believe that sediment is adequately passing through the system. The effect on the Sprague River as a result of these higher sediment loads is difficult to quantify, since nearly all streams pass through private property prior to entering the river. SOS contributes only a small fraction of the total annual sediment load of the Sprague River.

D. Have the timing and duration of peak flows changed since the reference era?

Precipitation is the main source of water for most subwatersheds in SOS, snowmelt providing the greatest input into the systems The rate and volume of water which is delivered to and through any system depends largely on the accumulated snow pack, and how rapidly it melts. Rain on snow events and localized thunderstorms occur in the area periodically. When these occur, large volumes of water are directed into the system at a faster pace (but shorter peak duration) than would occur under normal spring melt conditions

The rate at which runoff moves toward the stream is dependent on the drainage efficiency of the hill slopes. Drainage efficiency is influenced by the slope and length of the upland surface, it's topography, the permeability and moisture content of the soil, subsurface geology, and vegetative cover. The hydrograph shape is affected by these factors as well as catchment shape, drainage density, channel characteristics, and storm patterns. The condition and shape of the channel (wide, shallow, narrow, or deep), plus the presence of vegetation in and along the channel will also have an effect on the hydrograph shape

Modification of vegetation distribution and reduction in wetland function affects the hydrograph. Riparian vegetation, along with its capacity to hold water, has decreased due to grazing and streambank erosion. Logging has reduced the forest's ability to hold water. The reduced canopy cover of the watershed allows solar radiation to melt snow more rapidly. The disturbance of the forest floor has diminished it's ability to store water due to soil compaction.

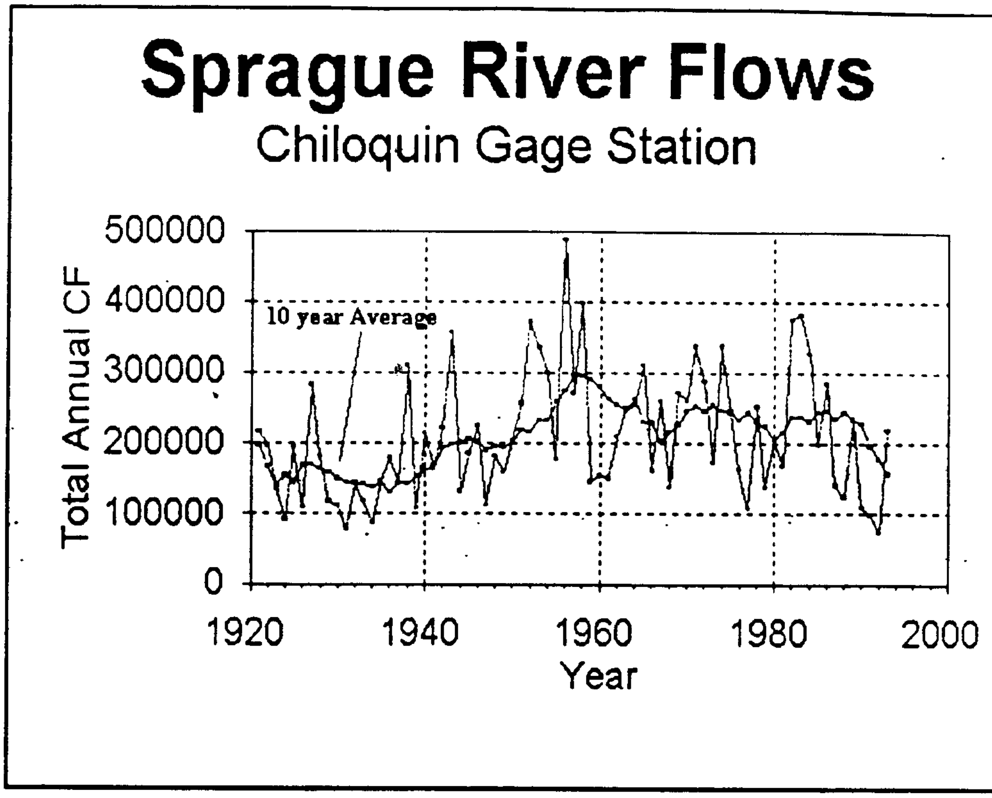
Channelization from degraded road and railroad systems, or structures such as culverts, prohibit the systems from utilizing their floodplains when discharge exceeds the capacity of the original channel. Loss of sinuosity moves water more rapidly though the system, due to a shorter distance and a steeper gradient. Sedimentation increases, thereby reducing riparian vegetation that holds moisture and reduces velocity.

Fire suppression has created a potential for more intense/severe fires. These fires can destroy moisture holding vegetation, often leaving bare soil that is susceptible to erosion, routing water quickly to the stream system. Extremely hot fires can create hydrophobic layers that repel water, inhibiting the infiltration and storage capacity of the forest.

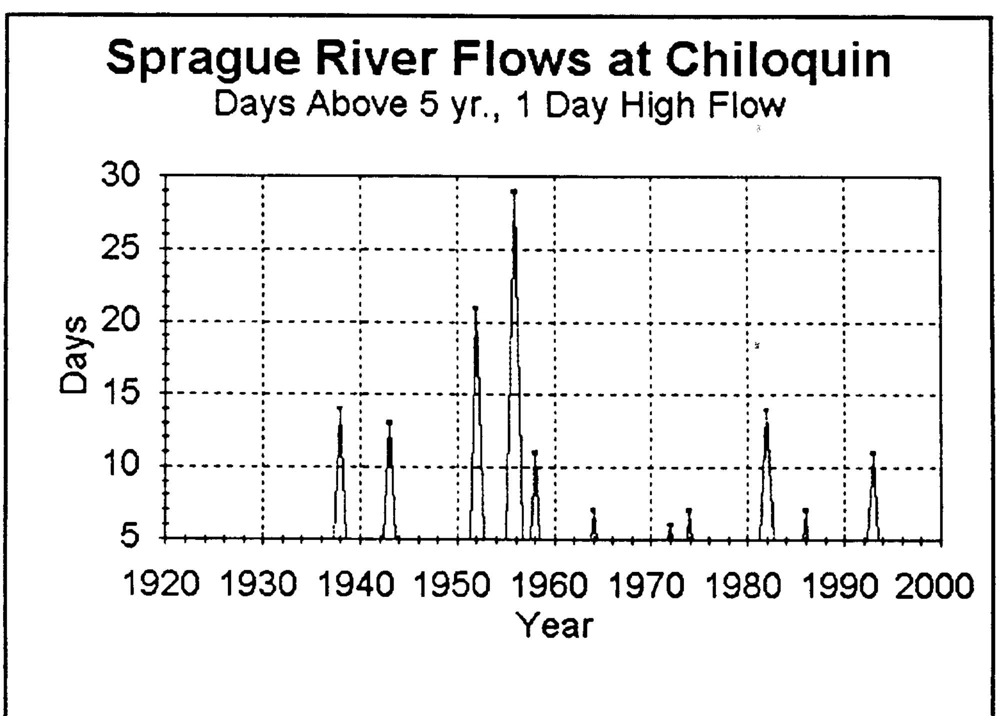
The timing and duration of peak flows may have changed since the reference era, as a result of land use and human influence. Generally, there are earlier peak flows of shorter duration. The hydrograph has a steeper rising limb, indicating water entering the system more quickly. The falling limb is also steep, as water moves through the system rapidly. The peak of the hydrograph is higher because more water is entering the system in a shorter period of time.

The Chiloquin Weather Station, located near the low point of SOS, is the closest and longest running station available for the SOS analysis. Since this station is the only source providing long term data, and it's location is close to SOS, we decided to include it in this analysis. This station will give a generally accurate account of the amount of precipitation received by the lower elevation portions of the study area over a 56 year period. The amount of precipitation, as well as the type, will likely differ as elevation increases from the Sprague River.

Most precipitation comes in the fall and winter months in the form of snow A low precipitation value of 8.49 inches was recorded in 1977, and a high of 32.3 inches in 1982. The annual average for the 56 year period is 18.41 inches. Records show substantial variation from year to year as the norm. Over a ten year period, the average is within ±3 inches of the average for the 56 year period. Low stream flows and short duration flows in intermittent systems reflect low precipitation years.



The following two peak flow graphs display the number of days, by year, that flows in the Sprague River at Chiloquin exceeded the 5 year one day high flow, and the 2 year peak flow. The 5 year one day high flow is the highest one day flow expected in any five year period. The 2 year peak flow is the highest measured instantaneous flow over any given two year period. These graphs indicate periods over the last 70-plus years when flows were high enough to aggressively modify channels. The Sprague River is not necessarily the perfect indicator for the stream systems in SOS, but it is assumed that the flows in the Sprague are a general indicator of flow conditions.

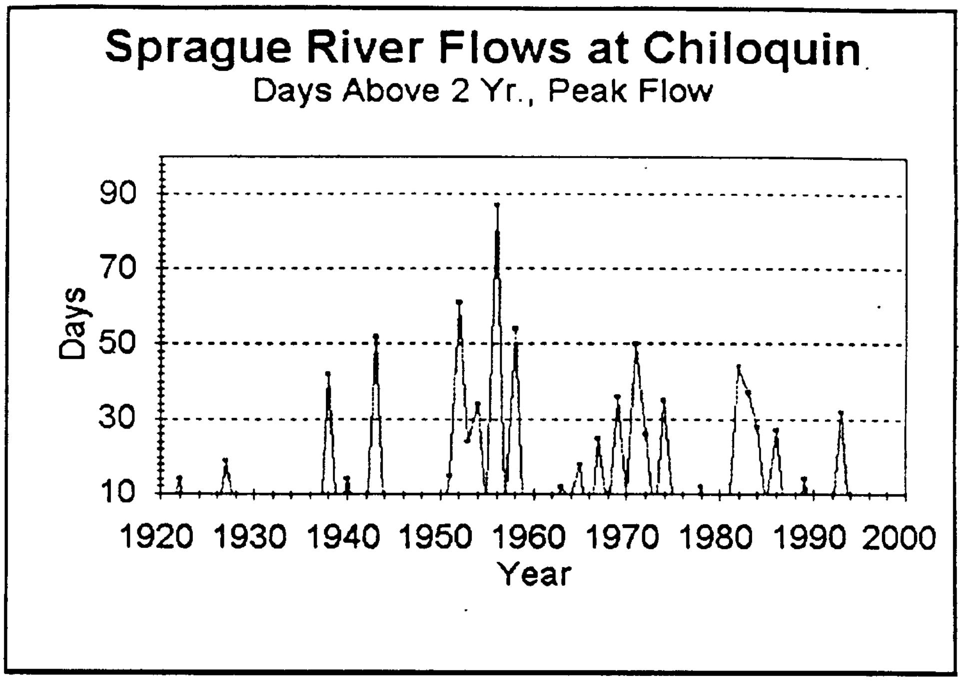


Data from the gaging station on the Sprague River at Chiloquin displays daily mean flow for a period from March 1, 1921 through February 27, 1995. Summaries of this data show a 5 year return, one-day low flow of 137 CFS for the period 1932 through 1987. The 5 year return, one-day high flow was 3,910 CFS for the period 1922 through 1987. The instantaneous peak flow presented for a 2 year return interval is 2,090 CFS.

The 5 year high flow value was exceeded by 10 or more days in seven years since 1938. In 1956, this value was exceeded nearly 30 days during the high flow season.

The 2 year peak flow value indicates a flow level at which channel forming processes are at work (channel bank erosion, bed load and suspended sediment transport). The normal channel is full or slightly over full and the flow is beginning to occupy the flood plain.

Since 1921, there have been 17 years which had 20 or more days exceeding the 2 year peak flow value. 1952 and 1956 had 60 or more days exceeding this value.



The 5 year return high flow is nearly double the two year peak flow, and fully occupies the flood plain. This level of flow has substantial potential to damage or degrade channels, especially if the channels were in a weakened or unstable condition (lack of riparian vegetation, increased channel gradient, diverted channel, dammed or blocked channels). This level of flow often subjects channels to instantaneous very high peak flows and unusual quantities of debris, enough to block drainage structures in road fills and cause fills to fail.

Subwatersheds Within the SOS Area
Note: See Appendix B, Rosgen Stream Type for descriptions of characteristics for channel types identified in the following subwatershed summaries.

The major channels in SOS display two basic profiles, depending on the terminus of the channel. Butler Creek and Crystal Castle Springs both enter the Sprague River in the relatively steep canyon above the town of Chiloquin. These drainages have their headwaters at the base of a headwall and move through gently sloping valley bottoms (1-3%) for 1-1.5 miles. Gentle sections are separated by short (0.5 mile) steep valley sections of 6-8% controlled by geologic formations of more resistant materials. The final 1 5 miles drop steeply (6-10%) into the Sprague River canyon.

Channels that end in the broad valley section of the Sprague have their headwaters on the steep valley headwall below a flat plateau (Ya Whee) or a catchment basin (Choptie Prairie). These include Copperfield Draw and Trout, Rock, and Whiskey Creeks. Often beginning as springs, these systems follow a steep path (10%) down the headwall to the base, and then step between flat valleys 1-2 miles in length through short sections of narrow, steep gradients controlled by geologic formations. Final sections actually flow through the valley formed by the Sprague River, and most are diverted for agricultural use.

No Name Flat and Dockney Flat are relatively short drainages (4-5 miles) north of Ya Whee Plateau between Saddle Mountain and Copperfield Draw These are intermittent systems that may have short spring-fed reaches at their headwaters The spring source is likely the ground-water from Ya Whee Plateau. Both drainage profiles consist of 2 mile sections of very flat valley at the confluence with the Sprague, then gradually increased gradients to their headwaters.

Copperfield Draw is experiencing downcutting and streambank erosion in the lower reaches and in Wright's Meadow Headcuts can start at the top of a system and work down, or at the bottom of the system and work up It appears that headcuts have run through the Copperfield system three or more times, and this continues at a moderate rate.

See Appendix C, Functional Condition of Streams Examined In Copperfield Subshed, for a summary of the Conditions in the Copperfield Subwatershed. It should be noted that the functioning condition calls were made by technicians not fully trained in the protocol, and may be subject to change when examined by the appropriate experts.

Soil pedestals are prevalent in the upland slopes of Wright's Meadow. Grazing has greatly reduced native vegetation. Wind and rain have eroded away the fine soils between the vegetated pedestals, and erosion pavement exists. These areas are less pervious and it is difficult for vegetation to become established, a pattern typical in semi-arid climates. Where subtle microgradients of the meadow meet, surface run-off concentrates and headcutting starts. The downcut continues to run down the channel, creating a gully.

A lowering of the grade downstream can initiate a nick point that works it's way upstream. It may have been induced when a railroad or a road was constructed. Natural geologic formations or beaver dams may also have initiated the process. The drop in grade creates a scour pool downstream, intensifying the headcut. Side channels run into the gully and a new nick point begins. High run-off accelerates the problem.

Water yield and hydrograph information should be analyzed to ensure restoration efforts meet their objectives. Attempts to control headcutting are successful only when the capacity of the structure is adequate. If more water goes through the system than it was designed for, scour or structure failure will occur. The change in grade below a structure or physical feature must be considered. Lowering of the grade through step pools, or lengthening of the channel are necessary to prevent scour pools and headcuts. Breaking the concentration of flow is necessary to control erosion. Vegetation is a key element in the restoration effort. Proper land management is vital for restoration to occur and the entire watershed must be considered. There are numerous old flow retarding structures in Copperfield Draw, most of which are no longer functional, and have created scouring around the structures. Exclosure fencing is down or in disrepair in many areas. The remnants of these structures (metal posts, fencing material) are scattered throughout the channel, are unsightly and ineffective, and should be removed.

For more thorough descriptions of SOS subwatersheds, with channel typing and profile and gradient graphs, see Appendix D, Subwatersheds.

2. How have fire exclusion, grazing, timber harvest, road construction, railroad construction and other management activities changed the biological and physical elements of the landscape from the reference condition?

A. What aspects of these activities mimic reference processes?

Management activities have affected ecosystem functions in many ways. Some aspects of management activities mimic natural processes of the reference period, but in most cases, the similarities are very limited.

Fire exclusion is a management activity that provides no similarities to the reference period. Fuels are allowed to accumulate and understory and overstory vegetation is allowed to occupy sites at densities far beyond reference period levels. Nutrient cycling processes are being dramatically altered (ecosystem nutrients are gradually being bound in organic form).

Grazing offers scant similarities to reference period processes. Nutrient cycling occurs on site, although at a much lower level than during the reference period. A significant portion of ecosystem nutrients are immobilized in animal form and transported off site. Wherever intensive grazing occurs, floristic composition is gradually moving toward greater amounts of woody plants at the expense of herbaceous vegetation.

Timber harvest can mimic some of the structural dynamics of the reference period. Understory thinnings are similar to low intensity underburns of the reference period. In mixed conifer, small group selection (or even small clearcuts up to 30 acres) provide forest structure changes which reflect those created by periodic wildfire in the reference era. However, the exportation of carbon and other nutrients off-site provides a much different nutrient cycling process than during the reference period.

Road and railroad construction have no reference period analogues with regard to ecosystem processes and functioning.

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

BIA records, reports by Lieberg and Munger (see Appendices E and F), and a 1920 cruise were all used to develop the reference era descriptions for forest types. Most available information refers only to timber types - ponderosa pine in particular. It is important to remember that both reference and current condition are not static, so ranges are expected to have changed over time.

Conditions (and ranges) come and go as natural or human caused disturbance events occur, and as the vegetation responds to those events.

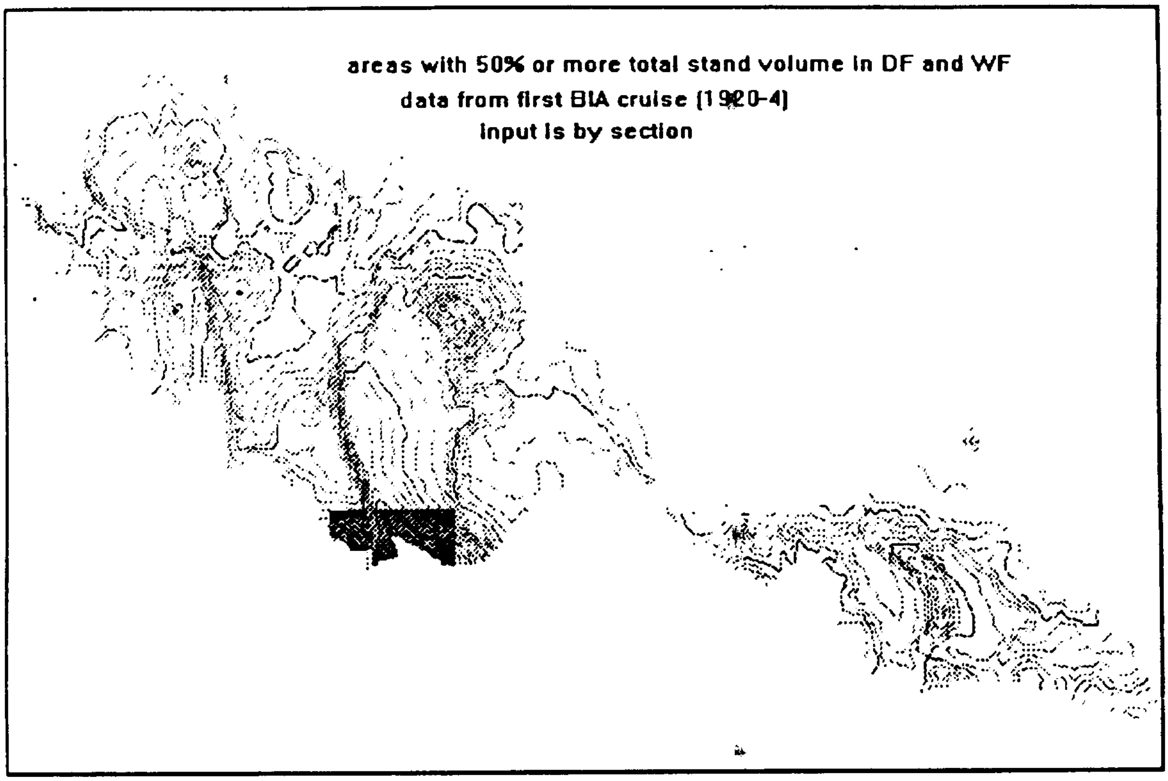
Forest Communities

<u>Lodgepole Pine</u>

Lodgepole is present as a minor species in both reference and current stands. There are very few acres of LP type within the assessment area, so the type will not be addressed further.

Stand Replacement Fir

This type occupied less than 4% of the watershed acres during the reference period, with stand compositions basically the same as today. The 1920 cruise showed this type as all in a climax condition. Today, this type occupies nearly 45% of the watershed, and may contain a higher proportion of mature rather than earlier seral stands, with higher stocking levels than in the reference period. This has resulted primarily from fire suppression lengthening the interval between stand replacement fires.



The above map shows the approximate location of reference era stand replacement pine/fir types. The 1920 cruise indicated all were high-volume (20-28MBF/ac) climax fir types (the Swan Lake Fire altered this in the 1940s). Unshaded areas show the extent of the reference period ponderosa type.

Ponderosa Pine

This type covered over 90% of the watershed in the reference era, but today covers only about 46%. Stands with less than 50% fir were generally in an open canopied condition dominated by a continuous large-tree structure with occasional clumps of reproduction (up to 5 acres). Trees were often growing in clumps of 2 or 3, with 50-100 foot openings between the small groups or trees. Ponderosa pine roots can occupy a large area, often reaching out 100 feet or more, so it is likely these supposedly open areas may well have been 100% occupied by large tree root systems. Proportionately less growing space was occupied by conifers, with grasses, sedges, and brush covering a larger percentage of area within the stands during the reference period. Today, this is reversed, with tree stocking levels 2-4 (or more) times those in reference period stands. This is generally true for all of this type, except where clearcuts less than 15 years old, and stand replacement fires have occurred.

Information regarding understory stocking in the reference period ponderosa stands is very limited Plot data from 1936 and 1948 (BIA Archive Files) for the South Calimus and Wildhorse Ridge areas, shows a range of 9 5 to 17 trees/acre larger than 12" DBH Though not in SOS, the data is considered representative of pine sites within the analysis area. Anecdotal notes and inventory entries during this period often comment on a lack of understory vegetation. The Long Prairie cut-over cruise recorded 2 8 small poles (4-7") and 3 4 large poles (8-12") per acre, and noted these were in clumps.

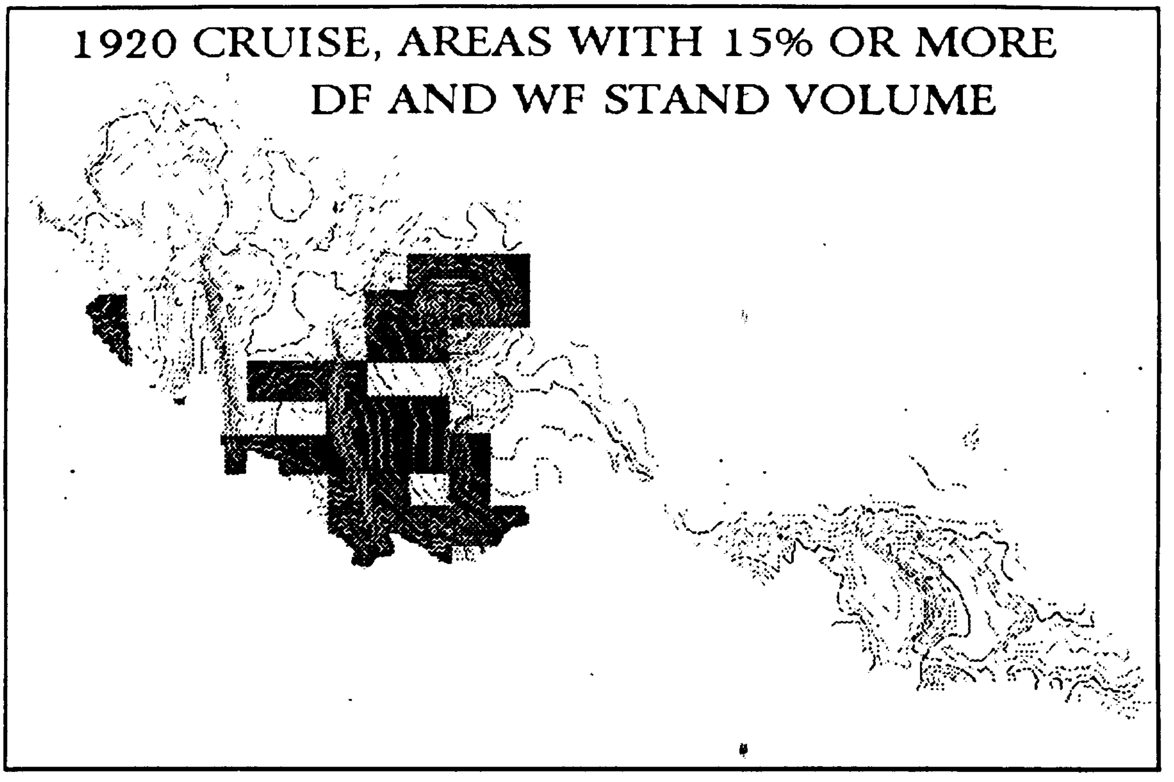
Data from the 1899-1920 period is considered sufficient for determining the reference period conditions, since most of the local forests were relatively untouched at that time. The seedling component may have changed, but it is doubtful. References scarcely mention older seedlings, but do address the open characteristics of most stands Our knowledge about fire frequency and intensity supports the theory that the understory component burned on a regular basis during the reference period, limiting seedling establishment.

Cochran, in one limited study, has demonstrated that individual ponderosa pine growth rates increased since the advent of fire suppression, but with an overall loss of the species. Reasons are still unknown. The increased growth may be due to less competing vegetation (increased surface litter may be causing a reduction in the availability of growing sites), or a soil productivity increase due to increased moisture holding capacity or nutrient availability. Much more research is needed on this subject.

The pine type dominated most upland areas, with stand volumes ranging from 5-20+MBF/ac. (average 10MBF). High volume stands occurred in higher elevation and moisture regime areas, and contained more sugar pine, Douglas fir and white fir.

The table below displays five stand conditions for comparison of stocking level parameters - basal area, trees per acre, and Stand Density Index (SDI). The M&M Uneven-age Demo Area (M&M) is not in SOS, but is included as a reference because it is well known and represents a type of stand common to SOS. The Current Uneven-Age Management Prescription (Current Rx) is included to show that most current harvests still leave stand stocking levels at higher densities than the reference condition. The SDI has been used here because it is a more accurate measure between differing stand types.

	BASAL AREA	TREES/AC	SDI	NOTES
M&M	80	232	140	More highly stocked next to road.
Current Rx	60-80	75-150 +	70-120	If stand is not pre-commercially thinned values can be much higher.
Current Stands	60-200+	100-400+	100-400	
Reference Stand (5 MBF)	28	7.58	35	Reference stand computation based on arbitrarily selected 26" DBH 4 log tree.
Reference Stand (10 MBF)	50	15.15	70	

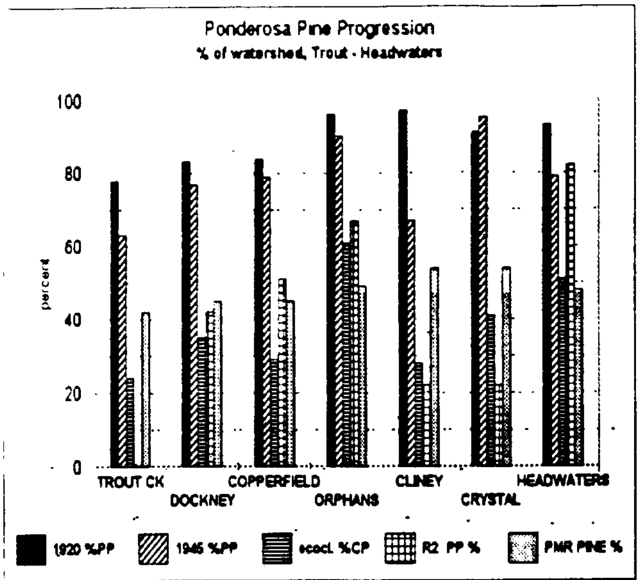


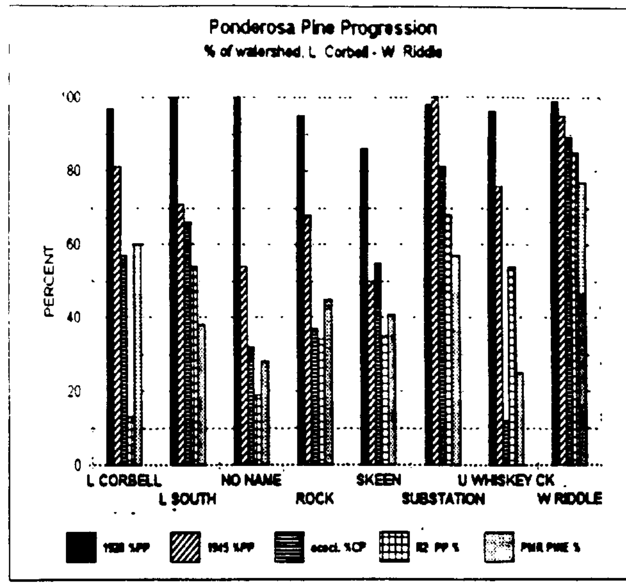
The above map shows stands which, in the reference period, had at least 15% Douglas-fir or white fir. The one section at the lower center is missing data, but likely had a 15% fir component. The remainder of the area was ponderosa pine, incense cedar or very minor amounts of lodgepole pine. (See Appendix G, 1920 Cruise Volume Distribution Maps, for additional maps showing 1920's cruise volume.)

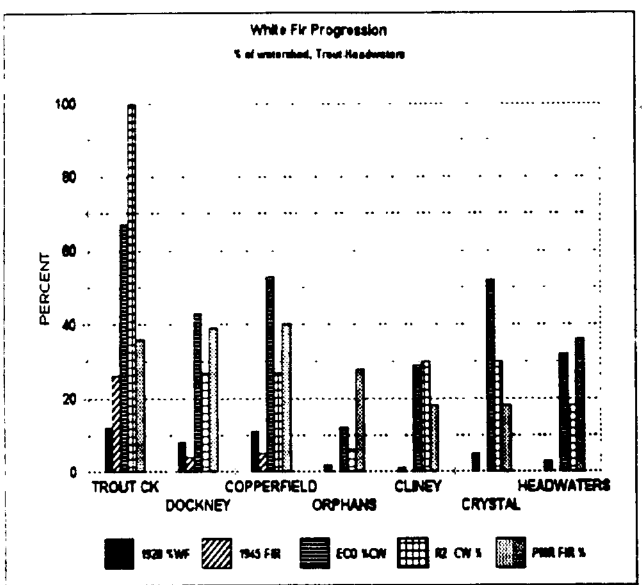
During the reference period, most trees were 14-30" DBH, with some trees reaching 60-80" DBH. From the initial BIA through the present harvests, residual trees would have had opportunity (reduced competition) to grow to much larger diameters. There may be as many (or more) extremely large DBH trees in current stands as were in historic stands. At present, there are fewer 20-30" DBH trees in SOS stands than were in the reference period stands. However, the "inventoried old growth" stands would contain as many 21"+ DBH trees as the reference condition, but the average diameter of the 20-40" range is smaller. (See Appendix H, Subwatershed Current Conditions, for statistical data on present subwatersheds conditions.)

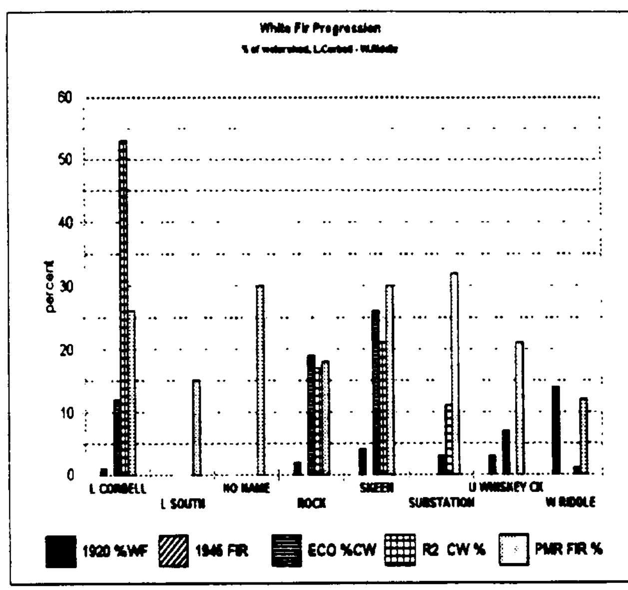
(Note: The use of value judgment terms such as low, high, overstocked, and understocked are relative to an objective. Not using value terms can result in lengthy descriptions. For this analysis, overstocked will be used to identify conditions that are not sustainable without major human interventions; or will sustain a major stand replacement event where stand replacement events were not the reference condition.)

The following charts illustrate the progression of stands from pine dominated (reference condition) to the point where they are converting to stand replacement fir types. Today's stands contain significantly higher percentages of white fir and Douglas fir, and maintain dense understories. These stands are highly overstocked and in a state of stress as a result.









The previous display is useful when considered at the watershed scale (to show relative trends and conditions), but its reliability is low at the absolute level or within small areas. Each data set measured different parameters and quantified them using different standards. The following information is offered to help the reader understand the differences. (See Appendix I, Additional Graphs and Charts, for bar graphs comparing the different standards.)

<u>1920 Cruise</u>

Unit of Measure: Scribner volume by species from Klamath Volume Table. For this analysis, volume was summarized by section. Conversion to trees per acre done using the same volume table.

Scale of Accuracy: Good as far as total volume per section, but no deductions for non-forest land lowers the volume/acre estimates in sections where non-forest lands are significant.

Method: 10% cruise, mostly 1 ch. in 10 ch. strip cruise. DBH measured with a biltmore stick, or taped if over 36" DBH.

1945 Inventory

Unit of Measure. Species class and stocking levels. The stocking levels are as a percent of an undefined stocking standard Looking at the volumes from 1920 and considering that the "cut" acres have had a 60% harvest within the last 20 years, the standard appears to be low compared to current.

Scale of Accuracy: Not quantifiable in an absolute sense. Good relative accuracy.

Method: Unknown

Ecoclass (1979)

Method: Aerial Photo interpretation with field verification. Generally typed at greater than 10 acres, but not quantified. This system places great emphasis on current existing vegetation occurrence, and provides a good picture of the pine to fir progression. A hint of how future progressions may go can also be derived from this system's data display.

R2 map (1986)

Method: Interpretation from satellite imagery at 22 acre pixels, classed as to type (PP, CW, etc...), and mature, immature, poles, seeds/saps and plantations.

PMR (1988)

Method: Satellite imagery, computer classified in 25 meter pixels. The data was re-sampled to 90 meter pixels for this analysis.

Scale of Accuracy: Ground verified.

Riparian Areas *(These are the most susceptible to impacts from grazing.)*

Hardwood Communities

Reference era conditions prior to 1900: Most hardwood communities were in good condition, with very little livestock impact. The systems cycled through most catastrophic events (major storms and fires) without suffering major impacts. The primary users were beaver, big game, insects, and neotropical birds.

Indicators of hardwood communities in good condition:

Plants: Willow or aspen (all growth stages), tufted hairgrass, and sedges (beaks, aquatic, inflated).

Soils: Friable, no pedestaling, no compaction, no puddling, no channelization.

Forage Use: 30% or less of current year's growth (light use).

Channel Conditions: Narrow, deep, but not entrenched; no headcuts, no channel widening, minimal bank exposure.

Community Functions: Filter, stabilize associated stream channels.

Hardwood community in good condition, Butler Creek drainage.

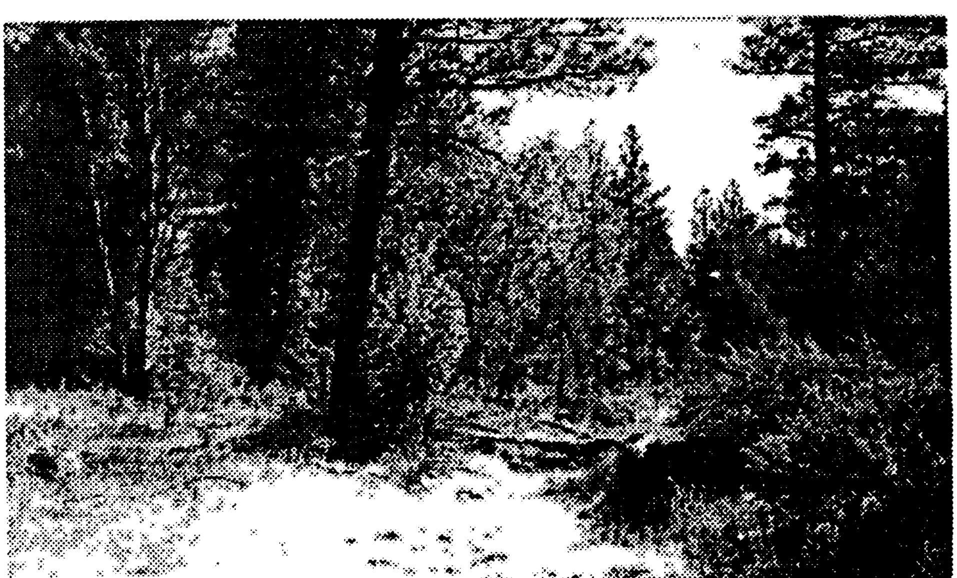
Indicators of hardwood communities at risk:

Plants: Lack of young plants. More dead material in hardwoods. Upland conifer invasion. Browse lines on older plants. More Increaser grasses and forbs (Kentucky bluegrass, Mat Muhly, Arnica, Rosy Pussy-toes, Potentilla sp.).

Soils: Compaction evident. Some displacement and movement, loss of litter. Puddling and pedastaling becoming evident.

Forage Use: Utilization more than 30% on hardwoods. Loss of leaders and leaves below 4 feet (browse line). Utilization more than 40% on palatable grasses/sedges/forbs. Young hardwoods hedged.

Channel Conditions: Channel may be entrenched or headcut. Channel widening becoming evident on over 10% of stream reach inspected. Evidence of exposed banks on more than 10% of stream reach being inspected.



Hardwood community at risk, also in Butler Creek drainage.

Indicators of hardwood communities in poor condition:

Plants: Only skeletons of hardwood plants present. Increaser grasses/forbs dominant. (K. bluegrass, Mat Muhly, longstalk clover, Potentilla, larkspur,etc). Conifer/upland shrub invasion to stream channel. No litter present.

Soils: Soil compaction moderate to severe. Soil displacement obvious, bare soil exposed between plants. Pedastaling and puddling extensive.

Forage Use: Forage utilization has exceeded 60%.

Channel Conditions: Channel degraded, depth greater than 5 ft., width greater than 5 ft. Bedrock exposure common. Active headcuts deeper than 1 ft., moving every year. Sediment load greater than stream's ability to carry, evidenced by deposition areas in channel.

Hardwood community in poor condition, Butler Creek drainage.

Meadow Communities

Indicators of meadows in good condition (Reference Era):

Plants: Native grasses/sedges dominant (Tufted hairgrass, cusick's blue-grass, beaked sedge, inflated sedge, etc...). Increasers may be present, but less than 10% species composition. Good litter layer between plants.

Soils: Compaction minimal. No evidence of displacement, puddling, or pedastaling. Very little bare soil exposure between plants.

Forage Use Forage Utilization light - less than 40%, or if used heavier, area is given extended rest for at least one grazing season.

Community Functions: Filters for overland water flows, trapping sediments, reservoirs for long- term water storage in the watershed.

Meadow in good condition, Trout Creek Ranch

Indicators of meadows in fair or poor condition (at risk):

Plants: Increaser plants dominant (Kentucky bluegrass, mat muhly, cinquefoil, longstalk clover, rosy pussytoes, etc.). Native plants make up less than 30% of species composition. Upland conifers/brush invading. Little or no litter layer. Shallow rooting depth.

Soils: Compaction, puddling, pedastaling prevalent. Water table dropping. Bare soil extensive between plants.

Forage Use: Use exceeds 50%, either from past grazing or by plant and soil condition.

Community Function: Meadows are losing their ability to function as filters and storage reservoirs. Where at one time they may have stored water throughout the summer until August, they now only store until the end of June, or mid-July.

Wrights Meadow, fair to poor condition (at risk).

The following photographs portray examples of areas which the team feels are beyond at-risk, and are not functioning properly.

Dams Meadow: Deeply incised, broad channel. Water table well below root zone for major portion of community. Note that new flood plain is forming, and vegetation is establishing on channel bottom.

Copperfield Draw: Deeply incised, broad channel. Water table well below the historic flood plain, which has dried out to the point that sagebrush is becoming established. New flood plain has been formed within the channel, and vegetation is establishing on the channel bottom.

Management Activities that have Influenced Decline of Riparian Communities

BIA Management

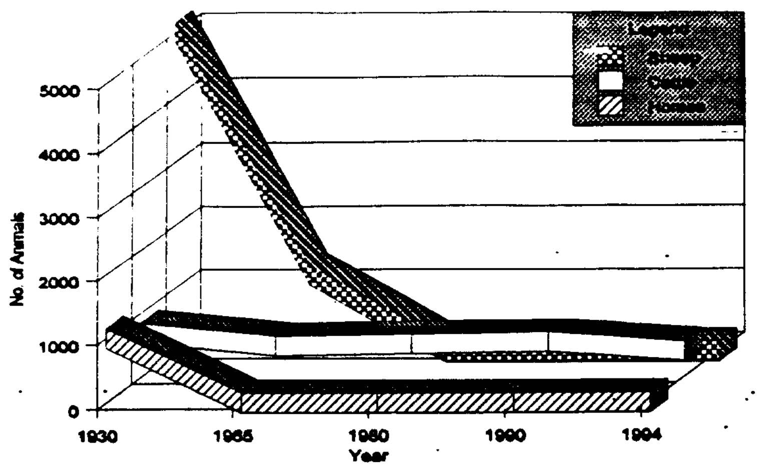
1920's - Fire suppression becomes more dominant in management activities.

1920 to 1940 - Major timber harvesting; road and railroad systems developed more access to, and use of, hardwood and meadow communities.

1920 to 1930's -Stocking of reservation with non -indian domestic livestock to generate income for the Klamath Tribes.

1930 grazing season: Six months to year-long; sheep, cows, and horses.

Year-to-year use of same plants.



The figure at left shows the amount and type of grazing from 1930-1994.

Sheep use reduced to 1000 head prior to FS administration.

Cattle are the primary livestock using the assessment area at the present time.

Number of horses estimated at 1,000 head (1930).

Early and late use further influenced decline of riparian communities:

Early use contributed to soil displacement and compaction.

Late grazing pressure removed and/or reduced young reproduction.

Foraging on new growth reduced native riparian plants' ability to maintain themselves (willow, aspen, Cusick's bluegrass).

Competition increases between riparian obligate species and livestock (beaver vs. livestock).

1930 Grazing report identified unauthorized livestock use occurring on the reservation - especially where reservation lands join private lands.

Agricultural land development.

Willows and hardwoods removed to expand pasture lands:

1920's -1930's - Major dike construction along the Sprague River for flood control.

Introduction of non-native forage plants began after 1930. (1930 Grazing Report documented shortage of winter feed for Indian-owned livestock. It is thought that the BIA's intent was to introduce better forage grasses.)

Range Improvements: During the late 1920's through the 1930's:

Many springs and stock ponds were developed.

Stream channels diverted.

<u>Results:</u>

Headcutting and destabilization of stream channels initiated.

Lowering of watertables.

Loss of new recruitment in willows and aspen.

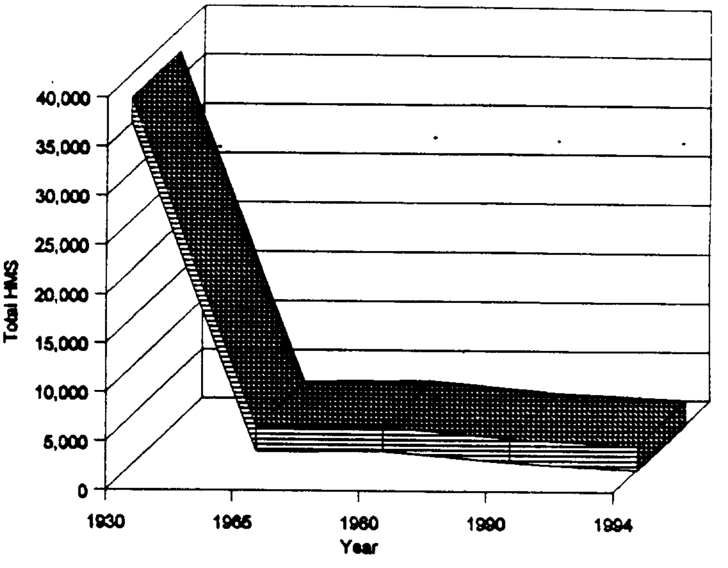
Decrease in native sedges and grasses.

Loss of native riparian communities.

Loss of fisheries and other wildlife.

The figure at right shows head months per year from 1930 to 1994. Notice that total grazing impacts have been reduced within the watershed. The graph assumes the following:

5 Sheep = 1 Headmonth
1 Cow/calf = 1 Headmonth
1 Horse = 2 Headmonths



Forest Service Management (1961 to Present)

Allotments are set up on deferred rotation.

Unauthorized livestock use is still a problem along FS property boundaries.

Lack of controls (fencing, herding) contributes to livestock returning to previously grazed areas.

Livestock still use roads into remnant hardwood communities, even though some roads and access points are closed.

Road density increases with new construction.

Water sources remain a problem on allotments.

Stock ponds in wet meadows.

Stock ponds in hardwood communities (late 60's through mid-70's).

Results:

Some remnant hardwoods are still present on Trout Creek Ranch and Wrights Meadow.

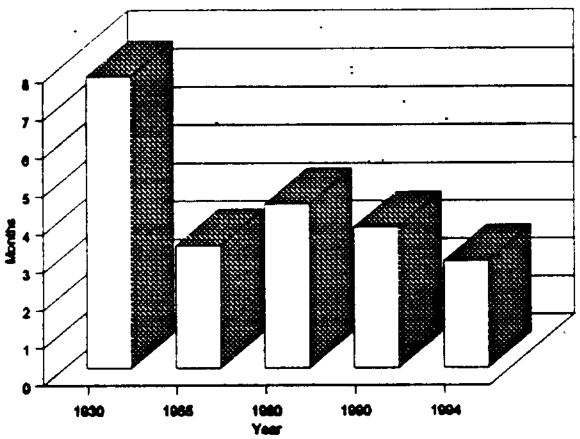
Continued decline of riparian communities on some active allotments

Continued degradation of some stream channels, lowering of water tables

Lower ability of hardwoods to reproduce, and reproduction to survive.

Water developments in meadows tend to concentrate livestock either in or near hardwood communities.

Soil compaction and increased grazing pressure during late summer, early fall.

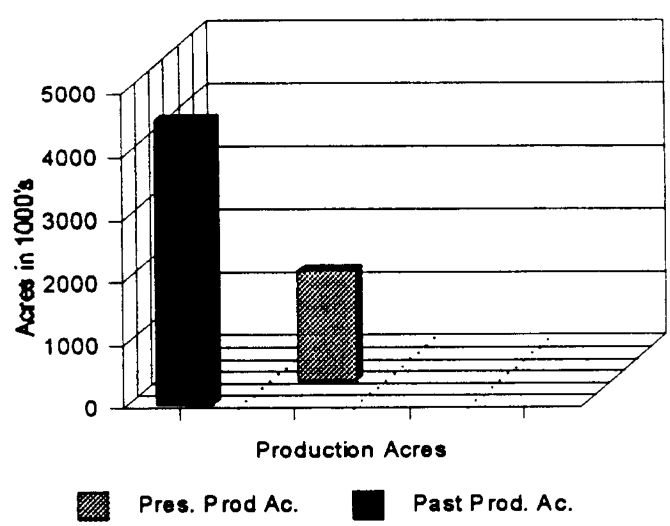


The chart at left illustrates how the average length of grazing seasons within the watershed has been reduced.

Through the mid-1980s, grazing still occuring in hardwood communities after August.

In the late 1970's, the FS began acquiring private holdings through land exchanges and purchases. These lands were previously used for agriculture and/or timber production. Most of these lands were incorporated into existing grazing allotments and/or timber producing lands. The lands used for livestock production were either grazed year-long or season-long, depending on the previous owners.

Timber companies conducted varying degrees of timber harvest prior to exchanging lands with the Forest Service. A total of 4,500 acres have been acquired within the analysis area through 1993 (see Appendix J, Lands Acquired by Forest Service Through Exchange or Purchase).



Present Production Acres are those acres still dedicated to either timber and/or forage production.

Past Production Acres are the lands used prior to Forest Service acquisition.

The Forest Service has attempted to correct headcuts and repair channels in Wright's Meadow, Copperfield Draw, Trout Creek Ranch, and No Name Flat. These efforts tended to temporarily slow erosion processes. In some places the water either cut around the end of the structure, started new downcuts, or the channel appears to have widened. The channels have not been restored, and the water table has not returned to historic levels. Ponded water behind the improvement structures also becomes a livestock water source during dry periods.

From the 1980's to the present, the livestock industry experienced major economic fluctuations which forced many operations out of business. Such economic factors, coupled with the recent drought, have resulted in fewer livestock grazing public lands for shorter grazing seasons.

Many documents describe the effects of livestock grazing on riparian plant communities and channel conditions. One of the best is *Managing Fisheries and Wildlife on Rangelands Grazed by Livestock (Dec, 1990)* by William S. Platts. This reference covers most encountered situations, and offers numerous management strategies for mitigating livestock impacts on sensitive areas. Costs associated with improvements and/or management requirements are also identified. Such costs can run from little to extreme, and should be weighed when doing any improvement project planning. (See Appendix K, Grazing Sytems Effects on Vegetation and Hydrologic Function for effects and costs associated with different types of livestock grazing systems.)

Achieving the desired objectives for the watershed by utilizing grazing systems depends on sound judgement and knowledge of the watershed. How grazing affects plant communities depends on the permittees' ability to manage their livestock, and the administrative capabilities of the district to deal with on-ground situations.

Mahogany Types

Mahogany was more prevalent in the reference period. Currently, this type is represented by older age classes of poor vigor, with little evidence of reproduction. Conifer encroachment and fire suppression may be the cause, but this theory has not been proven.

Non-forested Types

The non-tree component would favor annual and perennial grasses and forbs compatible with frequent, light ground fires. Sedges, ceanothus and grasses would have been good candidate species to have occupied this growing space, but there is no information to confirm this. Shrub species would be present, generally small and woody.

Areas Considered to Be Understocked

Approximately five percent of the SOS area is in an understocked condition, primarily as a result of wildfires. Most of this acreage has been recently planted and is not truly understocked, but stocked with young seedlings.

3. What Are the Current and Reference Era Risks of Stand Replacement Events from Fire, Insects, or Disease?

A. How do the current and reference era risks of stand replacement events differ?

Reference Era Conditions

Stand replacement events were closely tied to fire regimes for specific forest plant communities. There are three plant communities within the South of Sprague watershed that exhibited distinct fire regimes: Ponderosa pine (over 90% of the watershed); white fir-dominated mixed conifer (less than 4 % of the watershed); and subalpine lodgepole-white fir (less than 5% of the watershed).

The ponderosa pine communities fire regime can be characterized as frequent, low intensity/severity wildfire. Fire burned through the equivalent of the entire community every 5-15 years, consuming surface litter and portions of downed logs. Most understory tree regeneration was killed, while shrubs, perennial forbs, and grasses (which regenerate from root crowns or subsurface perennating organs) was often only top-killed . Only where other mortality agents had worked did the fire torch out small groups of trees. Such "stand replacement" events were very small, usually encompassing 1/2 acre or less. Larger stand replacement events have occurred in this forest community in other watersheds in the Klamath Basin (several hundred acres near the Upper Klamath Marsh early in this century). However, these larger events were so infrequent that they cannot be characterized as recurring events or aspects of a fire regime.

The fire regime for white fir-dominated mixed conifer communities can be characterized as frequent, low intensity/severity wildfire, punctuated by occasional, small-patch stand replacement events. Frequency of wildfire in these communities has been measured at about 10-50 years. Intensity/severity varied directly with frequency. As the interval between fires increased, the fire intensity/severity increased. Much of this forest community was maintained in an old-growth dominated overstory with a young shrub, perennial grass, and forb understory. The scattered stand replacement patches were mostly less than 50 acres.

The fire regime of the subalpine lodgepole-white fir community is characterized as infrequent, high intensity/severity wildfire. Fire frequency was 100-500 years. These fires were stand replacement events that were limited in size (usually less than 100 acres) to the extent of the vegetated area and topographic features. Within the perimeter of these fires, patches of lightly burned or unburned trees remained due to the discontinuous nature of fuels in this forest community.

Bark beetle epidemics had a periodicity of 50-80 years. These would reduce stands to lower stocking levels, but would not replace stands.

Current Conditions

Grazing, timber harvest, and fire exclusion have altered forest structure, vegetation mosaics, fuel loadings, and seasonal fuel moisture conditions during the last one hundred years in the ponderosa pine and mixed conifer forest communities. Management activities (very limited in this community) have had little influence in the subalpine lodgepole-white fir community. These changes have produced new fire regimes in the ponderosa pine and mixed conifer communities that are very different from those exhibited in the reference era.

The fire regimes in ponderosa pine and mixed conifer can now be classed as one regime exhibiting infrequent, high intensity/severity fire. Stand replacement fire during the past 15 years has increased such that 10% of the watershed burns per decade It is anticipated that this rate will increase as fuels continue accumulating and shrub and tree stocking increase. Current stands are at high and immediate risk as indicated by the Lone Pine, Cave Mountain and Cowboy fires, and the extensive stress related insect and disease mortality the last few years. Insect and disease agents have the ability to cause nearly 100% mortality. There is a high risk to residual stands if large amounts of dead material is not removed. Large numbers of dead/dying trees become a risk by:

- Increasing fire hazard.
- Mechanical damage or wounding to residual or regenerated stand when they fall.
- Short-term colonization sites increase insect numbers which then emerge to attack live trees.

The stand replacement rate exhibited in the South of Sprague watershed is significantly lower than the Chiloquin Ranger District average. This is likely due to the stochastic nature of fire occurrence and variance obtained when analyzing relatively small blocks such as this 83,000 acre watershed. If one uses the district averages for characterizing the current fire regime the significance of the recent changes and their critical nature becomes clearer. Stand replacement fire frequency has increased from every 220 years during the 1970's, to every 75 years in the 1980's, to every 17 years during the 1990's. While it is certain that some of this increase can be attributed to unusually dry climatic conditions, most of it derives from unnatural accumulations of dead and live fuel.

B. What is the frequency of conditions that lead to stand replacement events?

Those aspects of forest structure, health, and seasonal water allocation that predispose it to insect and disease outbreaks (beyond endemic levels) also contribute to high intensity/severity wildfire.

Conditions that lead to widespread mortality in forest overstories due to insect and disease are generally associated with overstocked stands. Stocking of trees and shrubs tends to increase with time until light limitations prevent additional recruitment. As stocking passes threshold levels, each new stem provides a degree of competition for ecosystem resources (at the expense of it's neighbors). As greater portions of the forest ecosystem nutrient pool become organically bound, and as more woody stems per unit land mass become established, water and nutrient deficiencies occur. During water-poor years large percentages of the overstory become susceptible to a wide variety of insect and disease agents. Partial mortality of trees and shrubs as well as complete mortality temporarily reduces competition but increases standing and down forest fuel loads. New recruitment of shrubs and trees feeds the cycle until, ultimately, fire combusts the fuel, mineralizing the organically-bound nutrients, making them available for plant uptake again..

Trees native to this area did not develop a survival strategy for growing under high stocking conditions. Most pine survival strategies were based on low stocking levels. The tree's natural defenses; thick bark to protect against fire, abundant sap to "pitch out" beetles etc., are ineffective in highly stocked stands. A continuous understory of seasonally flammable live fuel provides the competition that reduces resistance to insect and disease as well as a fuel strata that elevates surface fires to overstory crowns. Shade tolerant trees and shrubs become established in the understory over time when fire is excluded.

During the early part of the fire season (which generally is in effect from May through October) the understory shrub and tree component is relatively fire resistant (high live fuel moisture values). Later in the season (usually August through the season-ending rain event that occurs generally after September 15) the shrubs become very flammable and provide a "ladder of fuel" for surface fires to climb into the crowns. In addition to the ladder provided by the seasonal lows of live fuel moisture, needle and twig fall is caught by the shrub component. The fine dead fuel suspended in the air provides a highly flammable fuel that contributes to carrying fire to the crowns, even in early season fires when the shrubs have high live fuel moisture.

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

Reducing the stocking level of trees and shrubs, as well as reducing surface litter loads would decrease the stand replacement event return interval. Several methods might be employed to accomplish these items. Reestablishment of frequent, low intensity/severity fire would return the area to a fire regime that included very little stand replacement wildfire or insect and disease outbreaks. Reshaping the forest stand structure and fuel loadings to reach that type of fire regime while maintaining a living overstory will be difficult. It may require multiple entries of fire and/or combinations of harvest and fire, mechanical manipulation (whip felling, precommercial thinning, crushing, etc.) and fire.

4. What are the relationships between management activities and TES habitat? How has habitat been altered by management activities?

A. What was the role of reference era disturbance regimes in the creation of key habitat areas?

Riparian

Fire reduced conifer encroachment and facilitated riparian hardwood and grass species rejuvenation. Historic documents refer to large amounts of aspen, cottonwood, and some willow, in the Sprague River valley. These same references reported less willow in the upland riparian areas, mostly limited to channel areas. Sagebrush was also present in some riparian edge areas.

Mountain mahogany

References indicate there were large areas of Mountain mahogany in SOS during the reference period. Fire probably limited conifer encroachment into Mountain mahogany habitat (rocky soils, etc...). In the open grassy stands (common in the reference period), more gophers were probably present, and their feeding habits would have limited successful conifer regeneration. Mahogany regeneration may have been stimulated by fire, but this is an unproven theory at the present.

Pileated woodpecker

Input from the Klamath Tribes indicate more acres of pileated habitat were present during the reference period than currently exist. Reference conditions contained more open pine stands with larger average diameters, with more ponderosa pine suitable for nesting trees. Periodic low intensity/severity fire maintained these stands in the reference period.

Spotted Owl

There appears to have been little reference era owl habitat as now defined. The only suitable habitat would have been the stand replacement fir zones above 6200 feet, and narrow bands along the upper forks of Trout Creek.

B. What federal activities have led to an increase or decrease in the quantity or quality of habitat for TES species?

Fire suppression has increased the susceptibility of late seral stands (or areas) to stand replacement fire by allowing brush and conifer species to occupy potential and suitable habitats. Organic material at or near the ground surface has been able to build up beyond historic levels. Fire suppression tends to discriminate against more shade-intolerant species. Increased stem density has raised stand susceptibility to insect and disease infestation, and the potential loss of entire communities. Openings, both natural and man-caused, are closing with vegetation increases.

Roads continue to be the prime threat to TES species and habitats. Occupancy of areas by roads reduces available habitat. Roads accelerate runoff, reducing the system's ability to maintain water tables at levels necessary for TES plants. Culverts affect streams, channels, and riparian areas by collecting and accelerating delivery of water to the channel.

Grazing along some intermittent channels has reduced riparian hardwood occurrence through impacting channel and meadow integrity through compaction and bank degradation. Non-native forage species have been introduced for domestic animals and ungulate wildlife.

Some federal activities have maintained or allowed TES species and their habitats to increase. Fire suppression benefits some species, such as wild onion. Old Growth Areas have been established, and management activities have been excluded from other areas such as Saddle Mountain and the Badlands. Areas adjacent to stream channels and meadows have also been excluded from most intensive management activities. Road construction in riparian areas has been reduced. Implementing stricter forage utilization standards for domestic livestock grazing , controlling noxious weeds, and limiting introduction of non-native species for forage and erosion control have all been beneficial to TES species and habitats. In some situations, grazing may be favorable to some TES plant establishment. Harvest and reforestation have affected late seral plant community composition and conditions.

C. What federal activities affect specific key habitats for TES species, and how are these habitats affected?

Federal activities since the reference period have affected aquatic habitats within the Rock and Trout Creek drainages.

Inland Redband Trout - Sensitive

Rock Creek

Rock Creek appears to have been a perennial system from the headwaters to the mouth in the reference period. Construction of the Yainax Agency, the Rail Line that parallels the north slope of Bly Mountain/Round Mountain highlands and intensive agricultural and grazing activities have caused major physical alteration to both the upper and lower Rock Creek drainage. Trout habitat has declined in quality and quantity since the reference period as a result of channel and system simplification.

The system is currently habitat for a resident population, but appears to be restricted to reach #4 and the unsurveyed, intermittent reach between the top of Dams Canyon and private lands in Dams Meadow during low water periods. There is a strong probability that a migratory population of trout occurred prior to system alteration. Restriction now occurs as a result of the discontinuous perennial system. During the recent drought, perennial flow occurred in reaches 1 and 4, but were physically separated by several thousand meters of dry channel. Reach 4 is approximately 7,500 meters from the Sprague River.

Surface flow connects federal property with the Sprague River during periods of high water. The lower drainage is lacking a single, distinct channel. Flow occurs overland across a broad meadow approximately 500 meters long. Any movement is via shallow, discontinuous channels over a broad expanse of grass/sedge meadow. Though hydraulic surface connectivity occurs in some years, the lower system is sufficiently discontinuous to dissuade annual or seasonal migration.

The quantity and quality of habitat at low flow (typically August thru October) appear to be limiting this population.

Instream cover: The quantity of pool habitat in perennial reaches is lower than the optimum recommended by many authors. The riffle/pool ratio for reach 4 is approximately 10/1, indicating a preponderance of glide and rapid habitat in this highly modified reach. The average pool depth in reach 4 is 0.4 meter.

Coarse woody debris (CWD) in reaches 3 and 4 is low (22 Pcs/Km), and nonexistent in reach 6. Reaches 3 and 4 received a high degree of impact/alteration from railroad construction in 1928 and 1929. A railroad grade was constructed directly up the stream channel to access timber in the upper watershed. Channel morphology in reach 6) contributes little to instream cover due to low angle banks (less than 90 degrees), though several plunge pools occur at nick points in the channel system. The duration of flow in reach 6 is unknown, but an ODFW survey in October, 1991, found no surface flow. In July, 1992, streamflow in reach 6 was sufficient to hold fish.

Water Quality: Water temperature in the upper system is a concern. The water temperature entering Dams Canyon on May 24, 1995, was 20.5° C. This temperature reflects the mixing of water from tributary 1 and the intermittent reach above the private lands in Dams Meadow. Water within the meadow may reach or exceed the upper lethal temperature (approximately 25° C) due to lack of shading during periods of low flow.

Ground water enters reach 4 somewhere below the confluence of the mainstem with reach 5. An ODFW survey recorded water temperatures in reach 5 at 14° C in October, 1991, and in reach 4 at 9° C. Pool habitats in reach 4 are the only refuge sites for redband trout at low water, but are low in quantity ($124m^2$; 10% of the wetted area) and quality (average less than 0.4m deep). No other data is presently available.

Habitat Trend and Threats: In the publicly held portions of the drainage, habitat is in an upward trend. Reach 6 exhibits a Rosgen F6 type channel which is beginning to form a C type channel. Instream cover should improve as the channel deepens and the width/depth ratio in reach decreases. A decrease in the width/depth ratio will favor lower temperatures during low flow as well.

In late May, 1995, intensive riparian hardwood planting occurred in reaches 5 and 6. Approximately 800 alder were planted within the F6 channels in an attempt to increase bank stability. Winema National Forest personnel will conduct temperature monitoring to determine if lethal temperatures are occurring.

Trout Creek

Trout Creek is one of the principle watersheds within the SOS. All three forks of Trout Creek are perennial, though discontinuous flow was recorded in mid October, 1991. This stream system appears to be in an upward trend, recovering from intensive earlier farming activities. The three forks of Trout Creek contain habitat that is rare on the Chiloquin Ranger District, and support resident populations of redband trout.

Some fish in this system may migrate to the lower reaches and/or the Sprague River. The upper reaches or the North Fork are very low in pool habitat and habitat complexity, whereas the lower reaches of the mainstem contain deep pool habitat and are in contact with the Sprague River.

Instream cover: In 1991, reach 1 was dominated by 3 deep (1.3m) backwater pools which appear to have been beaver impoundments. The large dams have apparently been breached and replaced by smaller structures, four of which appear to be the result of recent beaver activity. Pool habitat in reach 2 is high, with a riffle/pool ratio of 5/1. Habitat complexity is increasing through the addition of CWD from the 1987 Cowboy Fire.

Pool habitat in the North Fork is lacking. The average riffle/pool ratio is 16/1. The substrate in these reaches is dominated by sand (31%) and silt/organics (30%), with 27% of the substrate being gravel. All of the North Fork reaches received low wood complexity scores during the 1991 ODFW Survey.

The middle fork of Trout Creek is dominated by a large moist/wet meadow Though altered by agricultural activities for over 70 years, this fork appears to be in a distinct upward trend Habitat supports a population of redband trout in the mid · e reaches of this system. It is unknown if the population is migratory, resident or both. The m. .le fork was not surveyed by ODFW in 1991, but the team managed to visit sites along its course.

From the confluence upstream to the culvert/road crossing at the ranch site is a Rosgen C channel. This channel exhibits some incision and lateral movement into the historic floodplain, now a terrace. The width/depth ratio appears fairly high, though diagnostic measurements have not been made. In-channel habitat is low, but increasing through the development of willow sites and debris jams.

From the road crossing to the irrigation head gate at the top of the main meadow, the channel bisects a large open meadow with a narrow, deep channel. The width/depth ratio is very low. Sinuosity appears to be increasing, as do undercut banks. Willow is prominent in the lower end, but sparse in the upper end.

Downstream from the irrigation head gate, channel straightening has resulted in a short (100m) section of stream that is low in habitat complexity. A possible (low priority) restoration project could occur here: Remove the head gate and route the stream (in a sinuous pattern) back to a prior channel.

From the headgate upstream encompasses a variety of habitat types, with sections of different substrates and gradients. An impoundment created a well developed hardwood community over a branching, narrow channel in the lower portion of this reach. Upstream, the gradient increases sharply.

The south fork of Trout Creek may be the best representation of pre-management conditions in the south block of the Chiloquin Ranger District. Little is known about this fork from Section 15 down stream, but the entire south fork will receive a USFS level II survey during the 1995 summer field season.. Within section 21, habitat and water quality appear to be excellent.

Water Quality: Temperature measurements were taken at or near the confluence of the north and south forks in 1975 and 1976 . Water leaving the south fork was typically warmer than that leaving the north fork. In mid July 1976, the temperature of water exiting the south fork was approaching the upper lethal temperature for trout at 25° C. Temperatures recorded during the August 1979 ODFW contract surveys were considerably cooler at 22° C. High temperatures in the south fork above the confluence may represent a seasonal barrier to movement.

Northern Spotted Owl - Threatened

There are two nest sites located in the SOS area. Observations of spotted owls on the Chiloquin Ranger District date from the late 1970s and 80s, some of which were recorded in the assessment area. The identification of nesting owls eventually resulted in a modification of the eastern range line of the owl as presented in the ROD (1994), and adoption of a management strategy for the south block of the Chiloquin Ranger District that was developed for westside forests. Managing the South Block as spotted owl habitat may involve attempting to manage for an entirely different percentage, as well as stem densities, of white fir and Douglas fir than was present in the reference period.

Habitat suitability for the northern spotted owl and other late seral related species has most certainly been affected by management activities, specifically the exclusion of wildfire from the landscape. The spatial extent of habitat islands fluctuated over time in response to subtle and major changes in weather patterns, fire events and, more recently, management activities.

A forest inventory cruise conducted from 1920 through 1924 indicated a comparitavely large block of timber was dominated by white fir/Douglas fir on the north slope of Swan Lake Point, which may have been suitable habitat for spotted owls. Smaller habitat blocks were associated with the upper reaches of the Trout Creek drainage. Several thousand acres on the Ya Whee Plateau contained varying amounts (>15% of the total stand volume) of white fir and Douglas fir, but dominated by Ponderosa pine (see p. 26).

That local birds exist in total isolation from larger source populations is highly unlikely. The south block of the Chiloquin Ranger District is a sink for dispersing birds from a source population in the southern Oregon Cascades. Spotted owls that dispersed into the south block during the reference period or since fire supression crossed large areas of unsuitable habitat (Klamath Lake, Agency Lake). Fire suppression did not alter the size of these unsuitable habitat areas, so there is no reason to believe that dispersal into the south block did not occur during the reference period, much as it does now.

A viable, breeding population of spotted owls probably did not occur in the south block prior to management activities. Without regular immigration to the south block from a larger, source population, extinction for this local population will, and probably has, occurred. Small scale, stochastic events (fire, local disease) could easily force this population to extinction at any time.

Fire exclusion on a broad scale is believed to be the greatest threat. This activity has created and maintained stands that have a greater susceptability to stand replacement events - fire, disease and outbreaks of insects - more so than during the reference period.

<u>Bald Eagle</u> - Threatened

Historic timber harvesting and road construction removed large conifers, reducing nesting habitat. Road construction reduced effective nesting territories. Rail and road systems were constructed across stream channels, which reduced habitat for their prey base (fish and waterfowl) lowering water tables and changing water flows. Grazing removed and/or reduced stream bank stabilizing vegetation. DDT and 1080 affected eagle reproduction prior to their use being banned.

Present federal management has allowed improvement of conditions for bald eagles by restricting harvest activites and timing near active nests. Eagle nesting areas have been established and are monitored according to the W.N.F. L.R.M.P (1990). Use of pesticides within the vicinity of nests is prohibited. Grazing activities adjacent to perennial fish-bearing streams and wetlands have been reduced or eliminated on federally administered lands in SOS.

Present federal activities which contribute to a decline in habitat effectiveness, as well as placing nesting habitat at risk, continue to occur. Long-term fire suppression and an over abundance of roads are the primary factors. Road densities in eagle management areas are not being reduced. Management plans are not in place to reduce fire hazards in active nesting territories.

The major potential threat to present bald eagle habitat continues to be fuel loading build-up. Open roads in management areas facilitate harassment by allowing vehicles to enter during the nesting season. The de-watered condition of former wetlands, and lowered water levels in streams do not provide suitable habitat for the eagles' prey base.

Past activities which have, and future activities which may impact the habitats of TES Species are common to the species listed below. A description of the activities and the consequences, both negative and positive, follows the list.

American White Pelican - Sensitive

Greater sandhill crane - Sensitive

Northern Goshawk - Winema Indicator Species

Fisher - Category 2

Negative Impacts

The primary management activities that pose threats to habitat are fire suppression and roads. Current standards for fire suppression cause the build up of forest litter, and the retention of over stocked stands. The greatest threat to habitat is in the potential for a large fire within the watershed which could conceivably eliminate all habitat for any given species Retention of current transportation systems continues to negatively impact water tables and stream channels in meadow systems. Lack of restoration activities in many degraded stream channels facilitates the continuation of channel degradation.

Past federal management activities that reduced habitat were the channelization and diking of the Sprague River, which reduced wetland area within SOS. Water runoff was accellerated during spring thaw, and timing and duration of flows was altered. Some perennial stream portions became intermittent. Streamside vegetation was removed primarily for the development of grazing capacity. Domestic livestock grazed out stream cover, while other vegetation was removed with tractors and drag lines. Increases in road density directly affected riparian and streamside vegetation by occupying the space, or by altering hydrologic function to the point where water tables are no longer accessible to streamside vegetation. All this has contributed to the diminishing of feeding area within the watershed.

Fire suppression continues to jeopardize (large fire potential) more mid and late seral conifer stands, which may potentially reduce both nesting and foraging habitat for goshawks. Maintaining roads near or in goshawk nesting areas continues to discourage occupancy and breeding activities..

Positive Impacts

Stricter enforcement of livestock forage utilization in meadow systems has reduced the impacts to habitat on public lands. This is being accomplished on federally administered lands within the watershed through allotment administration, but must be a voluntary effort where private ownership is concerned. Less road construction near riparian areas, and a restriction of management activities in or near meadows would also improve the condition of habitat.

Designation of management areas has probably been the best management activity to benefit some species (such as the goshawk, for example). Restriction of management activities near active nests (distance and season) have also proven beneficial. Other positive steps have been to reduce harvest volumes, providing additional snag areas, and a reduction in road construction in areas frequented by goshawks.

Amphibians: At the present time there are no listed amphibians occurring within the analysis area. Historically, the only current listed species that may have occurred in this area is the spotted frog, but due to the large scale alteration of riparian habitats since 1900, there is no longer suitable habitat present.

Reptiles: The northwestern pond turtle probably occurred in the analysis area. Again, due to the lowering of water tables, it is doubtful that this species presently occurs.

For a complete Winema National Forest TES list see Appendix L, WNF Threatened and Endangered Species.

5. Has soil compaction increased and what impact has this had on vegetation?

No comprehensive study or intensive monitoring of soil compaction and vegetative impacts have been done within the SOS area. Based on the physical nature of the area's soils, an understanding of the compaction process, and some personal observations, it is safe to say management practices have caused an increase in the amount and severity of soil compaction within the assessment area. Whether this has been detrimental or not cannot be determined from available information.

The SRI (Soil Resource Inventory for the Winema National Forest. Carlson, 1979) identifies and describes several different land types and complexes occurring within the area. Susceptibility of the soils to compaction during management activities are variable. The B-Group soils are rated as having low susceptibility, while the H-Group is rated as low through high, depending on the rock volume within the individual soil profile. It should be recognized that the SRI is a reconnaissance level soil survey and does not have the scale or detail to be employed on more intense planning levels. Therefore, it is conceivable that the compaction susceptibity, especially for the B-Group soils, may be understated.

Evidence to support this statement is found in the soils monitoring program in progress on the Chemult Ranger District, north of SOS. Compaction monitoring on several hundred acres of similar soils (both A and B Groups) has established that compaction is present on every management area tested (mostly timber sales). Each timber sale monitored had some degree of severely compacted soils, most were between 10 and 50 per cent compacted and overall averaged about 30 percent severely compacted, not including roads.

It appears that if ground-based machines were employed during harvest operations, soil compaction resulted. On most of the units monitored in Chemult, severe or detrimental compaction exceeded forest plan standards and guidelines for soil impacts. Further personal observation of limited areas within the watershed revealed areas with highly compacted soils, which appeared to be the result of machine operations during timber harvest.

As stated previously, it is safe to assume that soil compaction has increased in response to management operations and that it has impacted vegetation to a certain unknown degree. We now need to establish a comprehensive soils monitoring plan to ascertain distribution, severity and effects of the soil disturbance.

Many studies have delved into the vegetative impacts of soil compaction, but none have been done on the Winema National Forest. Most of the studies have concentrated on the impacts of compaction on timber species, although some range studies have centered on the effects of compaction on meadows and riparian zones due to livestock grazing. Primarily, the timber studies were designed to detect losses in timber volume (height and diameter) for a given area, losses in germination and seedling establishment, and early growth rates on compacted soils compared to undisturbed soils. Some examples of these studies include:

- Helms and Hipkin measured Bulk density (Db) around 423 ponderosa (California Sierras). They found a Db increase of 43% on landings, 30% on skid trails, and 18% on adjacent cut over areas. Tree volume per unit area was reduced 69, 55, and 13% respectively.

- Steinbrenner and Gessel (S. Washington Cascades), found a 24% increase in Db on tractor-logged lands, a 35% loss of permeability, and a 10% decrease in macropore space. Skid trails showed a Db increase of 2.6-133.6%, a 53% loss in macropore space, and a 93% loss in permeability. An average of 1260 seedlings/acre were established in cutover areas, but only 410 seedlings/acre on skid trails.

- Forristal and Gessel (Snohomish County Washington) noted that Douglas fir and Western hemlock root growth was restricted significantly by a Db of approximately 1.25 g/cc.

- Minore et al, in green house studies, compacted soils to 1.32, 1.45 and 1.59 g/cc and planted trees into these compacted soils for two years. They found that all seven northwest tree species roots would penetrate into the 1.32 g/cc soils; Western redcedar, Sitka spruce, and Western hemlock could not penetrate 1.45 g/cc, while White fir, Lodgepole pine, Red alder and Douglas fir could. None of the seven species penetrated into the 1.59 g/cc Db.

- Lanspa (Six Rivers N.F.) noted tree heights of 27.3 inches on skid roads, and 71.4 inches on adjacent cutover areas. He attributed most of the difference to soil compaction inhibiting growth.

- In Oregon, Power found that compaction in coarse-textured soils persisted for at least 40 years.

Changes in crop tree germination, seedling survival, and tree growth rates are generally used to measure changes in vegetation due to soil compaction in most studies. It appears that actual changes in vegetation types, unless blatant, have been ignored. Some range compaction studies may have identified vegetation changes. It may be that the study of compaction is still a fairly young field, and changes are not evident enough or of sufficient importance to justify identification.

6. Has soil productivity increased or decreased since the reference period? What impact has this had on vegetation?

A. What does the soil currently produce? How does this differ from the reference period?

Timber harvest and grazing have tended to reduce soil productivity as a result of soil compaction. Fire exclusion has been purported to increase productivity, specifically tree diameter growth, due to (assumed) increases in the L, F, and O horizons of the forest floor (and associated microbial nutrient mineralization). However, there is also evidence displaying increases in soil productivity due to fire applications.

The fire-soil productivity controversy cannot be resolved without further research. We do know that fire exclusion leads to changes in stand replacement event frequency (See Chapter III, Stand Replacement Frequency). Increased stand replacement frequency certainly offsets any soil productivity gains that might have accrued through fire exclusion.

Current forest conditions influence soil productivity through gradual accumulation of ecosystem nutrients in organic form. Most organic residues are deposited much faster than they decompose in the cold, dry climate of the Klamath Basin. Some organic forms of nutrients take literally thousands of years to decompose without fire. Under reference era fire regimes, organic residues were mineralized on a regular basis by frequent, low intensity/severity wildfire. Most of the overstory remained alive and capable of utilizing this natural flush of nutrients. Currently, the high intensity/severity wildfires mineralize nutrients in much larger quantities and kill most of the overstory in the process. Much of the available nutrients are then lost to the ecosystem from volatilization and leaching before revegetation can utilize them.

Management activities that compact the soil beyond threshold levels tend to cause reduced productivity. Heavy equipment operations, as well as grazing, have been identified as causes of compaction which result in reduced productivity. Examples of the expected reduction in growth on compacted soils in SOS are not readily apparent. More research is needed in this area.

Except for the Badlands and Devils Garden, multiple harvest entries have occurred on nearly every acre of SOS (see Appendix M, Summary of Harvest Related Activities from Available Information). Most of the soils in SOS are easily compacted, and though compaction surveys have not been done, the belief is that most of the soils in SOS are compacted to some degree. Studies in other areas with similar soils have shown reduced soil productivity due to compaction. The extent of reduced productivity in SOS, and how much of the compaction is actually detrimental, is unknown.

Soil productivity declines have a tendency to favor weedy species (many of them exotics) such as bull thistle and cheatgrass. Without intervention, these species tend to sequester more and more ecosystem resources at the expense of many of the other species. Soil compaction and lack of fire discriminates against grasses and forbs, especially annuals. This results in less on-site competition for conifers, leading to the assumption that increased conifer growth rates display increased soil productivity.

B. Can a change in productivity (fertility?) be attributed to management activities?

It is currently unknown whether present compaction in SOS soils is detrimental, or how long it persists. Ripping and subsoiling are mitigation measures that have shown effectiveness in some locations. However, one must recognize that avoiding or limiting the extent of compaction are the best alternatives for conserving soil productivity.

C. Has localized soil loss, such as has occurred in the near bank area of some riparian areas, resulted in a reduction in productivity?

Localized soil loss from stream banks causes a definite loss in productivity on those specific lands. Assuming that four feet of bank width has been lost (a generous estimate) along every mile of existing channel in SOS, the area lost to riparian vegetation would be approximately 160 acres out of a total estimated riparian acreage of nearly 6,500. Along sections of channel that have down cut and abandonded their flood plain, riparian vegetation width has been reduced 5-20 feet, and dry land species have moved in to occupy the area. Soil loss in upland areas has not been quantified, and there have been no local attempts to determine any effect this loss may have on the productivity of these lands.

7. How does the cost of maintaining high stocking levels in conifer stands differ from the cost of maintaining historic stocking levels in those stands?

A. Is the conifer stocking level higher now than in the reference period? If so, to what extent is stocking higher?

Stands are dynamic, and grow within a range of stocking levels. This question can only be answered with a combination of historic and current references, data, and professional judgment as to the actual range of stocking levels involved.

Reference fir type

These stands followed a stand replacement scenario, carrying relatively high stocking levels and volumes (1920 cruise). These stands have always developed to a conifer dominated climax stand condition that was limited by insects, disease, fire, or a combination of same. The overall conifer stocking is probably not significantly higher now than it was in the past.

Fire suppression might reduce the amount of this type that is in a seral condition, however the 1920 cruise showed all of the type in a climax condition.

Reference Ponderosa pine type

This type includes much of the current mixed conifer type. Previously, approximately 90% of the watershed was maintained in this type (excluding stand replacement fires and young plantations in clearcuts).

Current stocking ranges from 2-7 times higher than reference stands. The highest percent increase is present only on the higher elevation/higher moisture regime sites. A 2-3 fold increase in stocking is common for most stands which have had some recent partial cut activity, but not clearcut.

For approximately 5% of the acres, (stand replacement fire and up to 15 year old clearcuts), conifer stocking is less than most of the reference period. The reference period showed evidence of 1-2% of the acres in a stand replacement situation. Within ten years or less, the stocking on these acres will be equivalent to or exceed the reference period. The size and structure of the stands is totally different, with far more stems per acre than reference stands, and the saplings and poles are much smaller.

B. Has biodiversity been reduced as a result of higher conifer and brush stocking levels?

Biodiversity is the term used to describe the variety of all living organisms on the earth. It encompasses at least three levels of biological organization: Genetic (individual), species, and ecosystem. Species diversity is assessed by distribution and abundance across the landscape.

The most common factor within the analysis area is continual disturbance through human activities such as timber harvesting, grazing, non-native plant introduction (musk thistle, noxious weed; cheatgrass, exotic plant), road construction, mineral extraction (rock and cinder pits), and fire suppression activities.

Various plant communities are at stages where major fire events are imminent. Mid-sized fires have occurred recently (1980 Cherry Peak fire, 2000 acres; 1987 Cowboy Fire, 4000 acres). Following these fires, salvage logging, reforestation, road construction, and other associated activities have taken place. This has changed the structure and composition of plant communities, and consequently the distribution of animal species using these areas.

Conifer and brush stocking levels have increased over time with fire suppression. This increased stocking, along with less open-grown old growth across the landscape and a general lowering of water tables in the analysis area, has affected timing and quantity of water flows. This has decreased the wetland shrub component, in turn decreasing the diversity of native plants that grow in such areas, altering their usability by wildlife.

Plant communities prior to 1900 were composed of more fire climax species. Plants that were capable of resprouting, regenerating, and/or fire resistant tended to dominate the landscape. Ross's sedge, mountain brome, red fescue, Balsamroot, waterleaf, needlegrass, birchleaf and true mahogany, ponderosa pine, ceanothus, manzanita, aspen, cottonwood, alder, and willow were present at different water zones, elevations, aspects, and slopes. These plant species are present today, but except for ponderosa pine, are at reduced densities, primarily due to fire suppression.

Fire suppression and management activities, along with lowered water tables, have resulted in the establishment of more white fir, bitterbrush, curlleaf mountain mahogany, big sagebrush, low sagebrush, rabbitbrush, musk thistle, bull thistle, and introduced grasses (pubescent wheatgrass, orchard grass, and smooth brome). This has occurred in Crystal (207), Copperfield (208I), Dockney (208H), Rock Creek (Orphan), and Whiskey Creek (Orphan) subsheds. Native species dependent on lentic environments are not as prevalent as they were prior to increased brush and conifer stocking levels:

- Historic ponderosa pine tree cover was less than 50%.
- plants dependent on fire to maintain their presence are currently at lower densities.

Habitat changes have resulted in more generalist (species whose requirements are not specific to one habitat) and exotic wildlife dominating the available habitats today. Species which focus on areas of higher conifer plant densities and upland brush are more prominent (mule deer, elk, antelope, flickers, starlings, house sparrows, etc). Interior forest species such as goshawks, American marten, and whiteheaded and pileated woodpeckers occur in only minor amounts within the SOS area. Chinook salmon, bull trout, fisher, California wolverine, and the western pond turtle are not present today. Beaver, red-band rainbow trout, waterfowl, amphibians, and neotropical birds dependent on hardwood communities are present, but at lower populations than in the reference period. Historic accounts regarding the fire regime, as well as occurrence of cottonwoods, aspen, and alder indicate there were more areas available for these species historically (see Appendix L, Occurrence).

No stream or drainage within the analysis area has been exempt from man's activities. The most obvious signs are both current and past road systems and, together with other activities, their combined effects on drainages and riparian communities. Mule deer are the primary focus species in the analysis area, but Bald Eagles and some other late seral dependent species also receive attention. Overall, management approach has focused on improving habitat through timber harvesting and improvement projects. These projects include forage seeding, water developments, and underburning.

Effects of roads have not been corrected. Roads continue be the major source of accelerated runoff, resulting in lower water tables, slowly reducing the overall extent of riparian communities. This in turn has reduced the abundance and distribution of riparian plant and animal species. Specific examples include roads 5813210 and 5813360 in Copperfield Draw; 5810 and other roads that intersect Crystal Castle Drainage; 1119226 on Dams Meadow and Rock Creek; 5850 and 2228500 on Trout Creek; and 4083 on Whiskey Creek (see Appendix N, Road Treatment Recommendations).

For the reasons stated above, biodiversity has changed within the area, along with the number and diversity of species. There are probably more plants and animals today, but due to the cumulative effects of management, both outside and inside the analysis area, there is less abundance of riparian obligate and fire climax species. Those species dependent on fire are not as well-distributed across the landscape, but are still present. The extent and frequency of occurrence are not quantified at this time, and the time frames for this assessment do not allow for such information to be gathered; so this is an assumption based on limited field and site visits.

Whether one feels that biodiversity has been reduced depends on perspective. If one includes all species (general habitat users and occupiers along with introduced exotic species), the answer is probably no. If one looks at historic ranges of both native plants and animals dependent on fire and higher water tables (and less human manipulation), the answer is probably yes.

Other Factors to Consider:

Some determination of biodiversity change may be made by breaking down the communities present during different time periods (pre-1900, 1900 to present), and then determining the total acres of disturbance caused by human management activities for each time frame. Those areas not substantially influenced by human activities may then be used for comparison to determine the extent of biodiversity loss or gain within the areas being analyzed.

- If biodiversity changes, does that equate to loss?
- If connectivity between communities is changed, does that equal loss?

Another method for determining change in biodiversity is to derive the total miles (or meters) of community edges created by man's activities. These activities tend to create more habitat for species which utilize such areas (edge), such as mule deer, elk, antelope, flickers, starlings, bullfrogs, and house sparrows; and less habitat for interior forest species such as goshawks, America marten, and whiteheaded and pileated woodpeckers.

This leads to several other questions:

- How much edge habitat was in the analysis area prior to 1900?
- How much has been created since then?
- Are interior forest patches isolated?
- Does this equate to conifer/brush stocking levels?
- How do conifer/brush stocking levels fit into the edge measurements, or is there any correlation?

One hypothesis to consider is that biodiversity has been influenced more in areas closer to water than areas more removed. This may prove to be valid assumption for the period up until the early 1950's.

Appendix A. Bibliography

Agee, J K 1993 Fire Ecology of Pacific Northwest Forests Island Press, Washington, DC 493 P

Aikens, C M 1986 Archaeology of Oregon USDI Bureau of Land Management, Oregon State Office, portland, OR. 302 p.

Ahlgren, I F and C E Ahlgren. 1960 Ecological Effects of Forest Fires. Botanical Review 26.483-533

Ahlgren,I F , and C.E. Ahlgren. 1965. Ecology of prescribed burning on soil microorganisms in a Minnesota jack pine forest. Ecology 46:304-310.

Antevs, E. 1938. Rainfall and tree growth in the Great Basin. Carnegie Instn. of Wash., Publ. 469, Am. Geogr. Soc. , Spec. Publ. 21. New York.

Bettinger, K. 1994. Unpublished report. Data summary for 1994 neotropical migrant bird survey of the Winema and Fremont National Forests. On file at Chemult Ranger District.

Bissett, J., and D. Parkinson. 1980. Long-term effects of fire on the composition and activity of the soil microflora of a subalpine, coniferous forest. Canadian Journal of Botany 58:1704-1721.

Bohn, C.C. and J.C. Bunkhouse. 1986. Effects of Grazing Management on Streambanks. Trans. N. Am. Wild. Nat. Resour. Conf.; 51:265-271

Bohn, C.C. 1986. Biological Importance of Streambank Stability. Rangelands 8(2). P. 55-56

Borchers, J.G., and D.A. Perry. 1990. Effects of prescribed fire on soil organisms. In: Walstad, J.D. [and others] eds., Natural and prescribed fire in Pacific Northwest forests. Oregon State University Press: 143-157.

Bork, Joyce. 1984. Fire history in three vegetation types on the east side of the Oregon Cascades. Ph.. D. dissertation, Oregon State University, Corvallis, Oregon.

Boyer, D.E., and J.D. Dell. 1980. Fire Effects on Pacific Northwest Soils. USDA Forest Service, Pacific Northwest Region (R-6). Portland, OR. 59 p.

Brooks, K.W., P.F. Folliott, H. M. Gregersen and J.L. Thames. 1993. Hydrology and the Management of Watersheds. University of Iowa Press, Ames, Iowa. 392 P.

Bryant, L.D. 1979. Livestock Management in the Riparian Ecosystem. P. 285-289. In: Riparian Ecosystems and Their Management: Reconciling Conflicting Uses. Proceedings from the Symposium. USDA Forest Service General Technical Report RM-120.

Carlson, Garwin. 1979. Soil Resource Inventory Winema National Forest. USDA Forest Service, Pacific Northwest Region, Winema National Forest, Klamath Falls, Oregon. pp. 156, 227.

Chandler, C., P. Cheney, P. Thomas, L. Trabaud, and D. Williams. 1983. Fire in forestry, volume I: Forest fire behavior and effects. John Wiley and Sons, New York. 450 p.

Chapman, D.W. and R.L. Demory. 1963. Seasonal Changes in the Food Ingested by Aquatic Insect Larvae and Nymphs in Two Oregon streams. Ecology, Vol. 44. No. 1 P.140-146.

Clark, Bob 1994 Soils, Water, and Watersheds In Fire Effects Guide NWCG PMS 481 Edited by Melanie Miller

Clary, W P and B F Webster 1990 Riparian Grazing Guidelines for the Intermountain Region Rangelands 12 (4), P 209-212

Cochran, P H and W E Hopkins 1990 Does Fire Exclusion Increase Productivity of Ponderosa Pine? In Management and Productivity of Western Montane Forest Soils: Proceedings of the Symposium University of Idaho, Boise, ID

Coville, Frederick V, 1898, Forest Growth and Sheep Grazing in the Cascade Mountains of Oregon, USDA Bulletin No 15

Covington, W W, and S.S. Sackett. 1990. Fire effects on ponderosa pine soils and their management implications In: Krammes, J S. ed., Effects of fire management of southwestern natural resources USDA Forest Service Gen Tech Rep RM-191. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO pp 105-111

Daubenmire, R. 1968. Plant Communities; A Textbook of Plant Syecology. Harper and Row, Publishers, New York. 300 P.

Davis, O.D. 1982. Bits and pieces: the last 35,000 years in the Lahontan area. Soc. Amer. Arch. SAA Pap. No. 2. p. 53-75.

Debyle, Norbert V. and Robert P. Winokur, editors. 1985. Aspen: Ecology and Management in the Western United States. USDA Forest Service General Technical Report RM-119. GPO, Washington, D.C.

Dieter, C.D. and T.R. Mccabe. 1989. Habitat Use by Beaver Along the Big Sioux River in Eastern South Dakota. In: Practical Approaches to Riparian Resource Management: Proceedings of the Symposium. American Fisheries Society.

Dunne, T., and L.B. Leopold. 1978. Water in Environmental Planning. San Francisco: W.H. Freeman Co 818pp.

Dymess, C.T., & Youngberg, C.T., 1966, Soil-Vegetation Relationships within the Ponderosa Pine Type in the Central Oregon Pumice Region, Ecology, Vol. 47, No. 1

Eglitis, A. 1994. USDA R6 Ecologist. Personal communication with K. Johnson.

Forristal, F.F., and S.P. Gessel. 1955. Soil properties related to forest cover types and productivity on the Lee Forest, Snohomish County, Washington. Soil Sci. Soc. Amer. Proc. 19: 364-382.

Franklin, J. F. And C.T. Dyrness. 1973. Natural Vegetation of Oregon and Washington. Oregon State University Press. Corvallis, Oregon.

Frazier, B. 1994. Winema National Forest. Personal communication with J.Frederick.

Fuller, W.H, S.Shannon, and P.S. Burgess. 1955. Effect of burning on certain forest soils of northern Arizona. Forest Science 1:44-50.

Gecy, J.L. and M.V. Wilson. 1990. Initial Establishment of Riparian Vegetation After Disturbance by Debris Flows in Oregon. Am. Midl. Nat. 123:282-91

Ghil, M and R Vautgard 1991 Interdecadal oscillations and the warming trend in global temperature time series Nature 350 324-327

Gifford, G F and R.H Hawkins 1976 Grazing Systems and Watershed Management: A Look at the Record. J Soil Water Conserv, 31(6):281-283

Gordon, N D , T A McMahon and B.L. Finlayson. 1992 Stream Hydrology: An Introduction for Ecologists. John Wiley and Sons, New York. 526 P.

Gregory, S V , F J Swanson, A. McKee and K.W. Cummins. 1991. Ecosystem Perspectives of Riparian Zones. Bioscience 41.540-551.

Groeneveld, D.P. and T.E Griepentrog. 1985. Interdependence of Groundwater, Riparian Vegetation, and Streambank Stability: A Case Study. In: Riparian Ecosystems and their Management: Reconciling Conflicting Uses. Proceedings of the first American Riparian Conference, Tucson, Az.

Grier, C.C. 1975. Wildfire effects on nutrient distribution and leaching in a coniferous ecosystem. Can. J. of For. Res.:599-607.

Hackley, P.R. 1989. Riparian Vegetation, Streambank Stability and Land Use in the Salmon River Drainage, Idaho. in: Practical Approaches to Riparian Resource Management: Proceedings of the Symposium. American Fisheries Society.

Harvey, A.E.,J.M. Geist, G.I. McDonald, M.F. Jurgensen, P.H. Cochran, D. Zabowski, and R.T. Meurisse. 1994. Biotic and abiotic processes of Eastside Ecosystems: The effects of management on soil and properties, processes, and productivity. Gen Tech Rep. PNW GTR-323. Portland, OR. USDA Forest Service, Pacific Northwest Research Station. 71 p.

Harvey, A.E.,J.M. Geist, G.I. McDonald, M.F. Jurgensen, P.H. Cochran, D. Zabowski, and R.T. Meurisse. 1994. Biotic and abiotic processes of Eastside Ecosystems: The effects of management on soil and properties, processes, and productivity. Gen Tech Rep. PNW GTR-323. Portland, OR. USDA Forest Service, Pacific Northwest Research Station. 71 p.

Harvey,A.E., M.F.Jurgensen and M.J. Larsen. 1976. Intensive fiber utilization and prescribed fire: effects on the microbial ecology of forests. USDA Forest Service GTR INT-28. Intermountain Forest and Range Experiment Station, Ogden, UT. 46 p.

Hayes, F.A. 1978. Streambank and Meadow Condition in Relation to Livestock Grazing in Mountain Meadows of Central Idaho. M.S. Thesis, University of Idaho.

Hayes, Marc P. and Mark R. Jennings. 1986. Decline of Ranid Frog Species in Western North America: Are Bullfrogs (Rana catesbeiana) Responsible? Journal of Herpetology: 20(4), 490-509.

Helms, J.A., and C. Hipkins 1986. Effects of soil compaction on tree volume in a California ponderosa pine plantation. USDA For. Serv. Pacific Southwest Region. 4pp.

Holcheck, J.L. 1983. Considerations Concerning Grazing Systems. Rangelands; 5(5):208-211

Hovingh, Peter. 1988. Aquatic Habitats, Life History Observations and Zoogeographic Considerations of the Spotted Frog (*Rana pretiosa*) In Tule Valley, Utah. Great Basin Naturalist 53(2), 168-179.

Hupp, C.R. 1992. Riparian Vegetation Recovery Patterns Following Stream Channelization: A Geomorphic Perspective. Ecology V73. P.1209-26.

Jalaluddin, M 1968 Micro-organic colonization of forest soil after burning. Plant and Soil XXX, no 1 150-152

Jean, C 1995 Preliminary Findings of the Eastslope Cascades Vascular Plant Panel Unpublished report prepared for the Eastside Environmental Impact Statement On file at the Chiloquin Ranger District, USFS

Jean, C 1995 Chiloquin Ranger District Personal communication with J. Frederick.

Johnson, C G, R R Causnitzer, P J Mehringer, C D Oliver. 1994 Biotic and abiotic processes of eastside ecosystems The effects of management on plant and community ecology, and on stand and landscape vegetation dynamics. Gen. Tech. rep. PNW-GTR-322. Portland, OR, Forest Service, Pacific Northwest Research Station. 66 p.

Junk, W J ,P B Bayley and R.E. Sparks. 1989. The Flood Pulse Concept in River-Floodplain Systems. In. Proceedings of the International Large River Symposium. Can. Spec. Publ. Fish. Aquatic. Sci.

Kauffman, J B., K.M. Till, and R.W. Shea. 199X. The Biogeochemistry of Deforestation and Biomass Burning. In: Durrette,D.B., and R. O'Brien. The Science of Global Change: Environmental Impacts of Human Activity. American Chemical Society. Washington, D.C. [in press].

Kauffman, J B., W.C. Krueger and M. Vavra. 1993. Impacts of Cattle on Streambanks in North-eastern Oregon. J. Range. Mgt. 36(6) P. 683-685

___________1983b. Effects of Late Season Cattle Grazing on Riparian Plant Communities. J. Rnge. Mgt 36(6) P. 685-691

Kauffman, J.B. and W.C. Krueger. 1984. Livestock Impacts on Riparian Ecosystems and Streamside Management Implications...A Review. J. Rnge. Mgt. 37(5). P.430-437.

Kilgore, Bruce M. 1981. Fire in ecosystem distribution and structure: western forests and scrublands, In: Fire regimes and ecosystems properties. H. A. Mooney, et. al. (Tech. Coord.). USDA General Technical Report WO-26. Washington, D.C. pp. 58-89.

Kimmins,J.P. 1987. Forest Ecology. Macmillan Publishing Company, New York, NY. 531 p.

Knight, R.W. 1978. Streamside Erosional Response to Animal Grazing Practices on Meadow Creek in Northeast Oregon. Masters Thesis, Oregon State University.

Knopf, Fritz L. 1985. Significanace of Riparian Vegetation to Breeding Birds Across an Altitudinal Cline. In: Riparian Ecosystems and their Management: Reconciling Conflicting Uses. Proceedings of the first American Riparian Confrence, Tucson, Az.

Kovalchik, B.L. 1987, Riparian Zone Associations, USDA Forest Service, PNW.

Kovalchick, B.L. and L.A. Chitwood. 1990. Use of geomorphology in the classification of riparian plant associations in mountainous landscapes of central Oregon, U.S.A. For. Ecol. Mgt. 33/44. 405-418.

Kovalchik, B.L., & Wayne Elmore. Effects of Cattle Grazing Systems on Willow-Dominated Pla. Associations in Central Oregon.

Kovalchick, B.L. 1987. Riparian Zone Associations of the Deschutes, Fremont, Ochoco and Winema National Forests. USDA Forest Service, Pacific Northwest Region, R6-ECOL-TP-279.87. 171 P.

Krausman, P R., K R Rautenstrauch and B D Leopold. 1985 Xeroriparian Systems Used by Desert Mule Deer in Texas and Arizona In: Riparian Ecosystems and their Management. Reconciling Conflicting Uses Proceedings of the first American Riparian Confrence, Tucson, Az.

Krebs, Charles J 1994 Ecology The Experimental Analysis of Distribution and Abundance. HarperCollins College Publishers, New York. 801P

Lanspa, K 1975 Soils Notes. USDA Six Rivers N F

Leiberg, J B 1899 Cascade Range and Ashland Forest Reserve and Adjacent Regions. Twety-first annual report, Part II, Washington, D.C . U.S. Department of the Interior, Geological Survey. 498 p

Leonard, W.P., H.A. Brown, L.L.C. Jones, K.R. McAllister, and R.M. Storm. 1993. Amphibians of Washington and Oregon. Seattle Audobon Society, Seattle Washington. 168 p.

Levin, Harold. 1988. The earth through time. Saunders College Publishing, New York, NY. 593 p.

Lowrance, R., R. Todd, J. Fail Jr., O. Hendrickson, Jr., R. Leonard and L. Asmussen. 1984. Riparian Forests as Nutrient Filters in Agricultural Watersheds. Bioscience V34(6) P. 374-77

Marcuson, P.E. 1970. Overgrazed Streambanks Depress Fishery Production in Rock Creek, Montana. Special Report, Mont. Dept. Fish & Game. P. 143-157

Meehan, W.R. Editor. 1991. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. Am. Fish. Soc. Special Pub. 19. P. 389-423.

Marlow, C.B., T.M. Pogacnik and S.P. Quinsey. 1987. Streambank Stability and Cattle Grazing in Southwestern Montana. J. Soil Water Conserv.; 42(4): 291-296.

McNabb, D.H., and F.J. Swanson. 1990. Effects of fire on soil erosion. In: Walstad,J.D. [and others], eds. Natural and prescribed fire in Pacific Northwest forests: 159-176. Oregon State University Press. Corvallis, Oregon.

Miller, Melanie, and Jean Findley. 1994.Plants. In: Fire Effects Guide. NWCG PMS 481. Edited by Melanie Miller.

Miller, Richard F. and Peter E. Wigand. 1994. Holocene changes in semiarid pinyon-juniper woodlands. BioScience 44(7):465-474.

Miller, Richard F., Tony J. Svejcar, and Neil E. West. 1994. Implications of livestock grazing in the intermountain sagebrush region:plant composition. In: Vavra, M., W.A. Laycock, and R.D. Pieper eds., Ecological implications of livestock herbivory in the west. Society for Range Management. Denver, CO. pp. 101-146.

Morrison, R.B. 1964. Lake Lahontan:Geology of Southern Carson Desert, Nevada. Geol. Surv. profess. Paper 401. U.S. Government Printing Office, Washington, D.C.

Morrow, R.J. 1985. Age structure and spatial pattern of old-growth ponderosa pine in Pringle Falls Experimental Forest, Central Oregon. M.S. thesis, Oregon State University, Corvallis, Oregon.

Munger, T.T. 1917. Western Yellow Pine in Oregon. USDA Bulletin No. 418. 48 P.

Neal, J L , E Wright, and W B Bollen 1965 Burning Douglas-fir slash physical, chemical, and microbial effects in the soil Oregon State University Forest Research Lab Research Paper 1 , Corvallis 32 p

Null, H H 1994 Klamath Forest Marsh NWR Personal Communication with J Frederick

Olmedo, E 1994 Winema National Forest Personal communication with J Frederick.

Olson, R And W A Hubert 1994 Beaver Water resources and riparian habitat manager. University of Wyoming press, Laramie, Wy 48 P

Oregon State Water Resources Board 1969 Oregon's Long-Range Requirements for Water Agricultural Experiment Station, Oregon State Univ. Corvallis, Or pp. 103.

Orr, E.L., W N. Orr, and E. M. Baldwin. 1992. Geology of Oregon, 4th edition. Kendall Hunt Publishing Company Dubuque, Iowa. pp. 79-101, 254 .

Parker, M., F J. Wood, B.H. Smith and R.G. Elder. 1985. Erosional Downcutting in Lower Order Riparian Ecosystems: Have Historical Changes Been Caused by Beaver? In: Riparian Ecosystems and their Management: Reconciling Conflicting Uses. Proceedings of the first American Riparian Confrence, Tucson, Az.

Patton, D.R. 1992. Wildlife Habitat Relationships in Forested Ecosystems. Timber Press, Inc. Portland, Oregon. 392 P. Specific reference, P. 31.

Pielou, E.C. 1991. After the ice age: the return of life to glaciated North America. University of Chicago Press. 350 p.

Platts, W S. 1990a. Fish, Wildlife and Livestock: Protection of Riparian Areas. West. Wildlands; 16(2): 16-19

____________1990b. Manageing Fisheries and Wildlife on Rangelands Grazed by Livestock: A Guidence and Reference Document for Biologists. Nevada Department of Wildlife publication. 615p.

____________1982. Livestock and Fishery Interactions: What are the Facts? Trans. N. Am. Wildl. Nat. Resour. Conf.;47:507-515

Platts, W.S. and R.L. Nelson. 1988. Stream Canopy Conditions and Trout Biomass Relationships on Grazed Streams in the Intermountain West. Proc. Annu. Conf. West. Assoc. Fish. Wildl. Agencies; 68:207-226

__________ 1985a. Stream Habitat and Fisheries Response to Livestock Grazing and Instream Improvement Structures, Big Creek, Utah. J. Soil Water Conserv.; 40(4) P. 374-379

__________ 1985b. Morphological Characteristics of Riparian Community Types with Respect to Livestock Grazing and Instream Structures on Big Creek, Utah. Published in the Montana Riparian Workshop, Missoula, Montana. Copy on file.

Platts, William S, Karl A. Gebhardt and William A. Jackson. 1985. The Effects of Large Storm Events on Basin-Range Riparian Stream Habitats. In: Riparian Ecosystems and their Management: Reconciling Conflicting Uses. Proceedings of the First American Riparian Confrence, Tucson, Az. 1985

Pritchett, William L. and Richard E. Fisher. 1987. Properties and Management of Forest Soils. John Wiley and Sons, New York. 494 P.

Rauzi, F. and C.L. Hanson. 1966. Water Intake and Runoff as Affected by Intensity of Grazing. J. Rnge. Mgt. 19. P. 351-56

Rinne, J.N. 1988 Grazing Effects on Stream Habitat and Fishes Research Design Considerations N Am J Fish Mgt 8 240-247

Rosgen, D L 1985 A Stream Classification System, in Riparian Ecosystems and their Management, Interagency North American Riparian Conference, Gen. Tech. Report ROM-120, pp 91-95, Rocky Mt For and Range Expt Sta , USDA Forest Service, Fort Collins, Colorado.

Salwasser, H 1976. Interstate Wildlife Study: Spring 1975 Preliminary Deer Diets Report. University of California unpublised report.

Salwasser, H. 1977 Man, Deer and Time on the Devil's Garden. University of California unpublished report. Manuscript submitted to the Interstate Deer Herd Committee.

Steinbrenner, E.C., and S.P. Gessel. 1955. Unpublished notes. Effects of tractor on soils and Regeneration in the douglas fir region of southwestern washington. Soil Sci., Soc. Amer. Proc. 4pp.

Stelczer, K. 1981. Bed Load Transport. Water Resources Publications, Littleton, Co. 215p.

Stoddart, L.A., A.D. Smith and T.W. Box. 1975. Range Management. McGraw-Hill Book Company, New York. 531 P.

Stuth, J.W. and A.H. Winward. 1977. Livestock-Deer Relations in the Lodgepole Pine-Pumice Region of Central Oregon. J. Rnge. Mgt. 30(2) 110-116 *

Thomas, J.W., Technical Editor. 1979. Wildlife Habitats in Managed Forests of the Blue Mountains of Oregon and Washington. USFS Agriculture Handbook #553. GPO, Washington, D.C.

Thomas, J.W., Maser, C. and J.E.Rodiek. 1978. Riparian Zones in Managed Rangelands-Their Importance to Wildlife. In: Proceedings of the forum: Grazing and Riparian\Stream Ecosystems. Denver, Colorado.

Vance, E.D., G.S. Henderson, and D.G. Blevins. Nonsymbiotic nitrogen fixation in an oak-hickory forest following long-term prescribed burning. Soil Science Society of America Journal 47:134-137.

Volland, Leonard A., 1978, Trends in Standing Crop and Species Composition of a Rested Kentucky Blue Grass Meadow over an 11-Year Period, Proceedings of the First International Rangeland Congress.

Wallmo, O.C.(ed). 1981. Mule and Black-Tailed Deer of North America. University of Nebraska Press, Lincoln, NE. 605 P.

Washington State University Coop Ext., 1981, Interior West Watershed Management

Wesche, T.A., C.M. Goertler and C.B. Frye. 1987. Contribution of Riparian Vegetation to Trout Cover in Small Streams. N. Am. J. Fish Mgt. 7:151-153

Wells, C. G., R.E.Campbell, L.F.DeBano, C.E.Lewis, R.L.Fredriksen, E.C.Franklin, R.C.Froehlich, and P.H.Dunn. 1979. Effects of Fire on Soil. USDA Forest Service GTR WO-7, Washington, D.C. 34 p.

White, C.S. 1985. Effects of prescribed fire on factors controlling nitrogen mineralization and nitrification in a ponderosa pine ecosystem. Ph. D. Dissertation. University of New Mexico, Albuquerque.

Wigand, P.E. 1987. Diamond Pond,Harney County, Oregon:vegetation history and water table in the eastern Oregon desert. Great Basin Naturalist 47:427-458.

Woodmansee, R G . and L S Wallach 1981 Effects of fire regimes on biogeochemical cycles, p 379-400 In Fire and Ecosystem Properties Conference Proceedings, USDA Forest Service, Washington, D C Gen Tech Rep WO-26 594 p

Youngberg, C T. & Dyrness, C T , 1959, The Influence of Soils and Topography on the Occurrence of Lodgepole Pine in Central Oregon, Northwest Science Vol 33, No 3

Youngblood, A P , Padgett, W G and A H. Winward 1985 Riparian Community Type Classification of Eastern Idaho-Western Wyoming USDA-FS R4-Ecol-85-01. 78 P

Historic Documents from the National Archives and Other Sources

1) Moore, A.W. 1943. Outline of a Wildlife Management plan For the Klamath Indian Reservation.

2) Pigg, J.F. 1962. From:.Allotment Management Plan for Jack Creek Sheep and Goat Allotment, Chemult, Oregon, 1971.

3) BIA Grazing Summaries, 1930-1947 for Klamath Indian Reservation.

Forest Records and Sources

O'Conner Meadow Condition and Trend Studies

Subregional Ecological Assessment Team Report; i.e., Williamson River and Sprague River Reports.

Chiloquin District Records

Wildlife Observation Files

Wildlife Surveys

Chiloquin Allotment Files for Skellock, Deep Creek, Yamsi, Sycan, No Name, East Chiloquin Ridge, Saddle Mountain, Switchback, Trout Creek Allotments

1990-1992 Range Analysis Information for Skellock, Deep Creek, Yamsi, and Sycan Allotments, 1963 & 1966 Range analysis information for No Name, East Chiloquin Ridge, Saddle Mountain, Switchback, and Trout Creek Allotments.

Winema National Forest, Chemult Ranger District. 1977. Chemult Planning Unit.

USDA-Forest Service-Pacific Northwest Region. pp. 235

Meadow Creek Condition and Trend Studies

Appendix B. Rosgen Stream Type (Rst)

(Management interpretations of various stream types)

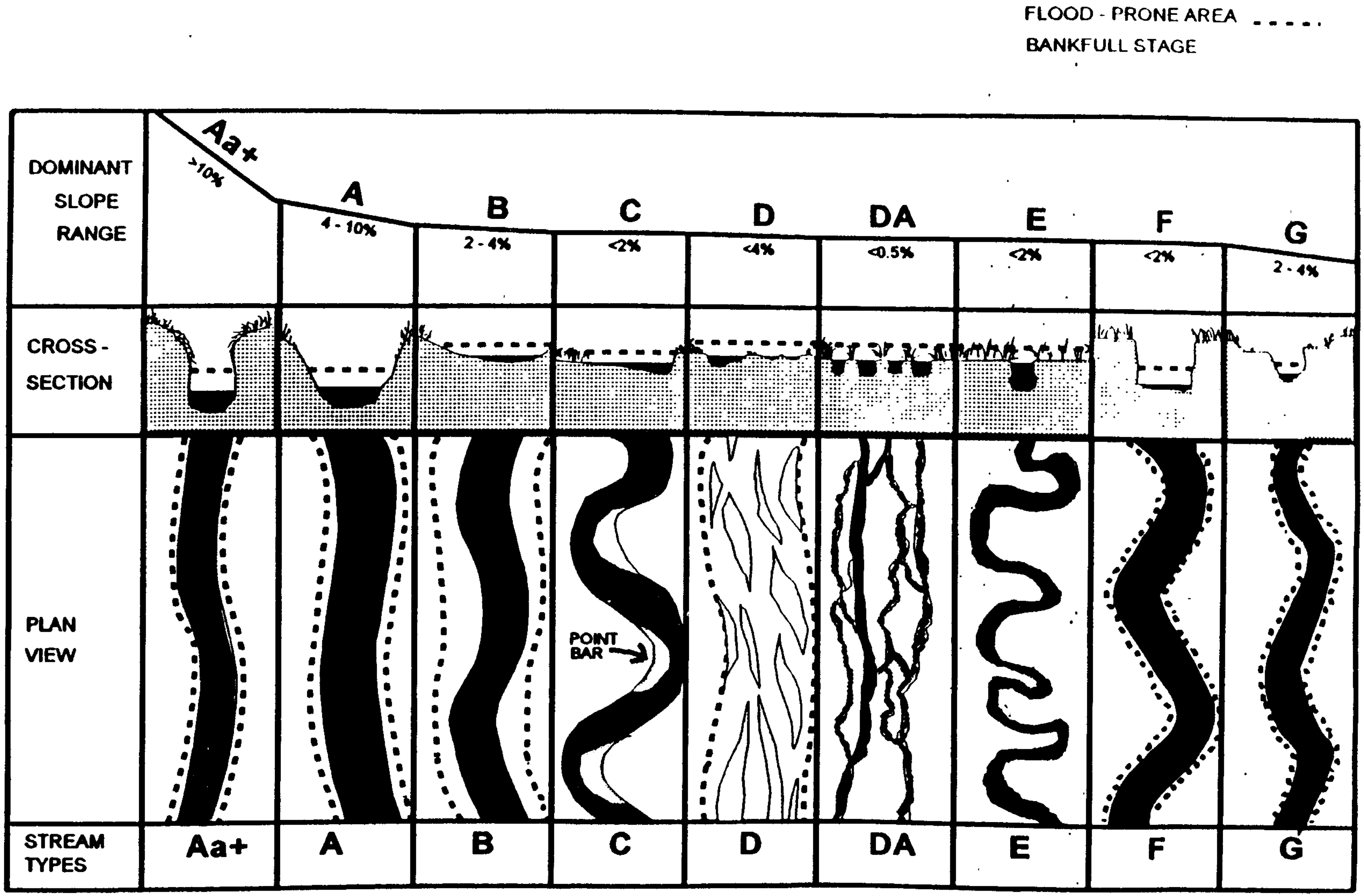
Stream Type	Sensitivity to Disturbance[1]	Recovery Potential[2]	Sediment Supply[3]	Streambank Erosion Potential	Vegetation Controlling Influence[4]
A1	Very Low	Excellent	Very Low	Very Low	Negligible
A2	Very Low	Excellent	Very Low	Very Low	Negligible
A3	Very High	Very Poor	Very High	High	Negligible
A4	Extreme	Very Poor	Very High	Very High	Negligible
A5	Extreme	Very Poor	Very High	Very High	Negligible
A6	High	Poor	High	High	Negligible
B1	Very Low	Excellent	Very Low	Very Low	Negligible
B2	Very Low	Excellent	Very Low	Very Low	Negligible
B3	Low	Excellent	Low	Low	Moderate
B4	Moderate	Excellent	Moderate	Low	Moderate
B5	Moderate	Excellent	Moderate	Moderate	Moderate
B6	Moderate	Excellent	Moderate	Low	Moderate
C1	Low	Very Good	Very Low	Low	Moderate
C2	Low	Very Good	Low	Low	Moderate
C3	Moderate	Good	Moderate	Moderate	Very High
C4	Very High	Good	High	Very High	Very High
C5	Very High	Fair	Very High	Very High	Very High
C6	Very High	Good	High	High	Very High
D3	Very High	Poor	Very High	Very High	Moderate
D4	Very High	Poor	Very High	Very High	Moderate
D5	Very High	Poor	Very High	Very High	Moderate
D6	High	Poor	High	High	Moderate
DA4	Moderate	Good	Very Low	Low	Very High
DA5	Moderate	Good	Low	Low	Very High
DA6	Moderate	Good	Very Low	Very Low	Very High
E3	High	Good	Low	Moderate	Very High
E4	Very High	Good	Moderate	High	Very High
E5	Very High	Good	Moderate	High	Very High
E6	Very High	Good	Low	Moderate	Very High
F1	Low	Fair	Low	Moderate	Low
F2	Low	Fair	Moderate	Moderate	Low
F3	Moderate	Poor	Very High	Very High	Moderate
F4	Extreme	Poor	Very High	Very High	Moderate
F5	Very High	Poor	Very High	Very High	Moderate
F6	Very High	Fair	High	Very High	Moderate
G1	Low	Good	Low	Low	Low
G2	Moderate	Fair	Moderate	Moderate	Low
G3	Very High	Poor	Very High	Very High	High
G4	Extreme	Very Poor	Very High	Very High	High
G5	Extreme	Very Poor	Very High	Very High	High
G6	Very High	Poor	High	High	High

[1] Includes increases in streamflow magnitude and timing, and/or sediment increases.

[2] Assumes naturalrecovery once cause of instability is corrected.

[3] Includes suspended and bedload from channel derived sources and/or from stream adjacent slopes

[4] Vegetation that influences width/depth ratio-stability.



Longitudinal, cross-sectional, and plan views of major stream types (after Rosgen 1994)

LEGAL	REACH	DEFINABLE CHANNEL	RIPARIAN COMMUNITY	PERIODICITY	CONDITION	RISKS
			EAST SIDE COPPERFIELD DRAW (cont.)			
T35SR08ES10	T11AR3DRI	Y	Y	I	FAR NA	A,E,G
T35SR08ES11	T11AR4DRE	Y	N	E	FAR NA	B
T35SR08ES14	T11BR1URI	N	Y	I	PFC	
T35SR08ES11	T11BR2DRI	Y	Y	I	FAR D	A,C,E,F,H
T35SR08ES11	T11BR3DNE	Y	N	E	FAR NA	A

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
- U - Upward Trend
- D - Downward Trend
- NA - Trend Not Apparent
- NF - Non-Functional

AT-RISK FACTORS COMMONLY ENCOUNTERED

- A Road activity contributing negatively
- B Presence of Active Headcuts
- C Side bank erosion
- D Side slope erosion
- E Presence of Increaser/Invader vegetative species
- F Loss of Riparian Zone/Floodplain
- G Past Logging Activity
- H Manmade Diversions/Channelization
- I Mixed effects from past Erosion Control Structures

CONCLUSION

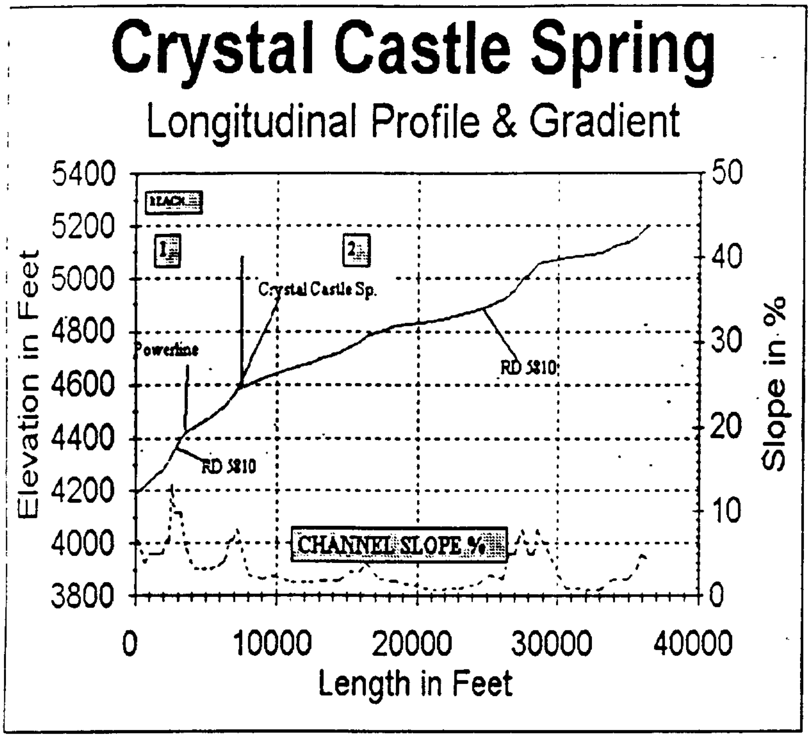
The overall functioning condition of riparian areas examined in the Copperfield Draw Subshed is on a downward trend. However, only a slightly lower percentage of the areas examined are on an upward trend. This determination is made by a tally of the reaches determined to be on an upward trend versus those on a downward trend. Proper functioning reaches and those where a trend was not apparent or stable were excluded from the tally.

Risk factors that influence the riparian areas examined were tallied and those occurring most frequently were identified. Of the risks most frequently identified were (1) Road effects, (2) Side Bank Erosion, (3) Presence of Increaser/Invader Plant Species, and (4) Presence of Active Headcuts.

Appendix C. Functional Condition of Streams Examined In Copperfield Subshed

LEGAL	REACH	DEFINABLE CHANNEL	RIPARIAN COMMUNITY	PERIODICITY	CONDITION	RISKS
			COPPERFIELD DRAW			
T35SR08ES15	T15BR1DRI	Y	Y	I	FAR D	B
T35SR08ES15	T15BR2DNE	Y	N	E	FAR D	G
T35SR08ES10	MR01DRI	Y	Y	I	FAR U	F
T35SR08ES15	MR02DRI	Y	Y	I	FAR U	E,F
T35SR08ES15	MR03DRI	Y	Y	I	NF	C,E,F
T35SR08ES15	MR04DRI	Y	Y	I	NF	A,B,E,F,I
T35SR08ES15	MR05DRI	Y	Y	I	FAR U	A,B,E,I
T35SR08ES15	MR06DRI	Y	Y	I	NF	C,E,F
T35SR08ES22	MR07DRI	Y	Y	I	FAR NA	A,E
			WRIGHTS MEADOW			
T35SR08ES22	MR08DRI	Y	Y	I	FAR U	A,B,C,E,I
T35SR08ES23	MR09URI	N	Y	I	FAR D	A,B,E,H,I
T35SR08ES27	MR10DRI	Y	Y	I	FAR U	A,C,E,I
T35SR08ES27	MR11DRI	Y	Y	I	FAR U	B,C,E,I
T35SR08ES27	MR12DRI	Y	Y	I	FAR U	B,C,E,H
T35SR08ES26	MR13DRI	Y	Y	I	FAR D	B,E,H
T35SR08ES35	MR14URI	N	Y	I	PFC	
T35SR08ES22	T22AR1DRI	Y	Y	I	PFC	
T35SR08ES27	T27AR1DNE	Y	N	E	FAR D	A
			SOUTH OF WRIGHTS MEADOW			
T35SR08ES35	MR15DNE	Y	N	E	FAR NA	A
T35SR08ES35	MR16DRI	Y	Y	I	FAR NA	B
T35SR08ES35	MR17UNE	N	N	E	PFC	
T36SR08ES02	MR18DNE	Y	N	E	FAR NA	A,G
T36SR08ES11	MR19UNE	N	N	E	N/A	
T36SR08ES13	MR20URI	N	Y	I	PFC	
T36SR08ES24	MR21URI	N	Y	I	PFC	
T36SR08ES24	MR22DRI	Y	Y	I	FAR U	G
T36SR08ES25	MR23DRI	Y	Y	I	FAR D	C,G,H
T36SR08ES25	MR24DRI	Y	Y	I	FAR NA	G
T36SR08ES31	MR25DRI	Y	Y	I	FAR NA	E,G
			WEST SIDE COPPERFIELD DRAW			
T35SR08ES09	T8AR1DRI	Y	Y	I	FAR NA	A,F
T35SR08ES09	T8AR2DRI	Y	Y	I	FAR D	D,G
T35SR08ES08	T8AR3DNP	Y	N	I	FAR NA	E
T35SR08ES16	T21AR1DNI	Y	N	I	FAR U	A,C,E,F
T35SR08ES16	T21AR2DRI	Y	Y	I	PFC	
T35SR08ES15	T15AR1DRI	Y	Y	I	FAR NA	A,H
T35SR08ES16	T16AR1DRI	Y	Y	I	PFC	
T35SR08ES16	T16AR2DNE	Y	N	E	PFC	
T35SR08ES16	T16BR1DNE	Y	N	E	PFC	
			EAST SIDE COPPERFIELD DRAW			
T35SR08ES03	T11AR1DNE	Y	N	E	FAR NA	
T35SR08ES03	T11AR2DRI	Y	Y	I	PFC	

represented by an A or B channel (RST), depending on field measurements of the sinuosity and bed material.



Reach 2: 30,000 feet in length, average valley slope is 3.1%. Much of this reach flows through two meadow areas connected by a short, steep canyon. The canyon area could be classified as A or B (RST). Evidence of sediment deposition exists, possibly due to roads and upland logging and thinning. A visit to both reaches on May 31, 1995 resulted in estimates of sinuosity at less than 1.2, and a low width/depth ratio of less than 12. The stream seemed functionally intact, with good age and type of riparian vegetation diversity, and fairly stable streambanks - except for an occasional short length of streambank erosion. An instream erosion control project may be appropriate to stop any further streambank erosion.

Substation Subwatershed - 2,447 acres

No flow information is available on this subwatershed. The WIN Inventory does not include any sites in this area. There are no recorded Water Rights with the OWRD.

91% of the area is in the Winema National Forest. 45 acres are classified as riparian areas. The area has a West/northerly aspect, with 85% being below 5,000 feet. There are 15 miles of road (3.9 miles/square mile).

Corbell Subwatershed - 3,439 acres

No flow information is available on this subwatershed. The WIN Inventory does not include any sites in this area. There are no recorded Water Rights with the OWRD.

92% of the area is in the Winema National Forest. The subwatershed contains 4.3 stream miles (.81 miles/square mile). 137 acres (4%) of the area are classified as riparian areas. 96% is below 5,000 feet, with a North and West aspect. There are 24 road miles and 2.4 railroad miles (4.4 miles/square mile). Two road miles are coincident with old railroad grades. 37% of the stream length falls within 210 feet of a road, and the mainstem is crossed at least three times.

Copperfield Draw Subwatershed - 21,512 acres

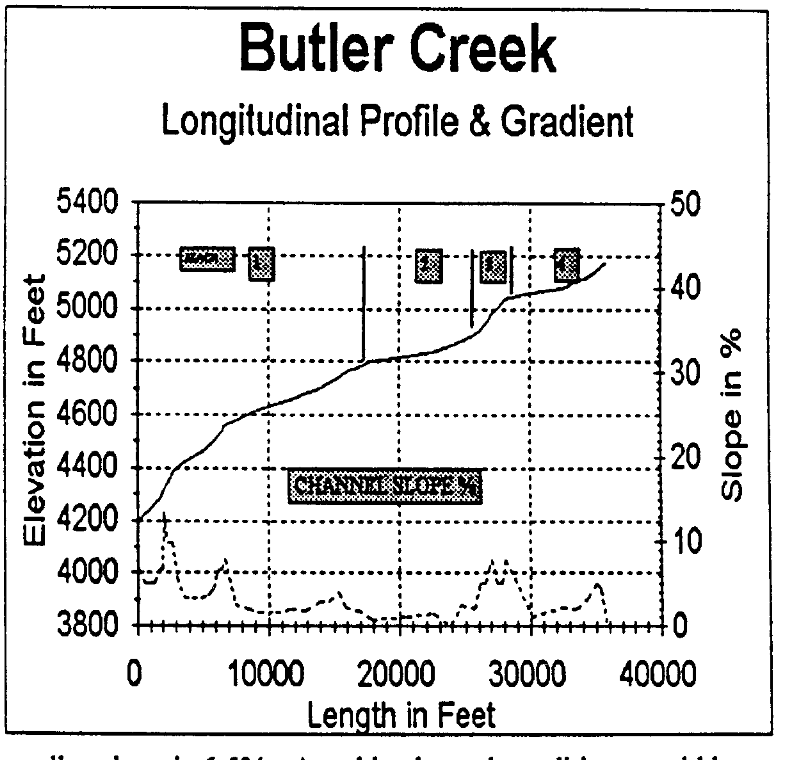
92% of the subwatershed is in the Winema National Forest. There are 35 stream miles (1mile/square mile). 1712 acres (8%) within the area are classified as riparian. There are 135 miles of road and 14.5 railroad miles (4 miles/square mile). 20% of the stream length falls within 210 feet of a road, and the mainstem is crossed at least six times.

Appendix D. Subwatersheds

Crystal Subwatershed - 9,945 acres

The timing of this assessment has not allowed for a site-specific survey of this system. No flow information is available. The Water Improvement Needs (WIN) Inventory does not include any sites in this area. There are no water rights recorded with the Oregon Water Resources Department (OWRD).

There are two primary channels, Butler Creek and Crystal Castle Spring. 97% of the subwatershed is within the Winema National Forest. From the GIS database it was determined 336 acres (3% of the area) are classified as riparian. This is an intermittent system, with 17.75 stream miles (1.15 miles/square mile). Elevation ranges between 5,000 and 6,000 feet, with a west aspect. 30% of the subwatershed has slopes less than ten percent. There are 66 road, and 49 railroad miles (4.3 miles/square mile). 29 road miles are coincident with old railroad grades. 31% of the stream length falls within 210 feet of a road, and the mainstem channels are crossed at least six times. The GIS database used to plot road locations uses pixels which are 210 feet wide, therefore that is the shortest distance from streams that we could determine roads to be.



Butler Creek: Beginning at the juncture with the Sprague River (at rivermile 3.5), the creek is broken into four reaches going upstream.

Reach 1: 17,500 feet in length, average valley slope is 6.5%. A stable channel condition would be represented by a Rosgen Stream Type (RST) A or B channel, depending on field measurements of the sinuosity and bed material.

Reach 2: 8,000 feet in length, average valley slope is 2.0%. Under these valley slope conditions, a stable channel condition would be represented by channel types C or E (RST).

Reach 3: 3,000 feet in length, average valley slope is 6.5%. A stable channel condition would be represented by type A or B (RST).

Reach 4: 8,000 feet in length, average valley slope is 4.0%, and may be classified as a B stream (RST). A field visit is necessary to verify the classification.

Crystal Castle Spring: Beginning at the confluence with the Sprague River (rivermile 8.3), the creek is broken into two reaches going upstream.

Reach 1: 7,200 feet in length, average valley slope is 6.4%. A stable channel condition would be

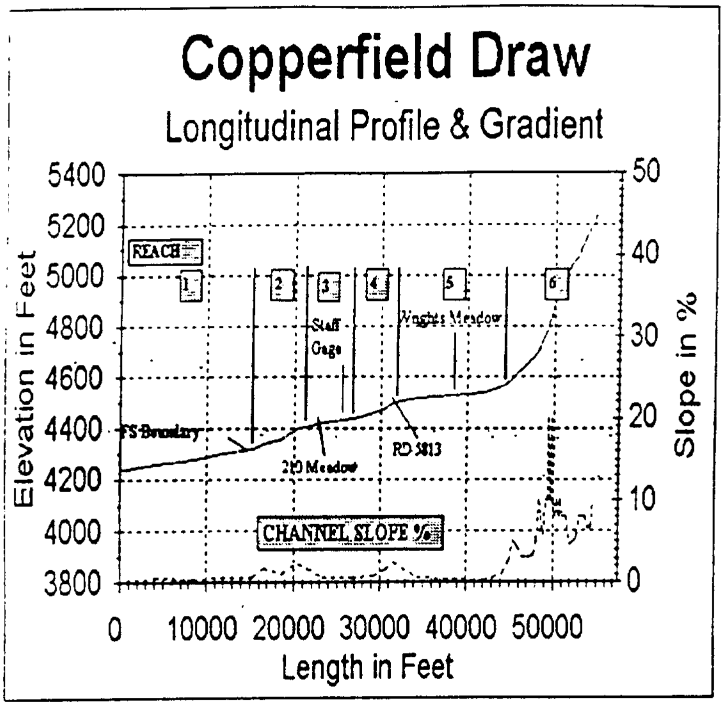
The subwatershed has two current water rights: Road water (1.0 cfs), and livestock (0.31 af), both held by the Winema National Forest.

The WIN Inventory identifies several areas needing erosion control work. The locations and remarks are listed below. Most indicate problems with historic roads draining water, or inadequate culvert structures. Cited are livestock trampling, need for improvement of overflow channels, fence failures around springs, and downcutting of channel banks.

T.	R.	S.	Subdiv.	Date	Comments
35	8	15	NW	8/93	Track has started moderate erosion.
35	8	15	NW	8/93	Stream pirated by road.
35	8	15	NW	8/93	Old road has become stream bed.
35	8	11,14,15		8/93	Water in old road templates producing erosion.
35	8	15	NESE	8/93	Log culvert caused erosion downstream.
35	8	22	NWNE	8/93	No culvert on road 266 causing moderate erosion.
35	8	23	NWSW	8/93	Road fill/culvert causing erosion.
35	8	26	NWNW	8/93	18" waterfall from culvert causing erosion.
34	8	33	NE	8/93	Erosion in road, absence of adequate ditches.
34	8	33	SWSE	8/93	Road drainage inadequate.
35	8	4	SWNE	8/93	Culvert inadequate to handle flow, downcut below.
35	8	9	N1/2	8/93	Old skid road has become channel.
35	8	16		8/93	Old roads pirated Grouse Spring drainage.
35	8	4,5		9/93	Old road template pirated annual flow.
35	8	4,5		9/93	Old road causing erosion and downcutting.
35	8	5,17		9/93	Road traps runoff, causing downcut.
35	8	17	NENE	9/93	Water table near surface, tire tracks collect water.
35	8	27	SWSW	9/93	Downcut from culvert.
35	8	27	SWSW	9/93	Reservoir overflow pirated by logging template.
35	8	16	NWNW	8/93	Reservoir could be deepened and sloped gradually.
35	8	5	NWSW	9/93	Severe trampling around water bowls.
35	8	16	SESW	8/93	Fence around Grouse Spring needs repair.
35	8	14,15		8/93	Severe headcutting.
35	8	9	NWSW	8/93	Rocky Hole Reservoir overflow has downcut.

Reach 1 (private property): 15,000 feet in length, average valley slope is 0.5%. Copperfield Draw enters the Sprague River at rivermile 14.5 on private property. A stable channel condition would be classified as E5 or 6 (RST). It appears that the current channel has downcut and straightened.

Reach 2: 5,000 feet in length, average valley slope is 1.3%. The 210 meadow enters Copperfield Draw in this reach. Currently, though altered, the channel is an F (RST). A stable condition of the reach could possibly be classified as a C or E (RST) type channel. 1995 observations indicate that downcutting, raw banks, and streambank erosion are occurring. Past efforts at erosion control have been to install rock and wire check dam structures. Some are functioning adequately, but most are not. Plans for restoration of this reach are being studied.



Reach 3: 6,000 feet in length, average valley slope is 0.7%. According to soil survey notes, this broad meadow flooded across the valley floor historically, but surface water presently flows in an entrenched channel. Access to the floodplain has diminished as the channel has degraded. A normal channel would beclassified as C4 (RST). The effects of sedimentation and high velocity run-off are apparent (downcut streambanks and straightened channels). A cross-section and staff gage have been installed near the top of this reach. Nine flows were measured in 1995 ranging from 0.9 cfs to 14.4 cfs.

Remnants of an old rock dam or road structure exist just above the cross-section area. Perhaps when the structure blew out (1965 or 1971), the resulting surge carved the straighter, entrenched channel. Restoration efforts on this reach are being considered and are recommended to decrease streambank erosion, sedimentation, and the velocity of water flowing through this reach. These include increasing meandering and placement of structures in conjunction with riparian planting.

Reaches 2 and 3 could presently be classified as G4 (RST). They are working themselves back toward F and natural C channels by increasing their overall width, developing point bars, and increasing sinuosity.

Reach 4: 5,500 feet in length, average valley slope is 1.9%. This portion of the stream channel runs through a canyon. This is a stable, functioning reach with a B3 (RST) channel.

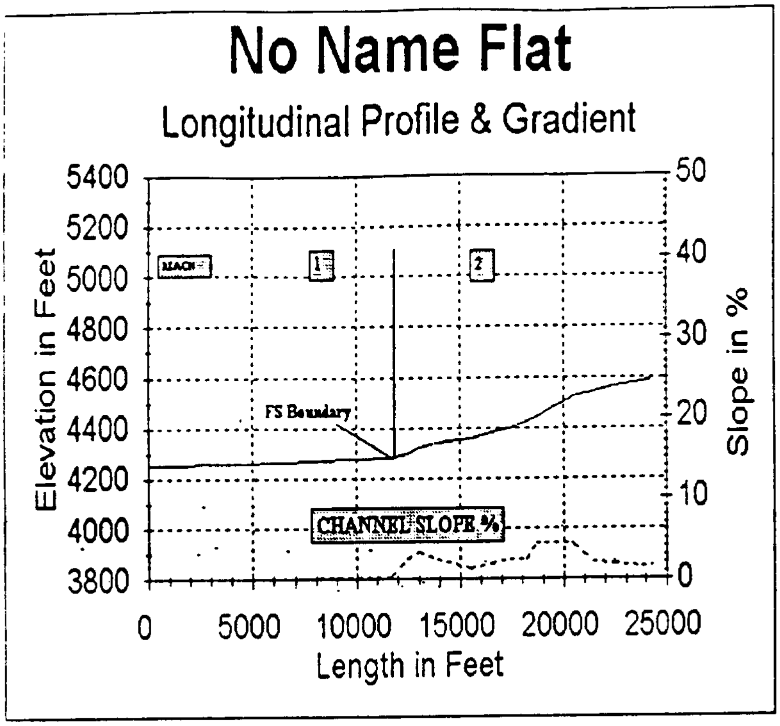
Reach 5: Wrights Meadow, average valley slope is 0.64%. It may not have had a defined channel and simply flooded a marsh area. If a channel had been in place, it would have been classed as E5 (RST). Recent check dams are in place, but scouring occurs around the structures. Improvement suggestions are to install structures to increase sinuosity, and plant riparian vegetation to reduce streambank erosion.

Reach 6: Currently an ephemeral system due to roads, average valley slope is 8.0%.

No Name Flat Subwatershed - 7,934 acres

There is no flow information available on this subwatershed. The WIN Inventory does not include any sites in this area. No water rights are recorded from information with the OWRD.

34% of the subwatershed is in the Winema National Forest. There are 27 stream miles, with a stream density of 2.2 miles/square mile. Riparian areas consist of 263 acres (3% of the drainage). 80% of the area is comprised of slopes less than 10%, and the entire area is below 5,000 feet. There are 36.5 road miles in the drainage (6.8 miles/square mile). 16% of the stream length falls within 210 feet of a road, and the mainstem is crossed at least twice. The channel enters the Sprague River at rivermile 25.8.



Reach 1: Private property, average valley slope is less than 1%. A stable channel condition would be classified as an E5 or 6 (RST). It appears that the channel is downcut and straightened.

Reach 2: Average valley slope is 2.7%. Appears to be in broad canyons, however there have been no site inspections in this area. A field visit is required to determine the type and condition of the channel. Historic photographs indicate there may be some problems with the area including the presence of F type channels.

Dockney Flat Subwatershed - 8,874 acres

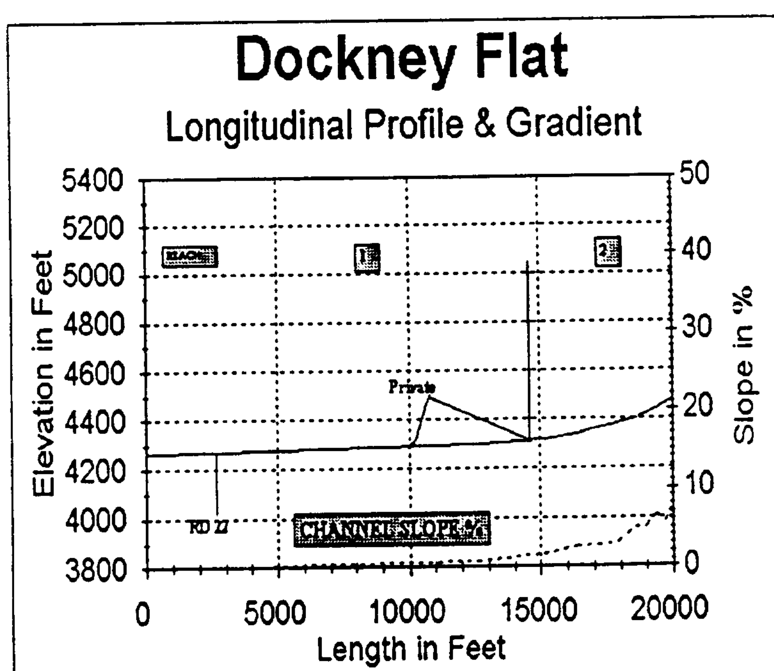
There is no flow information available on this subwatershed. The WIN Inventory does not include any sites in this area. There are no water rights recorded with the OWRD.

87% of the subwatershed is in the Winema National Forest. The area contains 19.2 stream miles (1.4 miles/square mile). 258 acres (3%) within the drainage are classified as riparian. 39% of the area has less than 10% slopes, with a Northwest aspect. 42.5 road miles and 0.9 railroad miles exist within the area (3.1 miles/square mile). 32% of the stream miles fall within 210 feet of a road, and the mainstem is crossed at least three times.

Reach 1: Average valley slope is less than 1%. A portion of this reach is in private ownership. Though a defined channel may not exist, it appears the drainage enters the Sprague River at rivermile 30. A stable channel condition would be classified as an E5 or 6 (RST) channel.

Reach 2: Average valley slope is over 10%. Springs are present along the Ya Whee Plateau.

A visit to this area is necessary to describe the channel condition.



Skeen Subwatershed - 4,607 acres

There is no flow information available on this subwatershed. The WIN Inventory does not include any sites in this area. There are no water rights recorded with the OWRD.

Cedar Spring lies between Saddle Mountain and Ya Whee Plateau, and the drainage enters the Sprague River at rivermile 30.5 near the end of S'Ocholis Canyon.

82% of the area is in the Winema National Forest. 235 acres (5% of the drainage) are classified as riparian. There are 8. stream miles (1.1 miles/square mile) within the area. 41% of the subwatershed has slopes less than 10%, and 84% of the area is below 5000 feet. There are 25 road miles in the drainage (3.5 miles/square mile). 24% of the stream length is within 210 feet of a road, and the mainstem is crossed at least four times.

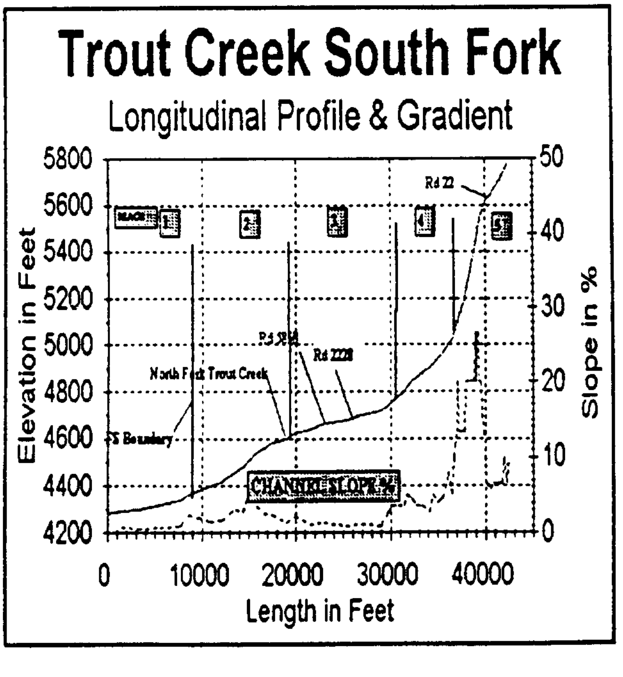
A field inspection is needed to determine the condition and channel type of this subwatershed.

Trout Creek Subwatershed - 17,244 acres

OWRD records show two current water rights for Trout Creek, both private: Irrigation (.49 cfs), and domestic use (.10 cfs). Previous water rights for the Trout Creek Ranch, acquired by the Winema National Forest, are no longer used.

This is a perennial system comprised of three forks: South Fork, Middle Fork and North Fork. 97% of the subwatershed is in the Winema National Forest. 606 acres (4%) are classified as riparian. 50% of the area has slopes less than 10%, and 35% lies below 5000 feet. The aspect is East. The drainage contains 34.5 stream miles (1.3 miles/square mile). There are 94 road miles and 29.4 railroad miles (3.5 miles/square mile). 22 road miles coincide with railroad grades. 13% of the stream miles fall within 210 feet of a road, and the mainstem is crossed at least six times.

24 discharge measurements have been taken in the past five years near the downstream Forest Service boundary. The flows range from 0.5 cfs to 25 cfs.



South fork (Mainstem)

Reach 1: Private property, average valley slope is 1.2%. Trout Creek enters the Sprague River at rivermile 38.2. A stable channel condition would be classified as E5 or 6 (RST) channel.

Reach 2: 10,000 feet in length, average valley slope is 2.7%.

Reach 3: 10,000 feet in length, average valley slope is 1.4%. A stable channel condition would be classified as E or C (RST) channel.

Reach 4: Average valley slope is 4.5%.

Final reaches: Average valley slope is 15%. Possibly an A or B (RST) channel.

South Subwatershed - 33,533 acres

There is no flow information available on this subwatershed. The WIN Inventory does not include any sites in this area. There are no water rights recorded with the OWRD.

73% of the subwatershed is in the Winema National Forest. The area contains 3 miles of stream channels (0.06 miles/square mile). 20 acres (1% of the area) are classified as riparian. Slopes less than 10% occupy 88% of the subwatershed, with no slopes greater than 40%. The entire area lies below 5,000 feet. There are 17.4 road miles and 4 railroad miles (.4 miles/square mile), with 3.3 miles being coincident with railroad grades. Roads cross the mainstem at least five times, and 7% of the stream length falls within 210 feet of a road.

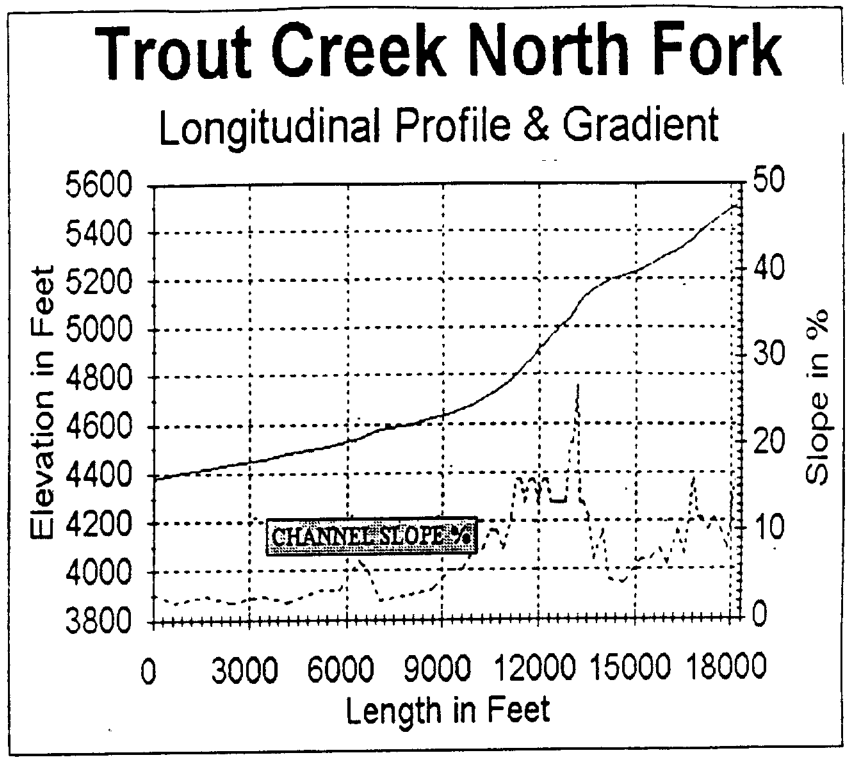
Rock Creek Subwatershed - 11,210 acres

There is no flow information available on this subwatershed. Water rights are held privately for livestock (0.19 af), and irrigation (3.62 cfs).

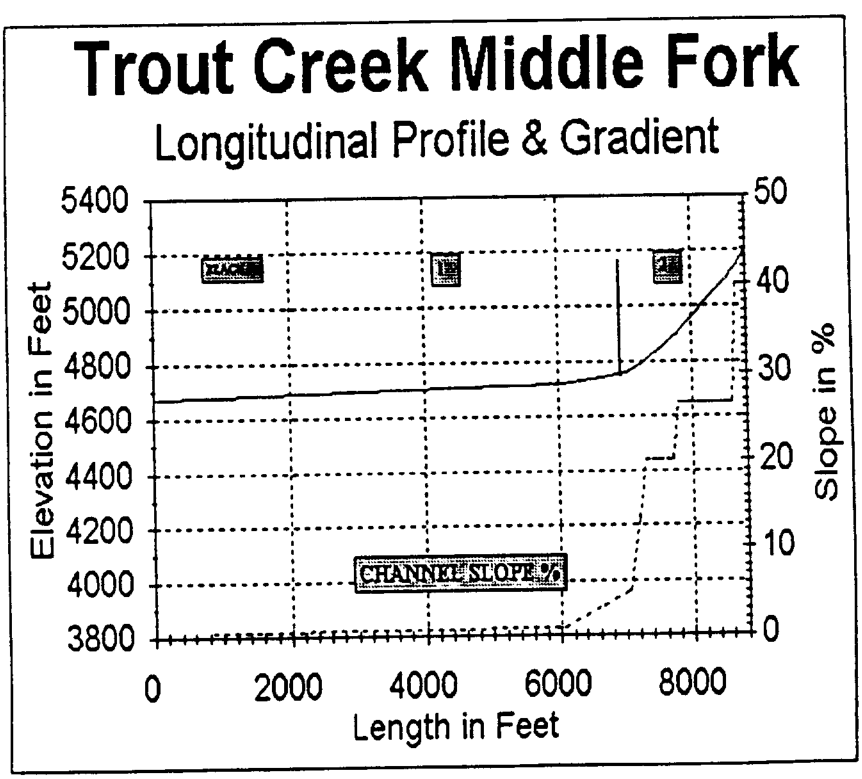
The WIN Inventory contains the following entries from the 1993 survey of Rock Creek. Streambank erosion and headcutting (effects from roads and cattle) are the primary concerns.

T.	R.	S.	Subdiv.	Date	Comments
36	11	31	NW	8/93	Channel is cutting down an average of 4'. Cattle.
36	11	19	SE	8/93	Downcutting 2-3'. Livestock eroded streambanks.
37	11 1/2	1	NESE	8/93	Downcutting 2-3'. Road pirating flow.
37	11	6	E1/2	8/93	Downcutting up to 5'. Old railroad grade present.
37	11 1/2	1		8/93	Downcuttting average of 2-3'.
37	11	6	E 1/2	8/93	Dams Meadow (private) downcutting.
37	11	6		8/93	Headcutting of channel.
36	11	31	SE	8/93	Severe downcutting.
36	10	36	NESE	8/93	Five foot downcut streambanks.
36	11	31	W	8/93	Severe downcutting as much as 10', railroad grade.
36	11	31	NW	8/93	Runoff has cut into wheel tracks up to one foot.
36	11	31	SW	8/93	Runoff down road #226.
37	11	8	NWSW	8/93	Downcut streambanks and cattle.

Rock Creek is a perennial system which enters the Sprague River at rivermile 58.5, and consists of 30 stream miles (1.7 miles/square mile). 62% of the area is in the Winema National Forest. 4% of the area is classified as riparian. There are 41 road miles and 17.6 railroad miles (2.35 miles/square mile) in the drainage. 3.4 road miles are coincident with railroad grades. 14% of the stream length falls within 210 feet of a road, and the mainstem is crossed at least eight times.



North Fork
Average valley slope is 9.5%.



Middle Fork
Reach 1: Average valley slope is 1.4%.

Reach 2: Average valley slope is 26%.

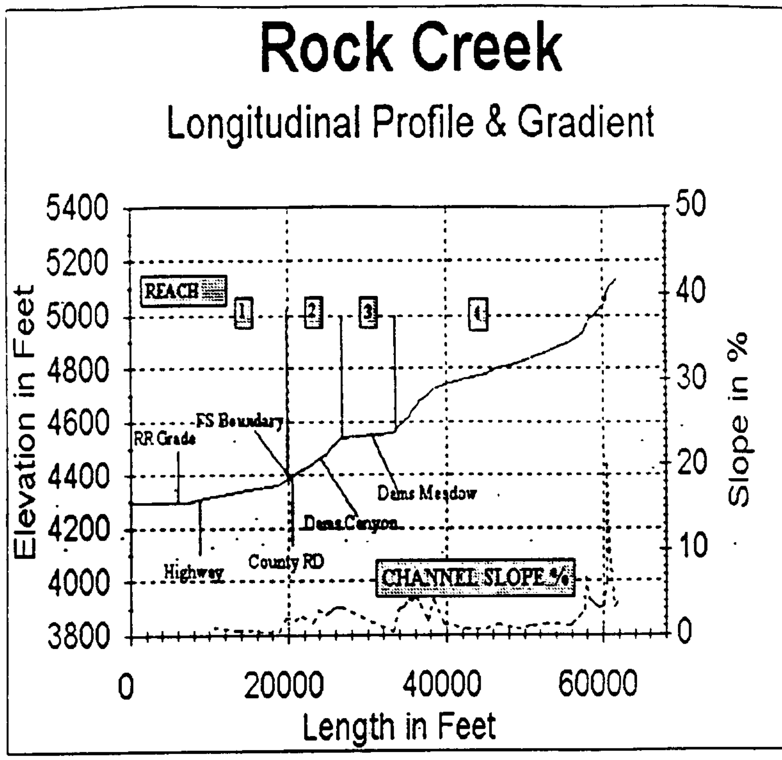
Many springs on Saddle Mountain lay in the headwaters of Trout Creek.

Reach 1 (private property): Diverted through ditches, average valley slope is 1%. A stable channel condition would be an E5 or 6 (RST) channel.

Reach 2: Dams Canyon, average valley slope is 2.5%. The natural function is intact.

Reach 3: Dams Meadow, average valley slope is 1.5%. This reach has extensive areas of downcutting and streambank erosion.

Reach 4: Headwaters of Rock Creek average valley slope is 9% (varying from 1% to 20%).



280Z Subwatershed (orphan) - 2,009 acres

There is no flow information available on this subwatershed. The WIN Inventory does not include any sites in this area. There are no water rights recorded with the OWRD.

This subwatershed is entirely within the Winema National Forest, and contains 2.6 stream miles (0.82 miles/square mile). 381 acres (19% of the area) are classified as riparian. 56% of the area has slopes less than 10 per cent. The aspect is East. There are 7 road miles and 3.7 railroad miles (2.2 miles/square mile) within the drainage (2.4 miles are coincident). Roads are within 210 feet of channels along 9% of the stream length.

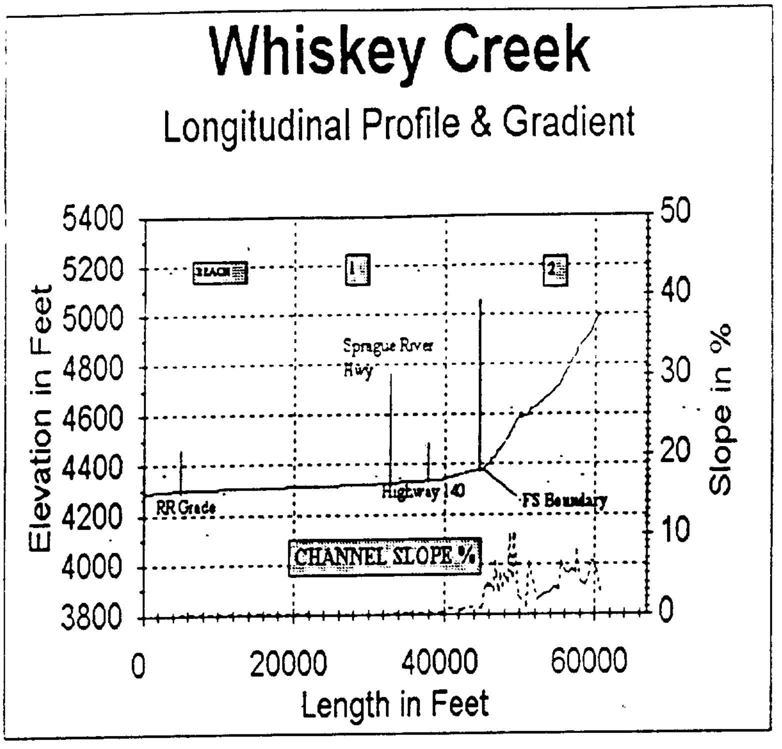
Cliney Subwatershed - 1,635 acres

There is no flow or WIN information available on this subwatershed.

83% of the area lies within the Winema National Forest. There are 2.5 stream miles; stream density is 0.95 miles/square mile. 446 acres (27% of the area) are classified as riparian. 65% of the area has slopes less than 10%. The majority of the area lies between 5000 and 6000 feet, and the aspect is East. The subwatershed has 7.7 road miles and 1.9 railroad miles (3.0 miles/square mile), with 0.96 road miles being coincident. 27% of the stream length is within 210 feet of a road, and the mainstem is crossed at least three times.

Whiskey Creek Subwatershed - 27,864 acres

The Water Improvement Needs (WIN) Inventory does not include any sites in this area. Water rights are recorded with OWRD for seven privately held permits, totaling 28.92 cfs for irrigation and irrigation/stock uses.



Only the headwaters lie in the Winema National Forest - 8% of the entire watershed. There are 60 stream miles (1.37 miles/square mile). 1106 acres (4% the area) are classified as riparian. There are 138 road miles and 11 railroad miles (3.2 miles/square mile) in the drainage. Of these, 4.7 miles are coincident. 14% of the stream length falls within 210 feet of a road, and the mainstem is crossed at least seven times.

The downstream portions of this watershed are on non-forest land or on the Fremont National Forest. Hydrologists and Fisheries Biologists on the Fremont N. F. were unable to provide information on this watershed. Whiskey Creek converges with the Sprague River at rivermile 62.

Historic flow information is available on this subwatershed from OWRD. A Miscellaneous Flows request resulted in 29 measured discharges dating back to 1915. Whiskey Creek was measured at various locations near Beatty. Flows ranged from 1.17 cfs in September, 1981 to 19.2 cfs in May, 1925. Due to the various locations and the limited number of flows measured (along with extensive diversion of water in the area), analysis of trends is not possible with this data.

ODDZ Subwatershed - 21,292 acres

There is no flow information available on this subwatershed. The WIN Inventory does not include any sites in this area There are several private water rights recorded with the OWRD for ground water and surface water from the Sprague River.

This area is a compilation of three orphan subdivisions along the Sprague River containing 75 stream miles (2.26 miles/square mile). Less than 1% lies within the Winema National Forest, and only 2 acres are classified as riparian. 92% of the area has a slope of less than 10%. There are 71 road miles and 4 railroad miles (2.1 miles/square mile), with 1.2 miles being coincident with railroad grade. 10% of the stream length falls within 210 feet of a road.

Appendix E. Notes from Leiberg

P 229
The volcanic character of the ridges which intersect the Klamath drainage basin is this region has already been alluded to. Some of these ridges have been built up around volcanic vents, others are irregular masses whose origin perhaps is to be sought in earth fissures. The entire basin seems originally to have been a plateau area. The lava outflows inclosed many flats, which in time became lakes. Most of these lakes have been drained by their waters cutting channels through the lava dams. Others are in various stages from marches to shallow lakes.

P 230
The plain or depression which stretches along the base of the Cascades in this region is comparatively narrow, varying from 10 to 15 miles in width. It consists of two distinct terraces, a northern and a southern, the former elevated about 400 feet above the latter. The terraces connect through the valleys of Williamson and Sprague rivers with the terrace or plain which borders the central areas of the Sprague River. ....

The upper terrace is separated from the lower by a broad, thick lava flow, which stretches from northwest to southeast, and possibly may have come from Mount Scott or adjacent craters. The lava flow created a large lake, of which all that remains is Klamath Marsh, most of its area having been drained by the Williamson River cutting a canyon through the lava flow at a point 8 miles east of Fort Klamath. The upper terrace stretches northward to the Klamath-Deschutes divide. Eastward it extends to the foot of the Yamsay Range, which it follows southward along the western base to the head of Williamson River.

The pumice covering both on the upper and on the lower of these terraces was deposited when they were deeply covered with water. The present smoothness of their surface, only roughened by ancient beach lines along high levels and by the courses of modern streams, proves (sic) this. Some of the pumice appears to have been thrown out as fine particles. Much of it came as large, coarse fragments or bowlders (sic) a foot or more in diameter.

The Sycan terrace is situated east of the Yamsay Range and has an elevation of 5,000 feet. It likewise was a lake in past geologic times. It was formed by a lava flow which came from a crater, now extinct. Situated in the Fuego Range, Sycan River has cut through the obstruction, the lake has been drained, and a swampy tract known as Sycan Marsh now remains.

P.231
The higher points in the region show marks of light glaciation, but the terraces and flats show no clear evidences of the scoring or wearing effects of ice. Here, as in the Cascades, the smoothness of the pumice deposits proves either that glaciation preceded their deposition or that the region has not at any time been subject to the action of ice.

P.234
... With the exception of the tracts.... none of the areas at the immediate base of the Cascade can now be considered as truly semiarid, But the region comprised within the limits of the Klamath Marsh terrace shows decided tendencies in that direction. The leaning toward semiarid conditions is there shown by deficient reforestation of burned tracts in the lodgepole pine stands, and the evident tendency of such places to become covered with a growth of desert shrubs or grasses in place of the former forest.

P. 238
It will be noticed that the yellow pine easily ranks above all of the other species either singly or combined. The reason for this lies chiefly in the smaller annual precipitation on the subhumid areas of

the western slope The large proportion of lodgepole pine is chiefly due to forest fires At least 90 per cent of the species owes its growth to this cause The remainder occurs as the first forest covering on areas gradually being laid bare along margins of marshes and lakes by the lowering of their waters

P 246
Yellow Pine Type
east of the range it sometimes runs pure to the extent of 99 per cent. Generally it is more or less mixed with varying percentages of white and red fir, incense cedar and sugar and lodgepole pine. When the forest contains yellow pine to the extent of 50 per cent, it is here considered as belonging to the yellow-pine type. The largest admixture of other species in the examples quoted above consists of lodgepole pine This growth here represents thin stands around marshy places or fringes along creeks and seepy spots where the soil humidity is too high for a yellow-pine growth.

P 248
The aspect of the type is that of an open forest with a minimum of undergrowth and seedling or sapling growth. The forest on the eastern side of the Cascades is more conspicuous in this respect than the forest on the western, owing to less variety in the frutescent flora of the former and, in general, to a smaller precipitation. But the open character of the yellow-pine type of forest anywhere in the region examined is due to frequently repeated forest fires more than to any other cause.

P.249
The forest floor in the type is covered with a thin layer of humus, consisting entirely of decaying pine needles, or it is entirely bare. The latter condition is very prevalent east of the Cascades, where large areas are annually overrun by fire. But even on the western side the range, where the humus covering is most conspicuous, it is never more than a fraction of an inch in thickness, just enough to supply the requisite material for the spread of forest fires.

Freedom from fires insures a good and abundant reproduction the forest type, whether east or west of the range. East of the Cascades, its area is steadily increasing at the expense of tracts covered by the lodgepole pine. The process is slow, owing to fires. Were they kept down most of the lodgepole-pine area on high ground would give way to pure or nearly pure growths of yellow pine.

Yellow-pine subtypes
The subtype referred to formed by pure or nearly pure growths of lodgepole pine. It might well be named the lodgepole-pine subtype. It occurs under two aspects, First in the contorta form of the species; secondly, in the murryana form. The aspect of the contorta form is that a dense masses of small, scraggy, limby trees forming a thick fringe along edges of marshes, creeks, or springy localities, or covering low, level areas, occurring in every case where the ratio of soil (p.250) humidity is too high to permit the growth of any other coniferous species indigenous to the region. The aspect of the murrayana form in its ultimate development, is that of close or moderately open stands of tall, straight, slender trees covering well-drained uplands. This form of the subtype is in every case a reforestation after fires, in this region after stands of yellow pine. Between the two forms there are many gradations.

The characteristic feature of the subtype is its habit of forming pure growths. In this respect it stands preeminent among the coniferous species which make up the sylva west of the.. The most conspicuous examples occur in Ts. 30 and 31 S., Rs 7 and 8 E., where lodgepole-pine stands cover 40,000 acres out of a total of 48,000 forested, with a growth that averages 99 per cent pure.

P.274
The age of the timber utilized in sawmill consumption varies from 100 to 350 years. Most of the yellow pine falls below 175 years; the higher limit is reached chiefly in the sugar pine.

P 278
The largest burns directly chargeable to the Indian occupancy are in Ts 30 and 31S . Rs 8 and 9 E In addition to being the largest they are likewise the most ancient. The burns cover upward to 60,000 acres, all but 1,000 or 1,100 acres being in a solid block. This tract appears to have been systematically burned by the Indians during the past three centuries. Remains of three forests are distinctly traceable in the charred fragments of timber which here and there little the ground. Two of these were composed of lodgepole pine, The most ancient one appears to have consisted of yellow pine, which would be the ultimate forest growth on this area following a long period of freedom from fire

P 288
A noticeable feature in connection with the after-effects of forest fires in the yellow-pine type of forest is the suppression of undergrowth and of seedling trees. The yellow pine is by all odds the best fire-resisting tree in the sylva of the North Pacific slope. Repeated conflagrations may run through stands of the yellow-pine type with-out serious damage to the older trees of this species, provided that litter and humus be not to great. But the fires; even should they be of no great force or intensity, work irreparable injury to the seedling trees. On the eastern side of the Cascades, especially, fires have run through the yellow-pine timber many times. The absence or relative scarcity of young growth and underbrush is here very noticeable and striking. Much of the region examined east of the Cascades is included within the boundaries of the Klamath Indian Reservation, and the red man has therefore been under no particular restraint in the matter of burning his timber. In late years it seems to have dawned on his intelligence that good yellow pine may have some value after all, and in consequence fires are set much less frequently than formerly, with the result that where the forest has enjoyed freedom from fire for a number of years seedling and sapling trees of the yellow pine are springing up in the greatest abundance.

P.290
Humus, as applied to a layer of decaying vegetable debris on the forest floor, is not, as a rule, of any great depth in the forests of these regions. In stands of the yellow-pine type it is a mere thin sprinkling of pine needles. ... To the light humus layer and the small quantity of litter, more than to any other cause, is due the preservation of the forest from total destruct on those areas.... It is not due to lack of fires that any timber remains. ..the yellow pine, both as an individual and as a species stands at the head of the list.. A fire in stands of this species runs rapidly, burns low, and with not great intensity owing to the extremely light humus cover. So long as the thick bark, which is a characteristic feature of the species, remains intact, the tree is tolerably safe, but sooner or later, either through the effects of repeated fires or through some accidental injury opening the bark and cursing an exudation of resin, fire finds its way into the trunk and produces a fire sear or scar. Each subsequent fire enlarges the burned spot until the tree finally succumbs. ...The custom of the Indians of peeling the yellow pine at certain seasons of the year to obtain the cambium layer which they use for food, is in some localities a fruitful contributory cause toward destruction of the yellow pine by fire. They do not carry the peeling process far enough to girdle the tree, but they remove a large enough piece of bark to make a gaping would which never heals over and which furnished an excellent entrance for fire. Throughout the forest on the Klamath Reservation trees barked in this manner are very common. Along the eastern margin of Klamath Marsh they are found by the thousands

(The report then describes surveyed areas by townships. Townships 29-9 and 10 - Mosquito area were not surveyed. Due to the general similarity of the areas, excepts from surrounding townships thought to be applicable to Mosquito are included here.)

P.321
30-9
This township is situated west of the Cascades and consists chiefly of tule and sedge-covered areas

belonging to Klamath Marsh The extreme eastern areas are formed by a projecting spur of lava and bear the forest Soil is uniformly a pumice deposit

All of the timber in the township is fire marked. Result of fires is the suppression of young growth, fire scarring of the older, with twisting and bending of the smaller trunck. There is little brush growth throughout. There is not humus, the foerst floor being bare, sharp, pumice sand.
Mill timber is easy of access, but poor in quality, and mostly of small dimensions.

P 322
30-10
This township is situated east of the Cascades. Its northern portion consists of grassy, non-forested bottom lands bordering the Williamson River, while the southern areas are formed of low lava hills, as a rule, deeply covered by a fine pumice deposit.

The forest in the township is fire marked throughout. In late years there has been fewer fires than formerly and the young growth, formerly mostly suppressed, is asserting itself everywhere. The young growth is yellow pine with a few scattered individuals of white fir. The lodgepole pine is found along the swales of the Williamson River bottoms.

Mill timber is very good in quality, being largely composed of standards and veterans with fair, clear trunks. It is easy of access from the Williamson River bottoms and forms, as a whole, a valuable stand of timber.

Appendix F. Excerpts From Munger

The following excerpts are from "*Western Yellow Pine in Oregon*", Thornton T. Munger, USDA Bulletin No. 418, February 6, 1917

p 17
In most of the pure yellow-pine forests of the State the trees are spaced rather widely, the ground fairly free from underbrush and debris And travel through them on foot or horseback is interrupted only by occasional patches of saplings and fallen trees. The forests are usually not solid and continuous for great distances, except along the eastern base of the Cascades, but are broken by treeless "scab-rock ridges", or natural meadows.

P.18
Yellow-pine grows commonly in many-aged stands, i.e., trees of all ages from seedlings to 500-year-old-veterans, with every age gradation between, are found in intimate mixture. In some stands there is a preponderance of very old trees; in fact, in many of the virgin stands of central and eastern Oregon there are more of the very old trees and less of the younger than the ideal forest should contain. Usually two or three or more trees of a certain age are found in a
p19
small group by themselves, the reason being that a group of many young trees usually starts in the gap which a large one makes when it dies. In the virgin stands throughout the State there seems to be a very large proportion of trees whose age is about 225 or 275 years, suggesting that after this age their mortality is greater.

P20
In pure, fully stocked stands in the Blue Mountains region there are commonly from 20 to 30 yellow pines per acre over 12 inches in diameter, of which but few are over 30 inches. Over large areas the average number per acre is ordinarily less than 20.

P21.
Yellow-pine forests are so irregular in density that figures for the average stand per acre or per quarter section are apt to be misleading.

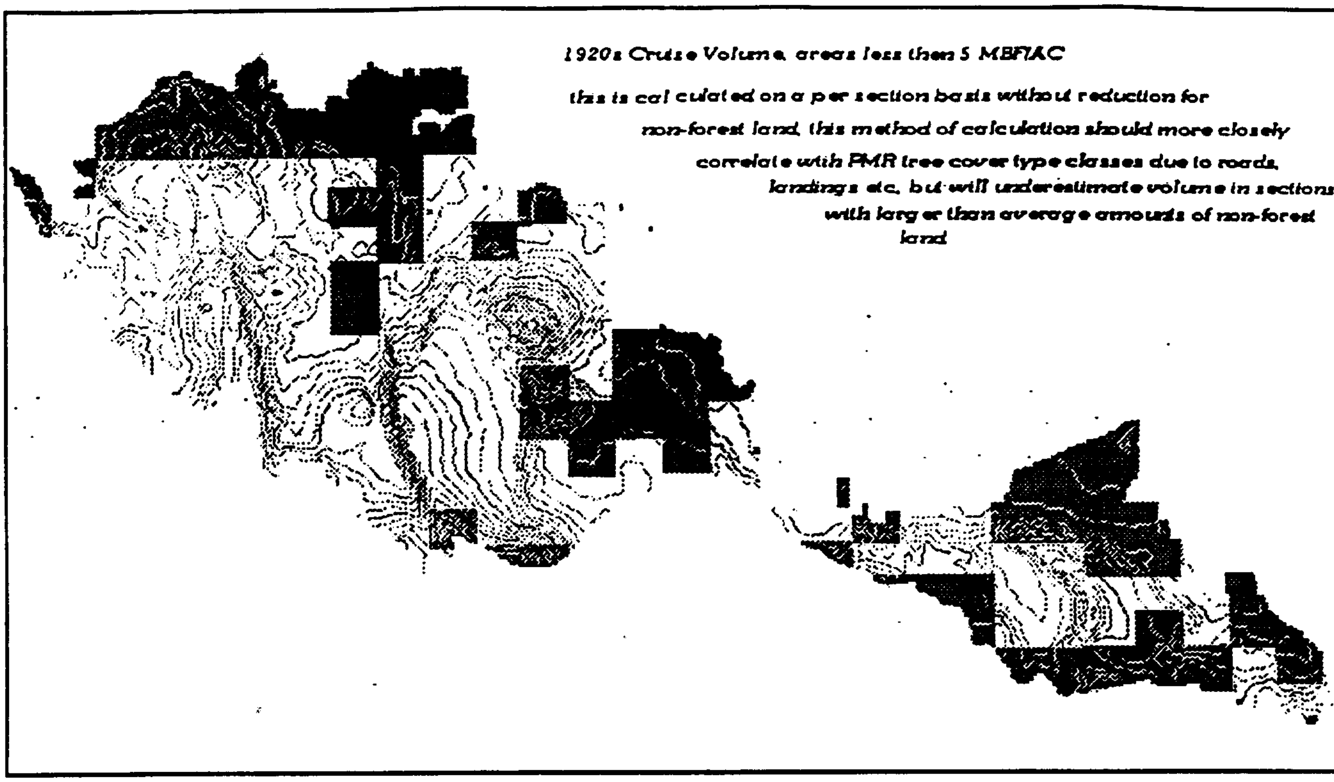
P.23
Because of the wide range of conditions under which it grows the rate of growth of yellow pine is exceedingly variable, perhaps rather more so than that of most species....
Broadly speaking, during its first 10 or 15 years yellow pine grows very slowly; then follows a period of 75 or 100 years in which both diameter and height growth are rapid, exceptionally thrifty trees making an increase of one-half inch in diameter and 2 feet in height in one year. By its one hundred and fiftieth year the height increment has fallen off very much, the trees has nearly reached its mature height, and thereafter grows but a foot or two each decade. Diameter growth also decreases after the first century of life, the rings become narrower and narrower with age, and on very old trees, or those that have been suppressed, they are so fine as to be hardly distinguishable except with a magnifying glass. It is usual, therefore, for the annual rings to be broad and well defined in young trees
p24
and at the center of old ones, but narrow in the exterior rims of old trees, sometimes 90 to an inch of radius.
Yellow pine is a long-lived tree. The oldest encountered in the analysis of 4,997 stumps in eastern and central Oregon was in its six hundred and eight-seventh year when cut for lumber.

P31.
In the yellow-pine forests of Oregon (except those on both slopes of the Cascades south of Crater Lake and those on the Siskiyou Mountains in southern Oregon and on some of the pumice-stone land towards

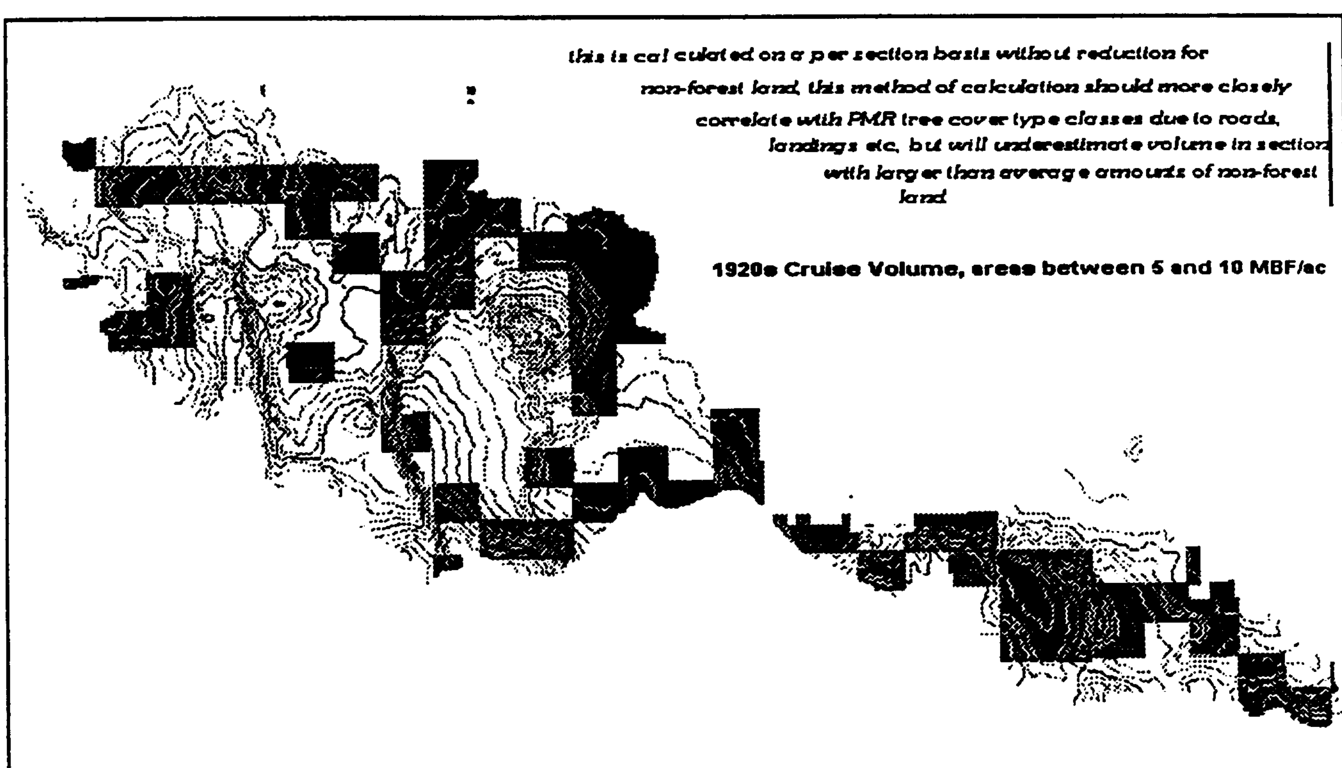
the head of the Deschutes River) the trees are so open-grown and the woods are so free of underbrush that a good herbaceous vegetation suitable for forage springs up each year. The character of the vegetation depends upon the region, but it usually consists in part of a variety of grasses and in part of "weeds" (annual flowering plants).

Appendix G. 1920 Cruise Volume Distribution Maps

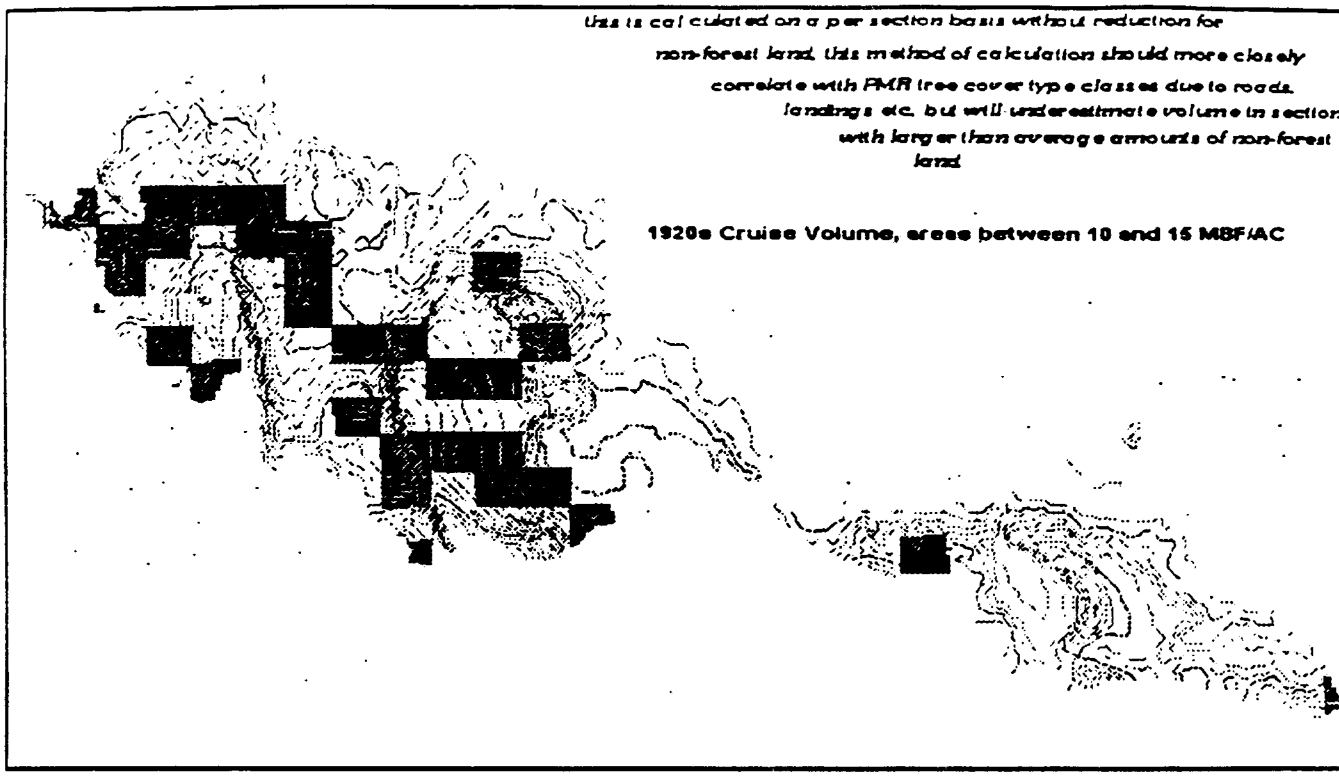
1920 - Less than 5MBF



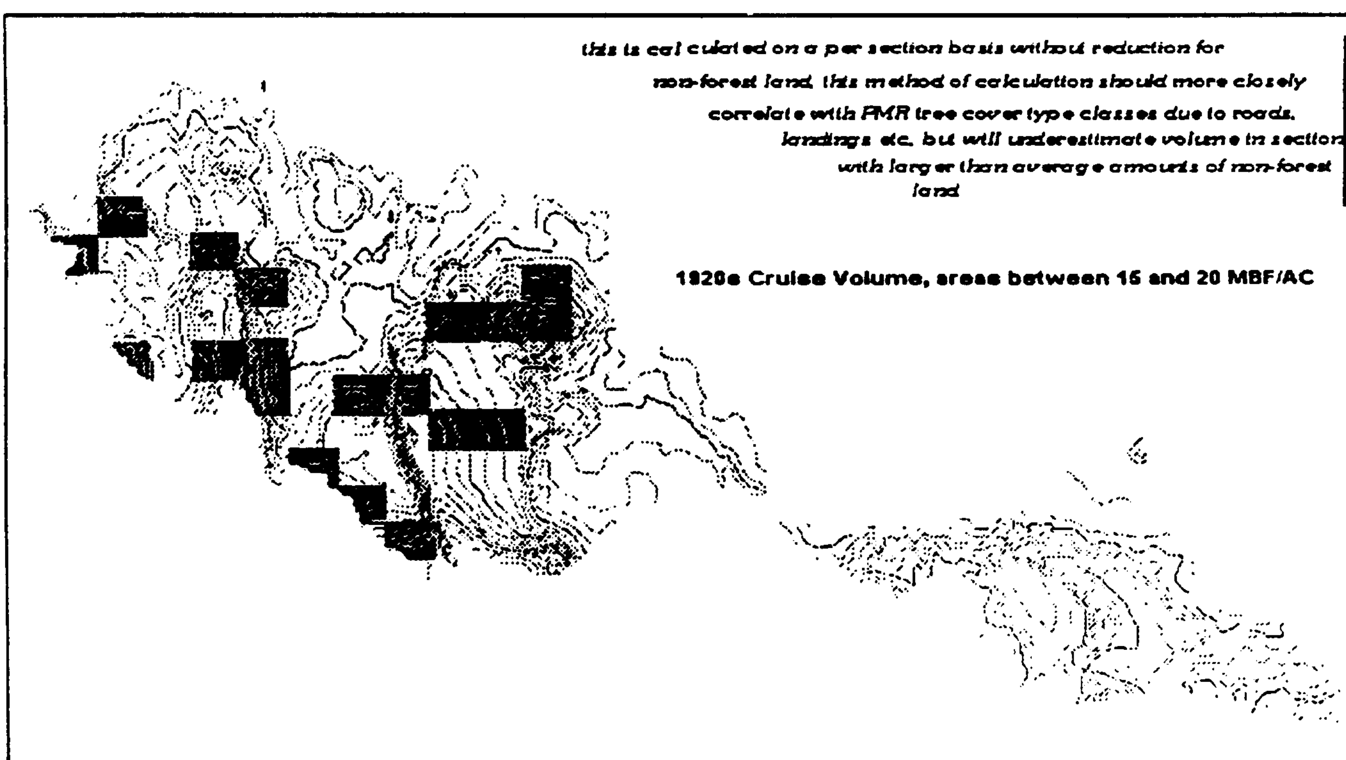
5-10MBF



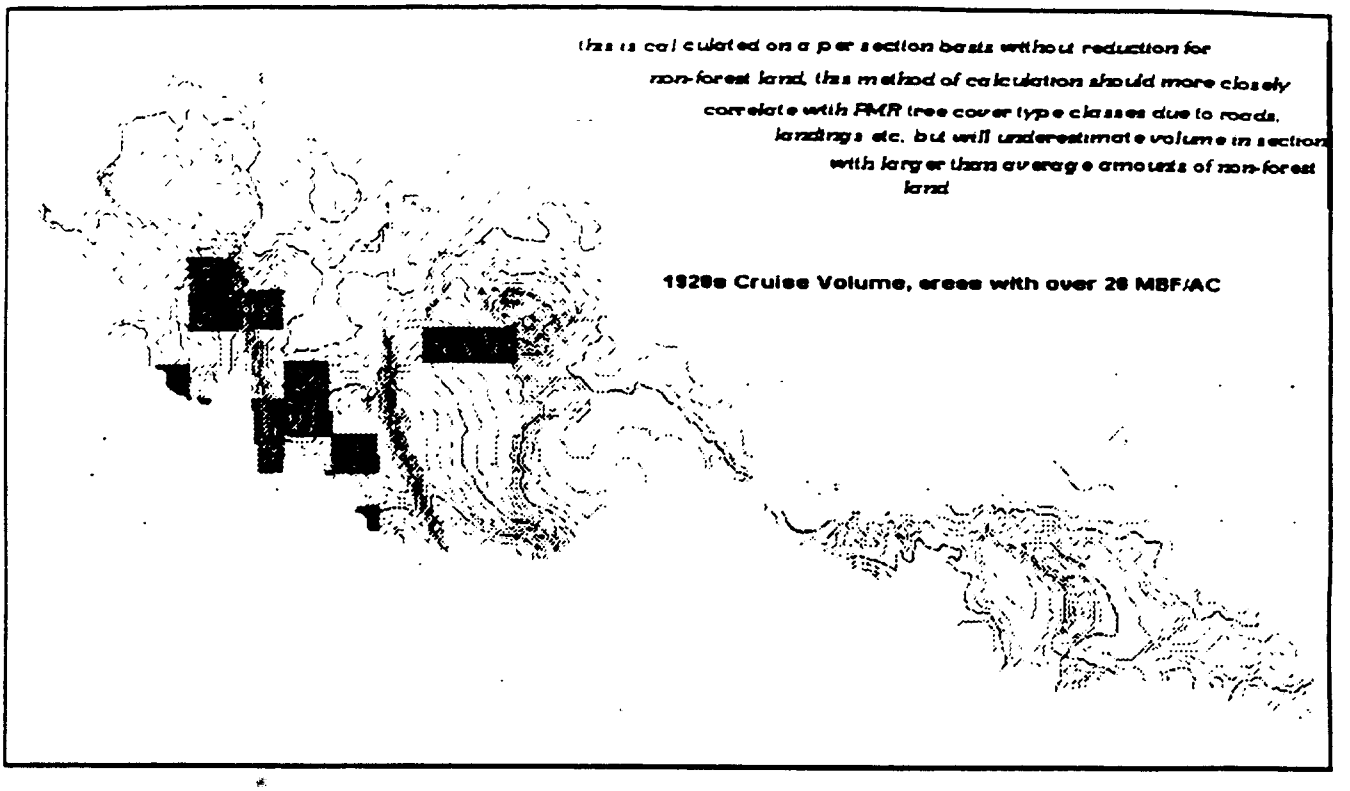
10-15MBF



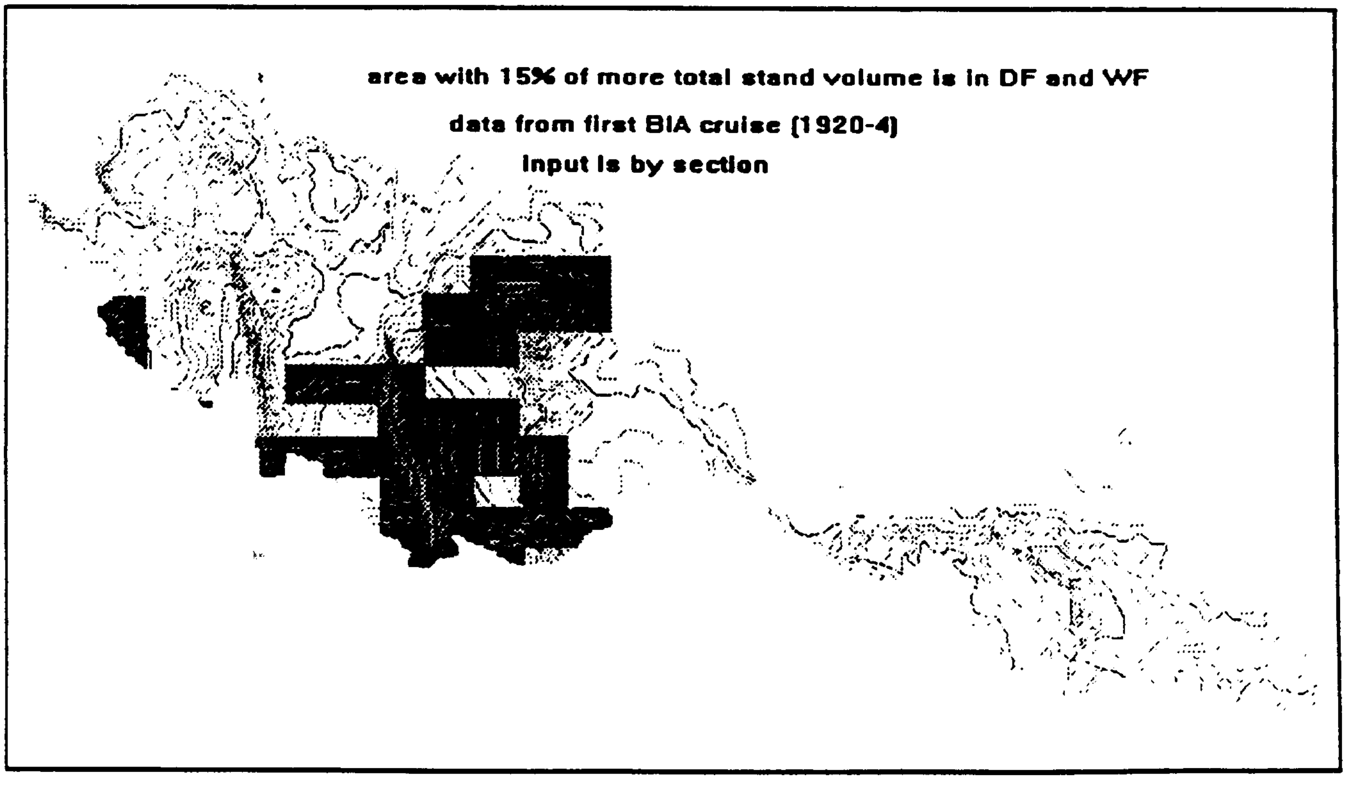
15-20MBF



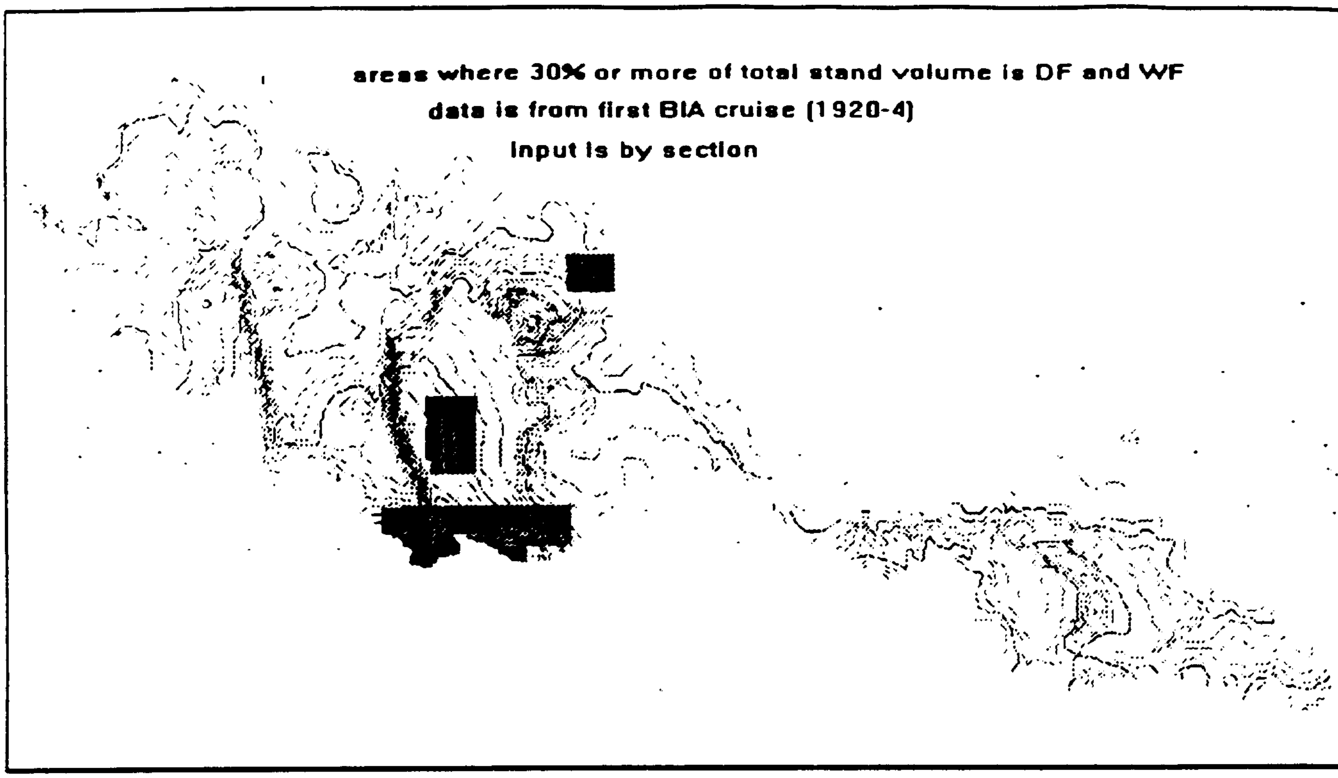
20+MBF



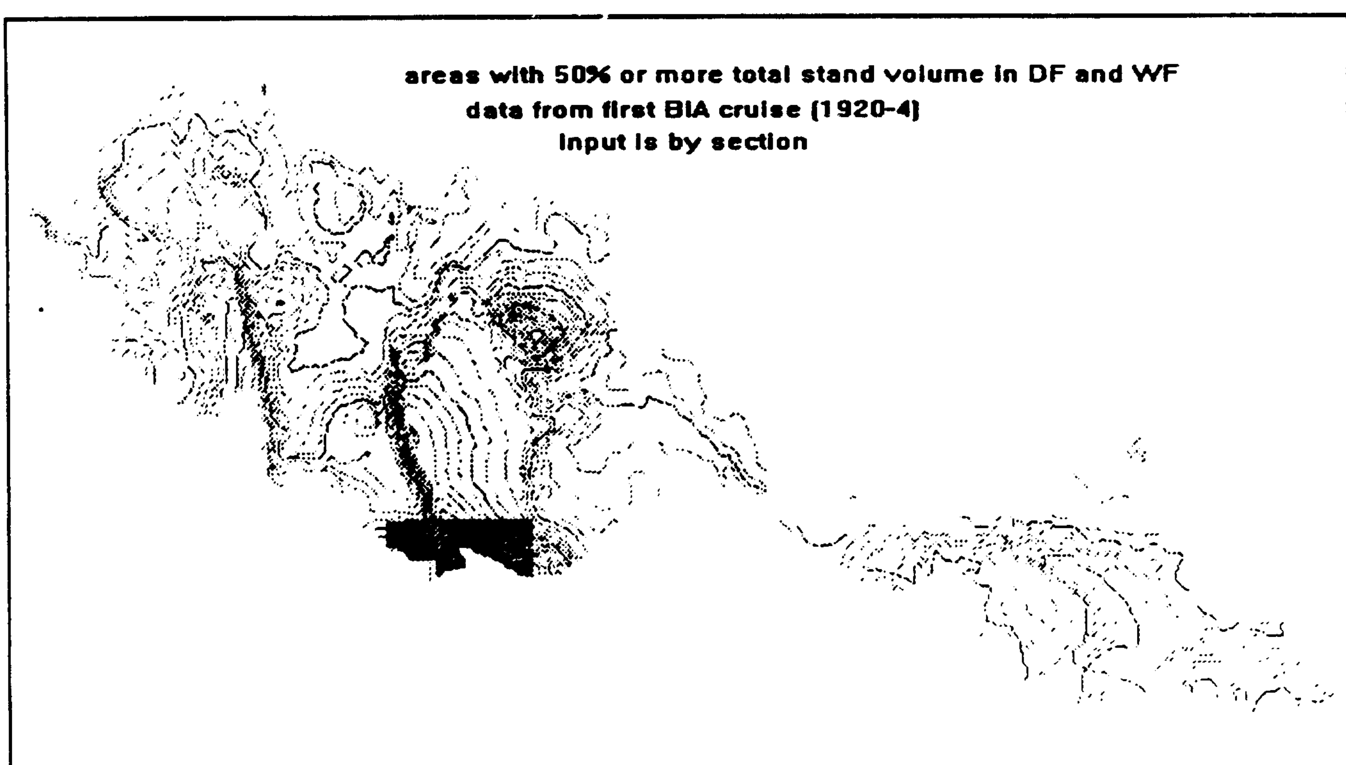
15%+ DF/WF



30%+ DF/WF



50%+DF/WF



APPENDIX H. SUBWATERSHED CURRENT CONDITIONS

SUBWATERSHED 208E

To understand the "current" condition of an area, it is important to understand how changes have occurred since the reference period.

- The current condition is in a less stable condition than the reference condition. The structure and species mix of the reference condition for much of the watershed was quite stable within a range of stocking levels.
- There is little stability in the current condition. Even if data was available to give a precise "current" condition description, this could easily be invalid in a very short time.

The "reference" condition specific to this watershed can be characterized by a summary of the 1920s cruise data for the area:

1920 Cruise Data

ACRES	PP VOL	SP VOL	DF VOL	WF VOL	IC VOL	VOL/AC	% OF AREA
4875	16198	18	334	1339	120	0 - 5	28
4688	23353	623	2046	8064	126	5-10	27
5014	48768	1030	8776		151	10-15	29
1713	23656	24	1019	6352	0	15-20	10
957	16500		1432	3852		20+	6
total	128475	1695	13607	19607	397		
% by species	78%	1%	8%	12%	0		

The above data does not describe structure. Refer to the reference condition description for structure descriptions. The watershed was 78% ponderosa pine by volume; 55% of the area had 10 MBF per acre or less. The cruise data is also suspected to show reference stocking level conditions at the high end of the range. This observation is supported by the high incidence of bark beetle mortality starting in this time period.

Several data sources will be used to describe the current condition of the watershed and how it has evolved over the past 50 years. This watershed is a large, long watershed covering several vegetative and moisture regimes and a high degree of variety. The watershed covers 17248 acres, including 332 acres of non-FS lands.

The watershed is 67% a white fir/snowberry/strawberry type. This type is highly productive for the area, timber productivity is rated at 60-70 cubic feet per acre per year. The type rapidly converts to a white fir stand in absence of fire. Conifer species are white fir, Douglas-fir and ponderosa pine. Heavy brush cover, snowberry, chinquapin and snowbrush, is characteristic. Also Prince's pine, Ross' and long stolen sedge are abundant with any stand opening. Most of the remainder of the watershed is in climax pine types as shown at left. Productive for the area, timber productivity is rated at 60-70 cubic feet per acre per year. The type rapidly converts to a white fir stand in absence of fire. Conifer species are white fir, Douglas-fir and ponderosa pine. Heavy brush cover, snowberry, chinquapin and snowbrush, is characteristic. Also Prince's pine, Ross' and long stolen sedge are abundant with any stand opening. Most of the remainder of the watershed is in climax pine types as shown in the following table.

Ecoclass

ECOCLASS	CP-F1-11	CP-S1-11	CP-S2-11	CW-S3-12	MW	NR	SD	SM
ACRES	230	1521	2388	11625	152	600	26	6

BIA Harvest

YEAR	1928	1929	1930	1931	1934	1935	1936	1937	1938	1939	1940	1941	1942
ACRES	338	1209	3066	1629	641	128	58	1835	777	961	1015	1577	779
YEAR	1943	Exempt		FP	Non Merge		Open	Swan Lake Fire					
ACRES	4	873		568	923		164	278					

Land Type From PMR Data

TYPE	Bitterbrush			Forest/						
	Sage	Bbrush	Manz	Bbr	Bbr-man	Gr-frb	Man-cea	Oth	O Shr	Sage
ACRES	26	336	4	1075	2788	663	6045	1075	2788	663
TYPE	D Mdw	M Mdw	W Mdw	O Shr	Spar Veg	Rk/Snw	Wet Shr/Shr [illegible]		Jun/Mt Mah	Man/Cea
ACRES	821	88	52	264	679	941	16		6045	88

In 1945 an inventory was done which included Klamath County, below is a summary of that data for the watershed. This gives a snapshot in time of the conditions of the watershed at the time the initial logging was complete, and 25 years after the first cruise, and after almost 40 years of fire suppression.

1945 type map classification, "20-" = type number .

"Y_2"= 20% Pine "DF_1" = 10% Douglas Fir, "WF_7"= 70% white fir . This refers to the species % of the **understory/regeneration**. CUT shows that type had been harvested.

1945 KLAMATH COUNTY INVENTORY	TOT ACRES	% of TYPE
CUT 20-Ponderosa pine 22"+, poor stocking, Y_2DF_1WF_7	736	4%
CUT 20-Ponderosa pine 22"+, poor stocking, Y_4WF_5DF_1	558	3%
CUT 20-Ponderosa pine 22"+ , poor stocking, Y_6WF_4	214	1%
CUT 20-Ponderosa pine 22"+, med stocking, Y_1WF_6SP_1D_2	24	0%
CUT 20-Ponderosa pine 22"+, med stocking Y_1WF_9	**1783**	**10%**
CUT 20-Ponderosa pine 22"+, well stocked, Y_3DF_3WF_4	8	0%
CUT 20.5-Pure Ponderosa Pine 22'+, med stocking,	**1459**	**8%**
CUT 20.5-Pure Ponderosa Pine 22'+, med stocking, Y_3DF_2WF_5	370	2%
CUT 20.5-Pure Ponderosa Pine 22'+, med stocking, Y_3D_2WF_5	336	2%
CUT 20.5-Pure Ponderosa Pine 22'+, med stocking, Y_5D_3IC_2	130	1%
CUT 21-PP 12-22", poor stocking	320	2%
CUT 21-PP 12-22", med stocking	436	3%
CUT 21-PP 12-22", well stocked, Y_9IC_1	576	3%
CUT 21-PP 12-22", well stocked, Y_9WF_1	462	3%
CUT 22-PP 0-12", non-stocked	54	0
CUT 22-PP 0-12", poor stocking	**1677**	**10%**
CUT 22-PP 0-12", poor stocking, Y_4WF_6	196	1%
CUT 22-PP 0-12", poor stocking, Y_6WF_4	152	1%
CUT 22-PP 0-12", med stocking	112	1%
CUT 27-Pine Mix Large, 20-50% PP, less than 10% stocking	**4049**	**23%**
20-Ponderosa pine 22"+, less than 10% stocking	430	2%
20.5-Pure Ponderosa Pine 22'+, less than 10% stocking	**841**	**5%**
29 - White fir 12"+ , less than 10% stocking	360	2%
2-grass/brush	**779**	**5%**
37-deforested burn	**879**	**5%**
38 - Non Commercial Rocky	4	0
5.5 - Douglas fir / poles	126	1%
5 - Douglas fir / small poles	172	1%
Total	17247	

The previous tables show a wide range of categories and some interesting changes in the 25 years since the first BIA cruise was done:

- Virtually all of the watershed was logged. This logging removed trees 18" basal diameter and larger and removed 60% of the volume of the stand.
- Fires burned 879 acres of the watershed.
- 25 years of growth had occurred.
- The bark beetle epidemic had run its course, killing 10-60% of stand volumes. This mortality was in ponderosa pine and fire suppression was allowing rapid fir regeneration. These events probably had as much effect of decreasing the ponderosa pine component as did logging.

In brief comparison with the 1920 data:

- The 1920 cruise showed **78% of the volume to be ponderosa pine** - The 1945 map shows 10,161 acres, or **60% of the acres in a type with less than 50% ponderosa pine regeneration**, even though the overstory type had often been classes as "pure" or mostly ponderosa pine.
- A *very rough* comparison of stocking shows:

1920 vol/ac	**acres**	**1943 stocking**	**acres**
0-5	4876	<10%	5734
5-10	4688	10-40%	3853
10-15	5014	40-70%	4650
15-20	1713	70%+	1046
20+	956		
total	17247		15283

This comparison also demonstrates how quickly regrowth occurs following logging The 1943 stocking is not well defined, but was probably based on Meyers yield tables or similar, where about a 50% stand is quite well stocked. this lower figure reflects the burned acres and more accurate calculation of non-forest land

The table below is a comparison of year of logging and the 1943 inventory was done to see if there was a correlation between stocking levels and year of harvest:(refer to previous table for definition of type, first four rows are % density)

TYPE	1928	1929	1930	1931	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943
<10%	188	1209		1060	36			206	136	64	26	464		10
10-40			110	30	100	120	26	800	452	344	812	494		
40-70			578	190	504		32	828	188	552	136	618	572	
70%+	150		546	348										
20			94	176	512			1012	332	384		88		
20B					100		12		98			168		
20.5			326				32	316	76	182	160	530	762	10
21	150		790	512				202			80			
22			66			120	14		194	344	734	370		
27	188	1209	1637	941	16			10	28	12				
29												28		
37					12							142		
5.5												48	6	
5A												154	10	

SUBWATERSHED 208H

Cruise Data from 1920 Cruise

WS ACRES	PP VOL	SP VOL	DF VOL	WF VOL	IC VOL	VOL/AC
885	3100	0	27	4	0	0 - 5
4526	26878	123	1446	165	0	5-10
951	9254	49	1370	1016	0	10-15
2265	31889	621	4587	4490	0	15-20
258	4820		103	1298	0	20+
	75941	793	7533	6973	0	
% by species	83%	1%	8%	8%		

1945 KLAMATH COUNTY INVENTORY	**TOT AC**	**%**
CUT - 20 - Ponderosa pine 22"+ , med stocking	**1211**	**14%**
CUT - 20 - Ponderosa pine 22"+, med stocking Y_1WF_6SP_1D_2	**542**	**6%**
CUT - 20 - Ponderosa pine 22"+, med stocking Y_1WF_9	36	0
CUT - 20 - Ponderosa pine 22"+, med stocking Y_5D_2WF_2IC_1	**905**	**10%**
CUT - 20 - Ponderosa pine 22"+, well stocked, Y_3DF_3WF_4	14	0
CUT - 20 - Ponderosa pine 22"+, well stocked,Y_3D_3WF_4	128	1%
CUT - 20.5 -Ponderosa pine 22"+, 80%+PP, poor stocked	**610**	**7%**
CUT - 20.5 - Ponderosa pine 22"+, 80%+PP, med stocked	**562**	**6%**
CUT - 20.5 -Ponderosa pine 22"+80%+ PP, med stocked, Y_3D_2WF_5	286	3%
CUT - 21 - Ponderosa pine 12-22", poor stocking	384	4%
CUT - 21 - Ponderosa pine 12-22", med stocking	16	0
CUT - 21 - Ponderosa pine 12-22", med stocking, YI_0	210	2%
CUT - 21 - Ponderosa pine 12-22", med stocking, Y_5D_3WF_2	152	2%
CUT - 22 - Ponderosa pine 0-12", med stocking, YI_0	16	0
CUT - 22 - Ponderosa pine 0-12", med stocking	190	2%
CUT - 27 - Pine Mix Large, 20-50% PP, less than 10% stocking	390	4%
20 - Ponderosa pine 22"+, less than 10% stocking	356	4%
20.5 -Ponderosa pine 22"+, 80%+ PP, less than 10% stocking	**1245**	**14%**
2 - grass/brush	**631**	**7%**
37 - deforested burn	88	1%
5.5 - Douglas-fir poles	**913**	**10%**
TOTAL	8887	

BIA Harvest

YEAR		1929	1930	1931	1939	1941	1942	1943	1944	1944A	Exempt	Open	Total
ACRES	1473	174	96	26	64	366	1437	1964	166	2118	98	905	8887

NRU Classification

CLASS	Bitterbrush/			D Mdw	Forest/						
	Sage	Bitbr	Manz		Bbr.	Bbr-man	Gr-forb	Man-cea	Oth	O Shr	Sage
ACRES	192	218	2	364	2492	1681	94	1209	1113	1121	46
CLASS	M Mdw	Jun/Mt Mah		Man/Cea	Sparse Veg			Total			
ACRES	256	50		8	38			8885			

Review of this table shows that there is little correlation between year of harvest and condition mapped in 1943. On productive sites regrowth appears to be rapid enough that in 25 years or less the stocking levels are generally at or above the 1920 level.

The PMR data shows the most recent "current" condition of the watershed.

PMR crown cover

Cover	Grass	Rk/Spar Veg	Shrub					Tree					Total
			15-25	26-40	41-55	56-70	71+	11-25	26-40	41-55	56-70	71+	
Acres	960	774	472	268	6	4	270	2339	3805	5564	2179	596	17237

PMR Species Group

CLASS	Dissolved Poly		< 25% any Sp	LP	Mix Con	W Fir	PP	LP/ PP	S RFir/ Mix Con	Wat./Rk./ Sn/Gr/Shr	W Jun	WF/DF /PP	WF/Mix Con	Total
	Non-tree	Tree												
ACRES	162	594	2634	116	180	176	7259	212	68	2628	18	2946	246	17239

Some notes on the PMR data; The pixel size is small , therefore any small opening, roads, landings, plantations etc may be classed as a non-forest type or drier type, such as ponderosa pine. For example the ecoclass data shows 91% of the watershed as a forested type, the PMR data shows 84%. The ecoclass typing is of low precision, but should break off well between forest and non-forest types. Many of our forest types are not uniform but clumpy, and some of this difference is reflecting that.

Forest Plan R2 mapping

CLASS	CW-M1	CW-M2	CW-PL	CW-PO	CW-SS	PP_M1	Total
ACRES	13314	1076	558	1995	294	8	17245

Ownership

OWNERSHIP	00035	20235A	20235P	Total
ACRES	332	514	16401	17247

Forest Plan Mapping R2 Classes

CLASS		CW-IM	CW-M1	CW-M2	CW-PO	PP-IM	PP-M2	PP_M1	Total
ACRES	2756	370	2317	964	72	634	334	1437	8884

Ownership

20235P	8885

Riparian

COMM	CML	HCM	HCW	HM	HW	MM	MW	total
ACRES	8	72	56	2	4	128	2	272

Ecoclass

TYPE		CL-F1-11	CP-S1-11	CP-S2-11	CW-S1-16	CW-S3-12	MD	MW	NR-Q9	SD
ACRES	1200	10	1036	2105	722	3100	174	40	10	276

TYPE	SD-19-13	SM	Total
ACRES	200	10	8883

Forest Plan Mgt Areas

MAM		03C	04	08	10	12	Total
ACRES	1200	1166	3210	272	1903	1132	8883

PMR Crown Cover

COVER	Grass	Rock/Sparse Veg	Shrub %					Tree %					Total
			15-25	26-40	41-55	56-70	71+	11-25	26-40	41-55	56-70	71-100	
ACRES	620	38	358	60	26	4	22	1319	1823	3132	1465	16	8883

PMR Species Group

CATEG.	Dis. Non-tree Poly.	Dis. Tree Poly.	< 25% of any Sp.	L P	LP/PP	P P	Mix Con Sp.
ACRES	82	138	1365	10	44	4019	138

CATEG.	S R Fir/Mix Con	Wat/Rock/Snow/Gr/Sh/etc.	W. Jun	WF/DF/PP	WF/Mix Con	Total
ACRES	4	1046	48	1953	36	8883

Size Structure

COVER	Grass	Pole			Rock/Sparse Veg	Shr-vig	Sm/MS+	Sm/MS-	Sm/MSLD	Total
		Sm	MS+	MSLD						
ACRES	620	770	204	16	38	470	278	4889	1597	8882

SUBWATERSHED 208I

WTR ACRES	% TOT AC	PP VOL	SP VOL	DF VOL	WF VOL	IC VOL	VOL/AC
1992	9%	3801	0	0	644	0	0 - 5
3778	18%	25777	40	164	1610	0	5-10
6671	31%	71397	776	3376	3310	0	10-15
4889	23%	59698	2090	3778	14450	0	15-20
4179	19%	80219	1890	4099	10170	0	20+
TOTAL		240892	4796	11417	30184		
species %		84%	2%	4%	11%		

1945 Klamath County Inventory	Tot Ac
CUT 20 - Ponderosa pine 22"+, med stocking Y_1WF_9	374
CUT 20 - Ponderosa pine 22"+, well stocked, Y_3DF_3WF_4	18
CUT 20 - Ponderosa pine 22"+, well stocked, Y_3D_3WF_4	358
CUT 20 - Ponderosa pine 22"+, well stocked, Y_3WF_5D_2	550
CUT 20 - Ponderosa pine 22"+, well stocked, Y_3WF_7	755
CUT 20 - Ponderosa pine 22"+, well stocked, Y_4SP_1DF_2WF_3	128
CUT 20 - Ponderosa pine 22"+, well stocked, Y_6WF_2IC_2	10
CUT 20.5 - Pure Ponderosa pine 22"+, poorly stocked, YI_0	819
CUT 20.5 - Pure Ponderosa pine 22"+, med stocked, YI_0	3787
CUT 20.5 - Pure Ponderosa pine 22"+, med stocked, Y_3SP_1DF_1WF	596
CUT 20.5 - Pure Ponderosa pine 22"+, well stocked, YI_0	715
CUT 20.5 - Pure Ponderosa pine 22"+, well stocked, Y_1WF_6DF_3	530
CUT 20.5 - Pure Ponderosa pine 22"+, well stocked, Y_1WF_9	286
CUT 20.5 - Pure Ponderosa pine 22"+, well stocked, Y_5DF_1WF_4	226
CUT 20.5 - Pure Ponderosa pine 22"+, well stocked, Y_6WF_1LP_3	426
CUT 20.5 - Pure Ponderosa pine 22"+, well stocked, Y_6WF_4	182
CUT 20.5 - Pure Ponderosa pine 22"+, well stocked, Y_7WF_3	366
CUT 21 - PP 12-22", poor stocking	454
CUT 21 - PP 12-22", med stocking	498
CUT 21 - PP 12-22", med stocking YI_0	2
CUT 21 - PP 12-22", med stocking Y_7WF_3	254
CUT 21 - PP 12-22", well stocked	86
CUT 21 - PP 12-22", well stockedY_6WF_4	296
CUT 21 - PP 12-22", well stockedY_1WF_9	350
CUT Pine Mix Large, 20-50% PP, well stocked, Y_2SP_1DF_3WF_4	468
CUT White fir 12"+, well stocked WF_6LP_4	396
CUT White fir 12"+, well stocked WF_9LP_4 (error)	4
20 - Ponderosa pine 22"+, less than 10% stocking	783
20.5 Pure Ponderosa pine 22"+, less than 10% stocking	4173
26 - Lodgepole pine, medium 6-12", less than 10% stocking	262
29 - White fir 12"+, less than 10% stocking	172
2- grass/brush	2512
37 - deforested burn	12
38 - non commercial, rocky	661

BIA Harvest

YEAR		1923	1924	1929	1930	1937	1938	1939	1940	1941	1942	1943	1944	1944A	Open	Total
ACRES	11025	104	70	1737	709	42	26	64	152	1269	1471	146	1097	1833	1767	21513

NRU Classification

CLASS	BSage/Bitbr	Bitbr	Bitbr/Manz	D Mead	ELD	For/Bitbr	For/Bitbr-manz
ACRES	262	212	30	448	2	3345	5450
CLASS	For/Gr-forb	For/Oth	For/Manz-cea	Fort/Oth Shr	For/Sage	Jun/Mt Mah	Manz/Cea
ACRES	584	1972	6255	1685	4	36	40
CLASS	M Mead	Oth Shr	Rock/Snow	W Mead	W Shr/Shr Asp		Total
ACRES	767	2	312	96	6		21511

Forest Plan R2 map

TYPE		CW-IM	CW-M1	CW-M2	CW-PL	CW-PO	CW-SS	LP-M1	PP-M2	PP-IM
ACRES	4283	1200	6096	3048	252	276	202	366	1655	1537

TYPE	PP-PO	PP-SS	PP_M1	Total
ACRES	932	27	1589	21508

Ownership

OWNER	00035	20235A	20235P	Total
ACRES	1212	154	20146	21512

Riparian

COMM	CM	CML	HCM	HCW	HM	HW	MM	MW	Total
ACRES	36	162	152	28	116	6	518	680	1698

Ecoclass

CLASS		AB	CL-F1-11	CP-F1-11	CP-S1-11	CP-S2-11	CP-S3-11	CW-S1-16	CW-S3-12
ACRES	1669	12	296	56	272	5130	826	8172	3268

CLASS	MD	MM	MW	NR	NR-Q9	W	Total
ACRES	468	220	678	430	6	6	21509

Management Areas

MAM		03A	03C	07	07OG	08	10	12	Total
ACRES	1513	28	70	328	1489	1765	2035	14283	21511

Pmr Crown Cover

TYPE	Grass	Rock/Spa Veg	Shrub %					Tree %					Total
			15-25	26-40	41-55	56-70	71+	11-25	26-40	41-55	56-70	71+	
ACRES	1315	312	298	2	42	38	208	3416	4947	7680	2632	614	21504

PMR Species Group

COVER	Dis Non-tree Poly	Dis Tree Poly	<25% any Sp	LP	LP/PP	Mix Con	PP
ACRES	120	534	3480	480	90	424	9605

COVER	SR Fir/Mix Con	W/Rk/Sn/Gr/Shr	WF	WF/DF/PP	WF/Mix Con	Total
ACRES	168	2095	90	3819	598	21503

PMR Size Structure

COVER	Grass	Med/	Pole			Rk/Spar	Sd/Sap/	Shr	Sm/					Total
		MS-	Sm	MS+	MSLD	Veg	Pol	vig	MS+	MS++	MS-	MSLD	Med	
ACRES	1315	10	554	732	676	312	354	588	1925	208	11431	3336	62	21503

SUBWATERSHED 208Z

1920 Cruise Data

% BY ACRES	VPA	TOT AC	PP	SP	DF	WF	IC	TOT
56%	0-5	1139	4178	40	15	94	17	4344
44%	5-10	895	4291	34	43	109	32	4508
total		2034	8469	74	57	203	49	8852
% by species			96%	1%	1%	2%	1%	

1945 KLAMATH COUNTY INVENTORY	SUM OF ACRES
CUT 20 - Ponderosa pine 22"+, med stocking Y_4WF_4IC_2	158
CUT 21 - PP 12-22", med stocking 2YI_0	458
CUT 21 - PP 12-22", med stocking	18
CUT 21 - PP 12-22", med stocking 2YI_0	622
CUT 21 - PP 12-22", med stocking 2Y_6WF_2IC_2	18
CUT 22 - PP 0-12", poor stocking 1	28
CUT 22 - PP 0-12", med stocking 2	190
CUT 22 - PP 0-12", med stocking 2YI_0	326
2 - grass/brush	214
total	2034

NRU Classification

CLASS	BSage/Bitbr	Bitbr	Bitbr/Manz	D Mdw	For/Bitbr	For/Bitbr-manz	For/Gr-frb	For/Manz-cean
ACRES	60	32	10	168	665	600	12	208

CLASS	For/Oth	For/O Shr	For/Sag	Jun/Mt Mah	M Mdw	O Shr	Rk/Sn	Spars Veg	W Mdw	Total
ACRES	10	164	6	24	4	22	42	2	4	2034

Ecoclass

TYPE		CP-S1-11	CP-S2-11	CW-S1-16	MD	NR	SD-19-13	Total
ACRES	176	190	1056	244	86	82	198	2032

Riparian

TYPE	HCM	HM	MM
ACRES	52	24	318

Forest Plan MA

MAM		CW-IM	CW-M2	PP-IM	PP-M2	PP_M1	Total
ACRES	550	106	24	586	370	396	2032

Ownership

OWNER	20235A	20235P	Total
ACRES	652	1381	2033

PMR Cover Class

TYPE	Grass	Rk/Sp Veg	Shrub%				Tree%				Total
			15-25	26-40	41-55	71+	11-25	26-40	41-55	56-70	
ACRES	176	44	116	4	4	24	492	712	434	26	2400

PMR Species Group Data

TYPE	Dis Non-tree Poly	Dis Tree Poly	<25% Sp	LP/PP	Mix Con	PP
ACRES	40	70	422	6	20	996
TYPE	WFir/DF/PP	WFir/Mix Con	W/Rk/Sn/Gr/Shr		Total	
ACRES	110	36	332		2032	

PMR size structure

TYPE	Grass	Pole/			Rk/Spars Veg	Shr vig	Sm/			Total
		-Sm	MS+	MSLD			MS+	MS-	MSLD	
ACRES	176	104	24	12	44	148	8	856	660	2032

BIA Harvest

YEAR		1931	1936	1939	1941	Open	Total		
ACRES	268	48	100	74	1281	262	2034		

SUBWATERSHED CLINEY

% BY VOLUME	VPA	TOT WS AC	PP	SP	DF	WF	IC	TOT
10%	0-5	160	508	0	0	0	4	512
90%	5-10	1472	9147	49	0	128	144	9468
total		1632	9655	49	0	128	148	
% by species			97%	0	0	1%	1%	

1945 KLAMATH COUNTY INVENTORY	TOT AC
CUT 20.5 - Pure Ponderosa pine 22"+, med stocking YI_0	40
CUT 20.5 - Pure Ponderosa pine 22"+, med stocking YI_0	496
CUT 21 - PP 12-22", med stocking, Y_6WF_2IC_2	370
CUT 22 - PP 0-12", med stocking	2
20.5 - Pure Ponderosa pine 22"+, less than 10% stocking	318
2 - grass/brush	202
2 - grass/brush	366
Non-Stocked cutover areas	20
Total	1815

BIA Harvest

YEAR		1930	1931	1936	1937	FP	OPEN	TOTAL
ACRES	14	218	192	352	182	162	512	1633

ANAL

TYPE		CW-IM	CW-M1	CW-M2	CW-PL	PP-IM	PP-SS	PP_M1	TOTAL
ACRES	783	260	144	32	54	236	24	100	1633

NRU Classification

TYPE	Bitterbrush/			D	Forest/						EK	Jun/Mt	M	Total
	Sage	Bbr	Manz	Mdw	Sage	Bbr	Oth	Bbr-man	Man-cea	O Shr		Mah	Mdw	
ACRES	110	8	4	246	28	80	34	927	110	58	2	12	4	1633

Management Areas

MAM		03A	03C	07	08	10	12	Total
TOT AC	290	90	643	6	498	60	46	1633

Ownership

00035	20235P	TOTAL
60	1573	1633

Riparian

HCM	HM	MM	MW	TOTAL
66	2	370	22	460

Ecoclass

TYPE		CP-S1-11	CP-S2-11	CW-S1-16	NC	SD-19-13	Total
ACRES	296	22	440	468	4	402	1632

PMR Crown Cover

GRASS	SHRUB 15-25%	TREE				TOTAL
		11-25%	26-40%	41-55%	56-70%	
250	134	182	426	590	48	1630

PMR Species Group

TYPE	Dissolved Poly		<25% any Sp	LP/ PP	PP	Mix Con	WF/Mix Con	WF/DF/ PP	Wa/Rk/Sn/ Gr/Shr	Total
	Non-tree	Tree								
ACRES	16	20	194	38	888	14	4	86	370	1630

PMR Size Structure

Grass	Pole-Sm	Pole/MS+	Pole/MSLD	Shr vig	Sm/MS+	Sm/MS-	Sm/MSLD	Total
250	384	92	60	134	2	532	176	1630

SUBWATERSHED CRYSTAL CASTLE

1920 Cruise Data

WS ACRES	PP VOL	SP VOL	DF VOL	WF VOL	IC VOL	VOL/AC	% ACRES BY VOLUME
496	1095	0	37	0	0	0-5	5%
2391	14826	308	1837	756	0	5-10	24%
2751	30571	47	687	1120	0	10-15	28%
2945	45571	216	731	2053	0	15-20	30%
1350	26922	268	974	2591	0	20+	14%
Total	118985	839	4266	6520	0		
% by Species	.91%	1%	3%	5%	0		

1945 KLAMATH COUNTY INVENTORY	TOT AC
CUT 20 - Ponderosa pine 22"+, well stocked Y_4SP_1DF_2WF_3	18
CUT 20 - Ponderosa pine 22"+,poor stocking YI_0	226
CUT 20.5 - Pure Ponderosa pine 22"+, well stocked YI_0	34
CUT 20.5 - Pure Ponderosa pine 22"+, well stocked Y_6WF_4	356
CUT 21 - PP 12-22", poor stocked	58
CUT 21 - PP 12-22", med stocking	2630
CUT 21 - PP 12-22", med stocking Y_7WF_3	150
CUT 21 - PP 12-22", med stocking Y_9WF_1	340
CUT 21 - PP 12-22", well stocked	2842
CUT 21 - PP 12-22", well stocked Y_3WF_5D_2	126
CUT 21 - PP 12-22", well stocked Y_3WF_6SP_1	887
CUT 21 - PP 12-22", well stocked Y_5WF_2DF_3	230
CUT 21 - PP 12-22", well stocked Y_6WF_4	604
CUT 21 - PP 12-22", well stocked Y_7WF_2DB_1	408
CUT 21 - PP 12-22", well stocked Y_8WF_2	130
CRYSTAL UNKNOWN	26
20.5 - Pure Ponderosa pine 22"+, less than 10% stocking	436
26 - Lodgepole pine 6-12", less than 10% stocking	3
2 - grass/brush	198
37 - deforested burn	76
38 - Non-commercial rocky areas.	68
5B - Douglas-fir poles	58
total	9907

NRU Classification

TYPE	B Sag/Bbr	Bbr	Bbr/Manz	D Mdw	For/Bbr	For/Bbr-man	For/Gr-forb	For/Manz-cean
ACRES	24	14	16	68	2638	4027	118	995
TYPE	For/Oth Shr	O Shr	Jun/Mt Mah	M Mdw	W Shr/Asp	For/Oth	W Mdw	Total
ACRES	206	88	18	96		1619	2	9940

Forest Plan R2 Map

TYPE		CW-IM	CW-M1	CW-M2	LP-IM	PP-IM	PP-M2	PP-M1	Total
ACRES	856	2157	1034	246	24	4515	74	1030	9936

Ownership

OWNER	00035	20235P	20235PC	Total
ACRES	92	9649	194	9935

Riparian

COMM.	CML	CWL	HCM	HCW	HM	HW	MM	MW	MWR	Total
ACRES	40	16	106	26	4	6	32	82	12	324

Ecoclass

TYPE		AB	CL-F1-11	CP-S1-11	CP-S2-11	CP-S2-12	CW-S1-16
ACRES	312	156	14	10	3833	212	4919
TYPE	CW-S3-12	MD	MW	SM	WR	Total	
ACRES	188	258	10	16	10	9938	

Forest Plan Mgt Areas

MAM		03B	03C	07OG	08	12	Total
ACRES	308	444	196	2	322	8666	9938

PMR Crown Cover

CLASS	Grass	Shrub %				
		15-25	26-40	41-55	56-70	71-100
ACRES	166	118	8	8	12	24
CLASS	Tree %				Total	
	11-25	26-40	41-55	56-70		
ACRES	894	2339	4647	1721	9937	

PMR Species Group

COVER	Disolved Poly		<25% any Sp	LP	LP/PP	Mix Con	PP
	Non-tree	Tree					
ACRES	68	296	944	52	28	162	5780
COVER	W/Rk/Sn/Gr/Shr	W Jun	WF	WF/DF/PP	WF/MixCon	Total	
ACRES	268	4	22	2087	226	9937	

PMR size structure

COVER	Grass	Pole			Seed/Sap/Pole
		-Sm	MS+	MSLD	
ACRES	166	552	162	76	6
COVER	Sm/MS+	Sm/MS-	Sm/MSLD	Shr Vig	Total
ACRES	590	7155	1060	170	9937

CURRENT CONDITION HEADWATERS

1920 cruse data

% OF AC BY VOLUME	VPA	TOT AC	PP	SP	DF	WF	IC
22%	0-5	885	3430	2	0	77	33
66%	5-10	2668	14255	139	14	573	355
12%	10-15	464	4303	0	0	62	306
total		4017	21989	141	14	713	694
% by species			93%	1%	0	3%	3%

1945 KLAMATH COUNTY INVENTORY	TOT AC
CUT 20.5 Pure Ponderosa pine, 22"+, med stocking Y_8WF_1IC_1	16
CUT 21 - PP 12-22", med stocking	594
CUT 21 - PP 12-22", poor stocking Y_7IC_3	180
CUT 21 - PP 12-22", med stocking	1135
CUT 21 - PP 12-22", med stocking Y_5IC_5	130
CUT 21 - PP 12-22", med stocking Y_8IC_2	354
CUT 21 - PP 12-22", well stocked	32
CUT 22- PP 0-12", poor stocking	16
CUT 22- PP 0-12", med stocking	94
CUT 22- PP 0-12", med stocking Y_6WF_3IC_1	633
CUT 22- PP 0-12", well stocked	10
CUT - 27 Pine Mix Large, med stocking Y_3WF_6IC_1	388
20.5 Pure Ponderosa pine, 22"+, less than 10% stocking	18
2 - grass/brush	168
37 - deforested burn	246
total	4015

NRU Classification

TYPE	BSage/Bbr	Bbr	Bbr/Manz	D Mdw	For/Bbr	For/Bbr-man	For/Gr-forb
ACRES	28	46	8	32	1011	1391	458
TYPE	For/Man-cean	For/Oth	For/Oth Shr	For/Sage	Jun/Mt Mah	Man/Cean	Oth Shr
ACRES	268	128	362	8	26	40	184

TYPE	Spars Veg	Wt Shr/Shr Asp	Total
ACRES	20	4	4015

BIA Harvest

YEAR		1925	1927	1928	1929	1936	1937	1939	Open	Switch Back Fir	Total
ACRES	410	342	268	1243	212	424	947	48	6	114	4015

Forest Plan R2 Map

TYPE	CW-IM	CW-M1	CW-M2	CW-PL	PP-SS	Total
ACRES	36	454	168	82	3274	4014

Ownership

OWNER	20235A	20235P
ACRES	308	3706

Riparian

TYPE	CM	HCM	Total
ACRES	18	112	130

Ecoclass

TYPE		CP-S1-11	CP-S2-11	CW-S1-16	MD	NR	NR-Q9	SD	Total
ACRES	342	1008	1054	1297	28	2	10	272	4013

Forest Plan Mgt Areas

MAM	03A	03C	07	08	10	12	Total
ACRES	526	1623	222	330	812	500	4013

PMR Crown Cover

COVER	Grass	Rk/Spar Veg	Shrub %				Tree %					Total
			15-25	41-55	56-70	71-100	11-25	26-40	41-55	56-70	71-100	
ACRES	32	20	116	4	184	36	1202	748	1451	186	34	4013

PMR Species Group

TYPE	Dissolved Poly		<25% any Sp	LP/PP	Mix Con	PP	W/Rk/Sn/ Gr/Shr	WF/DF/PP	WF/Mix Con	Total
	Non-tree	Tree								
ACRES	60	98	1200	170	68	1917	338	132	30	4013

PMR Size/Structure

COVER	Grass	Pole			Rk/Spar Veg	Sd/Sap/ Pole	Sm/			Shr	Shr vig	Total
		-Sm	MS+	MSLD			MS+	MS-	MSLD			
ACRES	32	132	44	294	20	2	58	2047	1044	4	336	4013

SUBWATERSHED LOWER CORBELL

VPA	TOT AC	PP	SP	DF	WF	IC	% ACRES
0-5	3254	data	missing	data	0	0	94%
5-10	208	1515	3	19	21	0	6%
total	3462	1515	3	19	21	2	
% species	3690	97%	0	1%	1%	300	22926

1945 KLAMATH COUNTY INVENTORY	TOT AC
2 - grass/brush	10
CUT 20.5 - Pure Ponderosa pine 22"+,med stocking YI_0	76
Cut 21 - Ponderosa pine 12-22", poor stocking	270
Cut 21 - Ponderosa pine 12-22", med stocking	496
Cut 21 - Ponderosa pine 12-22", well stocked	1847
Cut 22 - Ponderosa pine 0-12", med stocking 2	46
Cut 22 - Ponderosa pine 0-12", well stocked Y_8LP_2	94
25 - Lodgepole pine 12"+, less than 10% stocking	50
26 - Lodgepole pine 6-12:, less than 10% stocking	68
2 - grass/brush	506

BIA Harvest

YEAR		1923	1927	1929	1939
ACRES	3351	6	58	40	10

Forest Plan R2 Map

TYPE		CW-IM	CW-M1	PP-IM	PP-M2	PP-PO	PP-SS	PP-M1	Total
ACRES	1209	248	186	787	14	530	58	432	3465

NRU Classification

TYPE	BSage/Bbr	Bbr	Bbr/Man	D Mdw	For/					
					Bbr	Bbr-man	Gr-forb	Man-cean	Oth	Oth shr
ACRES	2	14	2	44	1497	1401	106	224	42	44

TYPE	Jun/Mt Mah	M Mdw	Oth Shr	Spar Veg	W Mdw	W Shr/Shr Asp	Total
ACRES	6	32	4	2	40	4	3465

Management Areas

MAM		03A	03B	07	08	12	Total
ACRES	735	480	12	64	152	2022	3465

VPC

TYPE		AB	CP-S2-11	CP-S2-12	CW-S1-16	MD	Total
ACRES	1059	22	1946	14	414	10	3465

Ownership

OWNER	00035	20235A	20235P	Total
ACRES	732	136	2594	3462

Riparian

TYPE	HCM	HCW	HW	MWR	Total
ACRES	108	8	4	28	148

PMR Crown Cover

TYPE	Grass	Rk/Spar Veg	Shrub %			Tree %				Total
			15-25	41-55	71+	11-25	26-40	41-55	56-70	
ACRES	116	2	16	2	14	732	1381	1128	72	3463

PMR Species Group

TYPE	Dissolved Poly		<25%	LP	LP/P	Mix	PP	W/Rk/Sn/Gr/Shr	WF/DF/PP	WF/Mix Con
	Non-tree	Tree	any Sp		P	Con				
ACRES	18	40	748	172	98	10	2087	132	90	68

PMR Size Structure

TYPE	Grass	Pole			Rk/Spars	Seed-	Shr Vig	Sm/				Total
		-Sm	MS+	MSLD	Veg	Sap-Pole		MS+	MS++	MS-	MSLD	
ACRES	116	264	22	110	2	6	32	96	8	2047	760	3463

SUBWATERSHED NO NAME

% BY ACRES	VPA	TOT AC	PP	SP	DF	WF	IC	TOT
65%	0-5	5133	4838	0	0	0	0	4838
35%	5-10	2783	16553	0	6	59	0	16619
0	10-15	2	22	0	2	1	0	24
total		7918	21413	0	8	60	0	21481
% by species			100%					

Ownership

OWNER		00035	20235P	Total
ACRES	4	5110	2808	7922

BIA Harvest

YEAR		1925	1927	1928	1929	1936	1937	1939	Open	Switch Back Fire	Total
ACRES	410	342	268	1243	212	424	947	48	6	114	4015

Forest R2 Mapping

TYPE		PP-IM	PP-M2	PP-M1	Total
ACRES	6443	464	639	376	7922

VPC

TYPE		CP-S1-11	CP-S2-11	MD	MW	NR	SD	Total
ACRES	5222	933	1595	134	10		424	7922

Management Areas

MAM		04	08	10
ACRES	5198	180	248	2296

1945 KLAMATH COUNTY CRUISE	TOT AC
CUT 20.5 - Pure Ponderosa pine 22"+, poor stocking YI_0	2
CUT 20.5 - Pure Ponderosa pine 22"+, med stocking	1293
CUT 20.5 - Pure Ponderosa pine 22"+, med stocking YI_0	659
CUT 21 - PP 12-22"+, poor stocking	66
CUT 21 - PP 12-22"+, med stocking	512
CUT 21 - PP 12-22"+, med stocking YI_0	108
CUT 21 - PP 12-22"+, well stocked	366
CUT 22 - PP 0-12", poor stocking YI_0	376
CUT 22 - PP 0-12", med stocking	152
CUT 22 - PP 0-12", well stocked	74
20.5 - Pure Ponderosa pine 22"+, less than 10% stocking	685
25 - Lodgepole Pine 12"+, less than 10% stocking	54
26 - Lodgepole Pine 6-12", less than 10% stocking	50
2 - grass/brush	3525
total	7922

NRU Classification

TYPE	BSage/Bbr	Bbr	Bbr/Man	D Mdw	ELD	Forest/					
						Bbr	Bbr-man	Gr-forb	Man-cea	Oth Shr	Sage
ACRES	372	352	2	1079	2	3006	653	58	4	973	16

TYPE	Jun/Mt Mah	M Mdw	Oth Shr	Spars Veg	Water	W Mdw	Total
ACRES	80	1017	18	8	20	262	7922

Riparian

COMM	HCM	HM	MM	MW	Total
ACRES	94	16	140	2	252

PMR Closure

TYPE	Water	Grass	Rk/Spars Veg	Shrub %					Tree %				Total
				15-25	26-40	41-55	56-70	71+	11-25	26-40	41-55	56-70	
ACRES	20	2357	8	520	38	90	40	136	2245	1749	708	6	7917

PMR Cover Class

TYPE	Dissolved Poly		<25% any Sp	LP/PP	Mix Con	PP	Wat/Rk/Sn/Gr/Shr	Total
	Non-tree	Tree						
ACRES	170	30	2351	50	10	2251	3056	7918

PMR Size Class

TYPE	Grass	Pole			Rk/Spar Veg	Shr vig	Sm/		Water	Total
		-Sm	MS+	MSLD			MS-	MSLD		
ACRES	2357	124	6	18	8	824	1921	2640	20	7918

SUBWATERSHED ROCK

1920 cruise

% acres by volume	VPA	TOT AC	PP	SP	DF	WF	IC	TOT
58%	0-5	6498	11624	30	40	120	127	11941
42%	5-10	4703	30610	79	341	687	731	32448
total		11201	42234	108	380	807	859	44389
% by species			95%	0	1%	2%	2%	

1945 KLAMATH COUNTY INVENTORY	TOT AC
CUT 20.5 Pure Ponderosa pine 22"+, med stocking	84
CUT 20.5 Pure Ponderosa pine 22"+, med stocking YI_0	1942
CUT 20.5 Pure Ponderosa pine 22"+, med stocking Y_8WF_1IC_1	24
CUT 20.5 Pure Ponderosa pine 22"+, less than 10% stocking Y_5WF_2IC_3	1355
CUT 21 - PP 12-22", poor stocking	156
CUT 21 - PP 12-22", med stocking	1017
CUT 21 - PP 12-22", med stocking YI_0	1083
CUT 21 - PP 12-22", med stocking Y_6WF_2IC_2	284
CUT 21 - PP 12-22", med stocking Y_8IC_2	24
CUT 21 - PP 12-22", med stocking Y_8WF_1IC_1	228
CUT 21 - PP 12-22", med stocking Y_8WF_2	190
CUT 21 - PP 12-22", poor stocking	84
CUT 21 - PP 12-22", poor stocking YI_0	102
CUT 22 - PP 0-12", poor stocking Y_5WF_5	106
CUT 21 - PP 12-22", med stocking	184
CUT 22 - PP 0-12", med stocking Y_5WF_3IC_2	168
CUT 22 - PP 0-12", med stocking Y_6WF_3IC_1	178
CUT 22 - PP 0-12", well stocked YI_0	246
CUT 22 - PP 0-12", poor stocking YI_0	156
CUT 27 - Pine Mix Large, 22"+, 20-50% PP, med stocking 2Y_3WF_6IC_1	124
20.5 Pure Ponderosa pine 22"+, less than 10% stocking	46
2 - grass/brush	2952
35B - nonstocked cutovers	402
37 - deforested burn	20
5B - Douglas-fir poles	50

NRU Classification

TYPE	Bitterbrush			D	Forest/						
	B Sage	Bbrush	Manz	Mdw	Bbr	Bbr-man	Gr-forb	Man-cea	Oth	Oth Shr	Sage
ACRES	348	140	140	913	2264	3867	120	679	248	825	46

TYPE	Jun/Mt Mah	Man/Cea	M Mdw	Oth Shr	Spar Veg	T	Water	W Mdw	Wet Shr/Shr Asp	Total
ACRES	74	26	36	204	10	2	1235	8	22	11207

Forest Plan R2 Mapping

TYPE		CW-IM	CW-M1	CW-M2	CW-PL	PP-IM	PP-M2	PP-PL	PP-SS	PP-M1	Total
ACRES	5436	394	1043	198	316	797	196	96	190	2540	11207

BIA Harvest

YEAR		1928	1929	1930	1931	1936	1937	1939	1941	Open	Total
ACRES	5318	42	452	66	194	1051	4	1023	911	2146	11207

Management Areas

MAM		03C	07	08	10	12	Total
ACRES	4295	1543	306	458	1990	2614	11207

Ownership

OWNER		00035	20235P	Total
ACRES	4	3527	7676	11207

Riparian

COMM		CM	CW	HCM	HCW	HM	MM	MW	Total
ACRES	10751	50	16	112	2	24	222	30	11207

VPC

COMM		CP-S1-11	CP-S2-11	CW-S1-16	MD	NR	SD	SD-19-13	Total
ACRES	4313	2290	1829	2178	416	18	140	22	11207

PMR Crown Cover

TYPE	Grass	Rk/ Sp Veg	Shrub %					Tree %				
			15-25	26-40	41-55	56-70	71+	11-25	26-40	41-55	56-70	71+
ACRES	2201	10	602	18	30	32	306	1855	2856	3006	272	14

PMR Species Group

TYPE	Dissolved Poly		<25% any Sp	LP/PP	Mix Con	PP	Wat/Rk/ Sn/Gr/Shr	W Jun	WF/DF/PP	WF/Mix Con
	Non-tree	Tree								
ACRES	246	502	1539	406	174	5056	3008	12	218	42

PMR

TYPE	Grass	Pole				Rk/Spar Veg	Seed-Sap-Pole	Shrub		Sm/		
		Pole	-Sm	MS+	MSLD			Shrub	Vig	MS+	MS-	MSLD
ACRES	2201	12	670	274	82	10	2	30	958	336	4411	2215

SUBWATERSHED SKEEN

VPA	% BY ACRES	TOT W AC	PP	SP	DF	WF	IC
0-5	5%	250	1070	0	0	0	0
5-10	88%	4052	23749	128	2478	821	0
15-20	6%	286	4091	99	464	673	0
total		4588	28910	227	2942	1494	0
% by species			86%	1%	9%	4%	

1945 KLAMATH COUNTY INVENTORY	TOT AC
CUT 20 - Ponderosa pine 22"+, med stocking Y_1WF_6SP_1D_2	90
CUT 20 - Ponderosa pine 22"+, med stocking Y_5D_2WF_2IC_1	396
CUT 20.5 Pure Ponderosa pine 22"+, less than 10% stocking	4
CUT 20.5 Pure Ponderosa pine 22"+, poor stocking	16
CUT 20.5 Pure Ponderosa pine 22"+, med stocking	418
CUT 20.5 Pure Ponderosa pine 22"+, med stocking Y_5D_3IC_2	162
CUT 21 - PP 12-22"+, poor stocking	106
CUT 21 - PP 12-22"+, med stocking	570
CUT 21 - PP 12-22"+, well stocked	288
CUT 22 - PP 0-12", less than 10% stocking	2
CUT 22 - PP 0-12", poor stocking	64
20.5 Pure Ponderosa pine 22"+, less than 10% stocking	180
2 - grass/brush	681
37 - deforested burn	993
5.5 - Douglas-fir poles 12-20", less than 10% stocking	618
5A - Douglas-fir small poles 6-12" , less than 10% stocking	6

NRU Classification

TYPE	Sage/ Bbr	Bbr	D Mdw	Forest/							Jun/Mt Mah	Man/ Cea	M Mdw	O Shr	Spar Veg
				Bbr	Bbr-man	Gr-forb	Man-cea	Oth	O Shr	Sage					
ACRES	50	92	478	1407	765	60	588	134	356	98	202	78	26	106	152

BIA Harvest

YEAR		1936	1941	1942	1944	1944A	Exempt	Open	Saddle Mtn. Fir	Total
ACRES	641	534	687	1093	120	26	12	2	1481	4596

ANAL

TYPE		CW-IM	CW-M1	CW-PL	CW-M2	CW-PO	PP-IM	PP-M2	PP-PL	PP_M1	Total
ACRES	2022	96	586	108	154	30	472	230	210	687	4596

Management Areas

MAM		04
ACRES	711	3885

Ownership

OWNER		00035	20235A	20235P	Total
ACRES	4	707	122	3763	4596

Riparian

COMM		CML	HCM	MW	MWR	Total
ACRES	4351	120	90	28	6	4596

VPC

TYPE		CP-S1-11	CP-S2-11	CP-S2-12	CW-S3-12	MD	MW	NR-Q9	SD-19-13	Total
ACRES	811	797	1699	10	1185	26	2	14	52	4596

PMR

TYPE	Grass	Rk/Spar Veg	Shrub %					Tree %					Total
			15-25	6-40	41-55	56-70	71+	11-25	26-40	41-55	56-70	71+	
ACRES	504	152	278	160	14	12	64	822	1339	914	304	28	4951

PMR Cover

TYPE	Dissolved Poly		<25% any Sp	LP/PP	Mix Con	PP	W/Rk/Sn/Gr/Shr	W Jun	WF/DF/PP	WF/Mix Con	Total
	Non-tree	Tree									
ACRES	96	88	808	56	34	1861	1100	4	540	4	4591

PMR Size

TYPE	Grass	Pole			Rk/Spar Veg	Shr vig	Sm/				Total
		-Sm	MS+	MSLD			MS+	MS++	MS-	MSLD	
ACRES	504	180	78	54	152	528	226	2	1801	1066	4591

SUBWATERSHED SUBSTATION

% BY ACRES	VPA	TOT W AC	PP	SP	DF	WF	IC	TOT
60%	0-5	1459	2324	0	0	0	0	2324
40%	5-10	968	5924	0	200	1	0	6124
total		2427	8248	0	200	1	65	6303
% by species			98%		2%	.	2	1552

1945 KLAMATH COUNTY INVENTORY	TOT AC
CUT 20.5 Pure Ponderosa pine 22"+, poor stocking YI_0	236
CUT 20.5 Pure Ponderosa pine 22"+, med stocking YI_0	272
CUT 20.5 Pure Ponderosa pine 22"+, well stocked YI_0	410
CUT 21 - PP 12-22", poor stocking	220
CUT 21 - PP 12-22", med stocking	488
CUT 21 - PP 12-22", med stocking YI_0	14
CUT 21 - PP 12-22", med stocking Y_9WF_1	302
CUT 21 - PP 12-22", well stocked	270
CUT 22 - PP 0-12", med stocking YI_0	212
CUT 22 - PP 0-12", less than 10% stocking	4

ANAL

TYPE		CW-IM	CW-M1	PP-IM	PP-M2	PP-SS	PP-M1	Total
ACRES	514	248	22	1059	210	76	300	2430

Management Areas

MAM		03A	03B	03C	08	12	Total
ACRES	226	256	48	394	48	1457	2430

NRU Classification

TYPE	Bbrush/			D	Forest/						Jun/Mt	M	Oth	Total
	Sage	Bbrush	Manz	Mdw	Bbr	Bbr-man	Gr-forb	Man-cea	Oth	O Shr	Mah	Mdw	Shr	
ACRES	4	12	6	62	799	1255	60	58	72	82	6	4	8	2428

Ownership

OWNER	20235A	20235P
ACRES	6	2424

Riparian

COMM		HW	MM	MW	MWR
ACRES	2390	2	6	14	18

VPC

TYPE		AB	CP-S2-11	CP-S2-12	CW-S1-16	MD	SD	WR	Total
ACRES	232	20	1882	88	82	120	4	2	2430

PMR Cover

TYPE	Grass	Shrub %				Tree %				Total
		15-25	41-55	56-70	71+	11-25	26-40	41-55	56-70	
ACRES	66	18	4	10	4	686	914	652	72	2426

PMR Size

TYPE	Grass	Pole			Shr-vig	Sm/			Total
		-Sm	MS+	MSLD		MS+	MS-	MSLD	
ACRES	66	536	6	42	36	18	974	748	2426

PMR Crown

TYPE		Dissolved Poly		<25% any Sp	LP	LP/ PP	Mix Con	PP	Wat/Rk/Sn/ Gr/Shr	WF/DF/ PP	WF/Mix Con	Total
		Non-tree	Tree									
ACRES	2	24	56	701	6	96	34	1395	78	16	22	2430

SUBWATERSHED UPPER WHISKEY CREEK

Data from 1920s cruise

SOS	VPA	TOT W AC	PP	SP	DF	WF	IC	%ACRES
Upper Whiskey cr	0-5	3812	6230	0	0	8	65	50%
Upper Whiskey cr	5-10	3690	21750	144	24	709	300	48%
Upper Whiskey cr	10-15	144	1423	0	0	127	2	2%
Total		7646	29403	144	24	843	367	
			96%	0	0	3%	1%	

1945 KLAMATH COUNTY INVENTORY	TOT AC
CUT CUT 22 - Ponderosa pine 0-12", med stocking med stocking	86
CUT 20.5 - Pure Ponderosa pine 22"+, med stocking YI_0	2662
CUT 20.5 - Pure Ponderosa pine 22"+, med stocking Y_6WF_3IC_1	865
CUT 21 - Ponderosa pine 12-22", med stocking	560
CUT 21 - Ponderosa pine 12-22", med stocking Y_6WF_2IC_2	246
CUT 22 - Ponderosa pine 0-12", poor stocking	76
CUT 22 - Ponderosa pine 0-12", poor stocking 1Y_5J_5	54
CUT 22 - Ponderosa pine 0-12", poor stocking 1Y_5WF_5	14
CUT 22 - Ponderosa pine 0-12", poor stocking 1Y_7WF_3	496
CUT 22 - Ponderosa pine 0-12", med stocking 2	172
CUT 22 - Ponderosa pine 0-12", med stocking 2Y_5WF_3IC_2	16
CUT 22 - Ponderosa pine 0-12", med stocking 2Y_5WF_5	166
CUT 22 - Ponderosa pine 0-12", med stocking 2Y_6WF_2IC_2	190
CUT 27 - Pine Mix 22"+ 20-50% PP, well stocked 3Y_3WF_7	324
CUT 29 - White Fir 12"+, med Stocking 2Y_2WF_8	6
CUT 22 - Ponderosa pine 0-12", less than 10% stocking	228
2 - grass/brush	943
35B - nonstocked cutover	396
37 - deforested burn	108
38 - Non Commercial rocky	34
5B - Douglas-fir poles	6

Bia Harvest

YEAR		1930	1931	1936	1937	1938	1941	1942	Open	Whiskey Cr Fire	Total
ACRES	2064	444	196	196	2504	190	1209	232	352	262	7650

Forest Plan Type Mapping

TYPE		PP-IM	PP-M2	PP-PL	PP-SS	PP_M1	Total
ACRES	1653	50	40	444	12	1357	3557

NRU Classification

TYPE	Bitterbrush/			Crk	D	EK	Forest/						
	Sage	Bbr	Manz		Mdw		Bbr	Bbr-man	Gr-forb	Man-cea	Oth	O Shr	Sage
ACRES	346	14	44	2	258	2	1241	1653	46	500	1829	653	931

TYPE	Jun/Mt Mah	Man/Cea	M Mdw	Spar Veg	W Mdw	Wet Shr/Shr Asp	Total
ACRES	18	14	86	2	2	8	7650

Management Areas

MAM		03A	03C	08	12	Total
ACRES	5747	839	288	679	98	7650

Ownership

OWNER		00035	02035	20235P	Total
ACRES	2	2454	3197	1998	7650

Riparian

COMM		CM	HCM	HCW	HM	HW	MM	MW	Total
ACRES	7006	24	102	18	4	4	486	6	7650

VPC

TYPE		CP-S1-11	CP-S2-11	CW-S1-16	MW	NR	SD-19-13	Total
ACRES	5733	64	847	500	6	2	498	7650

PMR

TYPE	Grass	Rk/Sp	Shrub %				Tree %					Total
		Veg	15-25	26-40	56-70	71+	11-25	26-40	41-55	56-70	71+	
ACRES	346	2	372	36	4	32	1571	2860	1995	420	6	7644

PMR

TYPE	Dis Tree Poly	<25% any Sp	LP	LP/PP	MixCon	PP	
ACRES	40	244	34	1643	8	230	

TYPE	Wr/Rk/Sn/Gr/Shr	WF/DF/PP	W Jun	WF	WF/DF/PP	WFir/Mix Con	Total
ACRES	4067	752	22	306	260	38	7644

PMR Size

TYPE	Grass	Pole			Rk/Sp	Shr	Sm/		Total
		-Sm	MS+	MSLD	Veg	vig	MS-	MSLD	
ACRES	346	216	410	160	2	444	4267	1799	7644

SUBWATERSHED WEST RIDDLE

1920 cruise data

% BY ACRES	VPA	TOT W AC	PP	SP	DF	WF	IC	TOT
19%	0-5	402	1647	0	0	0	6	1653
81%	5-10	1727	11669	12	15	10	38	11743
total		2129	13316	12	15	10	44	13396
% by species			99%				1%	

1945 KLAMATH COUNTY INVENTORY	TOT AC
CUT 20.5 Pure ponderosa pine 22"+, med stocking	1391
CUT 21 - PP 12-22", poor stocking	16
CUT 21 - PP 12-22", med stocking	192
CUT 21 - PP 12-22", well stocked Y_9IC_1	100
CUT 22 - PP 0-12", poor stocking	178
CUT 22 - PP 0-12", med stocking	170
2 - grass/brush	82
total	2130

BIA Harvest

YEAR		1930	1931	1936	1937	1939	1940	Total
ACRES	72	200	98	817	384	380	178	2130

ANAL

TYPE		CW-M1	PP-IM	PP-M2	PP-PL	PP_M1	Total
ACRES	284	30	44	188	140	1443	2130

NRU Classification

TYPE	Sage/ Bbr	Bbr	D Mdw	Forest/						Jun/Mt Mah	Total
				Bbr	Bbr-man	Gr-forb	Man-cea	Oth	O Shr		
ACRES	28	24	68	1091	775	4	26	36	70	8	2130

Management Areas

MAM	03C	08	09A	10	12	Total
ACRES	134	48	400	578	969	2130

Ownership

OWNER	00035	20235A	20235P	Total
ACRES	2	144	1984	2130

Riparian

COMM		HCM	MM	Total
ACRES	1996	58	76	2130

VPC

TYPE		CP-S1-11	CP-S2-11	MD	Unk	Total
ACRES	2	272	1633	78	144	2130

PMR

TYPE	Grass	Shrub %			Tree %					Total
		15-25	41-55	71+	11-25	26-40	41-55	56-70	71+	
ACRES	68	42	6	12	280	768	918	10	24	2128

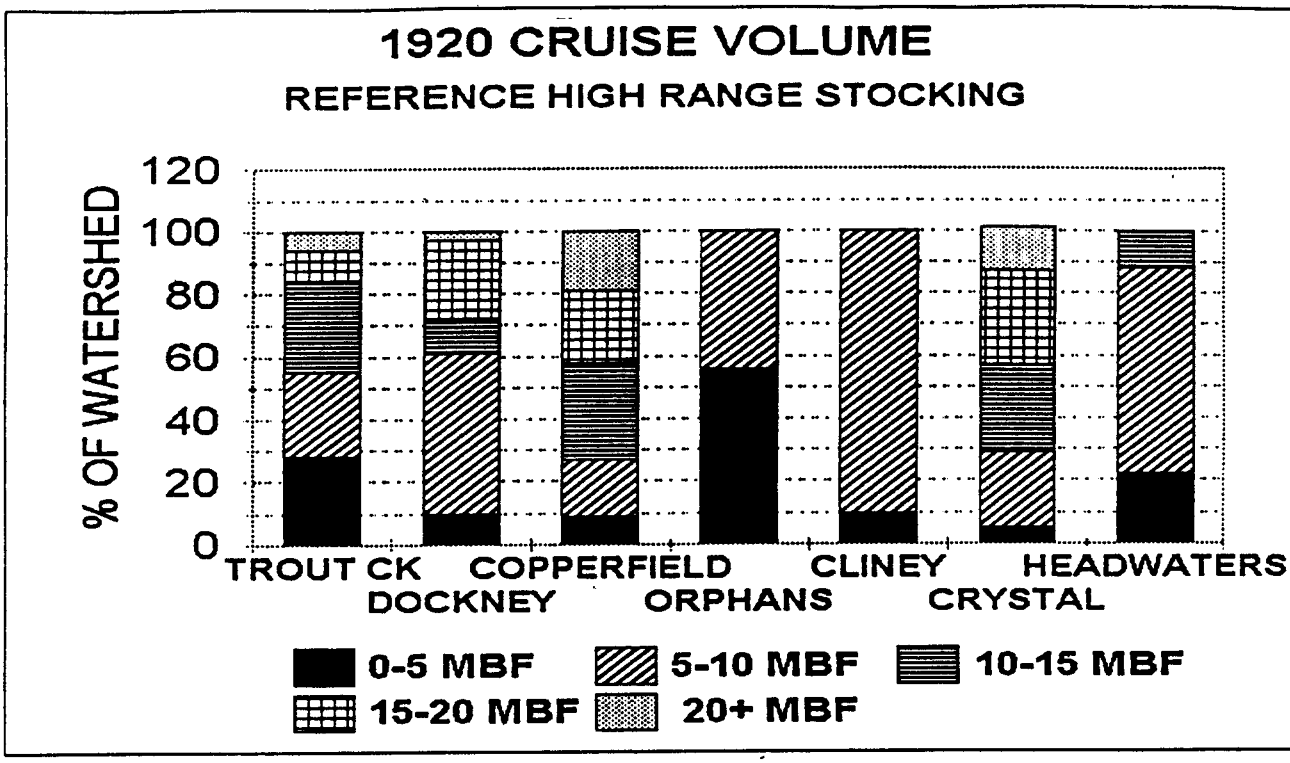
PMR

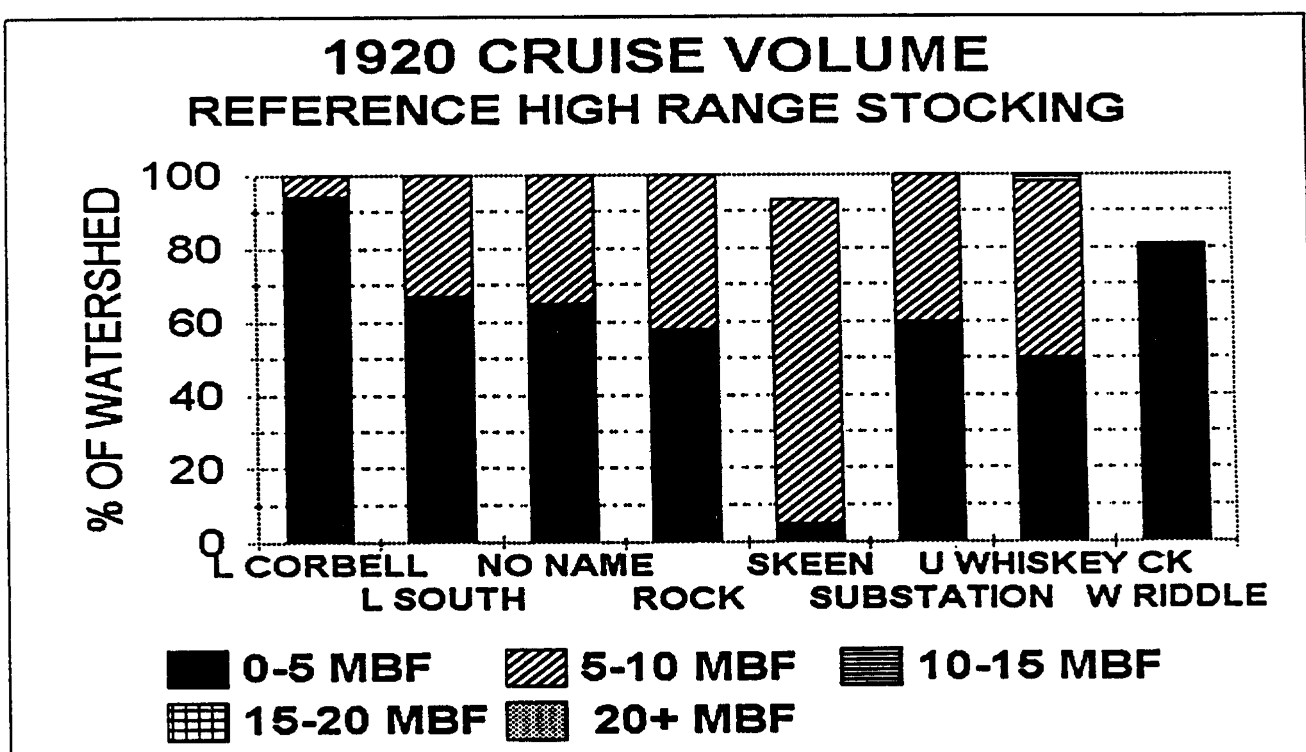
TYPE	Dissolved Poly		<25% any Sp	LP/PP	Mix Con	PP	Wat/Rk/Sn/ Gr/Shr	WF/DF/PP	Total
	Non-tree	Tree							
ACRES	12	28	256	58	10	1641	116	8	2129

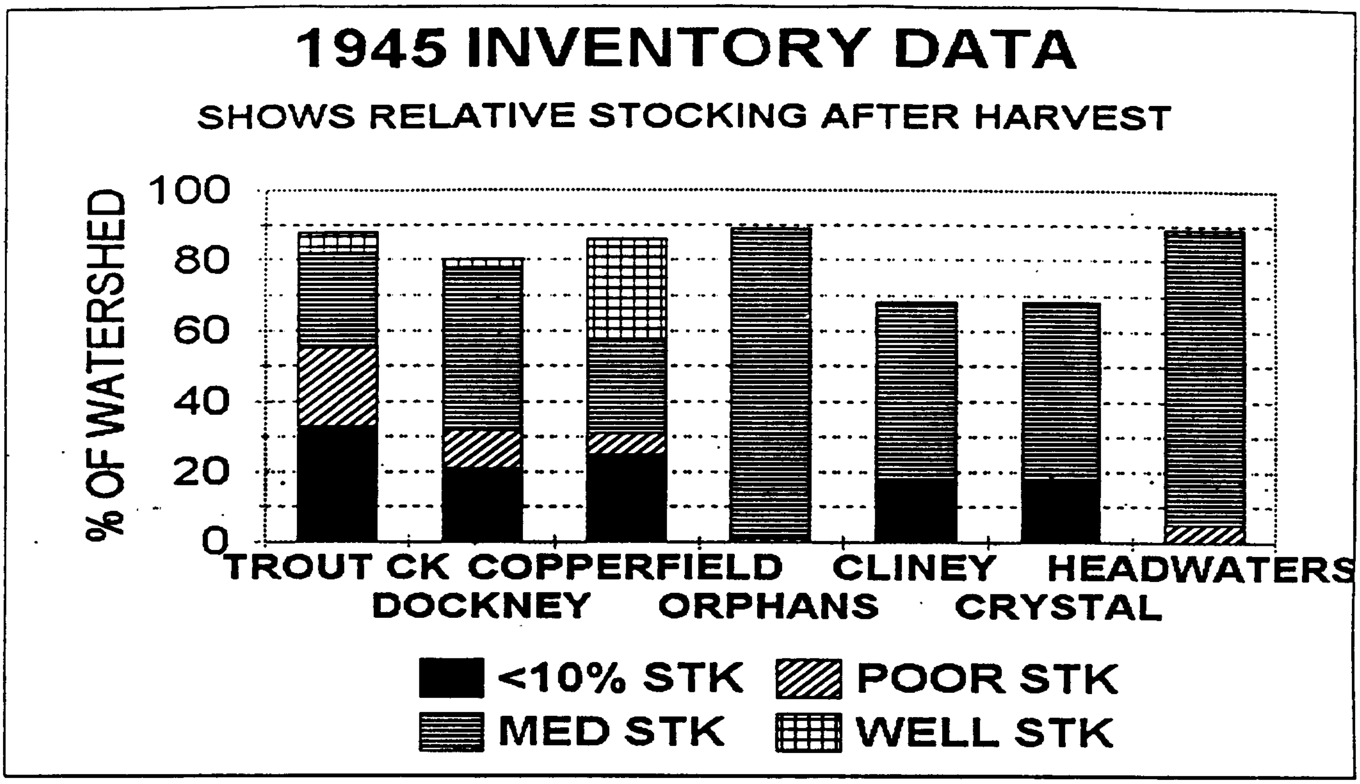
PMR Size

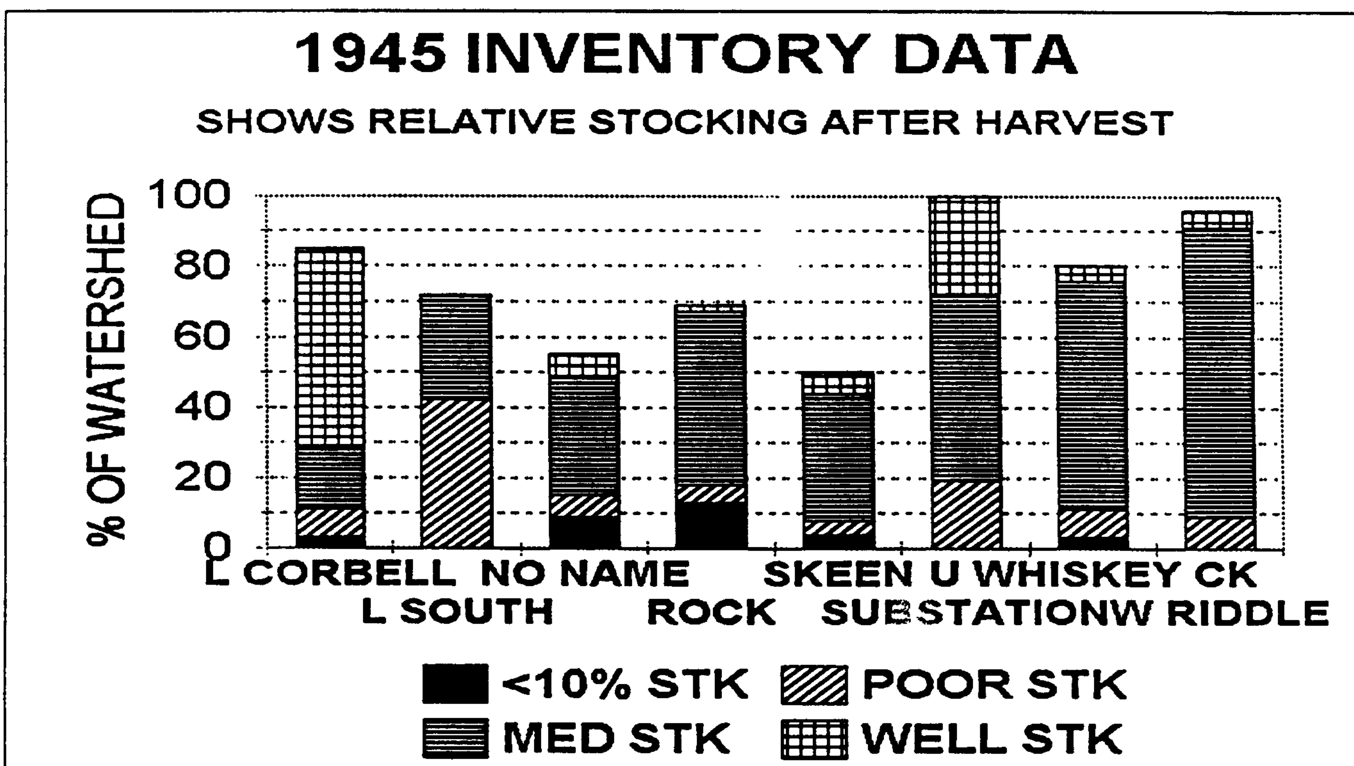
TYPE	Grass	Pole-Sm	Shr vig	Sm/MS+	Sm/MS-	Sm/MSLD	Total
ACRES	68	34	60	8	1625	334	2129

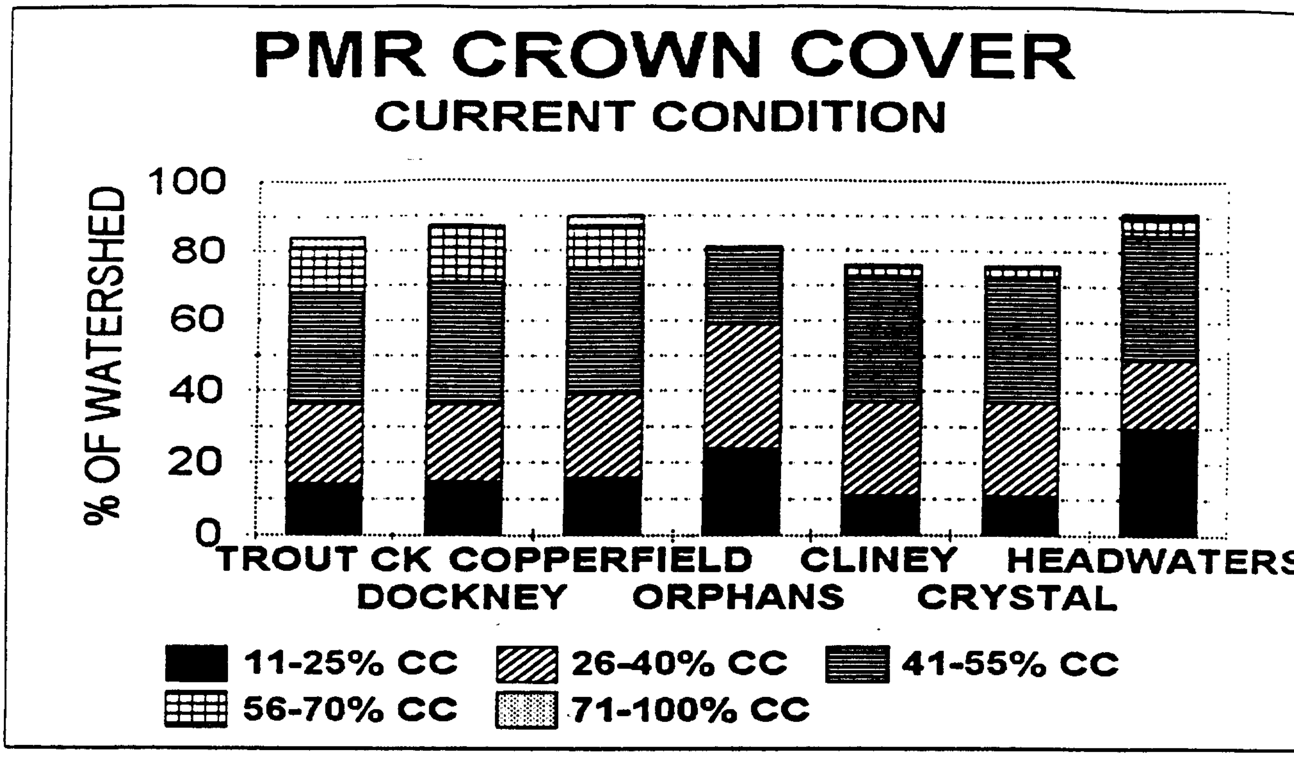
Appendix I. Additional Graphs and Charts

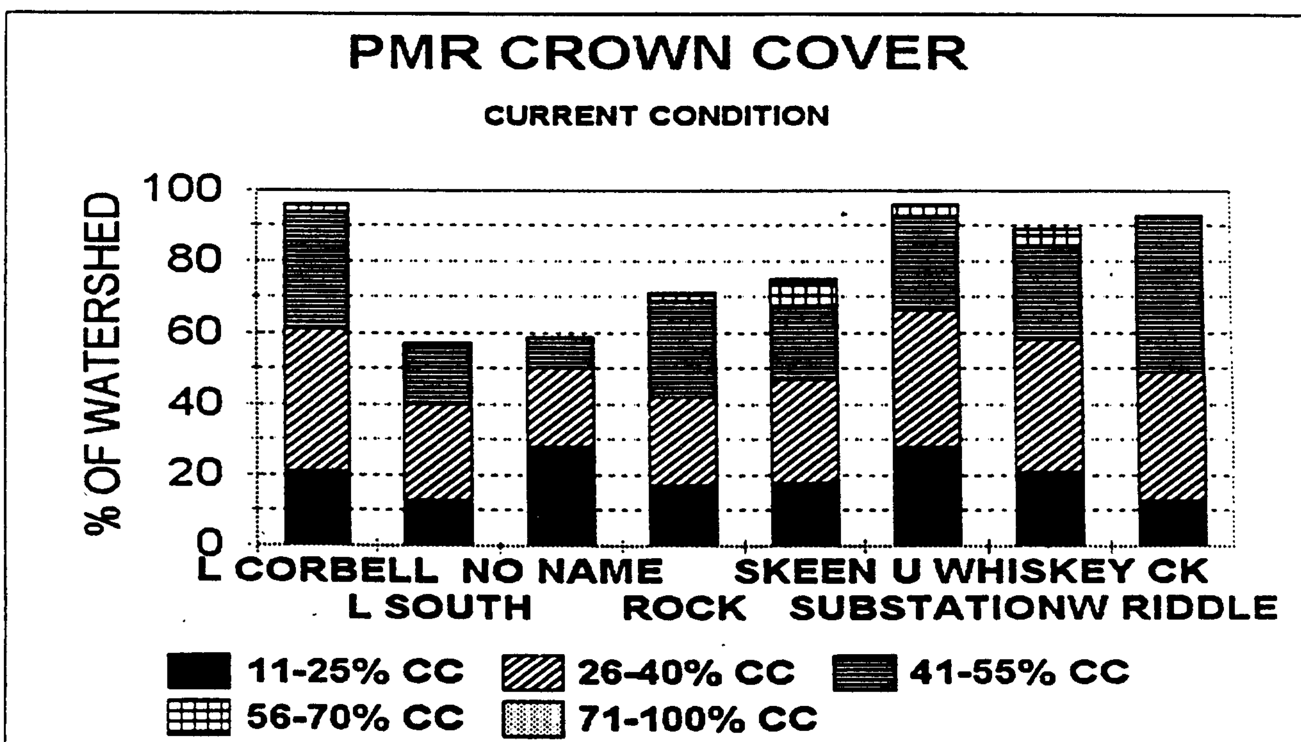


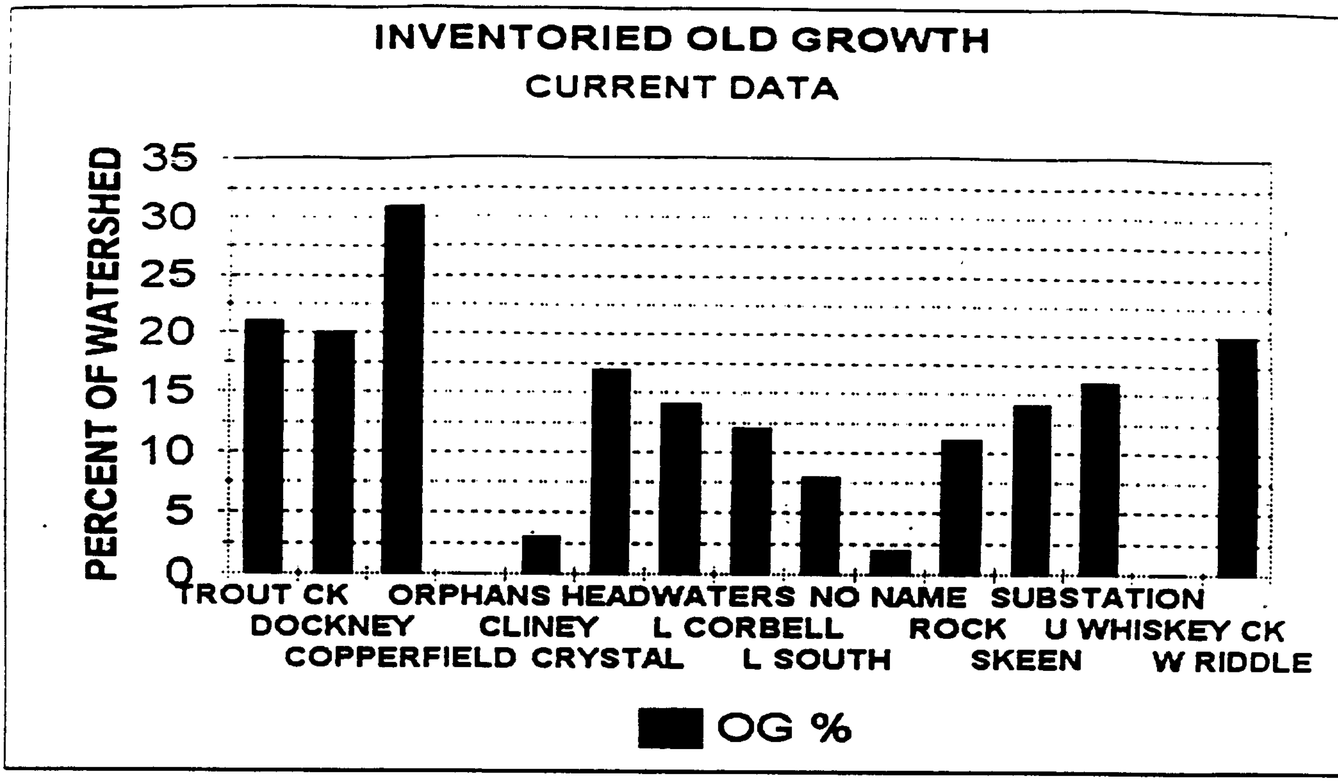


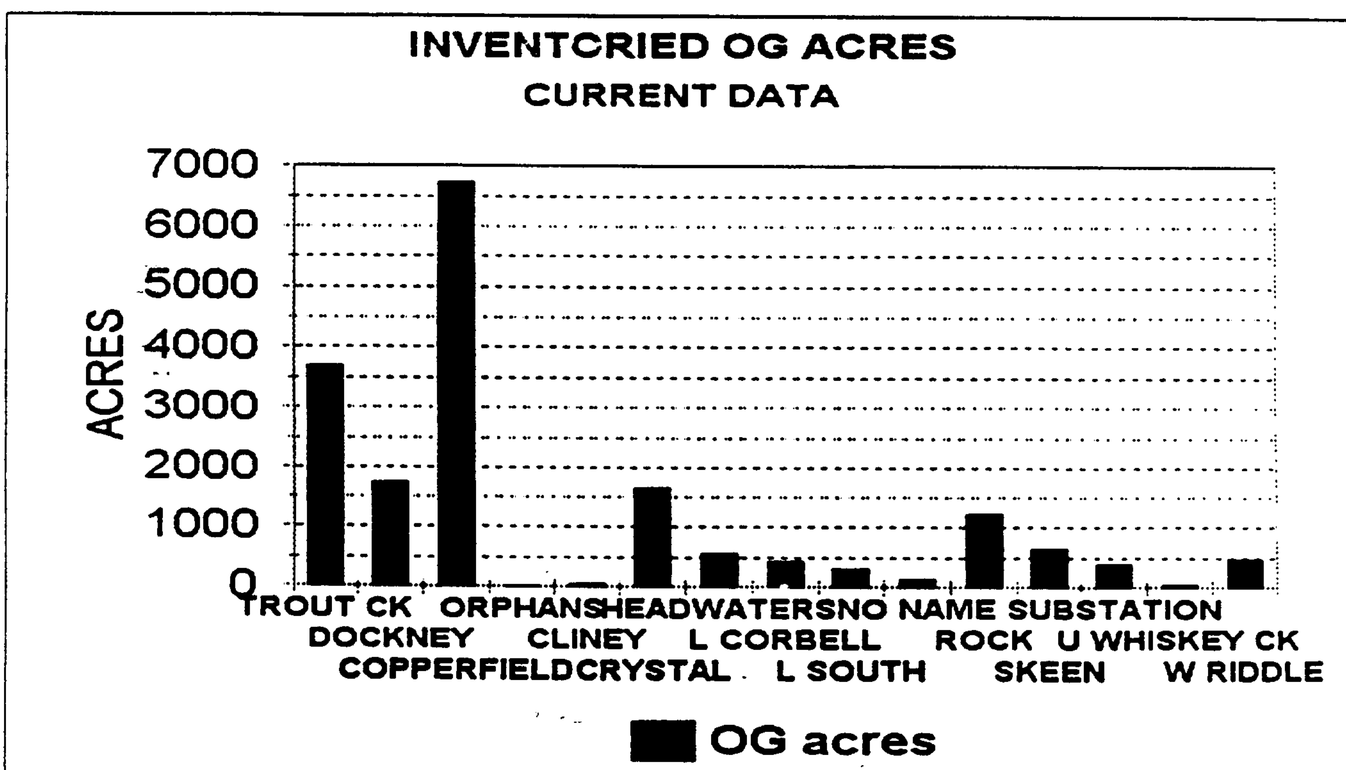

1945 INVENTORY DATA
SHOWS RELATIVE STOCKING AFTER HARVEST
% OF WATERSHED
100
80
60
40
20
0
TROUT CK
DOCKNEY
COPPERFIELD
ORPHANS
CLINEY
CRYSTAL
HEADWATERS
<10% STK
POOR STK
MED STK
WELL STK

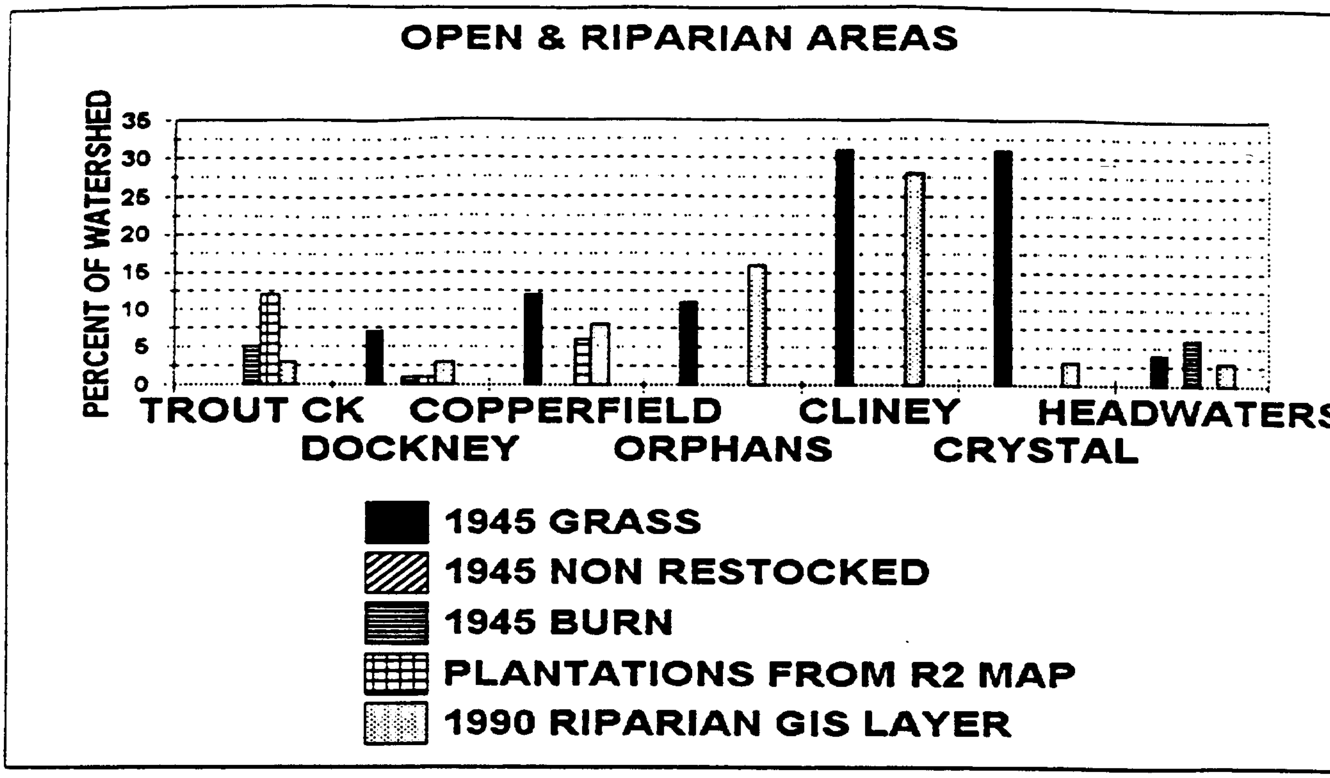

1945 INVENTORY DATA
SHOWS RELATIVE STOCKING AFTER HARVEST
% OF WATERSHED
100
80
60
40
20
0
L CORBELL
L SOUTH
NO NAME
ROCK
SKEEN
SUBSTATION
U WHISKEY CK
W RIDDLE
<10% STK
POOR STK
MED STK
WELL STK

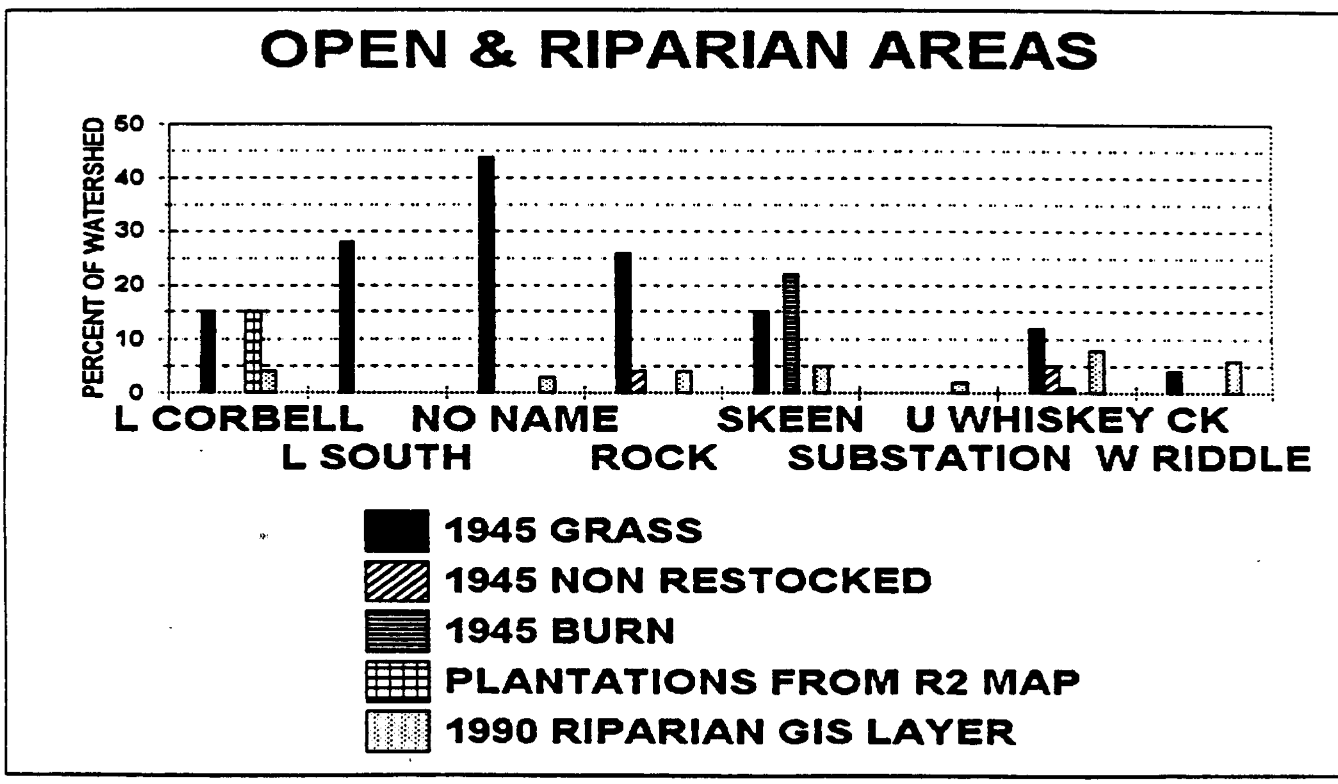

PMR CROWN COVER
CURRENT CONDITION
% OF WATERSHED
0
20
40
60
80
100
TROUT CK
DOCKNEY
COPPERFIELD
ORPHANS
CLINEY
CRYSTAL
HEADWATERS
11-25% CC
26-40% CC
41-55% CC
56-70% CC
71-100% CC


PMR CROWN COVER
CURRENT CONDITION
% OF WATERSHED
0
20
40
60
80
100
L CORBELL
L SOUTH
NO NAME
ROCK
SKEEN
SUBSTATION
U WHISKEY CK
W RIDDLE
11-25% CC
26-40% CC
41-55% CC
56-70% CC
71-100% CC


INVENTORIED OLD GROWTH
CURRENT DATA
PERCENT OF WATERSHED
35
30
25
20
15
10
5
0
TROUT CK
DOCKNEY
COPPERFIELD
ORPHANS
CLINEY
CRYSTAL
HEADWATERS
L CORBELL
L SOUTH
NO NAME
ROCK
SKEEN
SUBSTATION
U WHISKEY CK
W RIDDLE
OG %


INVENTCRIED OG ACRES
CURRENT DATA
ACRES
7000
6000
5000
4000
3000
2000
1000
0
TROUT CK
DOCKNEY
COPPERFIELD
ORPHANS
CLINEY
CRYSTAL
HEADWATERS
L CORBELL
L SOUTH
NO NAME
ROCK
SKEEN
SUBSTATION
U WHISKEY CK
W RIDDLE
OG acres


OPEN & RIPARIAN AREAS
PERCENT OF WATERSHED
35
30
25
20
15
10
5
0
TROUT CK
DOCKNEY
COPPERFIELD
ORPHANS
CLINEY
CRYSTAL
HEADWATERS
1945 GRASS
1945 NON RESTOCKED
1945 BURN
PLANTATIONS FROM R2 MAP
1990 RIPARIAN GIS LAYER


OPEN & RIPARIAN AREAS
PERCENT OF WATERSHED
50
40
30
20
10
0
L CORBELL
L SOUTH
NO NAME
ROCK
SKEEN
SUBSTATION
U WHISKEY CK
W RIDDLE
1945 GRASS
1945 NON RESTOCKED
1945 BURN
PLANTATIONS FROM R2 MAP
1990 RIPARIAN GIS LAYER

Appendix J. Lands Acquired by Forest Service Through Exchange or Purchase

Subshed	T-R-S	Yr.	Ac*	From**	Prev. Use	Pres. Use	Notes
208Z	36-11-27	1984	320	Weyco	Tim./Graz.	Tim./Graz.	
208Z	36-11-34	1979	160	OSDF	Tim./Graz.	Tim./Graz.	
208Z	36-11-34	1993	160	J-Spear	Tim./Graz.	Tim./Graz.	
Rock	37-11-6	1980±	140	Modoc	Tim./Graz.	Tim./Graz.	N.end Dams Mdw.
Rock	36-11-33	1980±	160	Gienger	Tim./Graz.	Tim./Graz.	See above
Hdwtrs.	36-10-25,26	1984	320	Weyco	Tim./Graz.	Tim./Graz.	Burned in 1980
W.Riddle	36-10-7	1984	160	Weyco	Tim./Graz.	Tim./Graz.	
Low. So.	36-9-1	1984	160	Weyco	Tim./Graz.	Mgmt Area 4	
208E	36-9-21,22,28	1979	520	OSDF	Timber	Timber	
208E	36-9-9,10,15, 16	1979	480	J-Spear	Tim./Graz./Ag.	Mgmt Area 4	Pt burned in 1987 Trt. Crk. Rnch.
208E	35-9-4; 36-9-2,3,4	1993	240	J-Spear	Tim./Graz./Ag.	Mgmt Area 4	burned in 1987.
Skeen	35-9-26	1984	130	Weyco	Tim./Graz./Ag.	Mgmt Area 4	part out of area
Skeen	36-9-26	1980±	135	Modoc	Tim./Graz./Ag.	Mgmt Area 4	Part in area
208H	35-8-24	1970±	80	Modoc	Ag./Graz.	Graz. till 1993	No Name Allot. Being rested.
208I	36-8-11	1980±	160	Gienger	Tim./Graz.	Timb/Graz.	N. End Choptie
208I	35-8-27,33,34	1970±	300	Modoc	Tim./Graz./Ag.	Graz. till 1993	Wright's Md. No Name Allot rested.
208I	35-8-4,9	1993	160	J-Spear	Tim./Graz./Ag.	Graz. till 1993	W. Copperfield No Name Allot.
L. Corb.	34-8-20	1987	160	Weyco	Tim/Graz.	Disp. Rec	Part out of area
Sbst/L.Corb.	34-8-19	1980±	79	Gienger	Tim/Graz.	Disp. Rec	Land Purchase
Crystal	35-7,23	1987	80	Weyco	Timber	Timber	
L. Corb.	34-8-30	1993	160	J-Spear	Timber	Disp. Rec.	
Subst.	34-8-30- 31	1987	280	Weyco	Timber	Disp. Rec	Part out of area

Total Acres = 4544

* Total lands acquired by Forest Service = 4544 acres

** Weyco = Weyhaeuser Timber Company; J-Spear = subsidiary of Modoc Lumber Company; Modoc = Modoc Lumber Company; Gienger refers to Gienger Enterprises, Inc.

Appendix K. Grazing Systems Effects on Vegetation & Hydrologic Function

Sheep routing schedules

Sheep are browsers, prefering palatable forbs (clover, strawberry, buckwheats) over grasses, and will use upland brush (bitterbrush). This forage preference permits more flexibility in routing sheep through the various communities to meet established management objectives for a particular area.

Time of routing through communities

- Little effect on riparian communities if each riparian area (meadow and hardwood communities) is used less than three to four days before mid-July.
- If routed later in the summer:
  - May reduce the young growth in hardwood communities.
  - May reduce some of the more desirable forbs.
- In upland brush communities:
  - If loose-herded and moved every four to five days, they will keep the upland brush in a more palatable and usable condition for a longer period of time.
  - If the sheep use the same area for an extended time period they will reduce the bitterbrush's ability to reproduce. Sheep tend to browse young conifers in June, during the candling period. This decreases vertical growth ability of young conifers. If sheep are loose-herded through young conifers after the candling period, they will tend not to remove terminal buds, thus should not effect young conifer's vertical growth.

Sheep Herding: If sheep are loose herded through areas, they tend not to impact areas as much as if they are close-herded. The effects of loose herding are: less soil disturbance, lighter utilization on forage plants, but may increase selectivity of browsing on individual plants, depending on length of time sheep are grazed in a particular area. Close-herding tends to increase soil disturbance, less individual plant selection, and higher utilization on all forage plants.

Plant response: Desired plant species (hardwoods, upland brush) if lightly browsed tend to increase growth, are generally able to reproduce, and maintain themselves. Heavy browsing tends to decrease lateral growth of plants, reduce young plant survival, reduce plants ability to reproduce.

Soils: Time of grazing, location of bedding areas, type of herding, length of time sheep are in an area, and soil conditions, will determine whether compaction, displacement will continue or occur in a particular area..

Channel Conditions: If sheep are loose herded, or herded around channels, forage utilization kept light, grazing timed to minimize impacts, there should not be any changes to the channel conditions. If sheep are close-herded, confined to an area for extended timeperiods at the wrong time, channel conditions can be expected to detiorate.

Upland Forage Use: Sheep are well suited for using the upland forage species (bitterbrush). They will actively move into the bitterbrush stands between July 1 and July 15, due to increased plant palatability. If forage use is maintained at less than 45% on bitterbrush, this will allow for plant maintenance and wildlife use. Utilization above 45% will keep plants in forage condition, will not allow plants to reproduce, may limit wildlife use on forage.

Cattle management systems:

Riparian pastures - The premise behind this system is to control cattle use in riparian areas, and only allow them in for short periods of time (two weeks to a month), when riparian communities are least susceptable to damage. Key forage species are identified and utilization standards set at 30% or less on these species Areas that need to be excluded are fenced out. Each pasture is given extended rest periods. Cattle are rotated so that they only use each pasture once during the grazing season , and each pasture is given a two or three year rest from livestock use.

Improvements : Water sources are located away from stream channels, fencing and control points needed are in place to keep animals from returning to the grazed pasture. Fence construction, water sources, administration, and maintenance of range improvements are expensive. Fencing cost can range from $4000 and up/mile. Water improvement costs can range from $10,000 and up depending on the type of development Fences, (1988) USDI, BLM & USDA, FS.

Plant Community response: Native plants should maintain themselves since each pasture is rested for two to three years, as long as utilization standards are strictly enforced. Increaser plants(Kentucky bluegrass) will maintain themselves and may increase slightly in density.

Soils: No detrimental conditions should become evident.

Channel Conditions: Channel conditions should improve, but will take longer unless sensitive portions are excluded within riparian pasture.

Partial Implementation of Riparian Pasture System:

Plant Community Response: Areas not under complete management, the native plant community will still experience detrimental impacts from overgrazing, loss of reproductive capability, stay in low maintenance condition. Increaser plants will maintain and increase at the expense of native plants (ex. Kentucky bluegrass increase, tufted hairgrass decrease).

Soils: Soil displacement, compaction, and movement will still be evident in areas not under management.

Channel Conditions: Channels that are degrading will continue to do so, that are not under complete management.

Corridor fencing combined w/rotation system: This system excludes livestock completely from channels, and the associated hardwood vegetation, plus cattle are rotated around the allotment using some type of pasture system, either, deferred rotation, rest rotation, etc.

Improvements: Fencing for pastures in place, plus exclusion fencing of channels in place, water developments located and in place to disperse cattle evenly across pasture. Forage balanced evenly in all pastures. Maintenance costs very expensive.

Plant Community Response: The riparian plant community associated with the stream channel will maintain and increase in density. Native riparian vegetation outside of excluded area will respond to grazing either positively or negatively depending on time of grazing, length of rest period, amount of time cattle are allowed to use each pasture, and utilization levels allowed.

Soils: There should not be any soil problems within the excluded area. Soil monitoring outside of excluded area will determine if detrimental compaction, movement, displacement is occurring.

Channel Conditions: Channel conditions should remain stable, and/or improve in excluded areas.

Rest-Rotation System: Grazing system set up with at least three or four pastures One pasture is rested completely through the grazing season, and the remaining pastures are rotated through the grazing season. Rotations are set up at different plant phenology stages, (5-leaf, boot stage, seed ripe), plus the desired utilization levels. Forage is balanced in all pastures. Water distributed throughout each pasture in order to spread the animals and minimize animal concentration areas.

Plant Community Response: Some native plants do not adapt to this system very well,(ex. willows, cusick's bluegrass if scheduled for mid to late grazing. Increaser grasses and forbs can be maintained for long periods of time, and will actually increase in density (ex. Kentucky bluegrass, longstalk clover, Mat Muhly).

Soils: There is a slight increase for soil compaction and displacement, as well as some pedastaling of plants especially native bunch grasses (ex. Cusick's bluegrass, tufted hairgrass).

Channel Conditions: Unstable banks will take longer times to repair unless excluded. Riparian vegetation armament may be weakened (sedges and hardwoods) during mid to late grazing schedule period.

Deferred Rotation: This system is either a two or three pasture system, where each pasture is alternated between early grazing one season then grazed late the following season. Forage amounts are balanced in each pasture. Fencing used only where needed to separate pastures. Water distributed throughout each pasture for more even distribution of animals.

Plant Community Response: Riparian hardwoods are more susceptable to grazing damage especially in August when grasses and forbs become less palatable. Native grasses and sedges may decrease in density, and species composition in meadows. Increaser plants will maintain and increase in species composition.

Soil Conditions: Same types of problems that occur under rest-rotation will surface with this system, also.

Channel Conditions: Same problems will become evident with this system as the rest-rotation system only there may be more tendency to destabilize channels since riparian hardwoods don't have the benefit of one or more seasons of rest from grazing.

Holistic Grazing: The allotment is broken up into cells, and each pasture (cell) is evaluated according to needs of the wildlife, plants, soils, permittee, and agency. Each cell is grazed for two weeks and then rested for two weeks. This is one type of intensive-flash grazing. This system usually requires very extensive fencing systems, and water developments. It is more suited for pastures that have the same type of vegetation throughout the entire pasture. The system is further designed for yearlong livestock operations, and not for three or four month grazing seasons, although it can be adapted to include areas with a three or four month grazing season.

Plant Community Response: Riparian hardwood communities are very susceptable to damage under this system if grazed at the wrong time of year, as well as some of the native grasses and sedges. Modification of the system to allow only a two week period during the entire year in riparian hardwoods would minimize damage especially if grazed before mid-July.

Soil Conditions: Soil compaction, displacement, and puddling can become more evident with this system.

Channel Conditions: Same problems with destablizing channels or furthering destablization, unless the system is modified to graze the channel areas when they are least susceptable to damage.

Continuous Grazing: This system allows livestock to graze over the entire allotment for the entire grazing season, very little control is exherted over the animals. Fencing is usually minimal along with minimal water developments.

Plant Community, Soil Conditions, Channel Conditions: All of these components become highly susceptable to damage under continuous grazing. Animals are allowed to move across the allotment there will be areas that are heavily impacted due to animal preference. There will be other areas that will not receive any utilization, generally these will be areas that do not havewater or preferred forage species.

Response of site under permanent exclusion:

Rapid response of hdwd community= more young plants
density of increasers reduced, soil displacement & compaction reduced.
more leaf growth on Hdwds below 4 ft height
upland conifer /brush encrc ıchment into riparian zone reduced.
Channel narrowing, raw banks revegetating.
Increase in litter cover.

Response of site under long-rest, then grazed:

Class of Animals: Whether cattle or sheep are to be used, will determine the length of time for plant communities to achieve proper composition of native grasses, and hardwoods. Generally communities will take longer to reach desired management objectives.

Grazing Season and System: Both of these factors will play a role in response of the plant communities, the soil conditions, and channel conditions, and will determine the success or failure in achieving desired management objectives for the plant communities, soils, and channel conditions.

Appendix L. WNF Threatened and Endangered Species

The following tables may or may not contain specific labels. To improve the reader's understanding of the tables, the following labels and definitions may apply.

Fed/St List: C2 - Category 2; LE - Listed Endangered; SV - State variable; SU - State undetermined; SC - Statecritical.
FS List: S - Sensitive: E - Endangered.
Cat: WIS - Winema indicator species; GF - general forest; FUR - Furbearer; BG - Big game; CAR - Carnivor; MWF - Migratory waterfowl.
P/A: P - Present; A - Absent

SOS FISH

Common name	Scientific name	Fed/St List	FS List	Cat.	Cold water	Warm water	P/A
brook trout	*Salvelinus fontinalis*			GF	Y		P
brown bullhead	*Ameirus nebulosus*					Y	P
brown trout	*Salmo trutta*			GF	Y		P
fathead minnow	*Pimephales promelas*				Y		A
inland rainbow trout	*Oncorhynchus mykiss gibbsi*	C2	S	GF	Y		P
klamath smallscale sucker	*Catostomus snyderi*				Y		A
largemouth bass	*Micropterus salmoides*			GF		Y	P
largescale sucker	*Catostomus macrocheilus*	C2	S		Y		P
lost river sucker	*Deltistes luxatus*	LE	E		Y		P
marbled sculpin	*Cottus klamathensis*				Y		P
pacific lamprey	*Lampetra tridentata*				Y		P
pit-klamath brook lamprey	*Lampetra lethophaga*				Y		P
shortnose sucker	*Chasmistes brevirostis*	LE	E		Y		P
slender sculpin	*Cottus tenuis*	C2	S		Y		A
speckled dace	*Rhinichthys osculus*				Y		P
tui chub	*Gila bicolor*				Y		A
yellow perch	*Perca flavenscens*			GF		Y	P

SOS AMPHIBIANS

Common name	Scientific name	Fed/St List	P/A
bullfrog	*Rana catesbeiana*		P
cascade frog	*Rana cascadae*	C2	A
foothill yellow-legged frog	*Rana boylii*	SU	A
great basin spadefoot	*Scaphiophus intermontanus*		P
long-toed salamander	*Ambystoma macrodactylum*		P
oregon slender salamander	*Batrachoseps wrighti*	SC	A
pacific tree frog	*Pseudacris regilla*		P
red-legged frog	*Rana aurora*	C2	A
roughskin newt	*Taricha granulosa*		A
spotted frog	*Rana pretiosa*	C2	A
western toad	*Bufo boreas*		P

SOS REPTILES

Common name	Scientific name	Fed/St List	FS List	P/A
common garter snake	Thamnophis sirtalis			P
gopher snake	Pituophis melanoleucus			P
northern alligator lizard	Elgaria coeruleas			A
northwestern pond turtle	Clemmys marmorata	C2	S	A
racer	Coluber constrictor			P
ringneck snake	Diadophis punctatus			A
rubber boa	Charina bottae			P
sagebrush lizard	Sceloporus graciosus			P
short-horned lizard	Phrynosoma douglassi			P
striped whipsnake	Masticophis taeniatus			P
w. terrestrial garter snake	Thamnophis elegans			P
wandering garter snake	Thamnophis vagrans			P
western fence lizard	Sceloporus occendatilis			P
western rattlesnake	Crotalis viridis			P
western skink	Eumeces skiltonianus			P

SOS WATERFOWL

Common name	Scientific name	Cat	P/A
american Coot	*Fulica americana*	MWF	P
american wigeon	*Anas americana*	MWF	P
barrow's goldeneye	*Bucephala islandica*	MWF	P
blue-winged teal	*Anas dicors*	MWF	P
bufflehead	*Bucephala albeola*	MWF	P
canada goose	*Branta canadensis*	MWF	P
canvasback	*Aythya valisineria*	MWF	P
cinnamon teal	*Anas cyanoptera*	MWF	P
common goldeneye	*Bucephala clangula*	MWF	P
common loon	*Gavia immer*	MWF	A
common merganser	*Mergus merganser*	MWF	P
double-crested cormorant	*Phalacrocorax auritus*	MWF	P
gadwall	*Anas strepera*	MWF	P
green-winged teal	*Anas crecca*	MWF	P
hooded merganser	*Lophodytes cucullatus*	MWF	P
lesser scaup	*Aythyra affinis*	MWF	P
mallard duck	*Anas platyrhynchos*	MWF	P
northern pintail	*Anas acuta*	MWF	P
northern shoveler	*Anas clypeata*	MWF	A
redhead	*Aythya americana*	MWF	P
ring-necked duck	*Aythyra collaris*	MWF	P
ross' goose	*Chen rossii*	MWF	A
ruddy duck	*Oxyura jamaicensis*	MWF	P
snow goose	*Chen caerulescens*	MWF	A
tundra swan	*Cygnus columbianus*	MWF	P
wood duck	*Aix sponsa*	MWF	P

SOS MAMMALS

Common name	Scientific name	Fed/St List	FS List	Cat.	P/S
american badger	*Taxidea taxus*			FUR	P
american beaver	*Castor canadensis*			FUR	P
american marten	*Martes americana*		WIS	FUR	P
american pika	*Ochotona princeps*				P
belding ground squirrel	*Spermophilus beldingi*				P
big brown bat	*Eptesicus fuscus*				P
black bear	*Ursus americanus*			BG	P
black-tailed jackrabbit	*Lepus californicus*				P
bobcat	*Lynx rufus*			FUR	P
botta's pocket gopher	*Thomomys bottae*				A
bushy-tailed woodrat	*Neotoma cinera*				P
california ground squirrel	*Spermophilus beecheyi*				A
california kangaroo rat	*Dipodomys californicus*				A
california myotis	*Myotis californicus*				P
california wolverine	*Gulo gulo*	C2		FUR	A
canyon mouse	*Peromyscus crinitus*				P
coast mole	*Scapanus orarius*				P
common gray fox	*Urocyon cinereoargenteus*			CAR	P
common muskrat	*Ondatra zibethicus*			FUR	P
common porcupine	*Erethizon dorsatum*				P
coyote	*Canis latrans*			CAR	P
deer mouse	*Peromyscus maniculatus*				P
douglas squirrel	*Tamaiasciurus douglasii*				P
dusky-footed woodrat	*Neotoma fuscipes*				P
elk	*Cervus elaphus*			BG	P
ermine	*Mustela erminea*			FUR	P
fisher	*Martes pennanti pacifica*	C2		FUR	A
fringed myotis	*Myotis thysanodes*	SV			P
golden-mantled ground squirrel	*Spermophilus lateralis*				P
great basin pocket mouse	*Perognathus parvus*				P
heather vole	*Phenacomys intermedius*				P
hoary bat	*Lasiurus cinereus*				P
house mouse	*Mus musculus*				P
least chipmunk	*Tamias minimus*				P
little brown myotis	*Myotis lucifugus*				P
long-eared myotis	*Myotis evotis*				P
long-legged myotis	*Myotis volans*				P
long-tailed vole	*Microtus longicaudus*				P
long-tailed weasel	*Mustela frenata*			FUR	P
marsh shrew	*Sorex bendirii*				P
mink	*Mustela vison*			FUR	P
montane vole	*Microtus montanus*				P
mountain beaver	*Aplodontia rufa*				A
mountain cottontail	*Sylvilagus nuttalli*				P

Common name	Scientific name	Fed/St List	FS List	Cat.	P/S
mountain lion	*Felis concolor*			BG	P
mule deer	*Odocoileus hemionus*		WIS		P
north american lynx	*Felis lynx canadensis*	C2		FUR	A
northern flying squirrel	*Glaucomys sabrinus*				P
northern grasshopper mouse	*Onchomys leugogaster*				P
northern pocket gopher	*Thomomys talpoides*				P
northern river otter	*Lutra canadensis*			FUR	A
norway rat	*Ratts norvegicus*				P
ord's kangaroo rat	*Dipodomys ordii*				P
pacific jumping mouse	*Zapus trinotatus*				A
pacific shrew	*Sorex pacificus*				P
pallid bat	*Antrozous pallidus*	SV			P
pinyon mouse	*Peromyscus truei*				P
pronghorn antelope	*Antilocarpra americana*			BG	P
raccoon	*Procyon lotor*			FUR	P
red fox	*Vulpes vulpes*			CAR	P
sagebrush vole	*Lemmiscus curtatus*				P
shrew-mole	*Neurotrichus gibbsii*				P
silver-haired bat	*Lasionycteris noctivagans*				P
snowshoe hare	*Lepus americanus*				P
spotted bat	*Euderma maculatum*				A
striped skunk	*Mephitus mephitus*			FUR	P
townsend's big-eared bat	*Plecotus townsendii*	SC	S		A
trowbridge's shrew	*Sorex trowbridgii*				P
vagrant shrew	*Sorex vagrans*				P
virginia opossum	*Didelphis virginiana*				A
water shrew	*Sorex palustris*				P
water vole	*Microtus richardsoni*				P
western harvest mouse	*Reithrodontomys megalotus*				P
western jumping mouse	*Zapus princeps*				P
western pipistrelle	*Pipistrellus hesperus*				A
western pocket gopher	*Thomomys mazama*				A
western red-backed vole	*Clethrionomys californicus*				A
western small-footed myotis	*Myotis ciliolabrum*				P
white-tailed jackrabbit	*Lepus townsendii*	SV			P
yellow-bellied marmot	*Marmota flaviventris*				P
yellow-pine chipmunk	*Tamias amoenus*				P
yuma myotis	*Myotis yumanensis*				P

SOS BIRDS

Common name	Scientific name	Fed/St List	FS List	Hdwd	Mdw /Mar	ES	MS	LS	H20	P/A
American avocet	*Recurvirostra americana*				Y		Y	Y		P
American white pelican	*Pelicanus erythrorhynchos*	SV	S		Y		Y	Y	Y	
bald eagle	*Haliaeetus leucocephalus*	LT	T		Y		Y	Y	Y	P
California gull	*Larus californicus*				Y	Y	Y	Y		A
Common poorwill	*Phalaenoptilus nuttallii*				Y	Y	Y			P
american goldfinch	*Carduelis tristis*			Y	Y		Y	Y		P
american kestrel	*Falco sparverius*				Y	Y	Y	Y		P
american pipit	*Anthus rubescens*			Y	Y	Y	Y	Y		P
american robin	*Turdus migratorius*			Y	Y	Y	Y	Y		P
anna's hummingbird	*Calypte anna*				Y		Y	Y		A
ash-throated fly catcher	*My iarchus cinerascens*					Y	Y	Y		P
bank swallow	*Riparia riparia*	SU			Y	Y	Y	Y	Y	P
barn swallow	*Hirundo rustica*			Y	Y	Y	Y	Y	Y	P
belted kingfisher	*Ceryle alcyon*			Y	Y	Y	Y	Y	Y	P
black tern	*Childonias nigar*				Y	Y	Y	Y		A
black-chinned hummingbird	*Archilochus alexandri*				Y		Y	Y		P
black-headed grosbeak	*Pheucticus ielanocephalus*			Y	Y		Y	Y		P
black-necked stilt	*Himantopus mexicanus*				Y		Y	Y		P
black-throated gray warbler	*Dendroica nigrescens*						Y	Y		P
blue-gray gnatcatcher	*Polioptila caerulea*			Y	Y	Y	Y	Y		P
bonaparte's gull	*Larus philidelphia*				Y	Y	Y	Y		A
brewer's blackbird	*Euphagus cyanocephalus*				Y	Y	Y	Y		P
brewer's sparrow	*Spizella breweri*				Y		Y	Y		P
brown-headed cowbird	*Molothrus ater*				Y	Y	Y	Y		P
calliope hummingbird	*Stellula calliope*			Y	Y		Y	Y		P
caspian tern	*Sterna caspia*				Y	Y	Y	Y		A
cassin's finch	*Carpodacus cassinii*						Y	Y		P
cedar waxwing	*Bombycilla cedrorum*			Y	Y		Y	Y		P
chipping sparrow	*Spizella passerina*				Y	Y	Y			P
cliff swallow	*Hirundo pyrrchonota*				Y	Y	Y	Y	Y	P
common nighthawk	*Chordeiles minor*			Y	Y		Y	Y		P
common snipe	*Galinago gallinago*				Y		Y	Y		P
common yellowthroat	*Geothipis trichas*				Y		Y	Y	Y	P
cooper's hawk	*Accipter cooperii*						Y	Y		P
cordilleran flycatcher	*Empidonax occidentalis*						Y	Y		P
dusky flycatcher	*Empidonax oberholseri*			Y		Y	Y			P
european starling	*Sturnus vulgaris*			Y	Y	Y	Y	Y		P
flammulated owl	*Otus flammeolus*	SC			Y		Y	Y		P
forster's tern	*Sterna forsteri*				Y	Y	Y	Y		A
franklin's gull	*Larus pipixcan*	SP			Y	Y	Y	Y		A
gray flycatcher	*Empidonax wrightii*				Y		Y	Y		P
great egret	*Casmerodius albus*				Y		Y	Y	Y	P
greater sandhill crane	*Grus canadensis*	SV	S		Y	Y	Y	Y	Y	P

Common name	Scientific name	Fed/St List	FS List	Hd wd	Mdw /Mar	E S	M S	L S	H20	P/ A
greater yellowlegs	*Tringa melanoleuca*				Y		Y	Y		P
green-tailed towhee	*Pipilo chlorurus*					Y	Y	Y		P
hammond's flycatcher	*Empidonax hammondii*						Y	Y		P
hermit thrush	*Catharus guttatus*						Y	Y		P
hermit warbler	*Dendroica occidentalis*						Y	Y		A
horned lark	*Eremophila alpestris*				Y	Y	Y	Y		A
killdeer	*Charadrius vociferus*				Y	Y	Y	Y		P
lark bunting	*Calamospiza melanocorys*				Y		Y	Y		A
lark sparrow	*Chondestes grammacus*			Y	Y		Y	Y		P
lazuli bunting	*Passerina amoena*			Y	Y	Y				P
lincoln's sparrow	*Melospiza lincolnii*			Y	Y		Y	Y		P
loggerhead shrike	*Lanius ludovicianus*				Y		Y	Y		P
long-billed curlew	*Numenius americanus*				Y		Y	Y		P
long-billed dowitcher	*Lomnodermuis scolopaceus*				Y		Y	Y		A
long-eared owl	*Asio otus*			Y	Y		Y	Y		P
macgillivray's warbler	*Oporornis tolmiei*			Y			Y	Y	Y	P
marsh wren	*Cistothorus palustris*				Y		Y	Y	Y	P
merlin	*Falco columbaris*				Y	Y	Y	Y		P
mew gull	*Larus canus*				Y	Y	Y	Y		A
mountain bluebird	*Sialia currucoides*			Y	Y		Y	Y		P
n. rough-winged swallow	*Stelgidopteryx serripennis*			Y	Y	Y	Y	Y	Y	P
nashville warbler	*Vermivora ruficapilla*					Y	Y			P
northern goshawk	*Accipter gentilis*	C2	WIS		Y		Y	Y		P
northern harrier	*Circus cyaneus*				Y	Y	Y	Y		P
northern oriole	*Icterus galbula*			Y			Y	Y		P
olive-sided flycatcher	*Contopus borealis*						Y	Y		P
orange-crowned warbler	*Vermivora celata*					Y	Y			P
osprey	*Pandion haliaetus*						Y	Y	Y	P
pacific-slope flycatcher	*Empidonax difficilis*						Y	Y		P
peregrine falcon	*Falco peregrinus*	LE	E		Y		Y	Y		A
prairie falcon	*Falco mexicanus*				Y	Y	Y	Y		P
purple martin	*Progne subis*	SC					Y	Y	Y	P
red-naped sapsucker	*Sphyrapicus nuchalis*			Y			Y	Y		P
red-tailed hawk	*Buteo jamaicensis*				Y		Y	Y		P
ring-billed gull	*Larus delawarensis*				Y	Y	Y	Y		A
rough-legged hawk	*Buteo lagopus*				Y		Y	Y		P
ruby-crowned kinglet	*Regulus calendula*						Y	Y		P
rufous hummingbird	*Selasphorus rufus*						Y	Y		P
rufous-sided towhee	*Pipilo erythrophthalmus*			Y			Y	Y		P
sage thrasher	*Oreoscoptes montanus*				Y	Y	Y	Y		P
savannah sparrow	*Passerculus sandwichensis*				Y		Y	Y		P
say's phoebe	*Sayornis saya*				Y		Y	Y		P
sharp-shinned hawk	*Accipter striatus*						Y	Y		P
short-eared owl	*Asio flammeus*				Y		Y	Y		P

Common name	Scientific name	Fed/St List	FS List	Hd wd	Mdw /Mar	E S	M S	L S	H20	P/A
snowy egret	*Egretta thula*	SV			Y	Y	Y	Y	Y	P
solitary vireo	*Vireo solitarius*						Y	Y		P
spotted sandpiper	*Actitis macularia*				Y		Y	Y		P
swainson's hawk	*Buteo swainsoni*	SV			Y		Y	Y		P
swainson's thrush	*Catharus ustulatus*			Y		Y	Y	Y		P
townsend's warbler	*Dendroica townsendii*						Y	Y		P
tree swallow	*Tachycineta bicolor*			Y	Y	Y	Y	Y	Y	P
turkey vulture	*Cathartes aura*				Y		Y	Y		P
vaux's swift	*Chaetura vauxi*						Y	Y		P
vesper sparrow	*Pooecetes gramineus*						Y	Y		P
violet-green swallow	*Tachycineta thalassina*				Y	Y	Y	Y		P
warbling vireo	*Vireo gilvus*			Y			Y	Y		P
western kingbird	*Tyrannus verticalis*				Y		Y	Y		P
western sandpiper	*Calidris mauri*				Y		Y	Y		P
western tanager	*Piranga ludoviciana*						Y	Y		P
western wood-peewee	*Contopus sordidulus*					Y	Y	Y		P
white-crowned sparrow	*Zonotrichia leucophy s*				Y	Y	Y	Y		P
white-faced ibis	*Plegadis chihi*				Y	Y	Y	Y	Y	A
white-throated swift	*Aeronautes saxatalis*				Y		Y	Y		P
willet	*Catoptrophorus semipalmatus*				Y		Y	Y		P
williamson's sapsucker	*Sphyrapicus thyroideus*	SU						Y		P
willow flycatcher	*Empidonax traillii*			Y			Y	Y		P
wilson's phalarope	*Phalaropus tricolor*				Y		Y	Y		A
wilson's warbler	*Wilsonia pusilla*			Y	Y		Y	Y	Y	P
Yellow warbler	*Dendroica petechia*			Y	Y		Y	Y		P
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*				Y		Y	Y	Y	P
Yellow-rumped warbler	*Dendroica coronata*						Y	Y		P

SOS TES PLANTS

SPECIES NAME	COMMON NAME	STATUS	HABITAT	PRESENCE
Allium bolanderi	Bolander's onion	Sensitive	Dry,rocky clay soil below 4000'.	Absent, not likely to occur on D2
Arabis suffrutescens	Crater Lake Rockcress	C2	Steep,barren,gravelly pumice. Above 7000'	Absent
Arnica vicosa	Shasta Arnica	Sensitive	Sparsely veg. rocky slopes, 6500-8200'.	Absent
Asarum wagneri	Green-flowered ginger	Sensitive	Mix Conifer,Aspen, old grth, dist. Or rocky sites. 3100-8400'.	Suspected in Analysis Area
Astragalus peckii	Peck's milkvetch	C2	Deep, loose Pumice, LP/BB, or Juniper. 3000-5000'.	Suspected on D2
Botrichium pumicola	Pumice Grape-fern	C2	Pumice gravels, LP/BB/ Needle-Fescue Grass 4200-5150'.	Suspected on D2
Calliergon trifarium	Pond Moss	Sensitive	Standing H2O, Completely submerged	Suspected on D2
Calochortus longebarbatus	Mariposa Lilly	C2	Vernally moist clay loam soil in meadows, or adj to PP or LP stands.	Present in analysis area
Castilleja chlorotica	Green-tinged Paintbrush	C2	Shrub-grass opngs. 5000-8200'	Suspected on D2
Cicuta bulbifera	Bulb-bearing Water hemlock	Sensitive	Swamps & Marshes	Thought to be extirpated in OR.
Collomia mazama	Mount Mazama collomia	C2	Mid to High Elev., mesic For. Env. Volcanic Sls. 4000-8800'.	Suspected on D2.
Eriogonum diclinum	Jayne's Canyon Buckwheat	Sensitive	Serp.&Granitic Soils. 5700-7800'.	Absent in Analysis Area.
Eriogonum prociduum	Prostrate Buckwheat	C2	Weathered, grvlly, shllw vol. Soils. 4000-8000'.	Present adjacent to Analysis area.
Gentiana newberryi	Newberry's Gentian	Sensitive	Subalpine mdws, wet to mod. dry Sndy loam. 4000-8700'.	Suitable habitat on D2.
Haplopappus whitneyi	Haplopappus	Sensitive	Rocky ridges & Slopes 5000-7600'.	Suspected on D2
Hieracium bolanderi	Bolander's Hawkweed	Sensitive	Steep, Rocky southern slopes, w/whitebk pine, above 7000'.	Absent in Analysis Area
Melica stricta	Rock Melica	Sensitive	Rock OtCrps, grvl, smtimes under Juniper. 4600-7200'.	Present in Analysis Area.
Mimulus jepsonii	Jepson's Monkey-flower	Sensitive	Mesic LP, 4000-8000'.	Absent
Mimulus pygmaeus	Pygmy Monkey-flower	C2	Vernally moist, poor to moderate draned soils3600-5600'	Present in Analysis Area
Mimulus tricolor	Tricolored Monkey-flower	Sensitive	Vernally wet, clay loam sls, strmbks,	Not in An. area, but on Sycan R.
Penstemon glaucinus	Blue-leaved Penstemon	C2	Opngs & understry of mid to high elev. forests. 5900-8400'.	Present in analysis area.
Perideridia erthrorhiza	Red-Root Yampah	C2	Mst Mdws of DECE, POPR, KOCR&FEID, siltcly, loam tex. Sls. 4200'	Suitable habitat in analysis area.

SPECIES NAME	COMMON NAME	STATUS	HABITAT	PRESENCE
Perideridia howelli	Howell's Yampah	Sensitive	Mst Mdws, ravines & strmbanks to 5000'.	Suitable habitat in analysis area.
Rorippa columbiae	Columbia Cress	C2	Intermittant & ephemeral strms or lake margins. Veg cover<15%	Present in analysis area.
Silene nuda	Fringed Campion	Sensitive	Dry mdws in PP/LP for. Hvy sls. 4000-6000'.	Present in analysis area.
Thelypodium brachycarpium	Short-fruited Thelypodium	Sensitive	Mdws, cult flds, pastres, alk. Sls. 3000-6500'.	Suitable habitat in analysis area.

Table excerpted from Chiloquin Ranger District 1995 Sensitive Plant Species List.

Appendix M. Summary of Harvest Related Activities from Available Information

For periods of bia harvest and major activities from early 1980s to current
Activities from 1964 to 1980 are not included.

SUMMARY

BIA harvest logged most of the area, sales after 1919 were a strict 60% volume removal high risk cut which left trees through most size classes.

High risk type cuts from 1964 to 1980 covered most of the area again, some areas several times, high risk cut generally removed larger ponderosa pine.

Harvest since 1980, shown in table following, type of cut shown on table, total of 30,447 acres shown, or about 30% of watershed.

Reforestation shown is approximately 5,000 acres of about 5% of watershed. Reforestation was done, on a very small scale as early as 1930, but records are limited and those acres/activities are not included.

Precommercial thinning shown is 11,574 acres, or about 11% of the watershed. This is believed to be fairly complete.

BIA HARVEST SUMMARY

BIA Sale/ Compartment	Estimated Timber	Timber CUT	Years Cut	Price	PPine Revenue	Company
Antelope V	250 mmbf	166,890,050	744,741.17	3.75	744,741	Algoma, Kesterton
Big Bend	6 mmbf	7,006580	1919-1920 -	3.75	26,274.70	Chiloquin LC
Bray	?	721,600	1937	3.76	2,584.16	Chiloquin LC
Cherry Creek	37 mmbf	41,071,550	1925-1937 -	6.11	218,683.01	Campbell-Towlw LC
Chiloquin	?30 mmbf	170,144,00	1920-1932 ?	4.06	702,390	Chiloquin LC
Eggsman	?	7,889,320	1919-1925	3.25	25,522.00	Sprague Rv LC
Kawumkan BU	?	4,472,370	1938-1939	4.00	20,155.07	?
Little Sprague	35 mmbf	39,154,490	1923-1927	?	195,654.16	Bray
Rock Creek	30 mmbf	33,251,720	1929-1936	5.77	149,827.49	Gilbert McLennan
Round Mtn	1 mmbf	855,900	1929	4.70	4,074.08	Jack Horton
Saddle Mtn	133 mmbf	6,069,640	1940-1948	5.79	19,566.55	Ewauna Box
Sprague Can.	17 mmbf	9,055,070	1937	8.00/3.00	35,563	Chiloquin LC
Squaw Flat	200 mmbf	137,770,866	1929-1939	5.72	725,945.13	Shaw-Bertram
Trout Crk	160 mmbf	?	1926-1942	4.78	?	Klement & Kennedy
Weeks	?	54,688,800	1926-1937	7.84	303,805.81	Chiloquin LC
Whiskey Creek	150 mmbf	133,552,160	1929-1944	7.12	557,251.52	G.C. Lorenz

HARVEST SUMMARY

Project Name	Date1	Activity Code	Ac
Bear Wallow	12/8/84	HTH	1015
Big Bend	11/17/80.	HSH	1063
Big Bend	12/18/80	HFR	345
Big Bend	12/20/80	HFR	1029
Bottle Springs	10/10/80	HSV	234
Chiloquin Ridge	10/25/80	HPR	39
Cliney	11/4/86	HFR/HTH	238
Cliney	11/4/86	HPR/HTH	90
Cliney	4/15[illegible]	HSA/SPC	82
Cliney	4/8/[illegible]	HFR/HTH	30
Copperfield	10/30/85	HFR	140
Copperfield	11/10/86	HFR	840
Copperfield	11/10/86	HFR/SPC	81
Copperfield	3/22/91	HCC	116
Corbell	10/1/85	HFR	52
Corbell	10/30/85	HFR	33
Corbell	10/5/85	HFR/HTH	45
Corbell	3/22/91	HFR	15
Corbell	3/22/91	HOR	304
Corbell	3/22/91	HTH	99
Corbell	4/30/85	HFR	183
Corbell	5/91	HTH	95
Cowboy Salvage	1/23/89	HSV	847
Crystal Castle	1/31/81	HFR	48
Crystal Castle	10/28/80	HFR	400
Crystal Castle	10/5/83	HFR/TSI	340
Crystal Castle	11/17/80	HFR	140
Crystal Castle	11/17/80	HTH	64
Crystal Castle	11/28/80	HFR	360
Dams	10/31/85	HPR	37
Dams	10/31/85	HSA/HPR	15
Dams	11/3/86	HFR	215
Dams	11/3/86	HFR/TSI	41

Project Name	Date1	Activity Code	Ac
Dams	11/4/86	HFR	192
Devils	11/22/93	HSC/Thin	96
Edgewood	11/1/87	HCC	264
Edgewood	11/1/87	HOR	894
Edgewood	4/30/88	HCC	40
Edgewood	5/10/88	HCC	14
Edgewood	5/25/88	HCC	64
Edgewood	5/28/88	HOR	24
Edgewood	5/28/88	HPR	119
Fourbit	11/1/86	HPR	1110
Fourbit	11/5/86	HFR	359
Fourbit	11/5/86	HPR	96
Fourbit	11/6/86	HFR	220
Friendship	10/1/85	HFR/HTH	225
Friendship	10/8/83	HFR	33
Friendship	10/8/83	HPR/HFR	61
Friendship	11/1/85	HFR/HTH	34
Friendship	12/8/84	HFR/HTH	201
Lobert	4/1/85	HFR/SPC	400
Lobert	4/15/85	HFR/SPC	62
Modoc Point	11/5/86	HFR	733
Modoc Point	11/6/86	HFR	996
Modoc Rim	10/25/80	HFR	1214
Modoc Rim	10/25/80	HPR	307
Mustang Salvage	1/23/89	HSV	669
North Fork	11/22/88	HPR	847
North Fork	11/22/89	HPR	662
North Fork	3/25/91	HPR	399
North Fork	8/8/89	HSV	489
Plateau	11/1/87	HCC	119
Plateau	11/1/87	HOR	403
Plateau	5/1/88	HCC	13
Plateau	5/10/88	HCC	23
Plateau	5/15/88	HCC	12

Project Name	Date1	Activity Code	Ac
Plateau	5/25/88	HCC	45
Power	11/1/82	HFR	50
Power	11/1/87	HFR	83
Ranch Salvage	1/23/89	HSV	536
Shaws	4/25/85	HFR/SPC	67
Shaws	4/8/85	HFR/SPC	40
Shaws II	11/10/87	HTH	39
Shaws II	11/22/89	HPR	353
Shaws II	11/22/93	HPR	137
Shell Rock	10/30/85	HSH	75
Shell Rock	12/1/84	HPR	38
Shell Rock	12/8/84	HFR	5017
Shell Rock	12/8/84	HPR	391
Shell Rock	12/8/84	HSA	19
Swan Lake	10/17/80	HFR	159
Swan Lake	10/17/80	HPR	589
Trout	11/1/87	HFR/HTH	396
Trout	11/1/87	HOR	356
Twobit	11/1/87	HOR	51
Twobit	11/1/87	HOR/HSA	271
Twobit	11/1/87	HOR/HTH	26
Twobit	11/1/87	HPR/HTH	24
Wood	11/15/89	HOR	782
Wood	11/15/89	HPR	389
Wood	5/21/91	HCC	161
Wood	7/3/91	HCC	29
Wrights Meadow	1/4/81	HPR	255

REFORESTATION SUMMARY

REFOREST EA NAME	ACT	ACT YR	Ac
CLINEY	P		688
CORBELL	P	92	36
CRATER	P	92	16
DAMS	P		192
EDGEWOOD	P	88	182

REFOREST EA NAME	ACT	ACT YR	Ac
FOURBIT	P		80
LOBERT	P		112
MODOC	P		174
PLATEAU	P	88	262
POWERLINE	P		26
SHELLROCK	P	88	30
SURPRISE	P		est. 1400
TWOBIT	P		86
WOOD	P	91	104
WOOD	P	92	26
WRIGHTS	P	91	354
YAINAX	P		1088

PRECOMMERCIAL THINNING SUMMARY

Project Name	Date1	Activity Code	Ac
?	10/3/83	SPC	14
?	4/25/85	SPC	15
Anderson	12/1/87	Thinning	238
Backlog	11/17/81	SPC	80
Backlog	11/25/80	SPC	63
Backlog	11/27/80	SPC	52
Backlog	11/28/80	SPC	104
Backlog	12/28/80	SPC	52
Backlog	12/31/80	SPC	46
Backlog	2/20/82	SPC	80
Backlog	4/10/85	SPC	77
Backlog	6/12/83	SPC	156
Backlog	7/11/83	SPC	139
Bad Burn	4/10/85	SPC	157
Big Bend	11/17/80	SPC	723
Calico Springs	7/11/82	Thinning	242
Chiloquin Ridge	11/18/80	SPC	400
Cliney	10/15/86	Thinning	434
Copperfield	3/22/91	Thinning	749
Copperfield	3/91	Thinning	46

Project Name	Date1	Activity Code	Ac
Corbell	3/22/91	Thinning	630
Corbell	4/1/91	Thinning	69
Corbell	5/30/80	SPC	78
Crystal	4/10/85	SPC	22
Crystal Burn	5/7/85	SPC	90
Crystal Castle	10/12/82	Thinning	32
Crystal Castle	10/5/84	SPC	105
Crystal Castle	8/18/82	Thinning	142
Crystal Castle	9/10/82	SPC	67
Crystal Castle	[illegible]/82	Thinning	431
Crystal Thinning	[illegible]/82	SPC	306
Dams	[illegible]/87	Thinning	148
Dockney	12/6/84	SPC	47
Edge	7/1/90	Thinning	45
Lobert	11/1/87	Thinning	167
Lobert	11/6/82	SPC	20
Lobert	11/6/82	Thinning	215
Lobert	12/12/80	SPC	491
Lobert	12/28/80	SPC	126
Lobert	12/7/83	Thinning	75
Lobert	8/28/80	SPC	168
Lobert	9/19/80	SPC	260
Long Burn	4/10/85	SPC	94
Modoc	7/11/83	SPC	301
Modoc	8/12/83	Thinning	321
Modoc 85	7/1/87	Thinning	287
Modoc Backlog	4/10/85	SPC	52
Modoc Point	10/29/92	Thinning	158
Modoc Point	12/6/84	Thinning	178
Modoc Point	2/4/93	Thinning	133
Modoc Rim	11/1/82	SPC	107
North Fork	2/1/93	Thinning	137
Plateau		Thinning	
Power	11/1/87	Thinning	107

Project Name	Date1	Activity Code	Ac
Section 29	4/10/85	SPC	110
Section 30	4/10/85	SPC	5
Shell	12/1/87	Thinning	505
Shell	12/87	Thinning	49
Shell	3/21/91	Thinning	23
Shell	3/91	Thinning	112
Shell	5/20/88	Thinning	200
Shell Rock	12/87	Thinning	116
Squaw	4/25/85	SPC	17
Trout Creek	11/1/87	Thinning	157
Whiskey Creek	12/8/84	Thinning	209
Wrights F A.	7/1/90	Thinning	340
Wrights Meadow	12/6/84	SPC	173
Wrights Meadow	8/28/80	SPC	82

Appendix N. Road Treatment Recommendations

The following are recommended treatments for specific roads within the SOS area. By implementing these recommendations, the hydrologic function of the involved drainage should improve.

Road Obliteration - Remove the road in its entirety, and return the prism to its natural state.

1119-201	2220-140	5805-040	5813-184	5813-190
1119-202	2220-142	5813-380	5813-185	5813-191
1119-211	4025-530	5813-210	5813-186	5815-546
1119-205	4083-150	5813-181	5813-187	5815-160
1119-226	4083-151	5813-182	5813-188	5850-800
1119-220	4083-152	5813-183	5813-189	5850-900

Roads Needing Engineering Modification - Redesign of culvert installation.

22	4083	5813	5825	5850
2220	5805	5817	5825-180	

Appendix O. Watershed Assessment Team

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

Susan Puddy, Chiloquin R.D.	Team Leader, Silviculture
Ken Van Zee	Alternate Team Leader
Jim Cassidy, Chemult R.D.	Soils and Geology
Elizabeth Williams, Chemult R.D.	GIS/Database Management
Jay Frederick, Chiloquin R.D.	Wildlife/Fisheries
Rich Howard, Chiloquin R.D.	Range/Wildlife/Cultural Uses
Tim Sexton, Chiloquin R.D.	Fire/Climate
Mike Mc Neil, S.O. Ecosystem Mgt.	Hydrology/Geology
Sue Mattenberger	Hydrology
Rex Appleby, S.O. Ecosystem Mgt.	Writer/Editor

Thanks also to the following individuals for their assistance, input and technical expertise. Their contributions, though sometimes seemingly miniscule, helped to make the completion of this assessment possible:

Elizabeth Budy, Forest Archaeologist	Carol Rogers, S.O. Engineering
Treg Christopher, D2 Biological Tech.	Barry Kolar, D2 Biological Tech.