INTERPRETATION

CHAPTER IV

INTERPRETATION

Introduction

This section is a synthesis and interpretation of the information presented in previous sections. It specifically resolves or interprets the import of differences or similarities between current conditions and reference conditions, and gives some indication of current use and resource trends. This interpretation is presented by each Issue and Key Questions as presented in Section III of this analysis and constitutes the answers to the Key Questions.

Issue #1

Intensity and pattern of vegetation manipulation related activities.

The acreage of various successional stages has not been changed appreciably across the whole watershed by vegetation management from the amounts of various age classes present prior to harvesting initiation and fire suppression. However, the pattern created across this landscape is now quite different from any pattern that has ever existed within this watershed in the foreseeable past.

Previous to vegetation management, the area west of the main channel of the North Fork typically had little edge habitat and abundant late-successional, interior habitat between the infrequent, landscape scale fires. This area is now highly fragmented and though late-successional forest still exists, it now contains little functional interior habitat due to the fragmentation that has occurred. The upper North Fork typically contained many acres of young stands generated by frequent large fires. This area now is almost totally occupied by mature forests. This area contains the Wilderness Areas and portions of the Late-Successional Reserve. Reserves located in areas prone to relatively frequent, large wildfires may not provide late-successional habitat over the long-term. Additionally, young fire stands often included riparian areas, especially in upper drainage areas.

Projecting current management direction into the future results more or less in a continuation of the current pattern. The steeply dissected slopes west of the river will continue to be managed relatively intensively (i.e., harvest rotations shorter than natural fire rotations), creating abundant edge and necessitating the maintenance of an extensive road system. Currently programmed intensive forest management will tend to keep substantial acreage's of this portion of the watershed in a hydrologically unrecovered condition. Elevated peak flows can mobilize sediment generated by natural slope failures and sediment stored behind in-channel structures.

Large acreage's with low hydrologic recovery percentages and many miles of open road could contribute to a chronic sediment generating condition, though roads typically produce most of the management generated sediment production. This may be of particular concern in the area west of the lower North Fork. This area has a dense stream network, areas of deep and potentially unstable soil, a high percentage of area within the transitional snow zone, and many areas of known slope instability adjacent to stream channels. Though riparian reserves will not be disturbed by harvest in the future, the currently programmed intensive management of the uplands will keep this area in a relatively fragmented condition. Though riparian reserves will provide functional habitat for some species (small patch and contrast guilds), riparian reserves are not wide enough to provide much, if any, interior, late-successional habitat.

ISSUE #1 KEY QUESTIONS

QUESTION 1

Given current Forest Plan (as amended) land allocations, where and how many acres are available for vegetation manipulation (especially timber harvest)?

Though the watershed contains relatively large acreage's of land allocations providing for timber harvest (see Table 1 of the Characterization chapter), a small percentage will be available for regeneration harvest over the next two decades due to the amount of regeneration harvest that has occurred in the past, and due to the amount of unsuited lands and riparian reserves. In the next 20 years approximately 4300 acres of General Forest management area, 1394 acres of 11a management area, 5200 acres of 11c management area, and 1100 acres of 11d management area would be available for regeneration harvest. These acreage's are only potentially available; various resource objectives such as overall viewshed conditions, big game habitat conditions, maximum allowable opening size restrictions, hydrologic recovery conditions, etc., may limit the amount of this timber that could be harvested in any given period within all Management Areas.

It is beyond the scope of this analysis to indicate exactly how many acres could be harvested given various Forest Plan objectives, especially in terms of hydrologic condition, big game habitat conditions, or visual quality objectives. It is also beyond the scope of this analysis to indicate exactly where these acres are available, but generally each sub-watershed with Forest Plan Management Areas providing for harvest has some areas available for regeneration harvest in the next ten years, with the exception of the Huckleberry Flats area and the Wild and Scenic River corridor, which have only areas available for commercial thinning, and of course those areas currently allocated to non-harvest uses such as wilderness. No area has substantially larger regeneration opportunities than do others, though a number of sub-drainage's (17-C, D, E, F, G, H, I, I, Q, and 17-1 through 8) have limited near-term opportunities due to a combination of past harvest and hydrologic sensitivity.

Approximately 22,000 acres will be available for commercial thinning over the next 20 years, depending upon how young stands develop, in areas previously harvested. This acreage includes riparian reserves, as this analysis has shown thinning of young, dense riparian stands to be, in the balance, beneficial to attainment of Aquatic Conservation Strategy objectives and Forest Plan objectives for availability of large woody material. These commercial thinning opportunities occur throughout the watershed, including the portion within the Late-Successional Reserve. Opportunities are concentrated in the northern portion of Huckleberry Flats, the North Fork Canyon west of Huckleberry Flats, and the eastern end of Christy Flats

Approximately 16,000 acres will be available for precommercial thinning and/or forage enhancement cutting over the next 20 years, including acres that may be harvested in the next 10 years. Virtually all the 50,000 acres that have been harvested are available for fertilization. The scope of this analysis was not intensive enough to identify fertilization needs. Such needs should be determined by site-specific analysis of plantation health, growth rates, and site conditions such as the need for buffered wetlands.

QUESTION 2

How has the intensity and pattern of vegetation manipulation (as compared to the change from prehistoric conditions) affected plant and animal habitat diversity, species composition, species viability, amount of interior habitat, habitat connectivity?

INTERIOR FOREST VS. EDGE HABITAT

As timber harvest strategies were applied in the watershed, the abundance of late-seral and old-growth habitat was decreased and the size of retained habitat blocks was reduced as forest fragmentation

progressed in watershed 17. Just as edge habitat increases with moderate levels of fragmentation, interior habitat decreases. As described above, this has likely resulted in a shift in the biotic community as less high quality interior late-seral forest habitat and more fragmented forest and early to mid-seral habitat became available in watershed 17. These landscape trends result in a decrease in large home range mosaic species and an increase in small home range guilds and contrast species of all home range sizes. Generalist species of all home range sizes likely gained occupancy to areas as they became less suitable for the species that select for large blocks of interior habitat. These effects have decreased the capability of the portion of this watershed in LSR 0219 to attainment of management objectives for the LSR. This LSR currently has 20 of 31 spotted owl sites with home ranges above 40% suitable habitat. With this LSR and within the Wild and Scenic River corridor interior late-seral habitat conditions should improve over time.

As described in the Current Condition section of this document, forest fragmentation has played a significant role in development of edge habitat within the watershed. A comparison of the seral stage maps (Figures 18 and 19 of the Reference/Current Condition chapter) reveals that the distribution and amount of edge habitat has disproportionately increased in the western half of the analysis area (watershed 17) and that average patch size is small relative to natural conditions. This trend may have resulted in a shift in the biological community, with a decrease in medium and large home range patch species (i.e. rosy finch), mosaic species (i.e. spotted owl and fisher), and an increase in small home range guilds and contrast species (ie. Mountain blue birds, California quail, and elk) of all home range sizes. This condition has resulted in higher populations of elk and deer than existed prior to harvest.

However, on the eastern half of the analysis area (watershed 24), forest fragmentation has been less prevalent and relatively more late-seral habitat and old-growth is present than in the historic example (compare Figures 18 and 19 of the Reference/Current Condition chapter). This trend occurs as fire regenerated stands matured in the absence of intensive timber harvest or repeated large scale and frequent fires. Though it is difficult to speculate on how intensive and extensive fires might have been had they not been suppressed, it is possible that fire suppression may have contributed to the development of more late-seral habitat than what existed 100 years ago. The result of having large tracts of timber maturing into late-seral and old-growth forests is a shift in the biotic community from early and early-to-mid-seral habitat users to mid-to-late and late-seral habitat users. This effect has increased the capability of the portion of this watershed in LSR 0220 to contribute to meeting management objectives for the LSR. This LSR currently has 22 of 30 spotted owl sites with home ranges above 40% suitable habitat. The quality and contiguity of interior late-seral habitat should generally continue within the LSR and along the Wild and Scenic River corridor.

The trend in edge habitat increasing with forest fragmentation is expected to plateau and then decline as late-seral and old-growth forests continue to be removed in General Forest under an 80 year rotation and Scenic Partial Retention under a 100 year rotation (which do not allow for return of stands to late-seral conditions). This scenario of edge habitat limitations is also expected to occur in the larger LSRs as early and mid seral stands mature and additional removal of timber (establishment of early seral conditions) is restricted. The exceptions to this trend may be for small home range species which have relatively small minimum patch sizes and may be afforded suitable habitat by the prescriptions for timber harvest on the matrix; and for sections of the watershed that have high densities of riparian reserves which will provide the late-seral component of edge habitat along harvested stands in the matrix. Though edge habitat may generally decrease across the landscape over time, edges would be concentrated along riparian reserves, along Supplemental and larger LSRs, along the Wild and Scenic River corridor, and occasionally along stand replacing disturbance patches within the larger LSRs.

As described above, habitat for edge dependent species has historically been on the increase within watershed 17. The vegetational elk habitat effectiveness has increased over time for much of the watershed in response to the arrangement of timber harvest units which strategically places forage blocks in proximity to cover blocks. The exception to this is in areas that have been treated with large

blocks of intensive harvest with little of no interspersed cover (such as Christy Flats, Huckleberry Flats, lower McKinley Creek and Grassy Creek).

HABITAT STRUCTURE

Approximately 16,000 acres were intensively harvested prior to 1970. On these areas snag levels may be variable, but are generally well below natural levels. Down woody debris may be abundant, but in some areas (Dead Mountain burn for example) much of the larger pieces are likely to be in advanced stages of decomposition. In these areas large woody debris levels are also likely well below the natural range between the time existing logs decompose and until existing regeneration begins to contribute large woody debris to the forest floor. As a result, species that utilize snags and down logs as habitat may become less abundant in these areas until new snags and down wood become available for use. In other areas, very large logs were left during initial harvest operations, and given comparable environmental conditions, these logs will continue to provide suitable habitat for many species that utilize log habitat over a much longer period of time than would smaller logs of the same species.

Approximately 17,000 acres have been intensively harvested between 1970 and 1989. These areas generally have low levels of both snag and large woody debris as a result of lower utilization standards and PUM/YUM logging that were employed during that period. These areas are below natural levels for these habitat components and will continue to be below natural levels until new snags and down wood become available for use.

Though approximately 1,200 acres have been harvested between 1990 and present, many of these acres included prescriptions that were in place prior to 1990. These areas may also be below natural levels of snag and large woody habitat. For sales implemented under recent prescriptions the trend is for wildlife trees to be generally smaller than what was left prior to 1990, though the number of snags retained is generally higher. Smaller snags and logs will not persist as long and will not accommodate as large of cavities, or retain temperature and humidity as well as larger diameters. Thus, the trend toward leaving smaller wildlife trees has resulted in habitat that will not provide for all cavity dwelling species (for example pileated woodpeckers and colony nesters). This habitat may not be as effective in providing shelter to temperature and humidity sensitive species (for example Oregon slender salamanders and ensatina salamanders), and will not provide habitat as long due to more rapid decomposition. Species that utilize snag and down wood habitat during reproduction are listed in Appendix A.

CONNECTIVITY / DISPERSAL

As Figure 28 in Reference/Current Conditions (chapter III) shows, potential connective corridors associated with riparian reserves have been exposed to habitat altering activities which decreases their ability to provide suitable linkages between various portions of the landscape for some species of plants and animals. Previously harvested areas within riparian reserves may not moderate solar radiation, temperature, and humidity or may not provide enough cover to allow successful movement through the area by some species. Adjacent positioning of sub-populations provides for genetic exchange in species that do not migrate. Without adequate connectivity of suitable habitat across the landscape, such populations may become isolated. Isolated populations may ultimately be detrimentally affected by genetic drift.

Comparison of management allocations in Figure 3 of the Characterization chapter and the currently unharvested connectivity areas from Figure 28 of the Reference/Current Condition chapter, indicates that there are gaps in connective corridors between LSR 0220 and LSR 0219. Though this may not impede genetic exchange between more mobile species such as northern spotted owls and pileated woodpeckers, it may reduce the exchange of genetic materials between less mobile species that may rely on habitat characteristics not currently present in managed stands.

Potential landscape linkages between LSR 0219 and LSR 0221 are somewhat limited by the positioning of Lookout Point Reservoir and private land associated with the communities of Oakridge and Westfir. Connectivity of habitat for less mobile species is further complicated by the presence of the Middle Fork of the Willamette River, Southern Pacific Railway and State Highway 58. The most direct linkages between these LSRs along riparian reserves occur west of this watershed boundary. However, connections along that route cross two prominent ridges and include a number of previously harvested riparian reserves. Most of the riparian reserves within this watershed between these LSRs are oriented west to east, rather than north to south, with the exception of lower Christy Creek and the North Fork. Riparian areas associated with the Wild and Scenic River corridor and Christy Creek have potential to provide connections between LSRs with the exception of the southern two miles adjacent to the community of Westfir, the railroad, highway, and river (refer to Figure 28 of the Reference/Current Condition chapter).

Analysis for dispersal habitat for northern spotted owls (50-11-40) may also have applications to other species that have good mobility, but that require visual cover, short term foraging habitat and some climatic moderation while moving across the landscape. The review of 50-11-40 analysis for these watersheds indicates that several quarter townships in watershed 17 are at or below the level considered to be adequate to provide for dispersal of northern spotted owls. However, all quarter townships in watershed 24 are currently well above the minimum level for dispersal. Of the quarter townships below the threshold, those of particular concern are positioned between LSR 0220 and LSR 0219 and within LSR 0219. The effect of having low levels of habitat suitable for dispersal between LSRs is that genetic exchange between LSRs may not occur as effectively for some species. Within LSRs low levels of dispersal habitat, like low levels of suitable habitat, compromise the capability of the LSR to function for its intended purpose.

Though potential habitat is present in the area for peregrine falcons, occupancy has not been observed. The area with the highest potential is relatively remote and is not accessed by existing trails, thus potential for adverse impacts to falcons by recreational use of existing facilities is low.

Both bald eagles and peregrine falcons can be adversely affected by low altitude flights by aircraft. Thus fire suppression activities should be coordinated so as to minimize the risk of disturbance to nesting raptors during fire suppression efforts. As most wildfires occur after the critical nest initiation to fledging period for falcons, the greatest concern would be for bald eagles which generally do not fledge until after mid June.

PLANTS --HABITAT DIVERSITY / INTERIOR HABITAT / CONNECTIVITY

Late successional species habitat in the watershed has declined due to extensive harvest of old-growth stands and associated road building. Remaining old-growth in the watershed is concentrated at higher elevations and, in some areas, is highly fragmented. Many survey and manage species have limited dispersal capabilities, thus in fragmented habitat areas geneflow may be restricted between populations. Single species management after harvest in riparian forests along with adjacent upland stands has contributed to a simplification of species richness in plant communities.

QUESTION 3

How has the intensity and pattern of vegetation manipulation (as compared to the change from prehistoric conditions) affected site productivity?

EROSION

Compared to the historic fire pattern, Watersheds 17 and 24 have altered the spatial and temporal distribution of non-vegetated condition on erosive soil. Stand replacement fires in Watershed 17 tended to be larger, localized blocks rather than the dispersed patchwork of clearcuts in varying stages of vegetative recovery currently exhibited. In Watershed 24, they tended to be very large blocks with a

reoccurrence interval around 60 years rather than the relatively minor amount of area impacted by clearcut harvest.

This reversal of patterns may or may not be beneficial to the system in terms of decreasing natural erosion levels. Larger stand replacement fires would tend to have a high impact to a few drainage's until vegetation is reestablished. The dispersed patchwork of clearcut units would tend to have a lower impact on individual drainage's, but would be distributed over a larger area and over longer periods of time.

In contrast to past management practices, the recent change toward the retention of more trees, snags, riparian areas, and LWM comes closest to mimicking historical fire impacts. The residual root strength from the trees and snags, the energy dissipating effect on overland flow that riparian reserves and LWM provide, and the fact that LWM can reduce the velocity and distance traveled of future debris torrents all tend to keep more soil on the hillside over time.

COMPACTION

Past harvest practices, notably on the roughly 15,000 acres harvested prior to 1970, included extensive use of tractors (skidders and cats) on gentle ground. Approximately 3000 acres of this was on high clay content soil that tends to be especially sensitive to compaction and soil disturbance. This harvest technique is not used as much as it was in the past and the amount of area compacted has leveled off. However, the effects of compaction can still be seen as evidenced by a reduction of height growth in trees.

Compaction has generally resulted in a reduction of site potential by up to one site class, which, over the span of an 80 year harvest rotation, may result in as much as a 25 percent reduction in stand volume growth. Additionally, soil compaction can increase the pathology of otherwise endemic natural root disease pathogens. Black stain (Ophiostoma wageneri) and armillaria (Armillaria ostoyae) root rots exist in the watershed and seem to be increasingly evident in plantations yarded with compacting ground-based yarding equipment. Further progression of these diseases could change the productivity of these sites from a timber growth perspective due to resultant understocking.

ORGANIC MATERIAL / NUTRIENT CAPITAL

Approximately 16,000 acres were harvested during the 1960's to 1980's when regeneration harvest utilization standards where high, little large woody debris was retained in harvested areas, and harvested sites were typically burned in the fall under dry conditions. Little is yet known about the long-term implications of such efficient harvesting methods. Several long-term studies are underway to quantify site productivity effects of retention of large wood but results are decades or more away. While it seems intuitive that removal of most of a site's above ground biomass could have negative effects on long-term site productivity, it is also known (see the Vegetation section of the Characterizations chapter) that fires may burn an area twice in a short time, effectively removing most above ground organic material. The amount of high utilization harvest that has occurred within this watershed is within the scope of the number of acres potentially affected by short return interval fires, and has not likely appreciably affected long-term site productivity more than has natural processes. In any event, infrequent removal of most biomass probably affects a site's inherent productivity less than does soil compaction. Nutrient levels are often maintained after near total biomass removal by the growth of various nitrogen-fixing plants (primarily Ceanothus species), commonly found in recently burned areas. It is thought that harvest has not affected site productivity much at all other than the effect from soil compaction.

QUESTION 4

Where and to what extent has the change in spatial and temporal distribution of vegetation influenced the potential for water yield, water quality, and peak flow changes? Where have these changes in hydrology affected channel function and habitat condition?

WATER YIELD

Water yield has varied over time due to changes in the vegetative condition as a result of wildfire and timber harvest. During time periods when large portions of the watershed were in early successional conditions, water yield was likely higher due to a short term decrease in evapotranspiration. Due to the limited water storage capacity of water yield Classes II and III land types, areas with high proportions of these classes would have a lower ability to store additional soil water input as a result of reduced evapotranspiration that would result from a wildfire event or timber harvest, but typically fall precipitation exceeds soil field capacity quickly, regardless of vegetation development (i.e., transpiration in this area does not affect storage capacity during the wet seasons).

Figure 1 of the Reference/Current Condition chapter indicates that subwatershed 175 has a relatively high proportion of its area as water yield class I. This area contains a significant area of landforms associated with deep seated mass movements. The parent material associated with these landforms typically have a relatively high clay content which generally would have a relatively low transmissivity of sub-surface water. The capacity of the ground surface to infiltrate water is sufficient that overland flow is unlikely even during times of high soil water input. Due to the relatively low transmissivity of deep subsurface layers, water may be rapidly routed to the stream network through macropores present in the A and B soil horizons. Therefore the ability of the planning subdrainages within subwatersheds 171 and 175 which have relatively large areas composed of soils of high clay content may be more accurately described as having a greater proportion of areas in water yield Classes II or III which have can greatly contribute to peak stream flows. The following planning subdrainages can be placed into this category; Hammer (17E), Chalk (17G), Coffee (171), McKinley (17F), and High (17D).

Overall water yield Class III (low ground water storage capacity) is highest in the Upper North Fork (watershed 24), however the average slope is lowest within the majority of this area and runoff can be stored within hundreds of lakes. In addition, the seasonal snowpack in a large portion of watershed 24 contributes to baseline flow during all or portions of the low-flow summer period. Therefore even when a majority of the Upper North Fork was in an early successional condition due to large wildfires resulting in reduce evapotranspiration, this area would have the ability to temporarily store much of the available water in surface features and infiltrate soil water input into streams and deep aquifers.

PEAK STREAMFLOW

ARP values are a measure of the potential for an area to experience increases in peak stream flow as a result of changes in vegetative condition due to management activities or wildfire combined with rain-on-snow events. Those areas with the lowest ARP values would be associated with areas most likely to have increased peak flows. Because roadside ditches function as extensions of the intermittent stream network, those areas with a high road density are more susceptible to management related increases in peak flows. Those planning sub-drainage's with a high proportion of their area within the transient snow zone combine with high road densities may be particularly sensitive to this effect. All sub-watersheds in the lower North Fork fall into this category.

Overall, planning subdrainages and subwatersheds in the Lower North Fork (watershed 17) would have the greatest risk of increased peak flows due to management effects. This area is predominantly within the transient snow zone, has a relatively high stream and road density, and has experienced, and will continue to experience, the greatest amount of timber harvest. The planning subdrainages of particular concern are those that are currently at or within five percentage points of the mid-point ARP. Those planning subdrainages in this category are; Chalk (17G), Dartmouth (17B), and High (17D).

WATER QUALITY

Stream Temperature

Generally where streams have been impacted by management activities such as timber harvest, summertime water temperatures tend to be elevated. Several streams in the Lower North Fork do not currently meet the state standard of 58 degrees F during the summer season. Monitoring data indicates the following streams are of particular concern; Lower North Fork (main stem), Christy Creek, Lowell Creek, and Huckleberry Creek. A slow trend of temperature recovery to natural levels is expected as riparian vegetation recovers in areas previously harvested.

Stream Turbidity

Turbidity levels have increased above natural levels in the lower North Fork (watershed 17) due to management activities associated with timber harvest. Chronic sediment sources are increasing turbidity levels especially where past management activities have impacted areas of active land flows composed of soils with a high clay content. The largest chronic source of turbidity for the North Fork at this time is the Chalk Creek planning subdrainage (17G). During relatively short periods of time, turbidity values have reached levels exceeding 40 NTUs (Nephalometric Turbidity Units) in the lower North Fork. Although research has shown that turbidity values of this level can interfere with the ability of salmonids to find prey, because of the short-term nature of these events it is unlikely that turbidity is causing significant long term adverse effects on fish species present in this portion of the North Fork. Increased levels of turbidity in the North Fork may result in reduced aesthetic quality during high flow events. Other sub-drainage's with a high occurrence of mass wasting in riparian areas are likely additional source areas. These include High Creek (17D), Hamner Creek (17E), and McKinley Creek (17F).

CHANNEL FUNCTIONS AND CONDITIONS

Large woody material is an important component of many streams. Large wood provides cover for fish and amphibians, creates large pools, stores and sorts sediment increasing the availability and quality of spawning gravel's, contributes to stream bank stability and contributes to the retention of smaller sized organic materials used as a food base for macroinvertebrates. The rooting strength of vegetation along stream banks is an important component contributing to bank stability especially where stream banks are composed of unconsolidated materials. Those riparian areas associated with streams that have experienced the greatest amount of harvest impacts are the areas of highest concern. Streamside vegetation also contributes to stream channel function and condition by supplying organic material to the stream channel. The input of small to fine sized organic material is an important component of a healthy, functioning aquatic ecosystem. The vegetative component that would require the longest time to recover from timber harvest related impact is the potential for the riparian area to supply large woody material (LWM) to the stream channel. Large conifers are the most important source of large wood since they decompose slowly and can benefit the stream channels for a longer time than do hardwood species.

Past management activities such as logging without leaving a buffer, salvage logging adjacent to the stream channel, and stream cleaning projects have reduced the amount of large wood in the stream channels of the North Fork Watershed to levels below objective values and historical conditions (Table 1 of this chapter).

The removal of this large wood from the riparian area and the stream channels has resulted in reduced channel complexity and therefore reduced the number of areas with high quality habitat for fish and other aquatic species. Nearly every reach, surveyed in the last five years, in every sub-watershed did not meet minimum objective values for large pools which are an important habitat for adult fish. It should be noted, however, that the natural conditions of streams in watershed 24 may be below objective levels for

Table 1: Percent of Subwatershed Not Meeting Objective Values For Large Woody Material

Subwatershed	Total Stream Miles Surveyed	% Of Streams Not Meeting WNF Plan LWM Objective Values	% Of Streams Not Meeting Pacfish LWM Objective Values
Mainstem North Fork	45.6	100	100
Mainstem Christy Creek	10.8	100	78.7
Westfir (171)	13.4	50.7	26.1
Devil's Canyon Creek (172)	7.8	93.6	93.6
Upper Christy Creek (173)	21.3	76.9	65.7
Lower Christy Creek (174)	10.5	16.2	15.2
N.Fk. Middle Fk. Willamette (175)	18.9	68.8	64.6
Fisher Creek (241)	8.8	91.9	74.7

LWM due to the high fire frequency, the generally smaller tree size in higher elevation areas, and the relatively faster wood deterioration rates of high elevation tree species. Other potentially limiting habitats are effected by levels of large wood such as spawning gravel's, rearing areas and overwintering habitat (see the Aquatic Habitat discussion in Chapter IV, Reference and Current Conditions). The areas of greatest impact from timber harvest within riparian reserves are located adjacent to Class II and Class IV stream channels. These areas are primarily located in all sub-watersheds in the Lower North Fork and in sub-watershed 241 in the Upper North Fork. Sub-watersheds 172 and 173 have had the greatest impacts from stand replacement timber harvest within the designated riparian reserves. Table 7 in the Reference/Current Conditions chapter shows the percent of the riparian reserves that have been harvested. Harvest in the riparian reserves has occurred most heavily in subwatershed 173, Upper Christy Creek (45.0 %) and subwatershed 174, Lower Christy Creek (50.0%). Subwatershed 241, Fisher Creek (9.7%) has been impacted the least by harvest activities in the riparian reserves.

Table 2: Percent of Harvested Riparian Reserves in Various Age Classes by Subwatershed

Subwatershed	0-25 Years	26-45 Years	46-65 Years	> 66 Years
Westfir (171)	44%	20%	18%	19%
Devil's Canyon Creek (172)	44%	28%	20%	7%
Upper Christy Creek (173)	52%	41%	3%	4%
Lower Christy Creek (174)	51%	45%	1%	2%
N. Fk. Middle Fk. Willamette (175)	53%	29%	9%	9%
Fisher Creek (241)	53%	20%	0%	27%

Table 2 of this chapter shows the proportion of these harvested areas within riparian reserves that are within specific age classes. This table indicates the probable recovery time for subwatersheds lacking in large wood. Those subwatersheds with the highest percentage of vegetation in unharvested and harvested before 1920 categories would be expected to have natural introductions of large wood sooner than those with a large percentage of riparian areas harvested since. The Fisher Creek subwatershed has the lowest percentage of riparian reserves harvested of all those having harvest allocations (9.7%) is also be expected to be the quickest to begin to see trees naturally entering the stream. Subwatersheds expected to take a number of years to reach a point where trees begin to enter the stream channel at near natural rates include Upper Christy Creek (173), Lower Christy Creek (174), and the North Fork Middle Fork Willamette (175).

Areas composed of steep slopes with potentially unstable land forms combined with areas impacted by stand replacement harvest within riparian reserves are the primary areas where a reduction of existing

and potential LWM is of greatest concern. These areas are all located in the Lower North Fork (watershed 17) and include planning subdrainages Hammer (17E), Chalk (17G), Coffee (171), McKinley (17F), and High (17D). These sub-drainage's also contain a number of small unstable areas adjacent to stream channels (see Chapter IV Channel Stability section). Appendix I lists the percent of the riparian reserves impacted by stand replacement harvest by planning subdrainage.

Stream channels with the greatest amount of stand replacement timber harvest are associated with the greatest adverse impacts. Short term impacts include the loss of fine organic material input to stream channels. Long term impacts are primarily associated with the loss of existing an potential LWM.

Removal of mid and late seral forests within and near riparian areas may have resulted in a decrease in lake/river aquatic/riparian and riparian guild species that use mid/late seral habitats, with a corresponding increase in such guilds that use early seral habitats.

QUESTION 5

What are the most important delivery mechanisms for sediment generated by vegetative disturbances in this watershed? What are relative rates of delivery by landform or slope to stream? Where are the high risk areas?

The rate of sediment yield for individual tributary areas has varied depending on the fire history, hillslope processes, landtype and channel type. During the pre-management time period, increases in sediment yield rates can likely be associated with large unstable land forms, fire activity and floods. Large fires coupled with steep topography resulted in increased sediment delivery to stream channels.

During the post-management time period, sediment yield has increased due to management impacts combined with fire and flood events. Those tributary areas that have a relatively high natural instability combined with moderate to high roading density and harvest impacts are the greatest current sediment sources.

Shallow mass soil movement, usually referred to as "debris torrents", are the typical delivery mechanism for large amounts of sediment to the stream network. These events often occur in unmanaged forests but are accelerated by reduction of rooting strength due to harvesting and, more typically, by road construction and road related disruption of drainage patterns and sub-surface water flow. Road drainage entering the stream network is a more chronic source of sedimentation and may, over time, contribute more fine sediment than do debris torrents.

Where deep-seated landflows interact with stream channels, significant sediment sources exist. Stream survey data indicate the High Creek (17D), Hamner Creek (17E), McKinley Creek (17F), and Chalk Creek (17G) sub-drainage's have relatively high numbers of mass wasting sites adjacent to stream channels and therefore may be relatively high-risk areas for adverse impacts from management activities. Given the amount of clearcut harvesting on steep ground with shallow, rocky soil, it is surprising that no harvest related slope failures were identified in this setting. It is also surprising that naturally occurring debris slides did not increase as a result of the 1964 flood. This is a striking contrast to the frequency of occurrence in the Lower Middle Fork Willamette Watershed Analysis area that has similar geology and geomorphology to Watershed 17. This apparent lack of events, especially in areas of known risk due to soil classification and ground observations, may be due to the low resolution of the debris torrent and landslide survey technique.

Watershed 24 has not been affected as extensively by clearcut harvest on steep ground, so the lack of response is not so surprising.

Large scale clearcut harvesting on high clay content soil in Tumble Creek and the southwest flank of

Christy Flats did not result in slope movement, but is considered a contributing factor to the sensitivity of the toe slope to excavation. Camp Five Slide in sub-drainage 17Q (1981) and the cutslope failure on Rd. 19 MP 13, in sub-drainage 17F (1972) are two examples of this increased sensitivity.

QUESTION 6

Where and to what extent has removal of existing and future sources of large woody material in stream channels changed the routing of sediment and in-stream habitat?

See the answer to question 4 under Issue #1.

QUESTION 7

Where and to what extent has vegetation manipulation affected riparian habitat?

See the answer to question 4 under Issue #1.

Issue #2

The exclusion of natural fire from the ecosystem has altered the natural processes.

ISSUE #2 KEY QUESTIONS

QUESTION 1

Fire pattern, fire behavior, and burn intensity are affected by fuel loading conditions. How do current conditions compare to fuel loading conditions before the advent of fire suppression? What areas are at high risk?

This question is addressed in the Current Conditions fuels discussion in Chapter III.

QUESTION 2

If we provided for prescribed fire within established forest stands (as opposed to bare ground for site preparation) in order to reduce high fuel loading, and to bring the landscape fuel loading back to a natural range of variability, under what conditions could we control the fire? How many acres (per period of time) could need to be burned (by land allocation) and remain within air quality limits?

During the Warner Fire Recovery Project, Charley Martin addressed the issue of allowing natural fire to burn within a prescription that would reduce fuel loadings and preserve habitat (Final Environmental Impact Statement, Warner Fire Recovery Project, Appendix B). Results are felt to be consistent with our ability to introduce prescribed fire into natural stands to meet the same requirements, given that the Probability of Ignition will change because we are the ignition source. Higher elevations will become available in early to mid summer even though conditions for burning will be similar to those found in the spring. However, the probability of exceeding prescription will be higher and the probability of a rain event will become lower.

Probability For Any Given Year

Time of Year	Probability RX* 5 Day Window	Probability of Rain in RX**	Probability of Exceeding RX***	Probability of Ignition
Spring	Moderate / High	Moderate	Moderate	Low
Summer	Low / Moderate	Low	High	High
Winter	Unknown	High	Low	Low / Unknown

* Probability includes all windows, all years
** With 1 foot and greater flame length
*** If given a window, what is the likelihood it will exceed prescription

Smoke Management and Air Quality are discussed in Chapter III.

QUESTION 3

Under a prehistoric (prefire suppression) fire regime, what would the habitat diversity look like?

Within the eastern half of the analysis area (watershed 24), fire suppression may have contributed to changes in edge habitat abundance that may have naturally developed along the borders of fires which frequently and extensively affected vegetation in this area (creating the early seral portion of edge habitat). However, at the same time fire exclusion may have allowed late-seral habitat conditions to develop in areas that might have otherwise been exposed to repeated burns. It is difficult to assess whether fire exclusion in watershed 24 has increased, decreased or had a neutral effect on the abundance of edge habitat above and beyond that created by timber harvest without knowing the intensity and patchiness of historic fire events. Frequent reburns in the area may have a tendency to mask the natural complexity that may have been present within this fire affected area, and speculations on what the pattern and intensity of fires might have been (had they not been suppressed) is difficult.

On the eastern half of the analysis area (watershed 24), forest fragmentation was less prevalent. Relatively more late-seral habitat and old-growth is present now than in the historic example (compare Figures 18 and 19 of the Reference/Current Condition chapter). This trend to more late-seral habitat continues as fire regenerated stands are allowed to mature in the absence of intensive timber harvest or repeated large scale and frequent fires. The result of having large tracts of timber maturing into late-seral and old-growth forests is a shift in the biotic community from early and early-to-mid-seral habitat users to mid-to-late and late-seral habitat users. This effect has increased the capability of the portion of this watershed in LSR 0220 to contribute to meeting management objectives for the LSR. This LSR currently has 22 of 30 spotted owl sites with home ranges above 40% suitable habitat. On the other hand, this trend has also reduced the abundance of early seral habitats which may have reduced capability to support high elevation early seral or contrast species such as Boreal owls, Cassins finch, Calliope hummingbird, Mountain bluebird, green-tealed towhee, and heather vole.

QUESTION 4

How would disturbance mechanisms associated with prescribed fire affect TE&S species, as well as fire dependent species?

Prescribed fires may be detrimental to localized populations of sensitive and threatened amphibian species such as salamanders and frogs. The existence of supplemental Late Successional Reserves and Riparian Reserves may help to minimize these effects if these areas are not subject to prescribed fire. Also cool or patchy burns may facilitate escapement of individuals within such populations.

Moderate intensity fall burns may assist in germination of fire dependent species such as woodland milkvetch and branching montia. Both the Warner Creek and Shady Beach fires burned in the fall. It is unknown whether spring fires will stimulate these species to germinate.

Issue #3

The density and condition of roads and trails has altered the landscape processes.

ISSUE #3 KEY QUESTIONS

Roads (system and non-system)

QUESTION 1

Where and to what extent has the density and condition of roads influenced natural and management induced disturbance (i.e. landslides, surface erosion, slope movement)?

Road related slope failures have altered the spatial and temporal distribution of landslides within the lower North Fork (Watershed 17). Roads have initiated debris torrents where they likely would never have occurred naturally over the time periods we are analyzing. Roads have also increased the frequency of these events over the landscape in areas that would eventually have experienced debris slides under natural conditions. Naturally occurring landslides have historically occurred in Hamner Creek, High Creek and Chalk Creek. Road related landslides have not only increased the frequency of occurrence by more than 370%, but have expanded the affected area to drainage's adjacent to Chalk, High, and Hamner Creeks.

The vast majority of road related debris slides occurred prior to 1968 and are associated with sidecast construction techniques on steep ground. Failure mechanisms associated with this construction technique come in two stages: immediate and delayed with approximately a 20 year gap between the two.

Influxes of sediment can silt in spawning gravel's thus reducing the spawning success of trout and salmon population. Currently the main stem of the North Fork and the majority of its tributaries probably have gravel's sufficient for successful spawning. However, there are areas of concern for the future addition of sediment to the watershed. Although all subwatersheds except Lower Christy Creek (174) have evidence of mass wasting, the North Fork of the Middle Fork subwatershed (175) has the highest number of sites of mass wasting and is the subwatershed of most concern for introducing large amounts of sediment into the watershed. Mass wasting sites are present throughout most of the stream reaches within this sub-watershed. Mass wasting sites in this subwatershed are both natural and management induced. Other potential sources of large amounts of sediment are roads having plugged or otherwise non-functioning culverts throughout the watershed. The failure of these culverts could result in large portions of the entire road prism entering the stream channel.

QUESTION 2

What sections of roads are currently or potentially introducing sediment to the stream system? Where and to what extent does the influx of sediment influence channel conditions?

Although all subwatersheds, except Lower Christy Creek (174), have documented mass wasting sites, the North Fork of the Middle Fork subwatershed (175) has the highest number of sites of mass wasting and is the subwatershed of most concern for introducing large amounts of sediment into the watershed. Mass wasting sites in this subwatershed are both natural and management induced. Other potential sources of large amounts of sediment are roads having plugged or otherwise non-functioning culverts throughout the watershed. The failure of these culverts could result in sediment from large portions of the entire road prism entering the stream channel.

The majority of the road system on steep ground was constructed 20 or more years ago and is therefore likely to be undergoing the second stage of slope failure. The mode of failure begins with outside edge cracking and settlement. If sufficient water is allowed to enter these areas, the probability of failure rises significantly.

QUESTION 3

Where and to what extent has the density and configuration of roads affected surface and subsurface hydrology (i.e. wetlands, expansion of the drainage network, etc.)?

Roads contribute to increases in peak flows primarily due to the area of road surface that has a reduced infiltration capacity, more rapid routing of water to streams in roadside ditches, interception of subsurface flow and conversion to more rapid surface flow, and the area within the transient snow zone devoid of a vegetative canopy. Appendix F lists the road density by planning subdrainage. The areas with the highest road densities are located in the lower North Fork. Subdrainages with road densities greater than or equal to 4.5 miles per square mile include; Huckleberry (175), Third (176), Short - Hemlock (17A), and Billy (17I).

Interception of subsurface flow by a mid slope road can result in the area below the road becoming dryer due to a routing of water away from these areas or, a road can concentrate water in roadside ditches and result in localized areas of increased surface water on the upslope portion relative to the road. In addition, surface water may be increased in those areas where relief culverts concentrate runoff from roadside ditches. Concentrating runoff from relief culverts has resulted in soil erosion, gully formation, or debris torrent initiation in some areas below the outlet of some culverts.

In some situations, roads have altered the natural hydrology by concentrating water on the upslope side. These areas many have increased soil moisture, and in some cases have created areas of standing water for a significantly long period of the year than would have occurred naturally.

QUESTION 4

Where are high risk or high priority road/stream crossings which do not have drainage structures designed to withstand 100 year events?

It is currently unknown which undersized or plugged culverts pose a substantial risk for road fill breach or significant diversion of water to adjacent relief culverts. Many variables outside the scope of the inventory techniques used in this analysis need to be considered when assessing the potential for a stream crossing that hydraulic analysis indicates has a strong likelihood of being overtopped during a 100-year flood event. Some of these variables include the quantity of water overtopping, potential diversion paths, fill stability and slope armoring. In other words, overtopping analysis should be considered the first step in hazard analysis, with more detailed, site specific investigation followed by an assessment of the potential downstream effects of failure and the value of the potentially affected aquatic habitat.

It is evident from condition surveys that a large number of the culverts within the watershed analysis area are functioning below optimum hydraulic capacity. This is the result of inlet plugging, inlet damage, or structural deficiencies such as seam separation, deformation or decomposition.

A complete copy of the hydraulic analyses for Oakridge and Rigdon District's FY-95/96 timber sale program is included in Appendix J.

QUESTION 5

Since funding is no longer available to maintain the entire existing road system to designated levels, what are the potential resource effects of not maintaining all the roads in this road system?

Since we are in a declining timber program and decreasing budgets in road maintenance we will not be able to maintain the existing system as we have in the past. Road maintenance will be concentrated on the maintenance level 5 and 3 roads. Maintenance levels will have to be reconsidered and lowered on a portion of the road system so as to balanced the budget with the maintenance program. This will amount to some of the system roads that have been accessible by passenger cars now only being accessible by high clearance vehicles and in some cases not being accessible at all. Brush will encroach into the roadway on many of the system roads, making them impassable. Rock fall, tree fall, and slope ravel will

close or make access available only by high clearance vehicles. Some loss of the roadway is possible from failed drainage systems.

If roads are not maintained there is a higher probability of culvert and roadbed failures that could introduce sediment into the stream system. Such introduction could silt in spawning gravel's, reducing the spawning success of native trout and potential future salmon and steelhead populations. Introduction of sediment would also increase stream turbidity. Culvert failures could also block up-stream migration of fish.

Decreased maintenance will compromise drainage structures, resulting in diversion of water onto fill slopes, creating an increased likelihood of road related slope failures.

QUESTION 6

Where and to what extent have roads (especially Aufderheide Drive) affected habitat connectivity and riparian reserves?

Figure 1 of this chapter displays the overlap between road clearings (including road surfaced area and altered roadsides) and riparian reserves. Table 3 of this chapter displays the acres of riparian reserve and percentage of overall riparian reserve included in such road openings. These road surfaces and open areas may pose barriers to movement by the least mobile species, but do not effect the dispersal of more mobile species (including wind blown seeds, spores and other vegetative materials). Table 4 of the Reference/Current Condition chapter displays the number of stream crossings along roads by stream class. Many of these stream crossings are associated with impassable culverts and/or steep fill slopes and cut banks. These features may also complicate travel for less mobile species. Though railroad tracks are known to pose migration problems for northwestern pond turtles, the length of railway in this watershed is small and most of it positioned adjacent to residential areas where pond turtle migration is not be expected to occur.

Table 3: Riparian Reserve Acres in Road Openings

Sub - watershed	Riparian Reserve Acres in Road Openings	Percent of Total Riparian Reserve Acres in Road Openings
17-1	187.25	2.6
17-2	184.29	2.2
17-3	152.37	2.7
17-4	109.94	2.6
17-5	75.96	1.5

Sub - watershed	Riparian Reserve Acres in Road Openings	Percent of Total Riparian Reserve Acres in Road Openings
24-1	66.12	0.8
24-2	11.00	0.1
24-3	25.61	0.2

There are many impassable culverts in the North Fork Watershed located adjacent to the main stem North Fork as well as higher up on tributary streams. Impassable culverts decrease habitat connectivity for trout and salmon populations. Impassable culverts do not allow the upstream migration of these species to otherwise available spawning areas. In addition, these culverts do not allow for resident trout migration, thus forming genetically isolated populations. It is also known that in small tributary streams with severe winter water velocities, trout commonly migrate downstream to overwinter in larger, deeper streams (Benhke, 1992). When impassable culverts are present these fish migrate downstream, but are not able to migrate back up to their summer habitat. There have been no studies on resident trout migration in this watershed but there exists a potential for this down-stream winter migration problem to have occurred in the past and to continue to occur in the future. There are many impassable culverts in the North Fork Watershed located adjacent to the main stem North Fork as well as existing high in tributary streams.

Figure: 1a
Roads Within Riparian Reserves

Lower North Fork Middle Fork
Willamette River Watershed

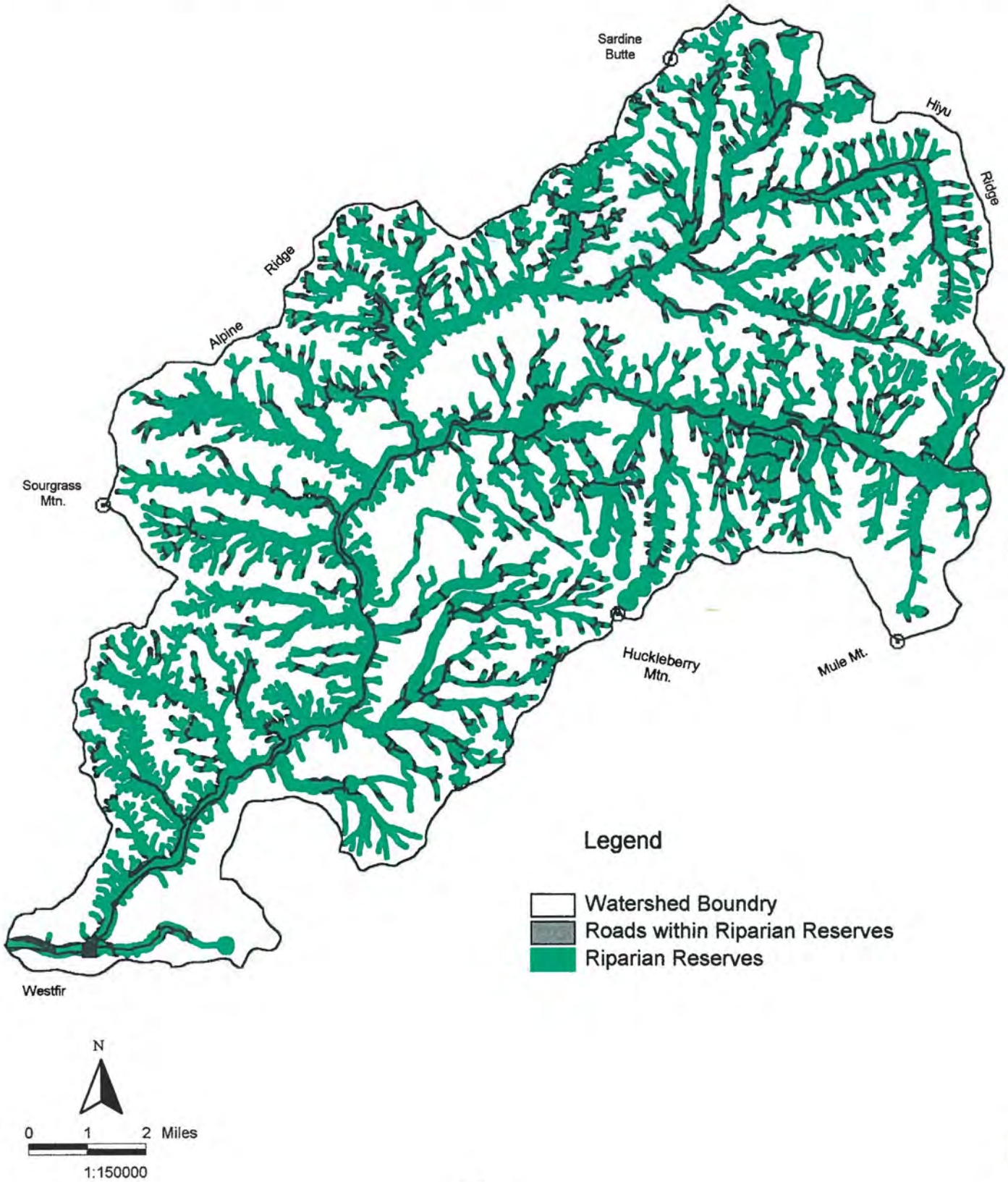


Figure: 1b
Roads Within Riparian Reserves

Upper North Fork Middle Fork
Willamette River Watershed

Legend

- Watershed Boundry
- Waldo Lake
- Roads w/in Riparian Reserves
- Riparian Reserves

N

0 1 2 Miles

1:150000

QUESTION 7

Where and to what extent have roads affected wildlife populations (points to consider: disturbance, poaching, etc.)?

The road density elk habitat effectiveness has decreased over time for the same portions of the watershed in response to intensive road construction which exceeds 3 miles of road per square mile of area in 11 of 19 Big Game Emphasis Areas. Road density is above levels prescribed in the Willamette Land and Resource Management Plan (LRMP) for five Big Game Emphasis Areas as displayed in Table 22 of the Reference/Current Condition chapter.

QUESTION 8

Where and to what extent have roads affected special habitats?

Though the extent of effects of previous management activities on special habitats is not well documented at this time, a number of specific cases are known. Many sites have been altered, degraded or created by past management actions. In some areas intensive timber harvest has been implemented up to the edges or across special habitat areas; quarry activities have altered rock habitats; and road cuts have potentially affected natural meadows by intercepting ground water or serving as a noxious weed vector. In other cases, special habitats may have been created or enhanced by impoundment's, rip rap placed over tall fill slopes, construction of bridges and mine adits. One known site with populations of a sensitive plant species (Rhomanzoffia thompsonii) is transected by a road that appears to be intercepting and diverting water away from the lower section of the meadow.

QUESTION 9

Where and to what extent has the condition and use of trails influenced disturbance (i.e. surface erosion, slope movement, landslides)?

There are no trails that have triggered major slope movement. No existing trails are located in "high risk", slope failure areas. All future planned trails also lay outside of high risk areas, except a potential segment of the North Fork Trail. This trail segment is yet to be constructed and opportunities exist to avoid the area of concern. On steep inclines and where trails cross streams, there is a potential for surface erosion. Trails that do not use bridges at stream crossings will increase local surface erosion, which enters the stream. If erosion is not controlled on steep trail segments, soil is displaced and the trail tread deteriorates, but sediment may not necessarily enter the stream system. It is thought that this potential is low, given the ability of trails to avoid areas with the potential to generate sediment. In any case, trail generated sediment is a very small problem compared to that generated by roads.

QUESTION 10

Where and to what extent are the trails and their use affecting wildlife and botanical values and where and to what extent have wildlife and botanical values affected trail use (via resource protection closures)?

Though the extent of effects of recreational and administrative use on special habitats or threatened, endangered and sensitive species of plants and animals is not well documented at this time, a number of specific cases are known. Some sections of trail cross areas that have been or may be altered by the type and level of use. In some areas trails pass across meadows and rocky areas (special habitat areas). In such areas extensive use by horses, motorcycles or mountain bikes may deepen trails which could effect the moisture regime of the meadow, or may loosen rocks that support the trail surface, causing raveling off at the trails edge. These occurrences are site specific as many miles of trails exist that have little or no effect on special habitats. Some features associated with trails may provide

structural habitat (for example bat roosts under bridges or in the roof of shelters or amphibian habitat under boardwalks across wet meadows).

Some segments of trail come close to occupied or potential sites for threatened, endangered or sensitive plant or animal species. Currently trail use in these areas is not restricted. However, seasonal restriction of motorized trail maintenance work has been applied to some segments of trails close to known bald eagle nests. This may also be applied to other areas if peregrine falcon use of potential habitat is confirmed. Based on feedback from USFWS, relocation or closure of some trail segments to protect T & E nest sites may be appropriate, as well as seasonal restriction of dispersed recreation sites close to bald eagle nest sites and peregrine falcon sites if occupied. The Forest Plan requires Management Plans to be prepared for Bald Eagle Management Areas in addition to consultation with USFWS for any actions potentially affecting these areas.
Though spotted owls are present in the area and are close to trails and dispersed sites, no activity centers have been identified that are likely to be adversely affected by recreational use of existing facilities.

QUESTION 11

How does changed access influence potential human caused fire ignitions and suppression response time for all fires (change in NFMS results)?

The Willamette National Forest Fire Management Analysis System (NFMAS)-
This planning process was developed to provide fire managers with optimal organizations and funds for fire suppression. Included are three segments; Level I analysis, Level II analysis, and Initial Attack Assessment (IAA) model. Level I analysis introduces all of the elements used to build a database for IAA, except for fire behavior information (output from Level II). This includes weather data, fire occurrence, fire management analysis zones (FMAZ), and representative locations (RL). The IAA model uses Level I data and combines it with resource values, suppression costs, escaped fire sizes, and resource information loss/benefit (Net Value Change or NVC) information. IAA also utilizes fire behavior information that is called Level II. The output from the model provides information on the changes in the number of acres burned, resource loss and emergency suppression costs over an array of alternatives (9 alternatives were used). Alternative 4 was chosen because it represented the least Cost + NVC.

Representative locations for this analysis were chosen based on primary type of first attack and time of attack on fires that occurred from 1970-1989 by district. Oakridge is assigned RL3, RL6, RL9. The types of first attack for the non-wilderness FMAZ were grouped into 3 categories: roaded (primarily an engine first response), roaded dispersed (primarily a hand first attack), and remote non-wilderness (primarily attacked from the air or by ground forces). The types of first attack for the wilderness FMAZ were grouped into two categories: hand and air. The above information is displayed in table format below.

South Zone -- Non Wilderness

Location Code	District	Type Response
RL1	Rigdon	Roaded -- Engine
RL2	Lowell	Roaded -- Engine
RL3	Oakridge	Roaded -- Engine
RL4	Rigdon	Roaded -- Hand
RL5	Lowell	Roaded -- Hand
RL6	Oakridge	Roaded -- Hand
RL7	Rigdon	Roaded -- Hand or Air
RL8	Lowell	Roaded -- Hand or Air
RL9	Oakridge	Roaded -- Hand or Air

South Zone -- Wilderness

Location Code	District	Type Response
RL1	Rigdon	Hand
RL2	Oakridge	Hand
RL3	Rigdon	Air
RL4	Oakridge	Air

Time to first attack was assigned as one hour.

It is important to remember that this analysis was based on a period of time when most of the district road system was established and fire size was minimized due to accessibility of engines and hand crews. With road closures or road removal, response times are estimated to increase by one half to one hour. This would also mean a decrease in RL3 and an increase in RL6 and probably little change in RL9 since it applies to areas similar to that which is found east of Waldo Lake to the Crest that is non-wilderness. Net changes expected would be increase in response time, increase in fire size, increased number of initial attack forces, increased mop up time, increased use of retardant, and increased resource damage. Overall, an increased Cost + NVC. This situation is currently being addressed on a regional level because of its expected impacts on regional resources such as smoke jumpers, retardant planes, Type I fire crews, helicopters, and rappel crews. Currently there are no fire dollars available to keep roads accessible.

Roads in areas of relatively low road density are more important for fire suppression activities than any given road segment in areas with a high road density.

QUESTION 12

How does changed access affect public and administrative use of forest and local economics? (include abandoned trails and historic sites)

Closure of roads will restrict the amount of roads used by hunters, firewood cutters, and recreationists in general. Many hunters do not venture far from roads and firewood collectors are closely tied to roads. Road closures would reduce the amount of land accessible for various activities such as driving for pleasure, hunting, special forest product collection, and firewood cutting.

It is assumed that road access to administrative sites (i.e. Huckleberry Lookout or Taylor Burn Guard Station) will be maintained in the future. A decrease in maintenance on roads accessing trail heads would make it more difficult for some to access existing trails. Road closures would have the effect of extending the trail system by effectively creating a new trailhead at the point of road closure. Such a trail system expansion could add to or detract from the trail experience and would certainly increase the amount of trail maintenance that would need to be done.

Transformation of roads to trails could increase horse, mountain bike, and ORV use. Business increases 20% at Sentry Market over the summer season (spring fishing through fall hunting). An increase in trail users could seasonally benefit local businesses, especially if increased recreational opportunities are marketed effectively.

Paving the Charlton Road (#5897) would increase through traffic, increase and potentially change the recreation use in the Waldo basin and has the potential to redirect traffic, bypassing Crescent Junction businesses on Highway 58.

It is not apparent that closing the Taylor Burn Road (#514) will have any economic effect on businesses in Crescent Junction or Oakridge. People who have used this road over the years would be displaced. This road provides an experience unique to the area. Very few roads on the west side of the mountains present its types of driving challenge and experience; a significant reason why the road has been kept open.

Issue #4

The introduction and spread of non-native species is affecting the native flora and fauna.

ISSUE #4 KEY QUESTIONS

QUESTION 1

Where and to what extent has introduction of non-native species affected native flora and fauna?

Some introduced species have contributed to beneficial effects to native species by contributing to local prey populations that are relatively free of chemical contaminants (such as those contained in the tissue of many neotropical migratory birds). Other species have detrimental effects on native species by competing for habitat and prey resources, or by direct interactions including nest parasitism and predation on native species. Loss of native species can have social and economic effects in terms of entity and medicinal values.

Stocking of non-native species and strains of fish and the introduction of fish to naturally fishless lakes has occurred since the early 1900's. ODFW has been largely responsible for fish stocking, with anglers stocking lakes and streams with their favorite fish species occurring to a lesser extent. The introduction of non-native species of fish has negatively affected naturally occurring aquatic species. The introduction of brook trout to many of the lakes has affected downstream native populations of cutthroat trout and rainbow trout as well as anadromous species such as bull trout. Brook trout often migrate down-stream from the lakes where they were originally introduced. Brook trout often out compete rainbow trout and cutthroat trout and hybridize with bull trout.

The introduction of fish to previously natural fishless lakes may negatively affect species naturally occurring in the lake. Introduced fish eat frogs and salamanders (which were previously the top predator), as well as aquatic macroinvertebrates and the larger species of zooplankton, thus changing the community structure of the lake. Bullfrogs have similar effects on native species. The relative importance of these native non-fish communities varies depending upon social values.

Several non-native plants are now well established in the vegetative communities in the North Fork watershed. Non-native vegetation will continue to be a formidable presence in the landscape. Continuing invasion and establishment will occur, whether from inadvertently traveling in underneath vehicles/equipment or on tires, from stock packing use on trails, spread by road grading activities, perpetuated by timber harvest, or road right-of-way maintenance activities. These non-native plants out compete natives in meadows formerly grazed and seeded with forage mixes, or by non-native erosion control and roadside seeding. Roadsides, temporary spur roads, and fire lines often serve as seed beds for noxious weeds. However, if roads are closed and allowed to overgrow, many noxious weed and non-native populations would eventually become shaded out by overtopping vegetation. The same trend holds true in maturing stands. Some will remain in the system as they are already naturalized species. Of concern are upper elevation areas where tree regeneration is slower and migrating weed populations could invade and establish and displace native plants, and floodplain areas where Himalayan blackberry exists.

QUESTION 2

What is the social and economic effect of introduced non-natives?

Some introduced species have contributed to social and economic well being by offering berry picking, sport hunting and fishing opportunities, by enhancing scenic quality, and controlling other undesirable exotic species, providing for erosion control, and providing flowers for sight-seeing. Others have less

desirable social and economic effects such as toxicity to livestock, infestation of agricultural areas, contamination of food stuffs and buildings, depredation on crops and poultry, and, in some areas, reduction of bird watching opportunities.

The social and economic effects of introduced fish species varies depending upon if social values determine that fishing for natives (rainbow and cutthroat trout) or non-native species (brook trout and kokanee) is more important, or whether amphibians native to lakes are more desirable than fish.

Issue #5

Need to restore and maintain the habitat for future re-introduction of salmon and bull trout.

ISSUE #5 KEY QUESTIONS

QUESTION 1

What are the potential social, biological, and economic effects of habitat restoration for and re-introduction of salmon?

Placement of stream-wide in-stream structures would affect kayaking and rafting. Partial spans would not have as great an affect, especially during high flows.

If salmon are reintroduced, Visitor Use Days in the drainage are expected to jump dramatically. There is a good chance that people will make use of the communities of Westfir and Oakridge, bringing recreation dollars into the local economy, potentially increasing property values, and contributing the amount and value of ocean salmon fisheries. Previously low and medium use dispersed sites would be expected to receive high use, and opportunities for solitude would be reduced. A new campground by Short Creek is proposed if Kiahanie becomes more well used. A day use picnic area is also planned for Camp Five, should increased use occur. Should salmon be reintroduced, anglers could monopolize interpretive and swimming hole parking areas. This could affect swimmers and visitors using the Scenic Byway.

According to the Wild and Scenic River Plan, no outfitter guide permits connected with boat and related activities will be issued, eliminating a niche for gaining economic benefit. This will force most anglers to fish from the banks (it's a very technical river to boat), which is expected to increase user formed trails and trampling of vegetation.

There are basically three major river users; anglers, boaters, and swimmers. If salmon are re-introduced and prime fishing days overlap with prime swimmer days, there is time before conflict occurs to develop education and outreach programs on proper behavior for each group. The greatest potential for such conflict could occur in late spring and early summer when anglers are fishing for anadromous fish. There could also be a need to close some areas to use if spawning activity would be affected by fishing, swimming, or boating.

If salmon are re-introduced, more intensive water treatment for the City of Westfir may be needed (increased amounts of chlorine) as bacterial counts could increase. Conversely, salmon carcasses in the stream system would provide for higher rates of primary productivity due to the nutrients released into the system, and would provide more prey base to species like the bald eagle and black bear. Salmon carcasses in the upper reaches of the system would probably not affect Westfir's water quality as the aquatic ecosystem would likely capture nutrients before they reach the water intake.

Issue #6

There is a demand for products from forest land (other than timber).

ISSUE #6 KEY QUESTIONS

QUESTION 1

Where are forest products (other than timber) located in the watershed?
Willamette NF ecoplot data was used during this analysis to determine areas in which several commonly requested miscellaneous SFP's could be found in sufficient quantities to collect commercially on a sustainable basis. The ecology plots were not systematically placed, so this information could only be used to make general assumptions about species' distributions. Ecoplots and associated plant associations were identified where cover measured at 35% and greater for vine maple, rhododendron, salal, dwarf Oregon grape, big huckleberry, and beargrass. Mazanita, wild ginger, cascara, and madrone were listed when any measurable cover was given. Willow was plotted at 15% and greater, and sword fern and prince's pine at 20% and greater. Figure 21 of the Reference/Current Condition chapter shows stands containing the plant associations that were identified to harbor potential SFP areas. This same map (Figure 21) also identifies where overlaps between product extraction and LRMP restrictions may occur.

Restrictions for commercial use as given in Forest Plan Amendment No. 23 that occur in the NFMF watershed are: Wilderness (MA1), RNA (MA4), Special Interest Areas (MA5a), Designated Wild and Scenic Rivers (MA6e), Old Growth Groves (MA7), Wildlife Habitat (MA9d), Dispersed Recreation Without Timber Harvest (MA10c/e/f), and Developed Recreation (MA12a/b). No commercial harvest of mushrooms, truffles, lichens, or bryophytes is permitted in Riparian Reserves, and LSRs.

Suction dredging is currently banned within the main stem of the North Fork. This activity, if it is conducted on tributary streams, may result in downstream increases in turbidity.

QUESTION 2

Are there conflicts between this product extraction and meeting land management objectives and where and to what extent is harvest of these products appropriate?

Special Forest Product extraction conflicts with meeting land management objectives are largely mitigated through collection guidelines set forth in the Willamette National Forest Special Forest Products EA (USDA, 1994c).

Recreational suction dredging may have a negative impact on trout and salmon spawning success if the suction dredging occurs at times of the year when eggs are in the gravel and shortly after emergence. Dredging could also affect water quality, the aesthetics associated with the Wild and Scenic river, and water potability for Westfir. At this time, this activity is thought to be rare and/or infrequent and no water quality problems have been observed associated with recreational suction dredging.

Issue #7

There is an existing infrastructure in this watershed that may have an effect on watershed values and processes.

ISSUE #7 KEY QUESTIONS

QUESTION 1

Where are existing infrastructure land uses and where are additional uses likely to occur in the future?

As per the Wild and Scenic River Plan, when use at Kiahanie Campground consistently exceeds 80% occupancy, construction of a second campground, by Short Creek, is proposed. When both reach capacity, Kiahanie is proposed for expansion. A day use picnic area is also proposed, at Camp Five. Locations for the three additional river access parking spots and 10 interpretive stops provided for by the Wild and Scenic River Plan (USDA 1992) will be limited to relatively flat ground.

At this time no additional infrastructure development, other than that discussed above, is foreseen.

QUESTION 2

Do the presence and use of these facilities affect the resources contained in the watershed, including riparian functions and water quality?

Infrastructure facilities need to be reviewed for compliance with standards and guidelines on the Willamette Land and Resource Management Plan, as amended. Potential conflicts between dispersed recreation sites and TE & S wildlife do occur. These conflicts could be addressed through seasonal restriction of a few sites, rehabilitation of some sites, changes in access to those sites, or a combination thereof.

Water source impoundment's (for suppression and road maintenance purposes) which block culverts are migration barriers for resident and anadromous fish. The impacts on salmonid populations vary depending upon the location of these sources. Those occurring high in tributaries to the North Fork are less detrimental than those occurring adjacent to the North Fork since they are less likely to create barriers to migration. Created water source impoundment's may be a benefit where high quality pool habitat is created.

Campground and picnic area are expected to impact 391 acres over 10 years and an additional 38 acres over 50 years (total of 429 acres). Even with use projected to increase along the North Fork to 14,600 RVDs (developed sites) and 45,000 RVDs (dispersed sites) in the first decade (USDA, 1992), it is unlikely it will affect bacteria levels. Although a study done on the Greenwater River, near Seattle, WA, showed a potential relationship between increased human use and increased densities of bacteria, it was based on 45-55 persons per site. The North Fork corridor is predicted to reach a concentration no higher than 4-8 persons per site.

This analysis has found that existing and planned campgrounds and other infrastructure (as discussed in the Forest Management section of Chapter I, under Issue #7 in chapter II, and the Recreation section of Chapter II) are not inconsistent with riparian and terrestrial objectives of the aquatic conservation strategy. This finding is based upon the relatively small areas affected by these sites in relation to the total area of riparian reserves within the watershed. Additionally, the modifications these sites have made to the landscape are not a high deviation from the natural conditions; that is, tree canopies are mostly intact and landforms are minimally modified.

Some vegetation will be destroyed during construction of recreational sites, but hopefully by directing use, people will use those areas, and not other areas.

The presence of Skookum Campground influences use within the Three Sisters Wilderness. When 100 foot camping setbacks from lakes began, use shifted from previous overnight use to day use. Skookum is now used as a base camp for day hikes into the Wilderness. This helped reduce camping impacts around wilderness lakes, and has no known effect on Skookum Creek.

See discussion for Issue 8 question 1, for impacts from North Waldo, Islet, Shadow Bay and Rhododendron Island Campgrounds.

Issue #8

Waldo Lake area access and travel management.

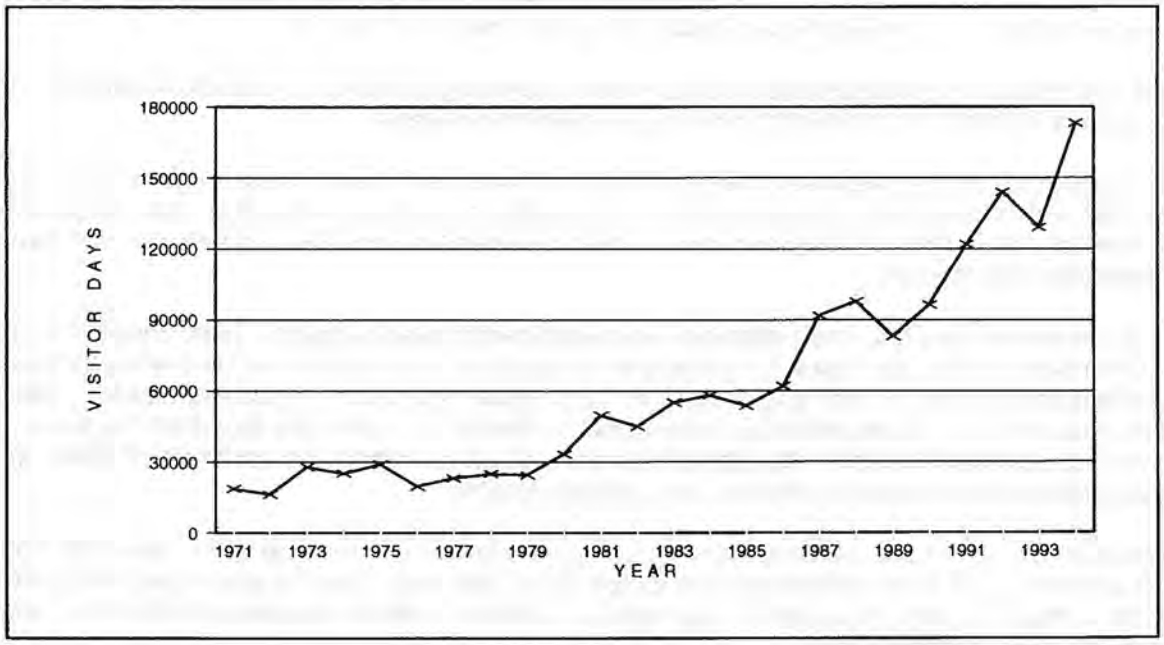
ISSUE #8 KEY QUESTIONS

QUESTION 1

What are the potential impacts from recreation use?

M. emarginata var. aquatica is a Survey and Manage survey strategy 1 and 2 plant species for which site specific management in local planning efforts (Access and Travel Management planning) is of the highest priority. Protection of the known location of this species and conducting additional surveys will improve its chances of viability (USDA/USDI, 1994b).

Figure 2: Waldo Lake Campgrounds Visitor Use Days



The three developed campgrounds at Waldo Lake tend to fill up only during holiday weekends. There has been a 925% increase in visitor-use days (from 18,700 to 173,004) between 1971 and 1994 (see Figure 2 of this chapter). A study of one of ten septic tank drain fields done by the EPA in the early 1970's found no evidence of human effluent reaching the lake. Preliminary analysis of water quality

monitoring data from 1969 through 1994 indicates a substantial increase in the Lake's primary productivity over the last five years in terms of phytoplankton densities and also an increase in zooplankton populations (Larson, 1995). Primary productivity increases are caused by increases in dissolved nutrients which are in turn used by phytoplankton. In an oliogotrophic lake such as Waldo, nutrients are quite scarce. Any available nutrients would be taken up quickly by the Lake's biota, so increased nutrient inputs are most readily seen as an increase in living biomass, especially phytoplankton. Phytoplankton is included in the range of particles which affect water clarity and color. Phytoplankton density is thought to be controlled by nutrient availability and/or zooplankton grazing pressure. Therefore, nutrient flux or concentrations, and zooplankton densities may ultimately affect water clarity and color (ODEQ, 1994b).

While causal mechanisms for the above increases in primary productivity are unknown at this point, the increase coincides with a significant increase in recreational use of the Lake and it's basin. It has also been speculated that the introduction of fish may have influenced this increase in primary productivity by introducing additional nutrients in the form of organic material. Continued increases in primary productivity are of concern since increases in phytoplankton can ultimately affect the Lake's ultra-oliogotrophic state as evidenced by the Lake's clarity and color, which lend it great aesthetic value (ODEQ, 1994b).

As the number of visitors to the Waldo Lake area grows in the future, the ten comfort stations located in developed campgrounds adjacent to Waldo Lake have the potential to fail and result in adverse impacts on water quality in the lake.

Other potential sources of pollution include petroleum products washed from the surface of the three existing boat ramps and fuel spills from gasoline powered boats. In addition, sediment from roadside ditches and heavily used recreation sites located on the lake shore have the potential to be sediment source areas as this material is washed into the lake during high intensity storm events or during the seasonal snowmelt period. Currently there is no documented evidence that water quality conditions within the lake are being adversely affected by anthropogenic sources of polution.

No research has been done to determine if human waste is entering Waldo Lake from dispersed sites on islands or from pit toilets in campgrounds, including Rhododendron Island.

The more popular of the 44 dispersed sites on Waldo's shores and islands show impacts from use. Vegetation has been destroyed by escaped campfires, trampled or otherwise damaged. Soil compaction is common in core site areas. Abandoned trash at sites changes the recreation experience, and invite the accumulation of more trash.

Campers in developed and dispersed sites get along with neighboring campers. Most conflicts occur regarding the noise motor boats make. Some people who camp or boat without motors feel motor noise is intrusive and undesirable (including comments on 1994 Wilderness visitor registration cards). Some people feel motors cause water pollution, some object to the noise, and some also find the smell of gasoline and exhaust objectionable. As both motorized and non-motorized use continues to climb, the conflicts surrounding motor use will continue, and probably escalate.

One potential impact from Lake-centered recreation is accidental fuel or chemical spills, especially from motorized activities. Due to the extremely pure nature of the lake water and the long replacement time for the water in the Lake, there is a concern that spills, or continuous small insertions of pollutants, could compromise the purity of Waldo Lake.

One overriding consideration when discussing potential water quality impacts for Waldo Lake is its sensitivity to change. Because of its low buffering capacity (Maleug et al., 1972; Lider et al., 1980, Carter et al., 1966; and Larson and Donaldson, 1970) and long water volume replacement period,

(Johnson et al., 1985), any changes in water chemistry and/or trophic status could last for some time, even after existing and/or potential pollution sources are corrected.

The effects, if any, of recreational use on bald eagles nesting at Waldo Lake and in the basin have not been studied. Little is known of the nesting success of two known nest sites in the area, but successful reproduction has not been confirmed. How the eagles of the area react to a variety of recreational users in direct proximity to their nests (including hiking, horseback riding, fishing, boating, mountain biking, camping and snowmobiling) is unknown. The critical period for disturbance to nesting bald eagles is considered to be from a month prior to nest initiation and through incubation (January through April). Rearing of young continues through May and fledging should occur between mid June and late August. The Forest Plan requires measures to reduce disturbance for nesting bald eagles within a primary zone of approximately 125 acres, with specific restrictions for the critical area within 660 feet of known nests. Two trail segments, some dispersed sites and popular fishing areas on two lakes are potentially within 660 feet of these nests. Potential use of the Shadow Bay facilities and over snow travel areas on and east of Waldo Lake Road could occur during the nest initiation and incubation period for bald eagles. Motorized activity usually does not occur within 1 mile of the nest site. The effect of human activity, motorized or not, on eagles during nest initiation and incubation in and around Shadow Bay is not known.

Though potential habitat is present in the area for peregrine falcons, occupancy has not been observed. The area with the highest potential is relatively remote and is not accessed by existing trails, thus potential for adverse impacts to falcons by recreational use of existing facilities is low.

Though wolverines are present in the Waldo Basin area, existing recreational activity probably has little or no effect on use of the area by wolverine. This is due to the presence of extensive remote areas, including the wilderness area, limitations on accessibility to most of the area from early winter through late spring or early summer, and recreational use being concentrated on a few trail corridors. Opening of the area east of Waldo Road, north of Bobby Lake trail and south of Charlton Lake to over-snow travel should not affect wolverine due to the presence of adjoining large tracts of area closed to oversnow travel, and the large home range size typical of wolverine. Also, due to the relatively extreme snow conditions in this area, low use levels are predicted if this areas was opened to snowmobile use.

QUESTION 2

What opportunities exist to better provide for a range of quality recreational experiences with lesser amounts of user conflict?

Summer -

Much of the Waldo Lake trail passes next to, or through, dispersed sites. Unknown people passing through sites tend to upset users of those sites who may fear theft or simply react to a reduction in their perception of solitude.

If current stretches of Waldo trail remain away from the shoreline, the solitude available to dispersed campers, trail users, and boaters would be maintained. Conversely, trail placement can be a management tool to decrease the desirability of some dispersed sites on the lake shore.

All new facility construction or reconstruction has the opportunity to include access to natural settings for users with disabilities.

Over the last 23 years campground use has increased by 925 percent. This suggests that trail use may also have increased by a similar amount. Use of trails by mountain bikes increased in popularity about five years ago. Opportunities exist to reduce or prevent conflicts between traditional trail users and this new use through education on trail etiquette.

Because the Harralson Horse Camp does not have a water source, there is an opportunity to prevent friction between horse and non-horse campers by providing a water source at the Harralson camp, or to provide a horse camp at another location far from other developed sites where water is available.

Removal or restriction of motor boat use on Waldo Lake would reduce or eliminate the conflict between those who find motor noise disruptive and intrusive (restriction could include electric engines only, or motorized use in designated areas of the lake). Elimination of internal combustion motors from Waldo Lake could provide a lake-oriented recreational experience for non-motorized boaters unparalleled in Oregon. However, such an action would reduce access to Waldo Lake for those wishing to use internal combustion motor boats.

Winter -
Use of snowmobiles east of a portion of road 5897 under specific conditions (greater than two feet of snow) offers local residents a nearby, challenging recreation experience. Opening the area north of Bobby Lake Trail has a low probability of having skier/snowmobiler encounters. Use of Road #5897 where it turns east (known as the Charlton Road) as the northern boundary for over-the-snow use, would protect the Charlton Butte Research Natural Area from potential effects of snowmobiles. However, this area is designated Semiprimitive Non-Motorized in the Forest Plan. Major snowmobile areas to the North (Bachelor), East (Crescent and Paulina) and South (Diamond Lake) all allow over-the-snow use. These areas are all immediately adjacent to the Deschutes National Forest.

Most snowmobilers are attracted to places offering gas and food and trail connections to similar areas. Many non-local snowmobilers prefer the Crescent Junction area, which offers dry snow, and groomed trials that connect to other popular snowmobiling areas. The snow park for the Waldo road is small and uneven and is used mainly by locals. If the Forest Service improves or expands this parking area, non-local use will not necessarily significantly increase. Local snowmobilers currently complain about the restriction to one travel corridor. Increasing use within the existing narrow corridor may exasperate the situation and increase violations of over-the-snow use.

QUESTION 3

What motorized and non-motorized boating opportunities exist within the immediate surrounding area?

The only lake with the size and clarity of Waldo is Crater Lake. The National Park Service prohibits public boating on Crater Lake. Only Park research vessels and a concessionaire craft are allowed, and they are motorized.

Almost all Oregon lakes in mountainous settings (outside of Wilderness areas) allow motorized use. If there are restrictions they are usually speed related. All the larger lakes close to Waldo allow motors (Crescent, Odell, Davis, Hills Creek, Crane Prairie, Wickiup and Summit). All of the larger, popular lakes around the state are motorized (Diamond, Lemolo, Detroit, East, Paulina, Timothy, Howard Prairie, Applegate, Lake of the Woods, Hills Creek, Lookout Point, Fern Ridge, Fall Creek, Foster, Green Peter, and Wallowa). Waldo Lake has a 10 mph speed restriction. Of the above mentioned lakes, seven and one half have 10 mph speed limits (Wickiup has portions under the 10 mph regulation). The rest have higher, or unrestricted speed limits. Private boating is not permitted on Crater Lake, which is the closest to Waldo in size and water quality.

Most non-motorized lakes are small and shallow and do not offer the same boating experience as a larger body of water. There are two small lakes close to Waldo, Gold and Hosmer, that are non-motorized. These lakes do not provide the same kind of recreation experience for non-motorized boat use that Waldo Lake could provide due to their small size.

QUESTION 4

What is the need for emergency and administrative access?

Emergency access to the west side of the Lake is required infrequently in fire suppression situations or to rescue boaters with mechanical or other problems. The changeable nature of the weather at Waldo Lake, the large size of the Lake, and the potential need for emergency rescue work is one rationale often presented for the use of motors. These conditions exist even more significantly in other areas that restrict the use of motors (specifically the Boundary Waters Canoe Area in Minnesota and Yellowstone Lake in Wyoming), apparently without any significant problems.

Administrative use on Waldo has historically been low; cleaning and checking use on dispersed sites; checks on fishing and boating regulations; medical and fire emergencies. If public use of boat motors were to be restricted, administrative use, aside that needed during emergency situations, could be efficiently provided by boats without internal combustion motors.