Upper Middle Fork Watershed Analysis

Update

January, 2002

Large Woody Debris Deposition Behind Hills Creek Dam, Upper Middle Fork of the Willamette River, Post 1964 Flood Event

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Introduction

This watershed analysis update is designed to supplement the August 1996 Upper Middle Fork of the Willamette River Watershed Analysis, August 1996. Changed conditions in the watershed created a need to update this Watershed Analysis.

Purpose of the Watershed Analysis Update

The initial need for an update of the Upper Middle Fork Watershed Analysis was identified in November of 1999, with a letter from the U.S. Fish and Wildlife Service. The Service recommendation for a revision was based on a new listing of threatened and endangered species in the Upper Middle Fork of the Willamette River. In addition, this letter, centered on concerns for habitat condition of North Spotted Owl Habitat and Canada Lynx in the Upper Middle Fork.

Watershed Analysis is the process of studying and analyzing watershed information to guide projects and restoration activities in watersheds. These reports are designed to be living documents and incorporate new information. The watershed analysis purpose and need is to address the issues in the November, 1999 letter from Fish and Wildlife Service that result from changed conditions (Kenops, 2001). These changed conditions include:

- The listing of Bull Trout and Spring Chinook Salmon.
- The fires of 1996 that burned in the South Zone Complex.
- The floods of 1996/1997 that changed stream conditions in the upper Middle Fork.
- Species recently added to R6 Regional Foresters Sensitive Species list and potential for federal listing under the endangered species Act. (Fisher, Wolverine).

The watershed analysis is updated to reflect recovery goals of these species and the changed environmental conditions generated from disturbance elements of fires and floods.

A new level II stream survey was completed for the main stem of Upper Middle Fork of the Willamette River (Ecosystems Northwest, 2001). This watershed analysis update will also disclose the new information discovered in the stream survey.

This update will follow the direction and guidance listed below:

- Re-analysis is centered on responding to issues listed in the November 1999 letter from the U.S. Fish and Wildlife Service.
- The re-analysis will track with the six step process in the original Watershed Analysis.
- Gathering of new information will be minimized.

Tiering to August 1996 Watershed Analysis

This update will tier heavily to the 1996 Watershed Analysis. This Watershed Analysis is divided into two parts. The goal of section I is to address all of the issues of the November 1999 Fish and Wildlife Service letter, synthesize information, and to relate these issues to key issues in the 1996 analysis. Section, II is a list of Findings and Recommendations to guide restoration and management projects in the Upper Middle Fork based on new information.

Several new plans guide management in the Upper Middle Fork Watershed, these include the Water Quality Restoration Plan for Upper Middle Fork and the Bull Trout Recovery Plan for Upper Middle Fork. The water quality restoration plan was completed in draft form in October, 2000. This analysis update parallels the draft restoration plan but clarifies some points.

Location

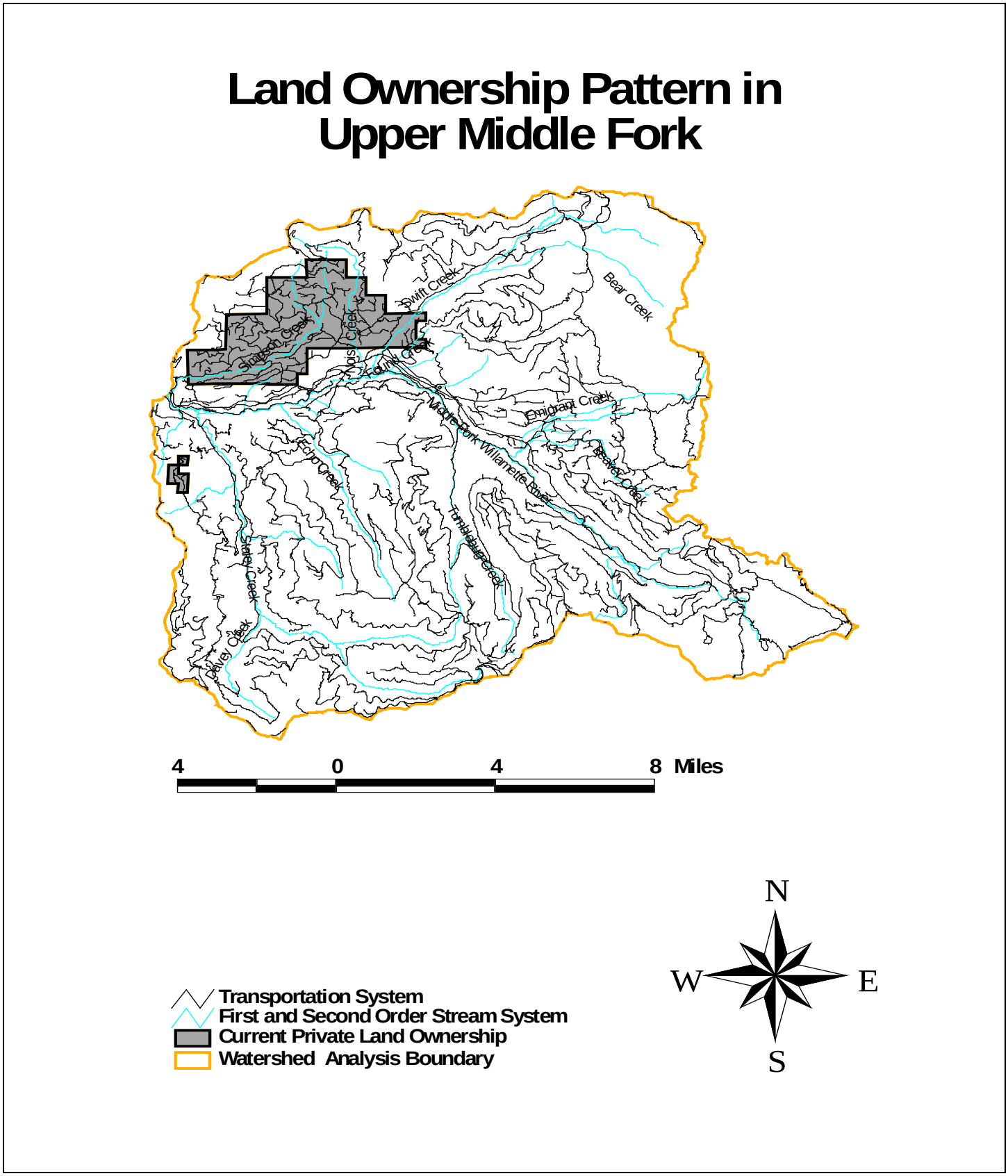
The location of the project area is on the Middle Fork Ranger District in the 5th field watershed 23. Six, sixth field sub watersheds comprise the watershed, these are:

23-1 Staley Creek
23-2 Tumblebug Creek
23-3 Upper Middle Fork/ Paddy's Valley
23-4 Middle Fork Willamette/ Indigo Springs
23-5 Swift Creek
23-6 Middle Fork of Willamette/ Echo Creek

The area is located in the vicinity of the Upper Middle Fork of the Willamette Watershed, see Figure 1 of the August 1996, Watershed Analysis.

Mixed federal and private land ownership exists in the Upper Middle Fork of the Willamette National Forest, Figure I-1, below, depicts the current mixed land ownership condition in the watershed.

Figure I-1 Upper Middle Fork Land Ownership Pattern



Response to the Watershed Analysis Amendment Request

Listed below are analysis and responses provided by the Middle Fork District to issues/concerns listed in the U.S.D.I. Fish and Wildlife Service November, 1996. In this portion of the analysis amendment, the original issue is listed, as stated by the Fish and Wildlife Service. Following this, the key question and issue from the 1996 Watershed Analysis is stated. Below each key question is the scientific, analytical, and professional response to these issues. In some cases the issue presented by the Fish and Wildlife Service do not related to the key issues presented in the original watershed analysis. In these situations a new key question is developed. For the most part, the original key questions are still valid with minor changes. Listed below are the eleven aquatic habitat condition concerns.

Eleven Listed Aquatic Concerns

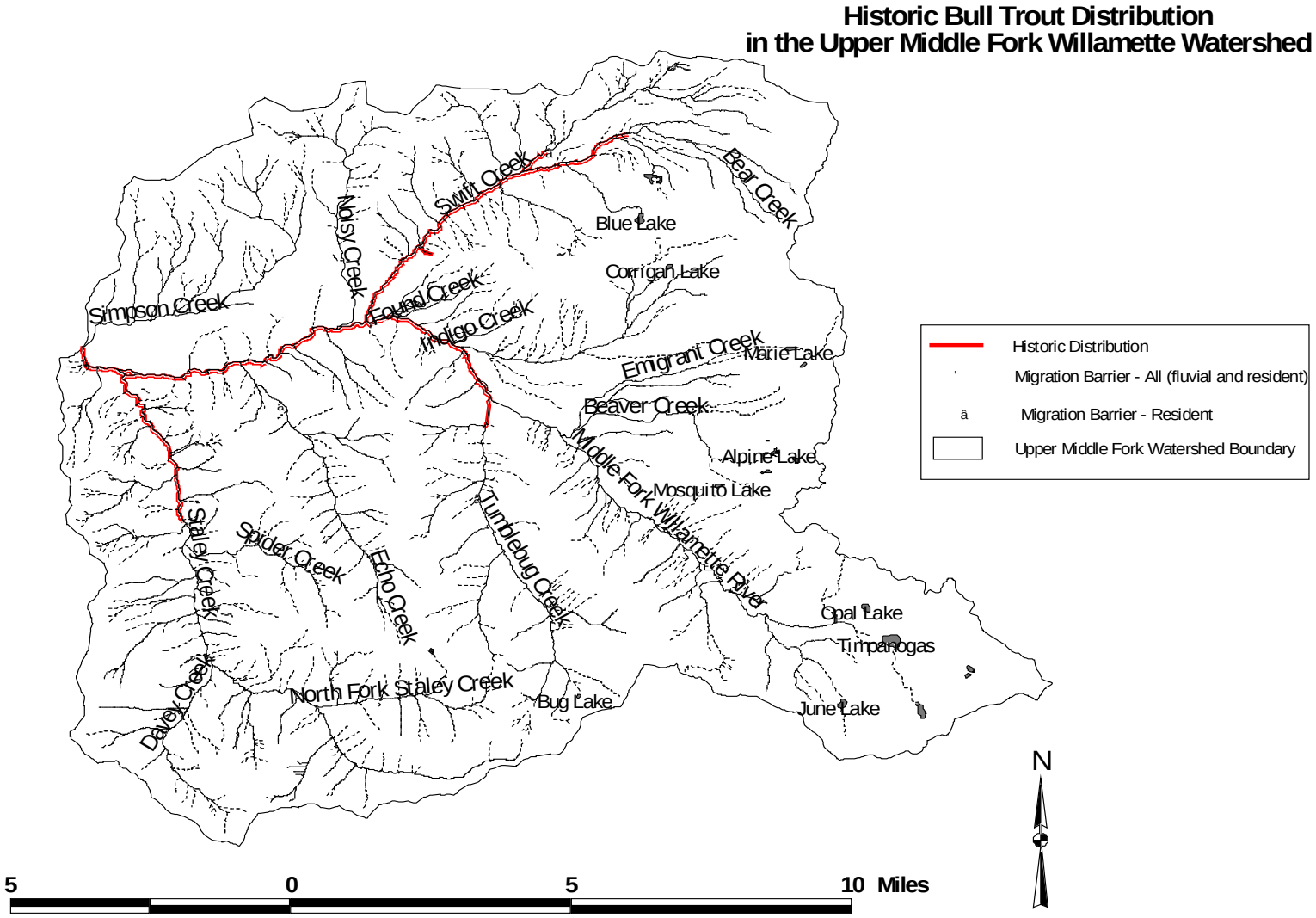
1. Identify and map important bull trout rearing and spawning habitat, as well as current and future re-introduction sites, and potential future distribution down to Hills Creek Reservoir – if this information is known or available.

Functional Relationship – Bull Trout Habitat

Historical references indicate that bull trout *Salvelinus confluentus* in Oregon were once distributed throughout 12 basins in the Klamath River and Columbia River systems. Bull trout were probably found throughout the Willamette Basin, however available documentation is limited (Buchanan et al. 1997). Bull trout in the upper Middle Fork Willamette Watershed likely ranged throughout the mainstem Middle Fork Willamette and associated larger tributaries (Figure 1-1, Historic Bull Trout Distribution Map). Reports of bull trout observations in the Upper Middle Fork Willamette Watershed gradually declined until the last known bull trout was photographed above Hills Creek Reservoir in 1990. In 1989, based on the decline of bull trout populations in much of their historic range the American Fisheries Society classified this fish as a "species of concern" (Ziller and Taylor 2001). In 1993, the Oregon Department of Fish and Wildlife (ODFW) listed all of the state's bull trout populations as "sensitive". Buchanan et al. (1997) listed bull trout populations in the Middle Fork Willamette as "probably extinct". On June 10, 1998, the US Fish and Wildlife Service (USFWS) listed the Columbia River bull trout population segment (including the Willamette Basin populations) as *Threatened* under the Endangered Species Act.

Bull trout require a narrow range of temperature conditions to reproduce and survive. Adults may begin migrating to spawning grounds in the spring and migrate slowly throughout the summer. Spawning occurs when water temperatures drop below 9-10 °C, (48.2-50°F) usually in late summer through early fall (August-November). Eggs are deposited in gravel, usually near shallow, slow moving water. After deposition bull trout embryos incubate in gravel substrate for several months before hatching in January. The alevins remain in the gravel, absorbing the yoke sac until about April. Emergence from the gravel to the fry stage usually takes approximately 200 days. Newly emerged fry average 25-30 mm (1-1.2 inches) and double their length in the first summer of growth. The extended period between egg deposition and emergence make bull trout extremely sensitive to increases in stream sediments and

Figure 1-1 Historic Bull Trout Distribution



Map

water quality. Therefore, bull trout are an excellent indicator species for the overall health of the entire aquatic ecosystem.

Most juvenile bull trout remain in the tributary streams for 1-3 years before emigrating to the larger river system. During stream residence juvenile bull trout are opportunistic feeders, primarily eating aquatic insects. Bull trout larger than 110 mm (4.3 inches) usually eat only other fish, but have been known to feed on frogs, garter snakes, mice, ducks and small children. The bull trout population in the upper Willamette system is largely migratory, growing to maturity in lakes or large rivers and migrating through the river system and into tributaries to spawn.

Limiting Factors that have adversely affected Upper Middle Fork Willamette bull trout populations include habitat alterations, especially impassable dams and culverts (Wevers et al. 1992). Ratliff and Howell (1992) list habitat degradation, passage barriers, over harvest, chemical treatment projects, and hybridization and competition with non-native brook trout as possible reasons for the decline or extirpation of Willamette Basin bull trout. The construction of Dexter, Lookout Point, and Hills Creek Dam in the 1950's and 1960's and chemical treatment projects prior to completion of Hills Creek Dam in 1961 to remove "rough fish" have undoubtedly had a significant impact on bull trout populations. Rough fish were directly targeted for removal by rotenone poison during these chemical treatments, however, salmonid species, which include bull trout were also killed (Appendix C). Habitat alterations from timber harvest and associated road construction, loss of juvenile spring chinook as an important food source, and over harvest from angling also contributed to the decline of the Middle Fork Willamette bull trout population.

Related Key Question

Where and to what extent has road density, condition, location, and use influenced aquatic species distribution and habitats?

Response: Description of Reintroduction Project

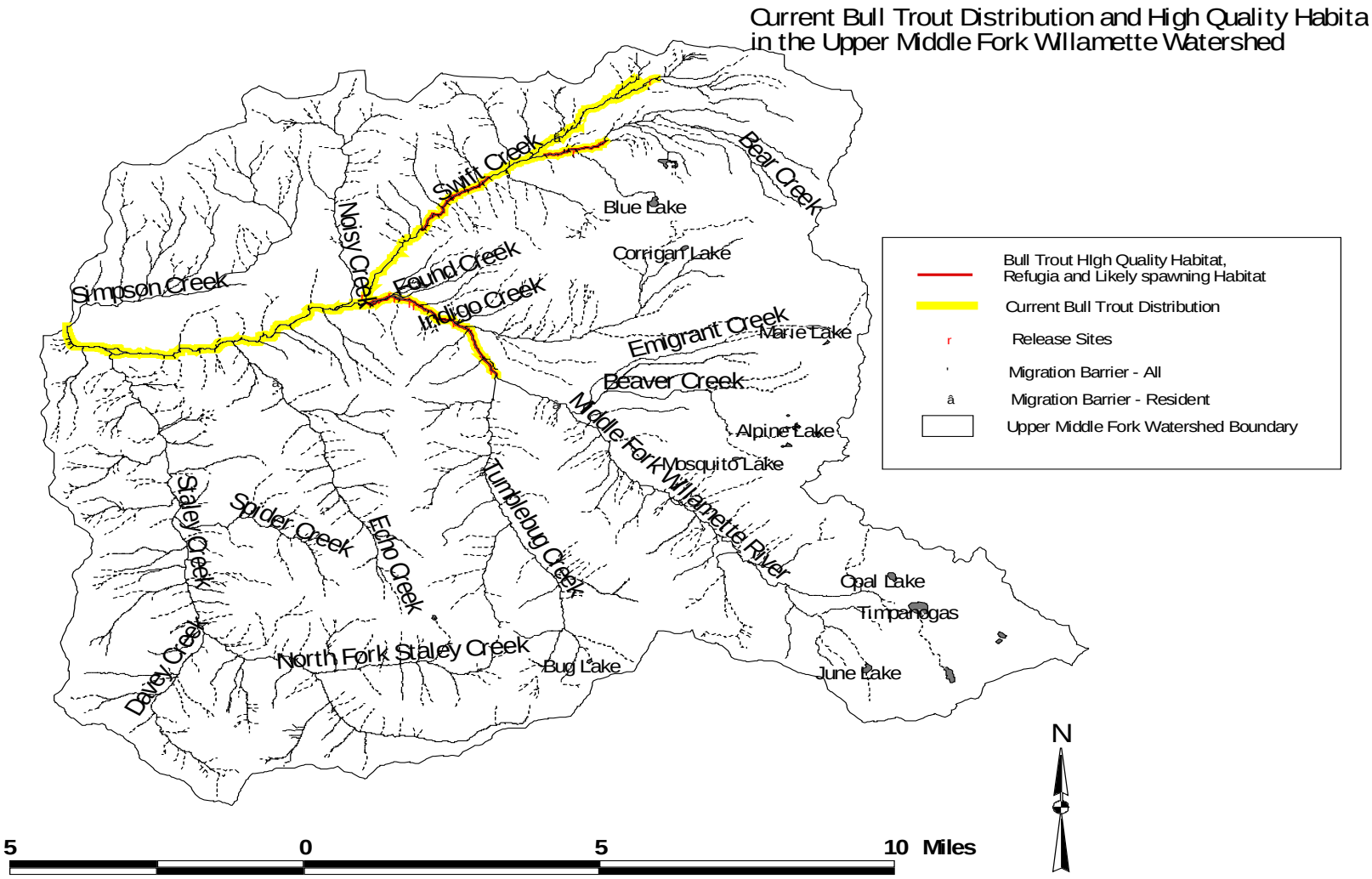
In a 1997-1998 cooperative effort with Oregon Department of Fish and Wildlife the U.S. Forest Service/Middle Fork Ranger District began analysis and feasibility studies for the selection of sites to reestablish bull trout in the Middle Fork Willamette Basin. Reintroduction sites were selected principally on criteria and life history information related to water temperature, juvenile rearing habitat and food availability. In May 1997, ODFW and the Middle Fork Ranger District transferred bull trout fry from Anderson Creek, a tributary of the McKenzie River, to three tributaries (Skunk Creek, Chuckle Springs, and Indigo Springs) of the Middle Fork Willamette River. Through 2001, five additional release sites (Iko Springs, Shadow Springs, Swift Creek, Bear Creek, and Found Creek) were identified and added to the reintroduction program. To date over 7800 bull trout fry have been released in the Upper Middle Fork Willamette Watershed.

High Quality Habitat

High quality bull trout spawning and rearing habitat exists in the Middle Fork Willamette and some associated tributaries (Figure 1-2, Current Distribution Map). High quality habitat includes refugial areas that offer protection during periods of extreme conditions, examples include low flow, high flow, and high

water temperatures. The area of the Middle Fork Willamette between Chuckle Springs and Found Creek is heavily influenced by natural cold-water springs. Water temperatures in some of the larger springs that are used for bull trout reintroduction sites typically range from 5.6 to 8.8°C (42 to 48°F). The main stem Middle Fork Willamette in this area generally remains below 10°C (50°F) year around. These cold-water tributaries provide outstanding habitat for bull trout fry and juveniles. The reintroduction sites themselves do not contain large areas that could be utilized for spawning, however, prior to the release of bull trout fry initial surveys documented several sites in the main stem Middle Fork Willamette that would be suitable for adult spawning. Ample spawning habitat is also available in the larger tributaries such as Swift Creek and Bear Creek. At this time it is not known precisely where returning bull trout will spawn. At the earliest, adult bull trout from the 1997 reintroduction should return to areas around their respective release sites in 2002.

Figure 1-2 Current Bull Trout Distribution Map



Monitoring

Monitoring of Middle Fork Willamette bull trout populations began shortly after the first reintroduction in 1997. The primary methods used to monitor bull trout are night snorkeling and various types of trapping techniques. The reintroduction program began in March 1997 with 178 bull trout fry released into Indigo Springs, Chuckle Springs and Skunk Creek by ODFW and the US Forest Service (Figure 1-2, above). After the initial release several attempts were made to observe and monitor growth of these fish. However, with one exception, near the Skunk Creek release site in October 1997, bull trout juveniles were not observed. Also, in the fall of 1997, Iko Springs and Shadow Springs were identified and assessed as unique areas that would likely be suitable for rearing juvenile bull trout. In March 1998, 938 and 150 bull trout fry were released in Iko Springs and Shadow Springs, respectively. In 1999 through 2001 Swift Creek, Bear Creek and Found Creek were added to the reintroduction schedule (Table 1-1). After release several efforts to observe these fish were made with few documented sightings in the reintroduction areas. Bull trout typically exhibit nocturnal behavior in all life stages. Young of the year fry generally rear in complex cover such as gravel, mosses, filamentous algae, wood, and detritus, which makes observation difficult. In October 1998, night snorkel surveys became much more effective at monitoring populations and growth as the fry became larger and less elusive. Subsequent surveys and trapping efforts through 2001 have resulted in numerous documented sightings of juvenile and sub-adult bull trout in all reintroduction sites and the mainstem Middle Fork Willamette.

Table 1-1 Number of Bull Trout Transferred to the Upper Middle Fork Willamette Watershed

Year	Indigo Springs	Chuckle Springs	Skunk Creek	Iko Springs	Shadow Springs	Swift Creek	Found Creek	Bear Creek	Totals
1997	73	49	56						178
1998		411		938	150				1499
1999		302		1000	150	526			1978
2000	204	349		1075	53	822	285		2788
2001		269		418		96		673	1456
Totals	277	1380	56	3431	353	1444	285	673	7899

The bull trout reintroduction program is scheduled to continue through at least 2002. It is expected that between 2,000 and 3,000 fry will be transferred to the Middle Fork reintroduction area in 2002. These fry will likely be distributed at previous levels in Iko Springs, Chuckle Springs, Swift Creek and Bear Creek. The Forest Service and ODFW are currently investigating Echo Creek as a possible addition to the 2002 schedule. Echo Creek was assessed early in the program as a possible release site, however, due to an impassable culvert (Road 2143-325) downstream of suitable bull trout habitat it was not utilized. The culvert will be replaced in 2002 with an arch that will again provide fish passage upstream to bull trout habitat. With the removal of the culvert and an adequate supply of fry from Anderson Creek in 2002, Echo Creek may become a bull trout reintroduction program release site.

Although spring chinook salmon are endemic to the upper Middle Fork Willamette and surrounding drainages, artificial propagation and transportation is required to maintain existing

populations. The species was Federally listed as threatened in 1999, due in part to a decline in populations within the Upper Willamette River ESU. Available habitat has been reduced by construction of dams in the Middle Fork Willamette River Basin, and these dams have probably adversely affected remaining production via thermal effects (NMFS 1998). Upstream migration of spawning adults in the Middle Fork Willamette is blocked by three dams; Dexter at river-mile (RM) 192, Lookout Point (RM 195), and Hills Creek (RM 221). According to Mattson (1948) principal spawning areas on the Middle Fork Willamette were from the West Fir Bridge (RM 214), downstream five miles to Duval Creek (RM 209) and the extreme range is listed from the Rigdon Gauging Station to Duval Creek, all of which are several miles downstream of Hills Creek Dam. Current populations upstream of Dexter Dam are sustained solely by an ODFW trap and haul program.

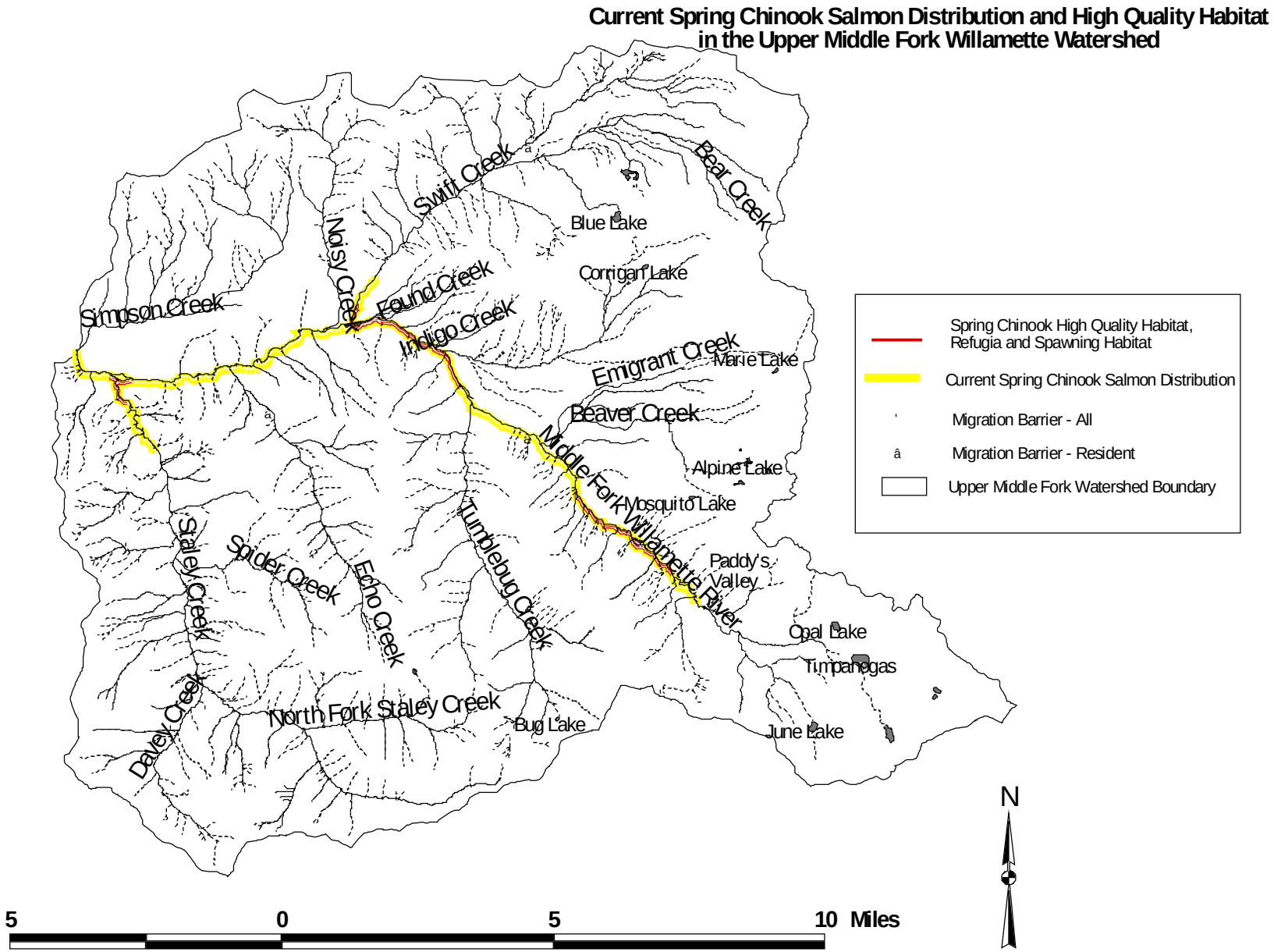
Spring chinook salmon are an integral component of bull trout diet. The selection of bull trout reintroductions sites strongly considered areas that already contained a high number of spring chinook salmon fry. Since 1993, ODFW has transported pre-spawned adult spring chinook salmon from downstream of Dexter Dam to the Middle Fork Willamette, upstream of Hills Creek Reservoir (Table I-2). Salmon redds and spawning have been documented since the project began, however, comprehensive surveys of redd counts, timing and preferred spawning were not completed until 1999. In the summer of 1999, ODFW transported 1073 of these pre-spawned adults to the Paddy's Valley area of the upper Middle Fork Willamette. Redd surveys were completed on approximately 1.75 miles of stream channel in Paddy's Valley. At least 44 redds were observed with the highest concentration within 0.8 miles upstream and 0.4 miles downstream of the release site. In many cases entire areas were covered with redds and it appeared that numerous salmon spawned in the same location. Given the number of fish released in the area it is likely that the actual number of redds was higher than recorded. The majority of redds were closely associated with accumulations of gravel collected by large woody material (LWM) in the stream channel. Redds were rarely observed in areas that lacked LWM in the stream. Of the 1073 adult fish transported to the area, 40 carcasses were observed during redd surveys. Carcass consumption by wildlife was evident in that many were observed pulled onto the bank or on top of logjams.

Table 1-2 Spring Chinook Salmon Released in the Upper Middle Fork Willamette

Year	Adults	Juveniles (Hills Creek Reservoir only)	Jacks	Location
1992		49,950		Near Echo Creek
1993	764		32	Near Echo Creek
1994	176		1	Near Echo Creek
1995	515	50,142	7	Near Echo Creek
1996	341	50,160	19	Near Echo Creek
1997	956			Near Echo Creek
1998	564		8	Near Echo Creek
1999	1049		24	Paddy's Valley
2000	1983		20	Paddy's Valley and near Echo Creek
2001	2261			Paddy's Valley and near Echo Creek
Totals	**8,609**	**150,252**	**111**	

Prime chinook salmon spawning and rearing habitat is located primarily in the mainstem Middle Fork Willamette and its major tributaries. Spawning and rearing also occurs in smaller streams close to or where they meet the Middle Fork Willamette. Areas of the mainstem Middle Fork Willamette that serve as principle spawning and rearing habitat are near Staley Creek, Swift Creek to Tumblebug Creek and the Paddy's Valley area (Figure 1-3, Current Salmon Dist Map). ODFW plans to continue releasing adult spring chinook salmon upstream of Hills Creek Reservoir. These salmon currently provide an important food source for bull trout and return essential organic nutrients to the entire watershed.

Figure 1-3 Current Spring Chinook Salmon Distribution



2). *Outline recovery objectives for bull trout in the Middle fork (i.e. self-sustaining populations in the spring area within 5 years and 5-10 years for the remainder of the basin- or something similar).*

Functional Relationship – Recovery of Bull Trout

Bull trout in the United States are distributed within a large area that encompasses five distinct population segments (DPSs). The U.S. Fish and Wildlife Service (Service) adopted a two-tiered approach to develop the recovery plan. The first tier addresses broad aspects of bull trout recovery that applies to the entire United States and DPSs. The second tier addresses aspects of bull trout recovery at the level of specific areas within a DPS (i.e., recovery units).

A recovery team was convened to address the first tier with members of Service biologists, a representative from fish and wildlife resource agencies in each of four northwestern states (Idaho, Montana, Oregon, and Washington), and a representative of the Upper Colombia River United Tribes (Confederated Tribes of the Colville Reservation, Coeur d' Alene Tribe, Kalispel Tribe, Kootenai Tribe of Idaho, and Spokane Tribe). To address the second tier, recovery unit teams were enlisted, one for each recovery unit or recovery subunit. Membership on the recovery unit teams consists of persons with technical expertise in various aspects of bull trout biology within each recovery unit. Primary functions of the recovery teams were to assist in addressing issues specific to an individual recovery unit. Members of the recovery team led recovery unit teams to ensure consistency among recovery units.

Related Key Question

Where and to what extent has road density, condition, location and use influenced aquatic species distribution and habitats?

Response: Bull Trout Recovery Objectives

The goal for recovery of bull trout in the Willamette Recovery Unit, which includes Middle Fork Willamette population, is to ensure the long-term persistence of self-sustaining, complex interacting groups of bull trout distributed across their historic range. In order to achieve this goal the following objectives have been identified for the Willamette Recovery Unit.

1). Current distribution of bull trout within the Upper Willamette basin is maintained and bull trout are re-established in previously occupied habitats.
2). Stable or increasing trends in abundance of bull trout in the Willamette Recovery Unit are maintained.
3). Suitable habitat conditions for all bull trout life history stages and strategies are restored and maintained.
4). Genetically diverse populations of bull trout within the Willamette Recovery Unit are conserved.

5). Improve public and agency awareness of bull trout value and importance of protection and restoration efforts.

Individual recovery units are "recovered" when the specified criteria in the recovery plan are met. The following list of key words and definitions describe important concepts and terminology specified in the recovery plan.

Distinct Population Segment – The US Fish and Wildlife Service has formally determined there are five bull trout DPSs across the species range within the coterminous United States; Klamath River, Columbia River (DPSs that includes upper Middle Fork Willamette population), Jarbidge River, Coastal-Puget sound, and St. Mary-Belly River. Each meets the test of discreteness and significance under joint policy of the service and National Marine fisheries Service (61 FR 4722), and these are the units against which recovery progress and delisting must currently be measured.

Core Area - The combination of core habitat (i.e., habitat that could supply all elements for the long-term security of bull trout and a core population (a group of one or more local populations that exist within core habitat) constitutes the basic unit on which to gauge recovery within a recovery unit. Core areas require both habitat and bull trout to function, and the number (replication) and characteristics of local populations inhabiting a core area represents the closest approximation of a biologically functioning unit for bull trout.

Core Population - A group of one or more bull trout local populations that exist within core habitat.

Local Population – A group of bull trout that spawn within a particular stream or portion of a stream system. Multiple local populations may exist within a core area. Until site-specific research indicates spatial, temporal, or genetic isolation, a local population will be considered as the smallest group of fish that is known to represent an interacting reproductive unit. For most waters where specific information is lacking, a local population may be represented by a single headwater tributary or complex of headwater tributaries. Gene flow may occur between local populations (e.g., those within a core population), but is assumed to be infrequent compared to that among individuals within a local population.

Recovery Unit – Recovery units are the major units for managing recovery efforts, with each recovery unit forming a separate chapter in the recovery plan. Most recovery units consist of one or more major river basins. Several factors were considered in identifying recovery units (e.g., biological and genetic factors, political boundaries, and ongoing conservation efforts). In most instances, recovery unit boundaries were modified to maximum efficiency of established watershed groups, encompass areas of common threats, or accommodate other logistic concerns. Biologically, recovery units are considered groupings of bull trout for which gene flow was historically or is currently possible.

Individual recovery units are recovered when the following criteria are met.

A). Bull Trout are distributed among six local populations in four core areas in the recovery unit. The four core areas would be McKenzie, Middle Fork Willamette, Santiam, and Clackamas. The six local populations would have 1) Mainstem McKenzie, 2) South Fork McKenzie, 3) **Upper Middle**

Fork Willamette, 4) Salt/Salmon/North Fork Willamette, 5) Upper North Santiam, 6) Clackamas. Estimated abundance of adult bull trout is at least 1200-2000 (300-500 individuals per core area) individuals distributed among four core areas in the recovery unit.

B)**.** Adult bull trout exhibit stable or increasing trends in abundance in the recovery unit.
Based on work by Maxell (1999), stable-increasing trend can be inferred by demonstrating a non-declining trend and achieving the abundance criterion. A 10-year time series (2 generations) is the likely minimum required for establishing a non-declining trend, which depends on variability of the abundance estimates and magnitude of the "true" trend.)

C). Specific barriers inhibiting recovery as listed in individual recovery unit chapters have been addressed.

Site-specific recommendations for the upper Middle Fork Willamette bull trout populations include a diversity of management actions and strategies to ensure that current distribution of bull trout within the Middle Fork Willamette and associated tributaries is maintained and continue to re-establish in historically occupied habitat. The following is a list of actions and recommendations from the Draft Bull Trout Recovery Plan that are relative to achieve recovery and enhance habitat in the Middle Fork Willamette bull trout population. These are just some of the recovery actions that appear in the Recovery Plan that are of primary importance and focus for the Upper Middle Fork Willamette Watershed (See Draft Bull Trout Recovery Plan for complete list of recovery actions).

1). Develop and implement tasks to protect, restore, and maintain suitable habitat conditions for all bull trout life-history stages and strategies.

- Maintain areas with adequate water quality and eliminate sources in areas with impaired water quality in bull trout core habitat or potential core habitat.

- Identify and reduce or eliminate sources of human induced fine sediment that may impair spawning success. For actions in the upper Willamette Basin of particular concern are completing access and travel management prioritization and inventory of dispersed recreation sites on federal lands.

1.2). Identify areas and structures that are barriers or sites of entrainment for bull trout and implement tasks to provide passage and entrainment.

- Correct barriers impeding bull trout access to suitable habitat, e.g. road culverts (Echo Creek Rd 2143-325; Swift Creek Rd 2300-422 and Rd 2300; Coal Creek Rd 2133 and 2133-228; and other culverts that may be identified in the future that create migration barriers to migrating bull trout of all life stages.

- Identify where stream channel and riparian area contributions to bull trout habitat is impaired and implement tasks to restore their appropriate functions.

- Re-vegetate to restore shade and canopy, and native vegetation.

- Restore, or allow recovery of, stream channel habitat complexity.

- Increase recruitment of large woody debris to improve in-stream spawning and rearing habitat.

- Restore habitat connectivity for all native species within the range of bull trout (i.e. prey base for bull trout including cutthroat and rainbow trout).

5). Conduct research and monitoring to facilitate implementation and evaluation of bull trout recovery activities consistent with an adaptive management approach using results of implemented, site-specific recovery tasks.

- Develop and conduct research and monitoring studies to improve information concerning the distribution and status of bull trout.

- Conduct periodic surveys where bull trout re-colonization is anticipated.

- Develop and maintain a centralized database for all bull trout distribution and monitoring.

- Conduct physical and biological surveys to determine current abundance of populations and factors precluding or limiting productivity.

- Identify evaluations needed to improve understanding of relations among genetic characteristics, phenotypic traits, and local populations of bull trout.

- Determine life history characteristics and habitat requirements of local resident and migratory bull trout populations.

7.2). Develop and implement a standardized monitoring program to evaluate the effectiveness of recovery efforts.

7.3). Revise scope of recovery as suggested by new information.

- Periodically assess the priority of actions in the context of how to emphasize actions in certain core areas.

Time Frame for Restoration

The time frame for restoration actions to be completed in the watershed is directly dependant on funding sources. In the past, primary sources of restoration funding have come from timber sale associated KV collections. Due to restrictions and regulations on how KV funding can be applied, restoration projects were not always focused in areas that provided the most utility to the aquatic habitat. In the last several years the District timber sale program has decreased substantially and with that KV funded restoration projects will also decrease. Funding sources that have fewer restrictions and could be used in areas of specific need are currently being pursued. The Payments to Counties program may provide opportunities to target predetermined areas of bull trout and spring chinook habitat that would benefit the most from

restoration and enhancement projects. The Middle Fork Willamette Watershed Council, Oregon Department of Fish and Wildlife and U.S. Fish and Wildlife Service have expressed interest in securing restoration funding through grants.

Much work could be done to augment existing bull trout and spring chinook habitat in the Middle Fork Willamette and associated tributaries. However, based on recent stream surveys and extensive observations it is thought that bull trout will find suitable spawning habitat in both the Middle Fork Willamette and associated tributaries. Bull trout that were first reintroduced in 1997 are known to persist in at least one release location and should begin to spawn in 2002. However, at this time, biologists are uncertain as to precisely where they will spawn. Bull trout are thought to spawn in limited areas of critical groundwater upwelling (C.V. Baxter 1997; J.S. Baxter 1997). In areas where winter conditions are severe, egg freezing is a possibility for fall-spawners. Since groundwater is typically warmer than surface water in the winter, the probability of embryo mortality can be minimized if a spawning site is built in a suitable location (Baxter and McPhail 1999). Comprehensive surveys to identify areas of groundwater upwelling that could be used for spawning have not been completed and given the difficult nature of this type of survey will likely remain unfulfilled. Once bull trout reach spawning age, surveys to identify high use areas will be completed and from there, emphasis can be placed on creating additional habitat in those areas that will provide the greatest benefit to the species.

3). *Identify and list potential threats to bull trout recovery in the upper basin, such as unstable roads which may affect critical habitat (add to list of culverts on p.42), temperature limitations, long-term food availability (i.e. prey base dependant on manual transport and release of Chinook?), impacts of dispersed recreation (i.e. effects of camping, angling pressure, etc.).*
and
6). *List priority restoration opportunities, such as identifying mid-slope roads constructed prior to 1985 in high-risk storm response areas (Figure 3 and recommendations section p. 98), in-stream habitat conditions (LWD, pools, spawning gravel, passage blocks, etc.). Restoration opportunities should be clearly tiered to the access and travel management plans currently being conducted and should be addressed in the recommendations section on p. 98 of the WA.*

Reader Notation: Questions #3 and #6 are combined because they complement one another in a problem/restoration opportunity format. The following section covers both of these questions.

Functional Relationship – Threats to Bull Trout Habitat Recovery and Restoration Opportunities

The Middle Fork Willamette has for sometime maintained a strong ability to rear salmon and bull trout from the egg and fry stage to smolts and sub-adult fish. Trapping data and snorkel surveys, from 1997-2001, for juvenile chinook salmon and bull trout show healthy year classes and emigration counts from the Middle Fork Willamette into Hills Creek Reservoir. Growth rates of bull trout fry, transferred from the McKenzie Basin may be greater in the first three years than growth rates of donor stock in Anderson Creek (Doug

Larson, USFS, personal communication September 17, 2001). *Risks are present in the rearing environment, however given the known level of mortality of juvenile fish passing through Hills Creek Dam and the inability to get adult spawning stock back to the spawning grounds it seems imperative for the recovery and sustained viability of these populations that both upstream and improved downstream fish passage at these dams is addressed.*

Direct Habitat Threats

Potential threats to spring chinook and bull trout in the watershed may include unstable roads, temperature limitations, long-term food availability, effects of camping and angling pressure. All of these potential threats pose some degree of risk to the recovery of salmon and bull trout. However, after several years of research on salmon and bull trout populations in the watershed it appears that other more significant threats must be addressed at the same time. These more significant threats are barriers to fish migration.

Barriers

The greatest threat to Middle Fork salmon and which poses some threat to bull trout recovery in the watershed is the inability to return to spawning areas after migrating downstream of Hills Creek, Lookout Point and Dexter dams. In addition, fish that pass through the turbine and or regulating outlets of Hills Creek Dam are known to suffer high rates of mortality. Hills Creek and Lookout Point reservoirs are likely responsible for prolonged delays in salmon smolt migration and bull trout seasonal movement patterns. Fish passage through Lookout Point Dam likely results in significant mortality levels as the overall design is similar to Hills Creek Dam. Dexter Dam is a power generating facility, however little is known about fish passage consequences at this facility.

Indirect Upland Threats

Much has been studied and written about the possible interactions of roads and the aquatic system. Roads modify natural drainage patterns and can increase peak streamflows and hillslope erosion resulting in down slope transport and deposition into the aquatic system. Roads can also fragment habitat of aquatic organisms.

The 1996 Upper Middle Fork Watershed Analysis identified where roads are located on steep ground with shallow, rocky soil. This document also mentions side-cast construction methods used on the older road system and lack of road maintenance funds as increasing the chances of initiation of debris slides. Although these assertions are valid, it became clear in the November, 1996 storm event that diversion of water at road / stream crossings and at relief culverts was a much larger factor. Rather than attempt a new analysis tool to address diversion potential in this update, it is far more useful to integrate this concept into all field surveys, reconstruction, maintenance and hydrologic stabilization projects that take place on forest roads.

Key Site Specific Salmon and Bull Trout Habitat

In the Upper Middle Fork Willamette Watershed, high quality habitat for all life stages of spring chinook salmon and bull trout occurs in the proximity of an extensive road network. Salmon and bull trout habitat overlaps primarily near the bull trout reintroduction sites. The highest quality spring chinook spawning habitat is located in Paddy's Valley with substantial rearing habitat available downstream to Hills Creek Reservoir. Chinook salmon redds are highly correlated with large wood in the stream channels. Paddy's Valley contains much more wood then the downstream sections of the Middle Fork Willamette, which creates conditions of high redd density in this section of the river.

The highest quality bull trout habitat is located from Chuckle Springs to about Skunk Creek. This area offers ample rearing habitat for juvenile and sub-adult bull trout. At this time it is not known where bull trout adults will return to spawn. However it is expected that the adults will return to or near their original release site. Water temperature will likely be the most significant factor that influences bull trout spawning. The release areas are influenced by numerous springs and provide the most conductive temperatures for spawning. Juvenile and sub-adults are known to occupy habitat downstream of the release sites in areas where water temperatures are warmer and outside the normal range of bull trout preference (50°F). Mainstem water temperatures near the Echo Creek confluence reach 57°F in the summer.

District monitoring shows that temperatures near high quality bull trout release sites remain at or below the 50°F threshold shown in Figure 1-3. Outside of these high quality areas, cool water habitat exists in the Middle Fork, from the bottom of the gorge below Paddy's Valley to Swift Creek. Temperatures in this reach are sufficient for bull trout rearing throughout nearly all of the thermal influence season. Temperature in the designated high quality bull trout habitat areas meet the needs of the species and are not limiting. There are undoubtedly other areas in the watershed, outside of high quality habitat areas, where canopy closure can be limited, which can have a deleterious affect on stream temperature. *Based on recent thermograph data, there are no temperature concerns for bull trout within their designated high quality habitat area (See Table 3-1, below).* However, within the current bull trout distribution area, in some areas outside of or adjacent to designated high quality habitat; stream temperatures are elevated above desirable temperature levels for some life stages.

Table 3-1 Upper Middle Fork of the Willamette River Seven-Day Moving Average of the Daily Maximum Summer Stream Temperatures in or Adjacent to High Quality Bull Trout Refugia and Spawning Habitat

Stream Name	Station Name	1997	1998	1999	2000	2001
Middle Fork Will. R. *	Below Swift Cr.		53.3			
Swift Creek *	At mouth	55.6	57.2	54.6		
Swift Creek *	Side channel near mouth		55.3	50.6		
Skunk Creek *	At mouth	55.2	56.8		58.9	
IKO Springs *	Tributary of M. Fork Will. R.		45.2	45.2		44.8
Chuckle Springs *	Tributary of M. Fork Will. R.	40.9	40.6			
Bear Creek *	At F.S. road 2149			44.5	44.4	
Shadow Springs *	Tributary of M. Fork Will. R.				42.3	
Middle Fork Will. R.	At F.S. road 272	56.5	57.6	56.5		
Echo Creek	At F.S. road 2100-315	56.0	57.6			
Middle Fork Will. R.	Below Staley Cr.				57.7	
Simpson Creek	At mouth	61.4	61.5	58.7		
Staley Creek	At mouth	63.6	65.5			
Noisy Creek	At mouth	62.9	63.1			
South Fork Staley Cr.	Above North Fork Staley			51.3		
North Fork Staley Cr.	Above South Fork Staley			52		
Spider Creek	At mouth			57.1		
Tumblebug Creek	At mouth		57.9			
Middle Fork Will. R.	At F.S. road 2153		52.3			
Davey Creek	At F.S. road 2136			52.3		
Middle Fork Will. R.	At Paddy's Valley				52.1	
*Areas within High Quality Habitat, Refugia, or Spawning Habitat						

Related Key Question and Response

1. Where and to what extent has road density, condition, location and use influenced erosion, hydrologic, and channel processes?

2. Where and to what extent have management practices influenced distribution and condition of aquatic species and their habitats?

Reader Notation: This response is related to both questions #3 and #6 listed above.

Response – Threats to Bull Trout and Analysis of Roads Density, Condition, and Location

The existing transportation system was evaluated for risk to high quality spawning and rearing habitat of Bull Trout and Spring Chinook by using a three-step process. Initially, an office-based analysis was performed using the Aquatic Risk Rating (Appendix E) system developed for the Access and Travel Management (ATM) process (Figure 5-1). This analysis method is GIS based and utilizes existing databases (primarily Soil Resource Inventory, Streams, Transportation, and Digital Elevation Model) to

determine a rating that can be interpreted as a gross estimation of road segments that may deliver sediment to the aquatic system. The results of this analysis are shown on Figures 3-1, fifth field map of aquatic risk. The second step of the evaluation process was to interview those knowledgeable of the transportation system of the area and combine this information with the results of the Aquatic Risk Rating described previously.

The third step was to evaluate in the field as much of the transportation system as time would allow with the emphasis being on road systems which could have a direct cause-effect relationship with the high quality spawning and rearing segments described previously. Parameters which were evaluated include (but were not limited to) slope angle, slope position, road grade, integrity and adequacy of the drainage system, construction type, construction materials, fill slope vegetation, cutslope ravel, fill slope stability, etc.

A comparison was made of the results of the Aquatic Risk Rating analysis with the local knowledge and field reconnaissance methods. It was apparent that the ARR tended to overrate most roads located in and near valley bottoms. This is likely due to the high values assigned to the ‘proximity to fish bearing stream’ parameter. Also, some mid-slope roads on steep ground were under-rated and many were over-rated. Consideration was given to changing the ARR analysis, but it was concluded that the model (with minor adjustments to the range associated with the High ranking) was adequate for an office based analysis as long as field validation takes place before conclusions are drawn. In other words, it is important to recognize the limitations of the analysis method and resist the temptation to apply landscape level analysis to site specific recommendations without ground based evaluation.

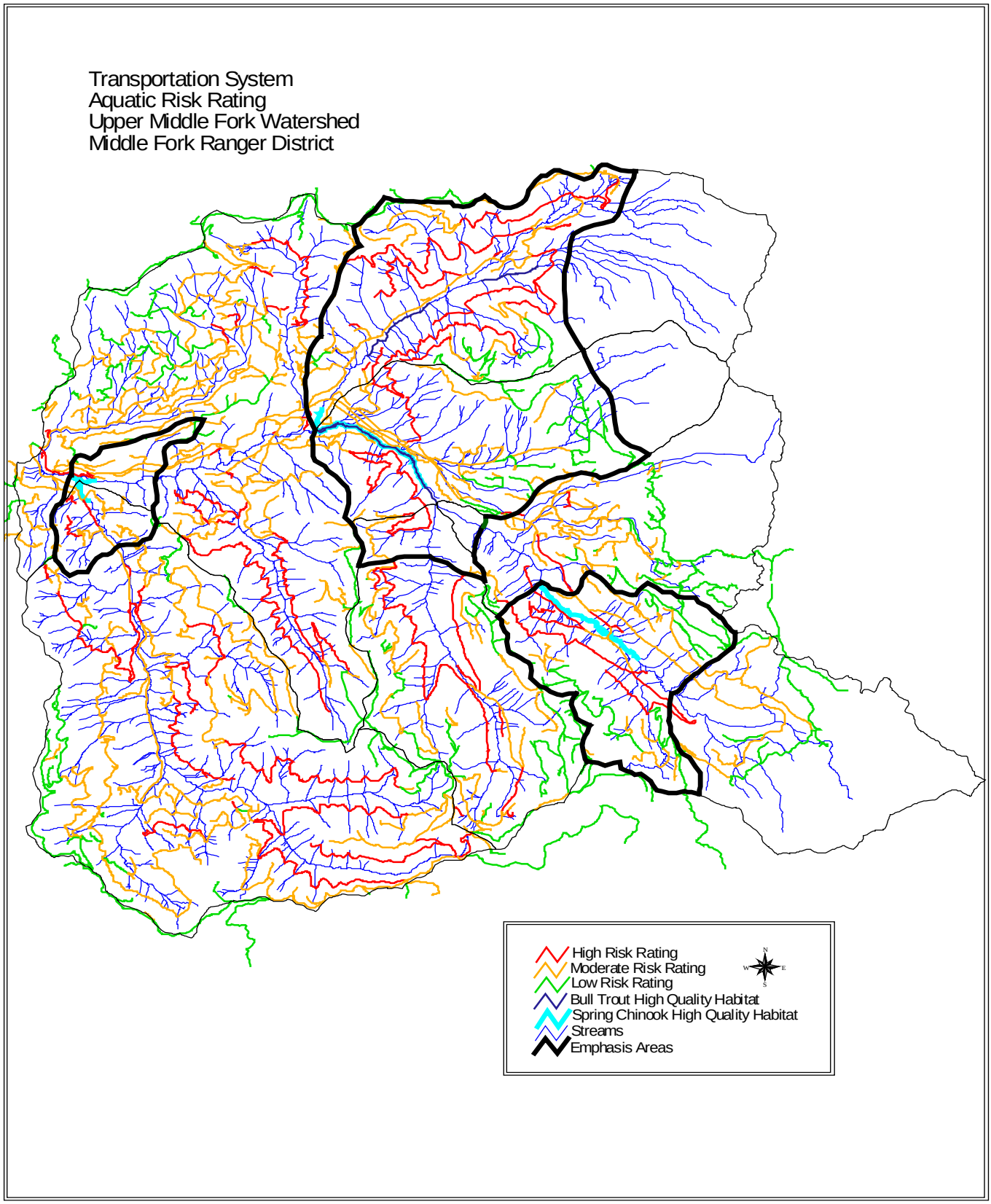


Figure 3-1 Aquatic Risk Rating Map for Upper Middle Fork Watershed

The 1996 watershed analysis did not consider the effect of hill slope position when assessing the potential for roads to contribute to increased sediment to streams or increases in peak flows. Jones et al. (2000) reporting on the H.J. Andrews Forest and vicinity, found that mid-slope roads were net sources of sediment to the stream network while valley floor roads were net sinks for sediment. In addition, Jones (2000) reported interception of subsurface flow by roads increased peak flows from 13 to 36 percent during runoff events with greater than a 1 year recurrence interval in seven of eight drainages with roads included in the study. The magnitude of the increase in flow was related to the density of roads on mid-slopes. Wemple (1994) found that roads may extend the stream network by 40 percent during storm events however she suggests that differences in the magnitude of these effects may depend on difference in hill slope position of roads in addition to road age, soil saturation, geologic substrate, and climate. Although roads on hill slopes have the potential to increase peak streamflows, this effect is likely most significant for events of relatively low magnitude with less than a 5 year recurrence interval (see response to aquatic concern number eight for additional information). Table 3-1 displays the density of roads on slopes greater than 30 percent by subwatershed. As shown in Table 3-1, Subwatersheds 23 1, 23 2, and 23 5 have the highest potential for mid-slope roads to influence peak streamflow.

Table 3-1. Roads on Slopes greater than 30 percent

Subwatershed	**Percent of Subwatershed with Slopes >30 Percent**	**Total Road Miles on Slopes >30%**	**Road Density on Slopes >30% (miles/mile^2)**
23 1 Staley Cr.	**65**	**55**	**2.10**
23 2 Tumblebug Cr.	**61**	**23**	**2.27**
23 3 Paddy's Valley	**35**	**23**	**1.64**
23 4 Indigo Springs	**48**	**11**	**1.29**
23 5 Swift Cr.	**55**	**33**	**2.30**
23 6 Echo Cr. (Simpson - north)	**42**	**20**	**2.30**
23 6 Echo Cr. (Echo - south)	**64**	**15**	**1.55**

The next step in identifying potential threats to critical spawning and rearing habitat for Bull Trout and Spring Chinook was to stratify the watershed based on the potential for cause-effect relationships that may exist, both directly and indirectly. This was accomplished by delineating polygons that include the "High Quality Habitat" for both species and all tributaries that feed directly into these stream segments and the tributaries which enter the mainstems within 1 mile upstream (See Figure 3-1). These polygons are intended to represent the area in which a debris slide generated upslope has the potential for direct deposition of slide material and a greater likelihood of negatively impacting the habitat for at least the short term.

The purpose of this stratification was to provide for prioritizing field analysis, road maintenance and hydrologic stabilization opportunities. In Fiscal Years 2000 and 2001, approximately 16 miles of High and Medium Risk roads have been maintained or hydrologicly stabilized within the direct cause-effect polygon,

23 miles of road are in the indirect cause-effect polygon. In addition to these work accomplishments, a proposal was submitted for Payments to the County funding for more extensive work in the Upper Middle Fork watershed.

Salmon/Bull Trout Restoration Projects and Opportunities

In FY 2000, 12 culverts on fish bearing streams in the Watershed Analysis area were analyzed for fish passage capability (Region 6 Fish Passage Survey Protocol). In the analysis, 11 of the 12 were judged to be fish passage barriers when considered for "all species, all life stages." This prognosis is predictable, given that the analysis is set up so that any culvert that has over a 4-inch jump height or over a 2% grade will not meet the fish passage criteria (Paul Bennett, pers. comm. 4/01). Using an outlet jump height of greater than 4 feet as an indicator, 3 to 4 of the 12 culverts analyzed are barriers to adult Bull Trout. These barriers are located on Roads 2143-325 (Echo Cr), 2135-283 (Simpson Cr- Private), 2300-422 (Swift Cr) and 2300 (Swift Cr). Currently, the Echo Creek culvert is scheduled for replacement in FY-02 and the two on Swift Creek have been submitted for funding as high priority replacements. Also, ERFO repair is scheduled for FY-02 to replace the only road related fish passage barrier on Tumblebug Creek. The table below outlines and prioritizes these culverts to be replaced.

Table 3-2 Prioritized Culvert Replacement Projects in the Upper Middle Fork

Road Number And Mile Post	Mile Post	Ranking	Creek Name	Species of Primary Concern
2300	17.1	H	Swift Creek	Bull Trout
2300-422	0.12	H	Swift Creek	Bull Trout
2143-325	0.4	H*	Echo Creek	Bull Trout
2300	19.75	M	Swift Creek	Bull Trout
2100	26.6	M	Noisy Creek	Bull Trout
2136-300	0.4	M	Staley Creek	Resident Fish
2154-380	0.1	M	Beaver Creek	Resident Fish
2134	0.85	L	Maple Creek	Resident Fish
2134-240	0.31	L	Maple Creek	Resident Fish
2135-283	0.9	L	Simpson Creek	Resident Fish
2135-283	5.3	L	Simpson Creek	Resident Fish

* Funded for replacement in F.Y. 2002

Dispersed Recreation Sites

There are 6 inventoried dispersed recreation sites located within the terrestrial riparian zone adjacent to "High Quality Habitat" for Bull Trout and Spring Chinook in the watershed. These sites are accessed by roads and in some cases also by a hiking trail. In general, access roads and dispersed recreation sites have the potential to result in increased sediment delivery to aquatic systems. Numerous factors including climate, topography, and type of use determine the magnitude of erosion from this source. Research studies have shown that erosion rates are highly variable depending on site-specific conditions (USDA Forest Service, 2000). In the Upper Middle Fork Watershed, several factors combine to result in a low risk of a

significant increase in sediment delivery to streams adjacent to dispersed recreation sites. These sites represent a very small portion of the Riparian Reserves in the watershed (.009%). Most of these sites are located in flat terrain with well developed vegetation adjacent to them and have porous soil which favors infiltration rather than overland routing. In addition, the heaviest period of use of these sites is during the summer dry season. When considering soil erosion and transport of soil into the aquatic system, these sites and the access routes associated with them have, for the most part, negligible impacts to the aquatic habitat.

Aquatic Species Distribution, Passages Issues, and Habitat Fragmentation

Spring Chinook and bull trout habitat likely overlap in most of the upper Middle Fork Willamette downstream of the reintroduction sites, including Hills Creek Reservoir. Spring chinook occupy habitat from Paddy's Valley to the reservoir and also migrate through the turbine and regulating outlets of Hills Creek Dam. At this time it is not known if spring chinook continue to migrate through Lookout Point and Dexter Dam, however, based on research from Hills Creek Dam and the similarities between the design and operation of the others it is probable that progeny of spring chinook that spawn in the upper Middle Fork Willamette migrate through the entire system to reach the sea. Excerpts of conducted studies are included below.

> "A study to assess spring chinook habitat usage that included, spawning distribution, migration tendencies and emigration survival through Hills Creek Dam in the upper Middle Fork Willamette River was conducted from July 1999 to January 2000. Radio telemetry was used to determine spatial and temporal spawning trends of adult salmon. Spring chinook spawned from late August and continued through late September. Water temperature and flow remained relatively constant throughout the spawning season. Five radio-tagged salmon captured downstream of Dexter Dam and released at Sand Prairie Campground on 12 July, migrated 8.5 miles upstream and 1.3 miles downstream to Hills Creek Reservoir. Five implanted salmon released on 12 July in Paddy's Valley migrated 0.8 miles upstream and 0.4 miles downstream. Five additional implanted salmon were released 2.5 miles downstream of a series of falls, near Tumblebug Creek, that may be a migration barrier on 02 September. The purpose of this release was to assess the likelihood of upstream passage of migrating fish over the falls and into Paddy's Valley. These salmon migrated 1.0 miles upstream and 15.9 miles downstream to Hills Creek Reservoir. No fish migrated upstream of the falls. Forty-eight redds were observed with the highest concentration in Paddy's Valley. Spawning habitat is less common below the falls although, prime habitat is available in the mainstem Middle Fork Willamette River and at the confluence of several tributaries".
>
> "Emigration sampling through Hills Creek Dam showed substantial numbers of salmon pass through the outlets. Estimates of salmon passing through the turbines and regulating outlet were 5,473 and 3,328 with 59 and 32% mortality, respectively. These results indicate spring chinook salmon effectively reproduce upstream of the dam in the Middle Fork Willamette and that passage survival through the dam outlets does occur. Alterations in the operating schedule of the dam could potentially reduce mortality in juvenile salmon".

Comprehensive studies similar to the one described above have not been completed for upper Middle Fork Willamette bull trout. However, several efforts are ongoing to monitor bull trout distribution and dispersal from the reintroduction sites. The bull trout reintroduction is currently in the fifth year and no spawning

surveys will be conducted until 2002. The most recent snorkel survey and trapping data on bull trout distribution shows that juveniles and sub-adults have moved approximately 0.25 miles upstream of Chuckle Springs and occupy habitat downstream to Hills Creek Reservoir. This entire area could be considered bull trout foraging habitat. In June 2000 a sub-adult bull trout was captured by an angler in the Middle Fork Willamette near Oakridge. It is not likely that bull trout have persisted downstream of the dam as no other observations have been made for over 30 years. The most likely explanation is that the bull trout migrated to Hills Creek Reservoir as a juvenile and subsequently went through the turbine or regulating outlet of Hills Creek Dam and reared in the mainstem Middle fork Willamette or possibly Lookout Point Reservoir. Once fish pass through Hills Creek Dam additional habitat in the North Fork of the Middle Fork Willamette, Salt Creek and Salmon Creek becomes available. Additional efforts to locate bull trout downstream of Hills Creek Dam have been unsuccessful. In 2002 the Forest Service will in stall a Vaki-River Watcher near the reintroduction sites in an effort to record adult bull trout returning to spawn.

4). *Identify potential bull trout refugia and develop long-term goals for these areas (address in the WA recommendations section p.98). How will future management activities affect these areas?*

Functional Relationship-Bull Trout Refugia and Long-Term Goals For Recovery

Important bull trout refugia in the Upper Middle Fork Willamette Watershed is depicted in the map of "Current Bull Trout Distribution" (Figure3-2). The areas represented as "High Quality Habitat" on the map were selected from information relative to known bull trout presence, water temperature, juvenile rearing habitat, etc. Areas listed as "High Quality Habitat" will likely be the same areas bull trout will use for refugia. Much more information and data will be required before biologists can accurately assess the specific boundaries of bull trout distribution. The bull trout reintroduction is in the fifth year and a large amount of data has been collected, however, codified assumptions about life history and range of habitat cannot be accurately assessed at this time. The bull trout in the Upper Middle Fork Willamette Watershed may adapt to habitat outside established parameters that apply to other geographic areas where the majority of bull trout research has occurred, specifically Montana and Idaho. Historic bull trout distribution in the Middle Fork Willamette and other tributaries was poorly documented up until the species was likely extirpated in the early 1990's. Accurate assessments and analysis of historic Middle Fork Willamette bull trout distribution range, spawning habitat, and rearing areas do not exist, which further compounds efforts to identify these areas today. Biologists are closely monitoring the reintroduced population to collect data relative to these questions. However, it will likely take several generations of bull trout to disperse and return before all habitat requirements are understood in the Upper Middle Fork Willamette Watershed.

Related Key Question

Where and to what extent has road density, condition, location and use influenced aquatic species distribution and habitats?

Response- Bull Trout Refugia and Long-Term Goals For Recovery

Research shows that bull trout spawn from late August through November in most geographic areas. Spawning is initiated when water temperatures reach 9-10 °C, (48.2-50°F). Given these temperature requirements and the seasonal nature of spawning, a large portion of the Middle Fork Willamette may be conducive to bull trout spawning when temperature alone is considered. However, data collected from spring chinook salmon spawning surveys shows that a large portion of the Middle Fork Willamette lacks substantial spawning habitat for large salmonids. The most likely explanation for the lack of spawning habitat is the overall absence of channel complexity and associated large wood in the stream channel to capture and hold appropriate size gravel. Chinook salmon redd location in the upper Middle Fork Willamette are typically associated with accumulations of gravel collected by large wood in the stream channel. The Paddy's Valley area contains highly productive chinook salmon spawning habitat, which is primarily related to increased amounts of large wood in relation to downstream areas. Salmonid spawning habitat could be improved in areas downstream of the bull trout reintroduction sites.

The U.S. Fish and Wildlife Service Draft Bull Trout Recovery Plan outlines specific requirements related to restoration and recovery of bull trout and their habitat. The following is a list of actions and recommendations relative to the Middle Fork Willamette from the Draft Bull Trout Recovery Plan that will assist and led to the restoration and enhancement of habitat in the Middle Fork Willamette bull trout population (See Draft Bull Trout Recovery Plan for complete list of recovery actions).

1). Develop and implement tasks to protect, restore, and maintain suitable habitat conditions for all bull trout life-history stages and strategies.

- Maintain areas with adequate water quality and eliminate sources in areas with impaired water quality in bull trout core habitat or potential core habitat.

- Identify and reduce or eliminate sources of human induced fine sediment that may impair spawning success. For actions in the upper Willamette Basin of particular concern are completing access and travel management prioritization and inventory of dispersed recreation sites on federal lands.

1.2). Identify areas and structures that are barriers or sites of entrainment for bull trout and implement tasks to provide passage and entrainment.

- Correct barriers impeding bull trout access to suitable habitat, e.g. road culverts (Echo Creek Rd 2143-325; Swift Creek Rd 2300-422 and Rd 2300; Coal Creek Rd 2133 and 2133-228; and other culverts that may be identified in the future that create migration barriers to migrating bull trout of all life stages.

1.3). Identify where stream channel and riparian area contributions to bull trout habitats is impaired and implement tasks to restore their appropriate functions.

- Re-vegetate to restore shade and canopy, and native vegetation.

- Restore, or allow recovery of, stream channel habitat complexity.

- Increase recruitment of large woody debris to improve in-stream spawning and rearing habitat.

- Restore habitat connectivity for all native species within the range of bull trout (i.e. prey base for bull trout including cutthroat and rainbow trout).

1.6). Identify where conditions outside the riparian areas (i.e. uplands) are negatively affecting bull trout habitats and implement tasks to restore appropriate functions.

- Identify existing road systems that have a high risk of adversely affecting utilized bull trout streams (e.g. through changes in sediment delivery and natural drainage networks, interception of ground water, interception of woody material delivery). Develop road management plans to modify, reduce, or eliminate these roads.

3).Establish fisheries management goals and practices compatible with bull trout recovery and implement practices and tasks to achieve goals.

- Develop and implement native fish management plans integrating research adaptively into fishery management programs.

- Restore historic prey base reintroducing spring Chinook salmon into habitats occupied by bull trout. Priority areas remaining in the Willamette Basin include the North Fork of the Middle Fork Willamette, Salt Creek, and Salmon Creek.

- Evaluate and prevent over harvest and incidental angling mortality of bull trout.

- Reduce angler pressure in areas where incidental mortality continues to be detrimental to recovery. (Utilize innovative techniques such as seasonal or permanent road closures). For example, restore dispersed campsites along the Middle Fork Willamette with temporary or permanent closure. Consider removal or relocation where risk of resource impacts are unacceptable.

5.2). Conduct research evaluating relations among bull trout habitat , and recovery tasks.

- Evaluate effectiveness of active and passive habitat restoration techniques in restoring watershed function and to recover local bull trout populations.

- Determine suitability of temperature regimes in potentially restorable bull trout habitat.

- Determine range of temperature tolerances for bull trout life stages in various habitats. Use results of ongoing temperature studies to address the adequacy of existing State rules.

- Identify and develop needed technologies, e.g., remediation, and evaluation methodologies.

6). Use all available conservation programs and regulations to protect and conserve bull trout and bull trout habitats.

- Use partnerships and collaborative processes to protect, maintain, and restore functioning core areas for bull trout.

- Designate core areas essential to recovery (similar to critical habitat) for the purpose of habitat protection and restoration.

5.) Identify and map limitations for natural recruitment of large wood (>21" dbh), such as location of stream-adjacent mature forest (>80 yrs.) which are intercepted by roads, or important areas which lack intact riparian vegetation (p.64). Section KQ6 (p. 82) should include discussions on habitat conditions/limitations for bull trout.

Functional Relationship – Riparian Large Woody Debris Condition and Recruitment

Large wood is critical to the proper functioning condition of upland forest streams. Large wood is a stabilizing and stream energy buffer in the aquatic ecosystem. Potential for deposition of large wood in stream systems is tied to disturbance regimes in adjacent forest. These include fire regimes, mass wasting, landslides; and small scale disturbance such as forest insects, wind throw, and disease. Wood in streams can be delivered in small amounts over time through stream channel dynamics and undercutting, or in large pulses from stand replacing wildfire. Wood presence decreases stream energy and increases channel

complexity. Complex channels lead to development of aquatic food chains, and spawning and rearing habitat.

Related Key Question:

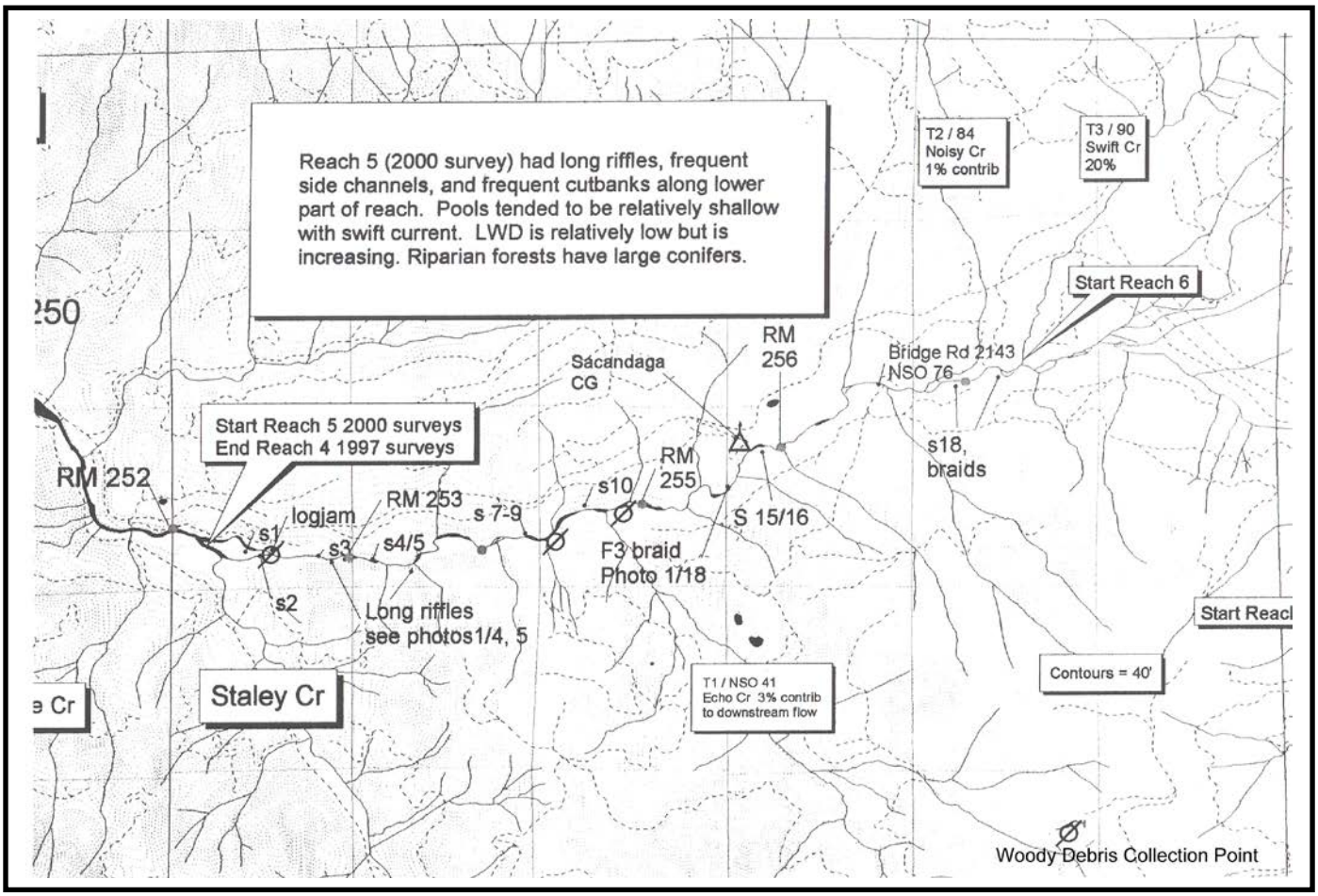
1. *Where and to what extent has road density, condition, location influenced erosion, hydrologic, and channel processes?*

Response– Riparian Large Woody Debris Condition and Recruitment

Recruitment of large wood in the main stem of Upper Middle Fork of the Willamette occurs via upslope delivery in first through third order streams (Lyons, Bechta, 1983). Two mechanisms involving initiation of debris delivery of large wood exist in the Upper Middle Fork, these include road initiated sloughs or slumps or, in the second situation, those that originate from natural stands. Sloughs and slumps that make it to stream channels from upper and mid slope positions can result in initiation of debris flows.

High energy debris torrents are the prime delivery mechanism for large wood from uplands to the Middle Fork of the Willamette and valley bottoms. Such debris torrents deliver large levels of sediments, spawning gravels, spawning cobbles, and large wood. Short-term affects to the watershed include increased turbidity, sediment pulses, and channel scour. Long term affects of these debris torrents is deposition of wood jams on river bars, channel nick points, and in flood plains on the main stem of the Middle Fork. This wood leads to desirable conditions such as channel complexity, pool creation, side channel development, and retention of organic material. These riparian hardwoods play a large role in nutrient delivery for the aquatic food chain (Hibbs, 1996). Riparian forests can provide natural wood levees that lead to future aggredation of flood related large wood and flood debris, leading to a dynamic stability in the Upper Middle Fork of the Willamette River main stem (Johnson et.al., 1999). This dynamic stability leads to desirable habitat conditions for salmonids and Bull Trout. Figures 5-1 thru 5-3 depict new information and show the existing woody debris collection points that exist in the main stem of the Upper Middle Fork (Ecosystems Northwest, 2001).

Figure 5-1 Current Large Wood Concentration Points, Reaches 4-6



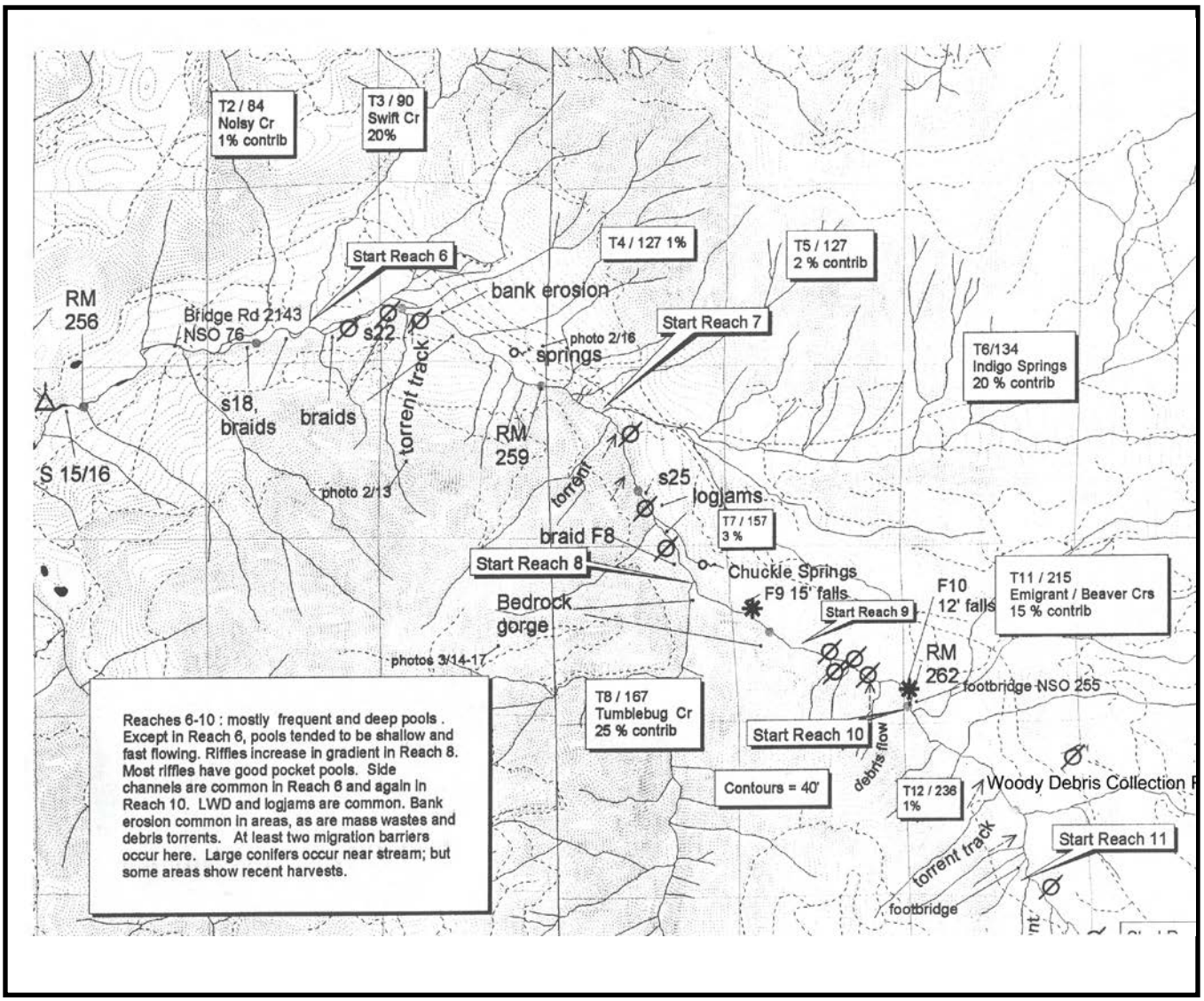


Figure 5-2 Current Large Wood Concentration Points, Reaches 6-10

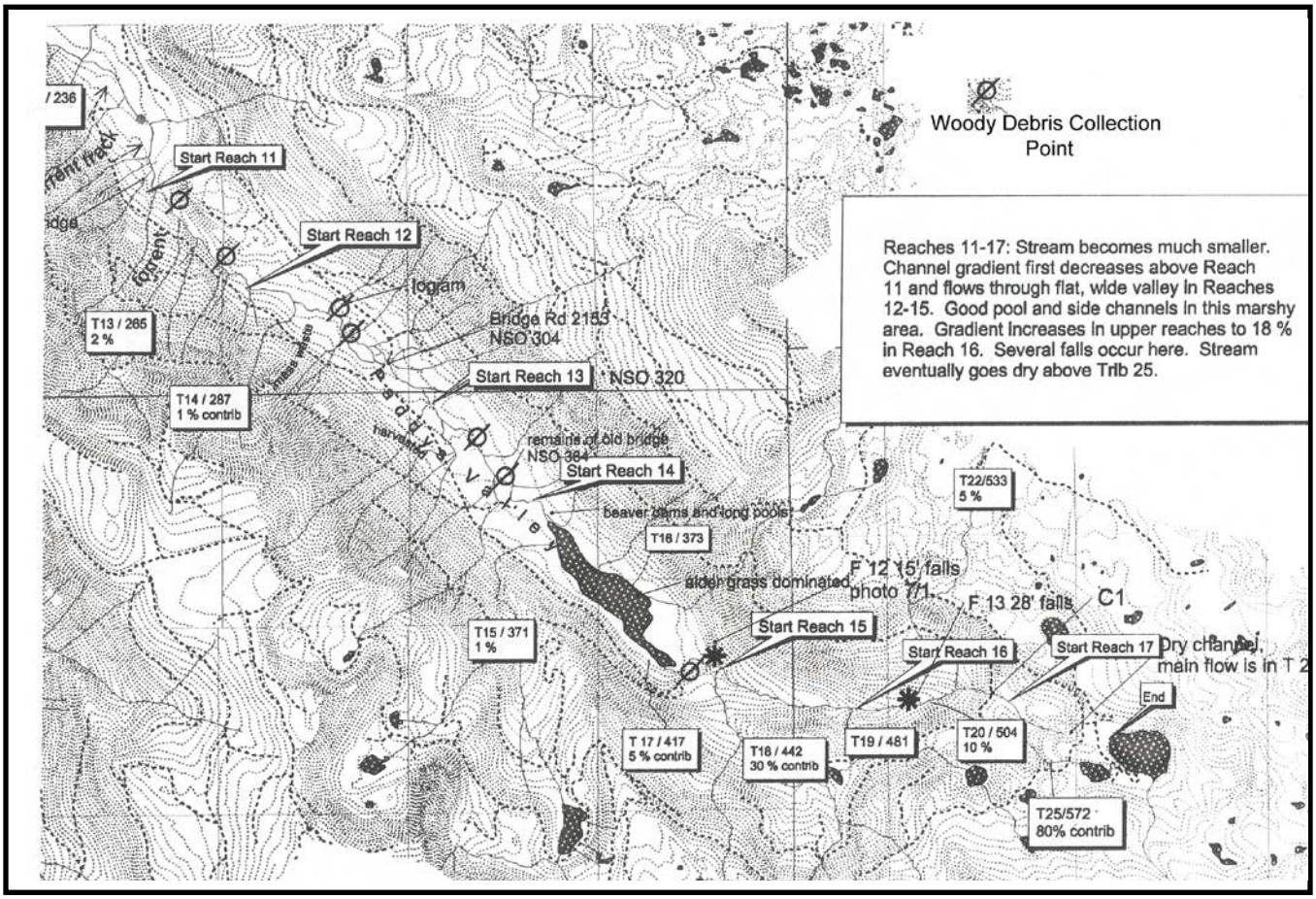


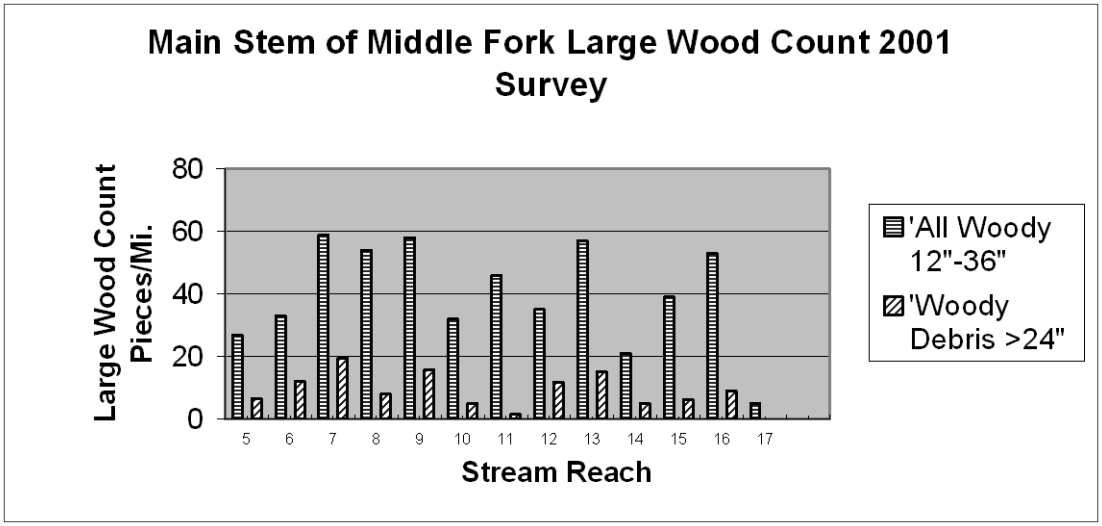
Figure 5-3 Current Large Woody Concentration Points, Reaches 11-17

The above maps spatially depict the distribution of wood in the Middle Fork. The 2000 stream survey (Ecosystems Northwest) also completed a large wood tally by stream reach in the Upper Middle Fork. This presence and distribution of large wood is important to Bull Trout and Spring Chinook Salmon habitat.

Large Woody Count By Stream Reach

The existing large wood count for the Upper Middle Fork stem by reach is outlined in the graph below. Counts range from 5 to 59 pieces/mile, counts were lowest in reaches 5 and 6, but also low in reaches 10, 14, and 17. Total piece count (>12”) is significantly higher than piece counts of >24”. Large wood greater than 24” appears to be at a premium in the main stem of the Middle Fork.

Figure 5-4 Large Woody Debris Presence in Upper Middle Fork -Year 2000 Stream Survey



Adjacent Riparian Vegetation Along the Main Stem of the Upper Middle Fork

The riparian zone vegetation along the Middle Fork is in a variety of disturbed vegetative conditions. This is due to the fact that the flood zone is routinely affected by peak flows and floods that can lead to desirable riparian conditions such as side channels, river bars, and natural levees (Bechta, Gregory, 1997.). The year 2000 stream survey indicated the following conditions; reaches 6-10 contain the highest density of large trees (21-32"DBH) within 100 feet of the bank channel, reaches 16 and 17 had a mixture of large and small trees. The graph below outlines the size classes of large wood in direct contact with the main stem of the Middle Fork (Ecosystems Northwest, 2001).

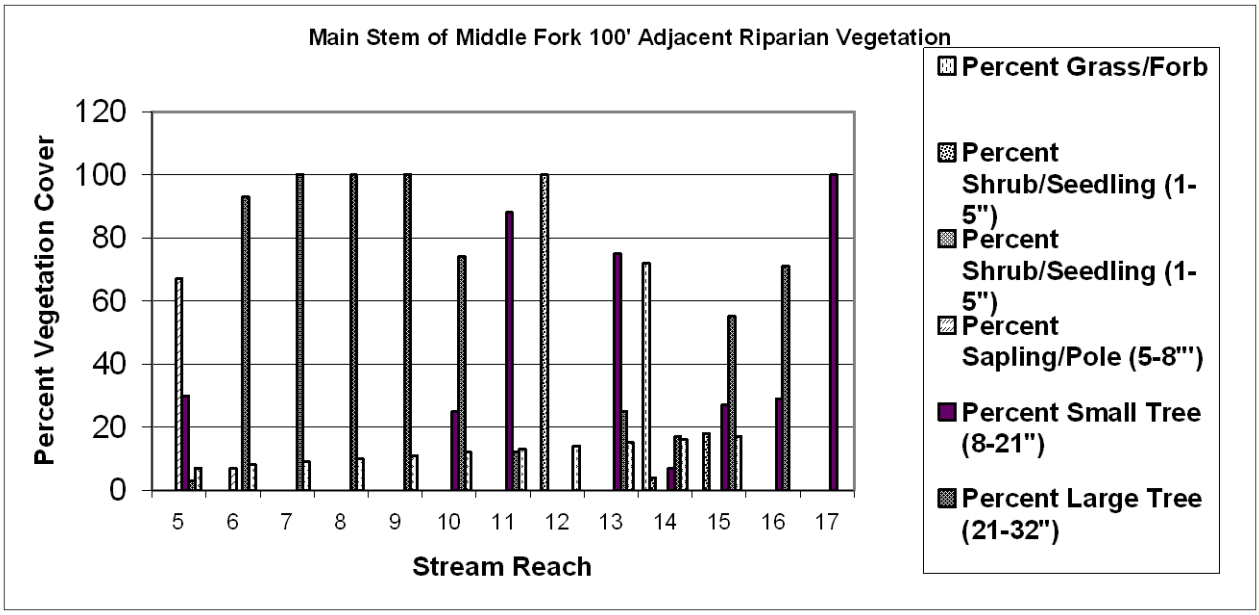


Figure 5-5 Upper Middle Fork Riparian Vegetation Condition

The density of large trees adjacent to the Upper Middle Fork of the Willamette are not uniformly distributed, most of the stream bank vegetation is flood derived riparian second growth due to the active nature of the channel and past riparian harvest. The flood terraces are nearly all dominated by riparian hardwoods and small conifers. This limits the size of wood available for input into the system from forest adjacent to the Middle Fork. Peak flows in the 1964 flood dramatically increased channel widths, these river widths returned to pre-flood levels within ten years of the 1964 flood, leaving only 40 year old vegetation adjacent to the active channel on many reaches (Bechta, 1983). Currently, only a small portion of the wood in the main channel comes from undercutting and bank movement of the main channel, most wood is delivered to the channel from upslope debris torrents and slope failures (Leverton, Pers. Comm.).

Upslope Riparian Large Wood Sources

The sixth field watersheds that feed large wood into the main channel of the Upper Middle Fork of the Willamette are in a variety of vegetation conditions. These conditions have been driven by land management practices, historic fire presence, and disturbance elements including insects and forest disease.

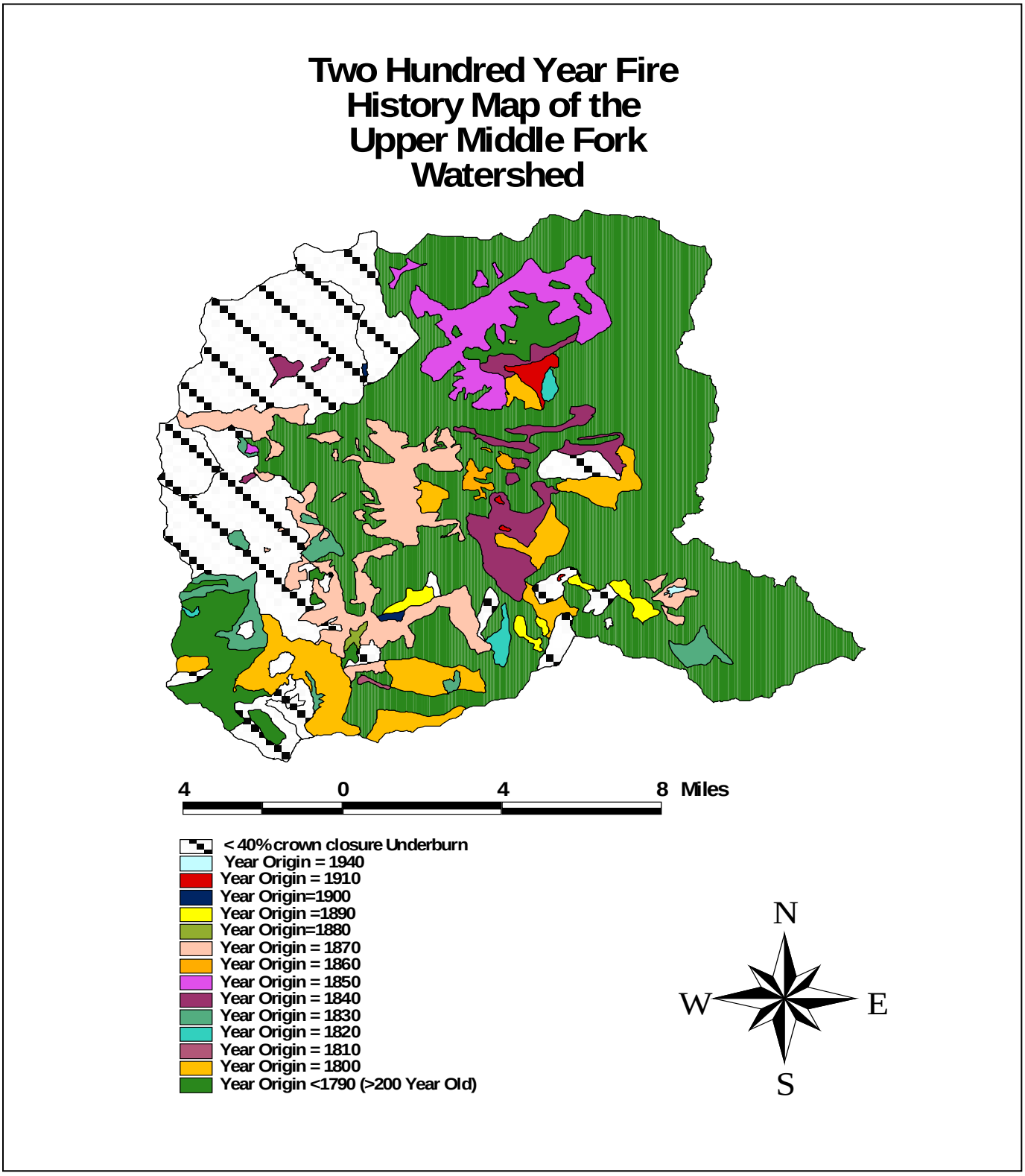
Fire Affects

Fire history sets the stage for upslope vegetation condition and delivery of large wood. A complete fire history map was generated for the Upper Middle Fork watershed using historic aerial photos, coring of trees in the field, and local stand information; this history was recorded back a total of 200 years (Agar, 1999). Several general trends were identified. These fires burned with increasing intensity from the lower slope, to the mid slope, and into upper slopes. From these photos and this study, it was noticed that fires routinely burn through riparian reserves at the mid and upper slopes. Two factors lead to the active presence of fire in riparian reserves in the Upper Middle Fork. This is explained by organic matter which accumulates at the bottom of steep draws, and that these same draws funnel upslope and downslope diurnal winds in a “chimney affect”, carrying fire in this fuel bed. (Agee). In this respect, the riparian reserves in the upper elevations are and have been transport mechanisms for fire (Tollefson, 2001). An analysis was conducted by combining a fire history layer and stream network of reserves to calculate the amount of area within current riparian reserves that have been burned in the last 200 years. By combining stream information and fire history across the fifth field watershed, trends were analyzed by sixth field watershed. Over the last 200 years, fires have stand replaced an average of 55 percent of the riparian reserve network on the watershed.

In this sense, a casual forest observation leads one to believe that historically, the watershed was always covered by older forest. When in reality, the watershed was in a perpetually disturbed condition where the only steady state phenomena was disturbance from constant burning and re-burning. Below is a map showing the extent of this fire history.

Below is the 200 year fire history map of the Upper Middle Fork.

Figure 5-6 Upper Middle Fork Two Hundred Year Fire History

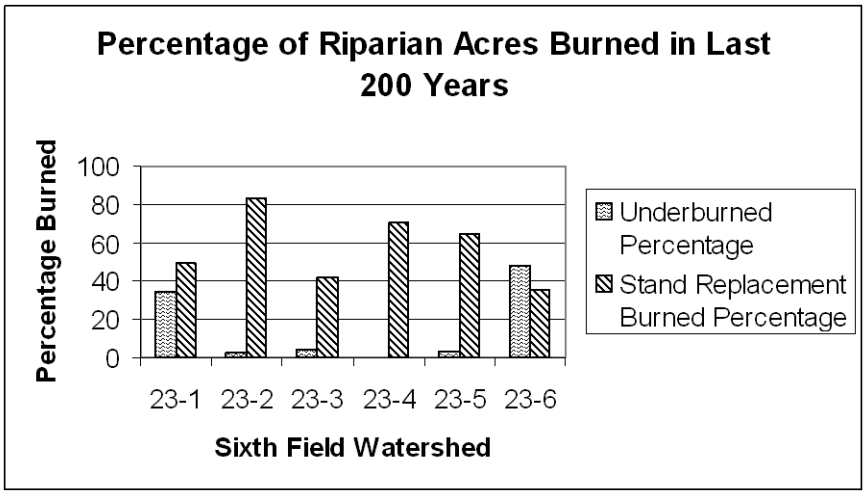


It is important to recognize the relative significance of this map of fire history (stand replacement fires) to Bull Trout and Spring Chinook Salmon in the watershed and their ability to survive in a fire disturbed landscape. At times in the past, before the advent of European forestry practices, the landscape was at equal or greater levels of disturbance than they are today. This fire history would periodically reduce shade and increase stream temperatures. Re-burns are common on this landscape. Re-burns are a result of fires that did not burn hot enough in the initial fire to consume the existing fuel, and re-burn a series of years later in a severe fire sets the stage for forest development under a condition of low levels of fuel loading. These re-burns tended to consume all carbon on the site, in some stands even stumps are consumed, leaving nothing but mineral soil and soil micro-organisms to re-inoculate the site. Severe re-burn fire intensity in many of these stands is evidenced by a lack of snags, downed wood, and stumps. In many second-growth fire stands, severe re-burns left the Middle Fork forest in a far worse condition than even clearcut harvesting in the 1970s. In re-burn situations, all forest biomass was consumed on the ground, whereas clearcut harvesting left brush, duff, stumps, and non-merchantable large wood in place on the site. Up until the early 1980s, it was standard practice to leave cull large woody material in place in both riparian areas, and on upslope logged stands.

Underburns provided frequent low levels of new snags and downed wood in valley bottoms; whereas stand replacement fires provide infrequent large pulses of downed wood to riparian areas from related upslope debris torrents.

Fifth field watershed 23-2 (Tumblebug) had the highest level of burned riparian area in the watershed.

Figure 5-7 Percentage of Burned Riparian Area in Last 200 Years in Upper Middle Fork Watershed



Management Related Affects on Riparian Reserves

A near- term affect on large wood levels has been timber harvest within what is now, designated, riparian reserve (ROD, April, 1994). This has resulted in reduced shade in some harvested areas. Regeneration harvesting from the 1930- through the mid 1980s inside these areas in the Upper Middle Fork watershed has resulted in a degradation of shade levels and large wood sources. After the mid 1980s, 50-100' buffers were left on perennial streams (Moody, Pers. Comm). These small buffers provided a relatively small amount of shade but a near natural level of large wood sources since 80% of large wood comes from within 50' of the

stream channel (Bechta, 1997). Graphed below are the cumulative historical affects of riparian timber harvest by stream class and sixth field watershed.

Figure 5-8 Seral Stage of Riparian Reserve in Sixth Field 23-1

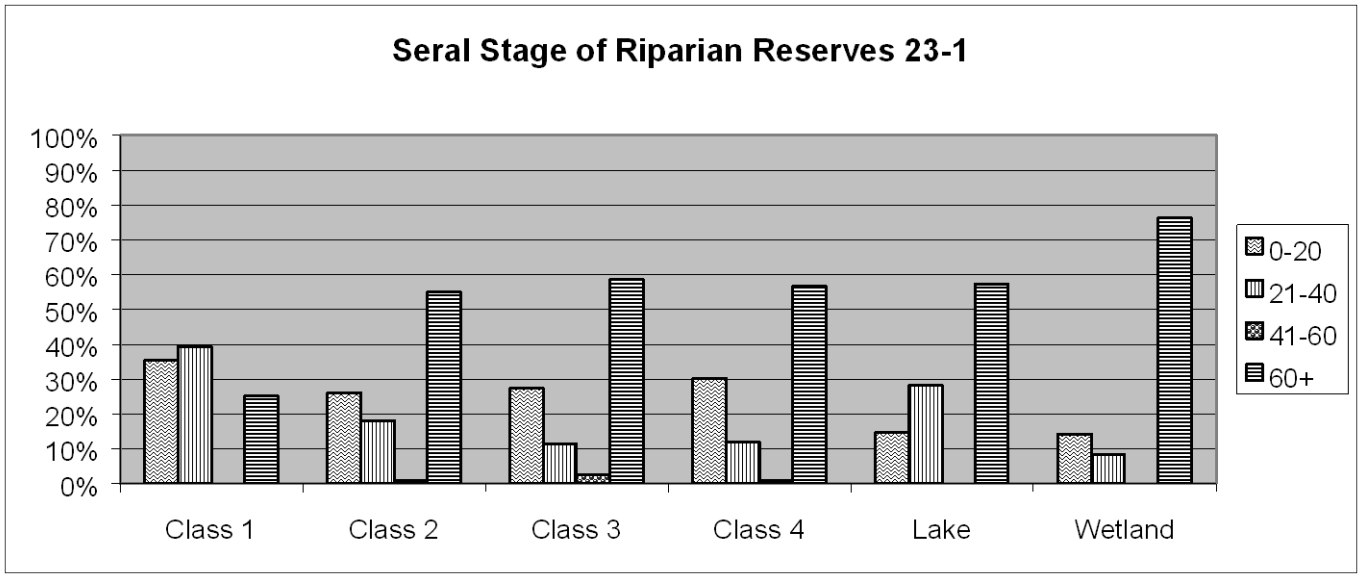


Figure 5-9 Seral Stage of Riparian Reserve in Sixth Field 23-2

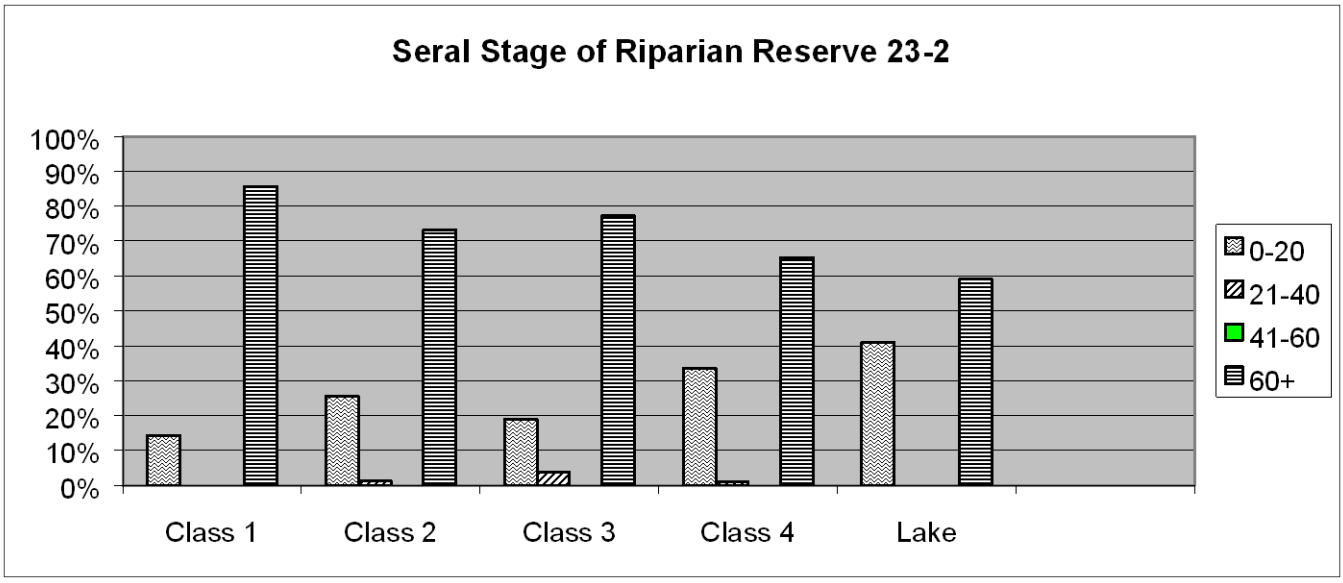


Figure 5-10 Seral Stage of Riparian Reserve Sixth Field 23-3

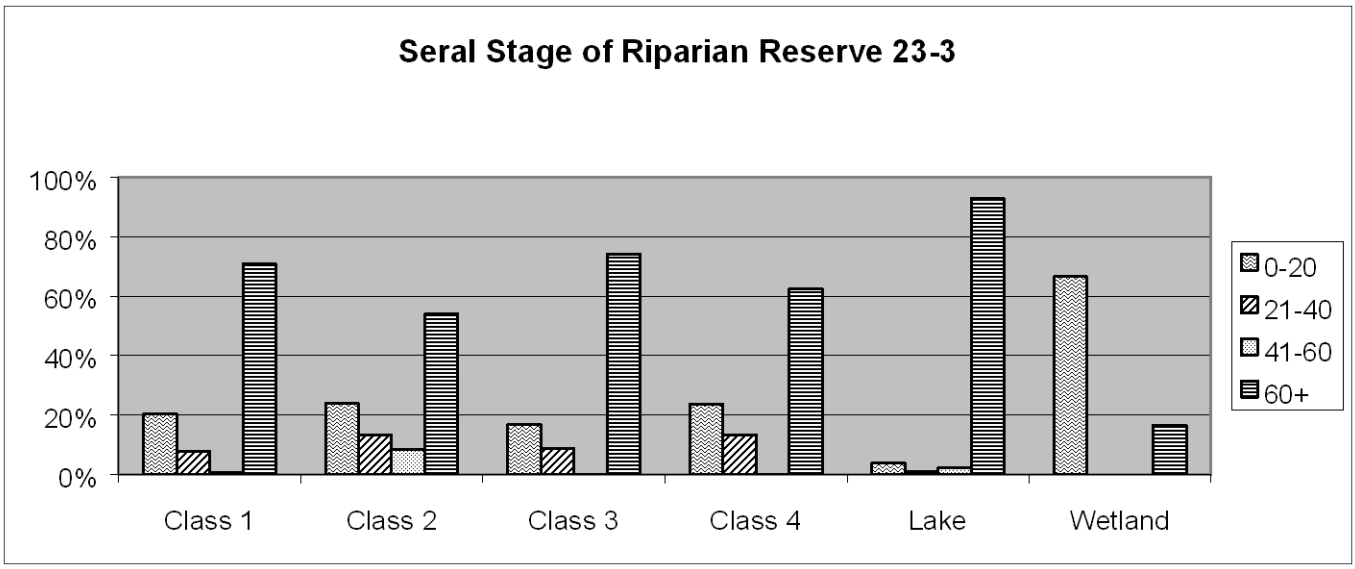


Figure 5-11 Seral Stage of Riparian Reserve 23-4

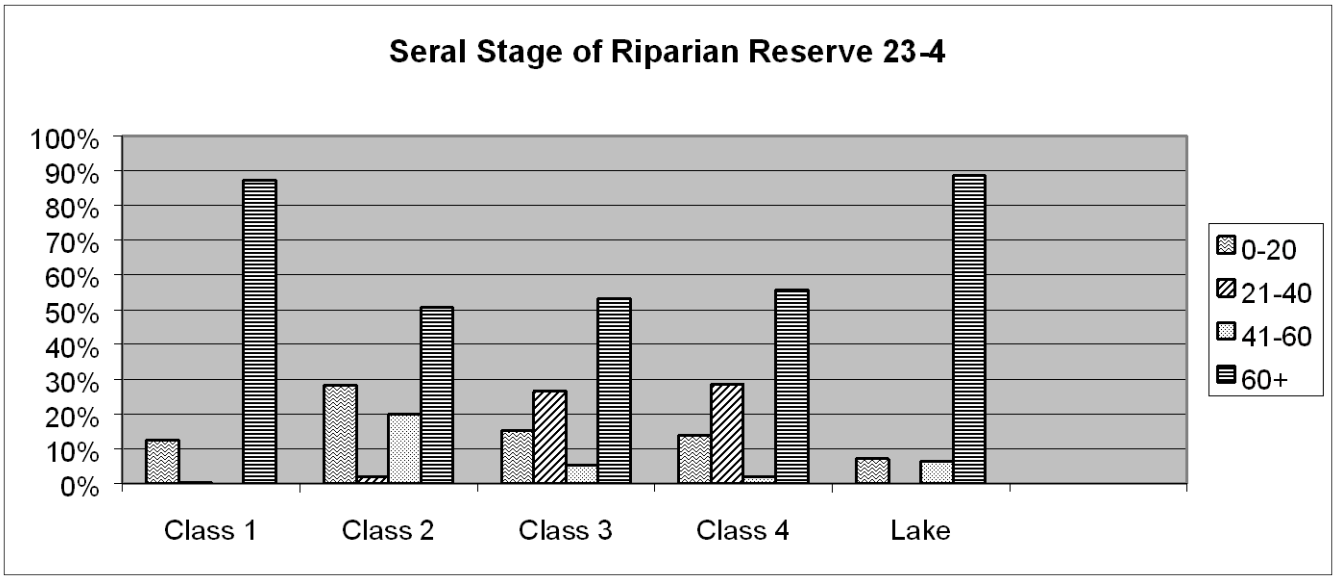


Figure 5-12 Seral Stage of Riparian Reserve 23-5

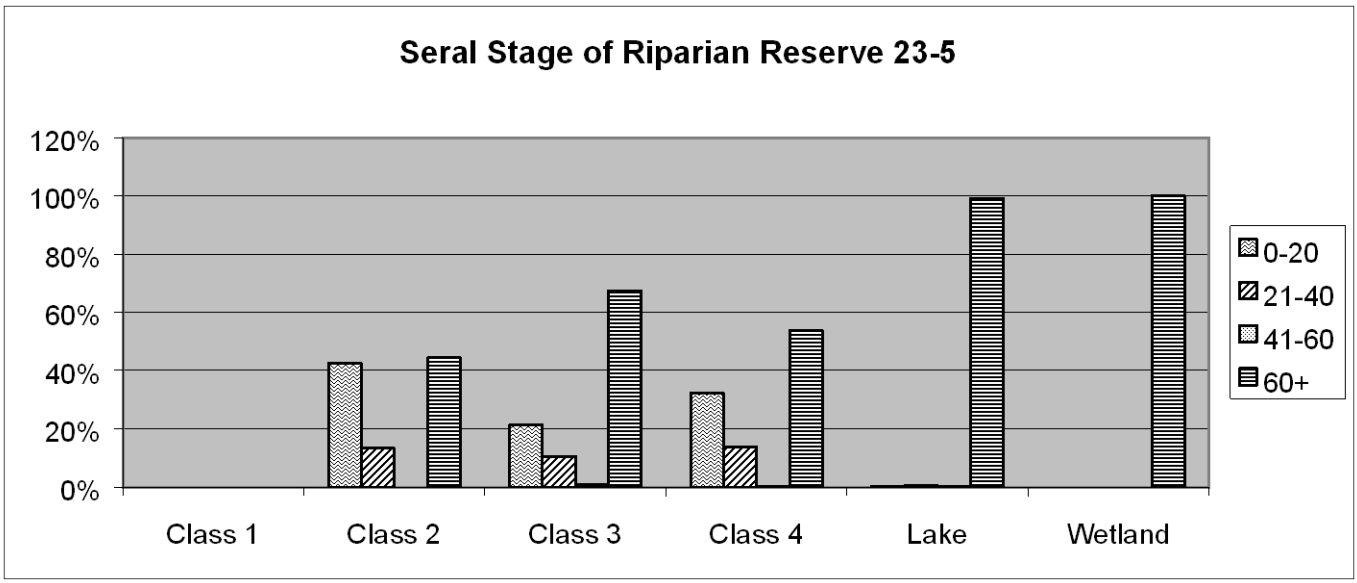
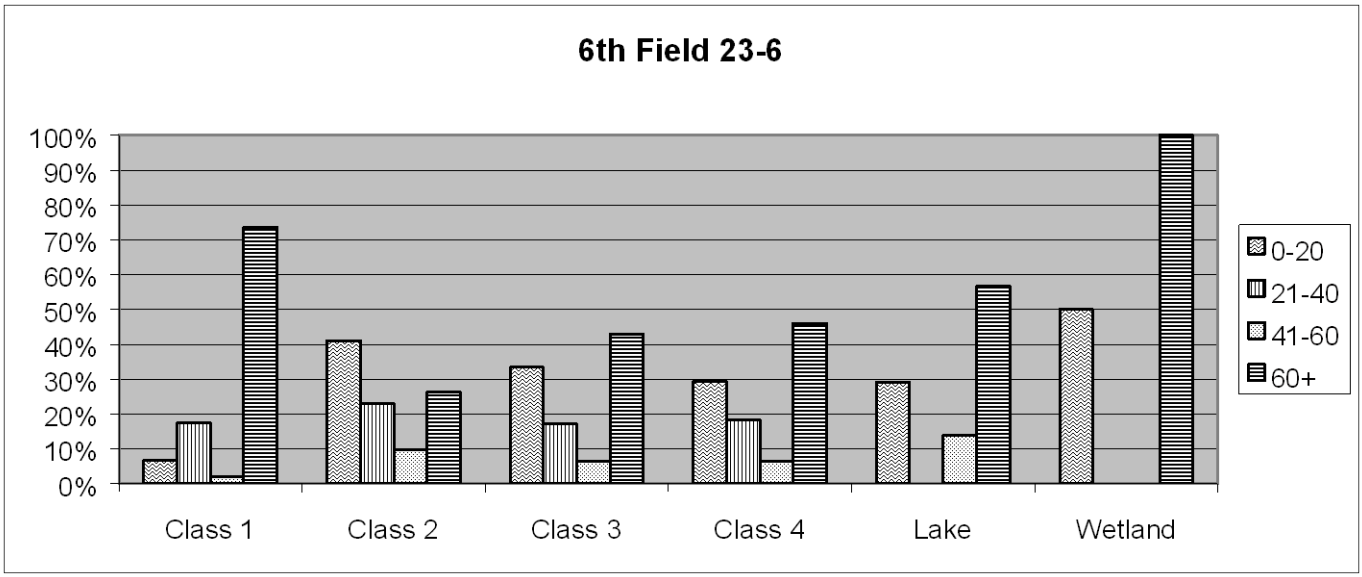


Figure 5-13 Seral Stage of Riparian Reserve 23-6



In addition to the graphical representation of this condition, the induced management condition of these riparian areas is mapped below.

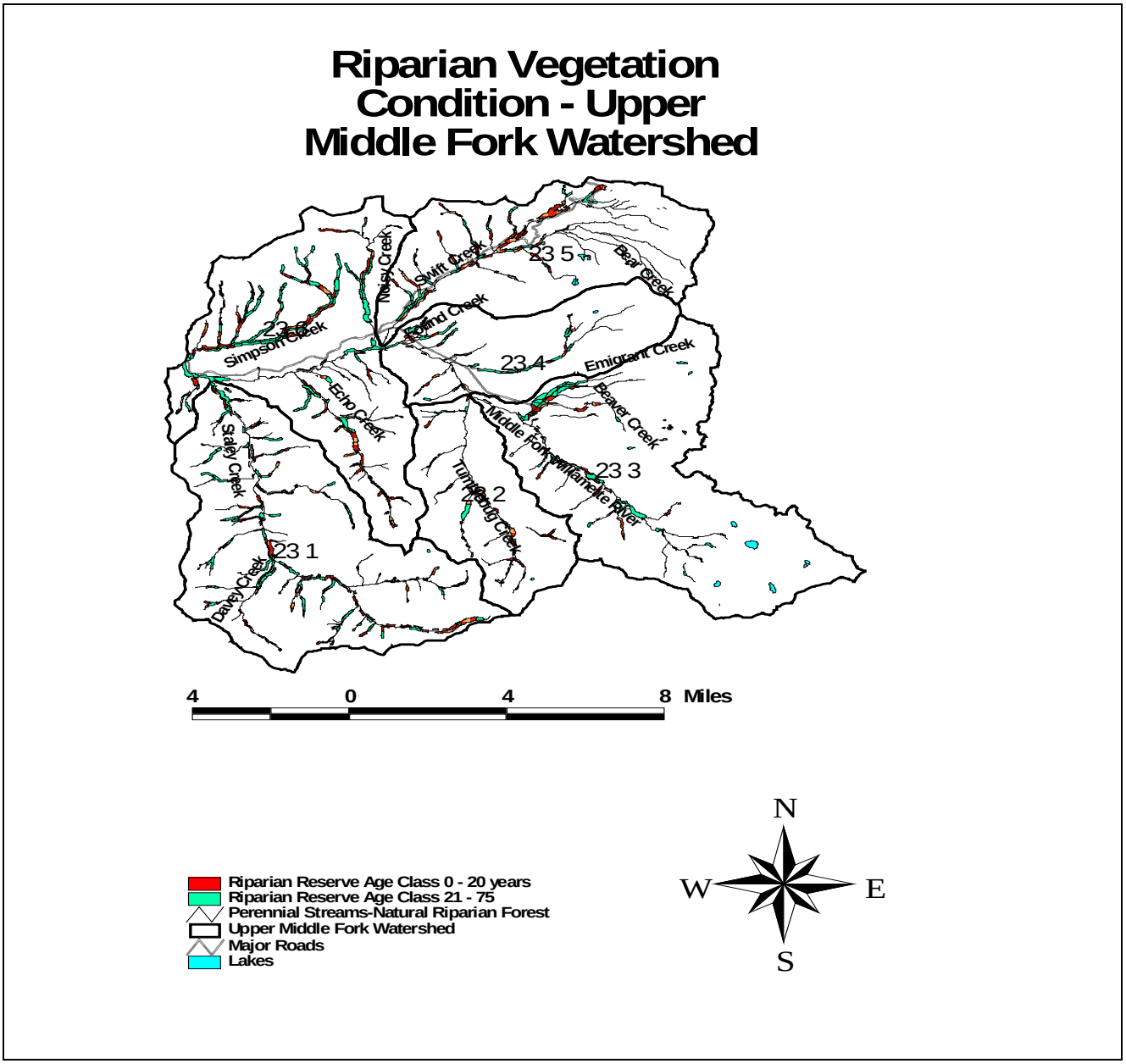


Figure 5-14 Mapped Riparian Condition of Fifth Field Watershed 23

Large Woody Debris Migration and Interception Points

Floods during the winter of 1996 created at least 51 debris torrents within the Upper Middle Fork watershed. Many of these debris torrents originated from road failures caused by re-routing of water. These are the most common affects of roads on debris torrent frequency and intensity (Swanson et. al., 1999). If these slope failures made it to class II, III or IV streams, they were synergized and resulted in complete alteration of steam channels from origination point to valley bottom, regardless of downstream road interception points.

A second source of debris torrents originates from roads when culverts plug due to undersized culverts or culverts that are not maintained. This results in release of entire road fills and debris in a large pulse of energy. The extended riparian system created by road interception of overland flow and faster release of this flow, leads to increased risk of culvert and road failures (Swanson, et.al., 1999). Most of this activity occurred on shallow steep slopes with hollows of unconsolidated colluvial soils in the Upper Middle Fork (Appendix A Upper Middle Fork WA, August, 1996). Many small landslides made it to creeks during the 1996 storm and then matured into large fast moving debris torrents downslope to higher order streams.

In the Upper Middle Fork, this is especially true in the upper Swift Creek area in the location of Mossy Creek and Baboon Creek where a concentration of debris torrents originated off of ridge top roads, sluiced through mid slope roads overrunning culverts and taking fills downslope, crossing valley bottom roads and finally dumping soils, gravels, debris, wood, trees, and root wads into Swift Creek. Much of this debris today is slowly migrating down to the Middle Fork through the Swift Creek drainage. Road densities in the area range from 5-7 miles per square mile. This same area produced the highest density of debris torrents in the Upper Middle Fork, approximately 10 debris torrent tracks were produced in an eight square mile area. A major debris/large wood jam currently exists 200 yards above the junction of Swift Creek and the Middle Fork of the Willamette. During the fall of 2000, a concentration of hatchery introduced adult Chinook salmon were observed using these structures in pools (Leverton, Pers.Comm.).

The quality of large wood does seem to be affected by road interception, observations from district storm monitoring teams shows that short wood pieces (<25’) clear roads successfully but that larger pieces (>25’) get hung up on road prisms.

Nearly all culverts in the watershed will not pass a tree length size piece of large wood and depending on the orientation of smaller pieces and size of the culvert, debris torrent sizes of large wood will not pass these culverts either. This can and does lead to road failures and delivery of debris down-slope. Open arches, bridges, rolling dips, and drivable dips are newer road designs used to facilitate passage of large wood associated with debris torrents in riparian reserves.

Large woody debris restoration projects on the district are designed to mitigate the natural wood delivery mechanisms that have been altered by historical riparian harvest. Stream surveys are designed to inventory streams and identify areas deficit in large wood. Since 1990 several large wood mitigation projects in watershed 23 have occurred, these are listed below:

Table 5-1 Upper Middle Fork Large Wood Restoration Projects

Upper Middle Fork Watershed Large Wood Restoration Projects				
Stream System	Stream Reach Distance	Number of Structures	Number of Pieces	Restored Density Per Mile
Beaver Creek Reach A - 1996	.75	18	106	141 pieces/Mile
Beaver Creek Reach B - 1996	.5	11		22 Structures /Mile
Middle Fork – Echo Ck to Found Ck.1994	4.0	60	----------	15 Structures /Mile
South Fork Staley Ck. 1995	3.0	56	124	19 Structures /Mile
Middle Fork – 1988 Pine to Buck Creek, Lower Buck Ck.	1.5	44	201	134 pieces/Mile
Middle Fork – 1999 Indian Ck.- Cone Ck., Snake Creek1.0	1.0	6	105	105 pieces/Mile
Staley Creek 1999	1.2	7	110	91 pieces/Mile
Swift Creek 1993	.5	10	70	140 pieces/Mile

Although the types, kinds, and randomness of delivery of large wood to riparian systems via restoration projects is different than that provided by debris torrents, these above listed projects could potentially ameliorate for lost wood sources along riparian reserves that were regeneration harvested. The degree to which these projects substitute for delivery of natural sources of large wood is unknown at this time. Perhaps the greatest change in stream dynamics and hydraulics in the Upper Middle Fork is the removal of large wood jams, channel spanning logs, and salvage logging in riparian reserves after the 1964 flood (Gregory, Pers.Comm.)

7.) Identify the process for possible changes in the riparian buffer widths around important bull trout recovery areas. Areas which are key are those around the springs (Iko, Chuckle, Shadow, and Indigo) where upstream buffer widths may be inadequate because of intermittent status.

Functional Relationship – Riparian Buffer Widths

Buffer widths on key riparian areas such as cold water springs and Bull Trout refugia are key to preserving water quality. Buffer widths function to protect riparian values such as shade, water temperature, rooting strength of the soils, solar radiation, affect of wind, filtering of overland flow, and amelioration of climatic regimes. Vegetation that influences riparian conditions generally does not extend beyond the distance of one site potential tree from riparian areas (FEMAT) . Buffer widths that extend beyond a site potential tree function meet terrestrial dispersal needs (FEMAT). Since these systems are class II streams and could be classed as class I streams due to recovery of threatened and endangered species, they would get a 340' buffer. This distance extends well beyond the aquatic influence zone. Intermittent status streams would be buffered 170', also well beyond the aquatic influence zone.

Related Key Question:

5. Where and to what extent have management practices influenced stream temperature? (UMFWA – 25).

Response – Adjustment of Riparian Buffer Widths

The first attempt at establishing riparian reserve widths was done under the Forest Ecosystem Management Assessment Team (FEMAT, July 1993). The team of scientists examined the impact and affects of the preferred alternative (Option 9) on aquatic species at risk (July 1993). At the time this first assessment was made, only half site potential tree heights were planned for retention on class III and IV streams (75') while full site potential tree heights would be left on class I and II streams (150'). All of the alternatives were evaluated for attaining an outcome of, " aquatic habitat will be widely distributed on federal lands throughout the range of the northern spotted owl" (Outcome A). Outcome A has a requirement for "clean gravels, cool waters (generally less than 68 degrees) and diverse and complex habitat." (FEMAT V-67,). All the fish in the species/groups for which assessments were made are salmonids, including Bull Trout.

At the time FEMAT was written, options 2,3,5,6,9, and 10 all had a 70% likelihood of perpetuating outcome A for all races/ species/ groups of salmonids at risk. At the time of the analysis, riparian reserves were one-half a site potential tree width (FEMAT V-68) . Outcomes for Options 1 and 4, which employed full site potential tree buffers predicted an 80% likelihood of achieving well distributed habitat for anadromous & resident salmonids and bull trout(FEMAT V-68). Since Option 9 was modified to employ full riparian buffers (equal to Options 1 and 4), it would offer the same level of protection as Options 1 and 4 (FEMAT,

p.V-67 and V-68), that is, well distributed habitat would be maintained at over 80% for all race/species/ groups of concern. For Bull Trout, the likelihood of widely distributed habitat would remain between 85% and 90%, for Spring Chinook Salmon, the likelihood of widely distributed habitat would remain between 80% and 85% (FEMAT V-69, Table V-11).

Riparian Reserve Widths as They Relate to Aquatic Organisms

The preceding description tracks the history of riparian buffer widths and the associated species viability assessment. The following description shows how variables such as root strength, large wood delivery to streams, large wood delivery to riparian areas, leaf and organic matter input, and shade relate to riparian reserve widths. Nearly all of these parameters are fully buffered within a buffer width of one site potential tree.

Rooting Strength- Rooting strength for bank stability provided by live trees, is generally fully realized at ½ a site potential tree (FEMAT V-27). With a full site potential tree width, all rooting strength is retained and only marginally compromised with density management treatments. Therefore, all benefits of retaining rooting strength is realized within the full site potential tree width. See Figure below.

Large Wood Delivery to Streams- Large wood delivery to streams is based on probability that when a tree falls, it will intersect the stream channel to later be incorporated into the wetted channel (Bechta). This probability is dependent on distance of the tree to the stream. Fifty percent of all streamside woody input comes from within a .4 site potential tree height (80') of the stream channel, and eighty percent of all streamside woody input comes from within a .75 site potential tree height (130') of the stream channel. With a full site potential tree width, all wood delivery options are retained. Density management treatments creates condition favorable to development of large wood sources within this effective input zone. Nearly all woody debris input comes from within one site potential tree (FEMAT V-27). Therefore, all benefits of retaining large wood sources are realized within the full site potential tree width. See Figure below.

Large Wood Delivery to Riparian Areas – This variable follows the same pattern above as outline for large wood delivery to streams, it is dependent on adjacent forest edge (FEMAT V-27). Therefore, all benefits of retaining woody debris sources are realized within the full site potential tree width. See Figure below.

Leaf and other particulate organic matter input – This variable is also distance dependent, beyond a one-half site potential tree height from the stream channel, litter input is greatly diminished (FEMAT V-27). Therefore, all benefits of leaf litter sources are realized within the full site potential tree width. See Figure below.

Shade – The shade variable is dependent on vegetation height, canopy opening above the channel, topography, forest structure type. For native forest structure, buffer width correlates closely with degree or percent of shading (Bechta, et. al., 1987). At a 100' distance up to 100% of the shade levels are maintained. Solar radiation is the only efficient mechanisms for heating water, a lack of shade in upslope forests generating heated convective winds, are ineffective at heating mountain streams (Johnson). Therefore, all benefits of retaining stream temperature are realized within the full site potential tree width. See Figure below.

Below is shown a graphical representation of riparian forest effect on streams as a function of buffer widths. Current forest plan buffer widths exceed the zones of influence in all areas of riparian function. Based on the variable discussed on page 45, there is no aquatic driver for increasing the width of riparian zones around spring areas such as Iko, Chuckle, Shadow, and Indigo springs.

Figure 7-1 Riparian Width Buffering Curves

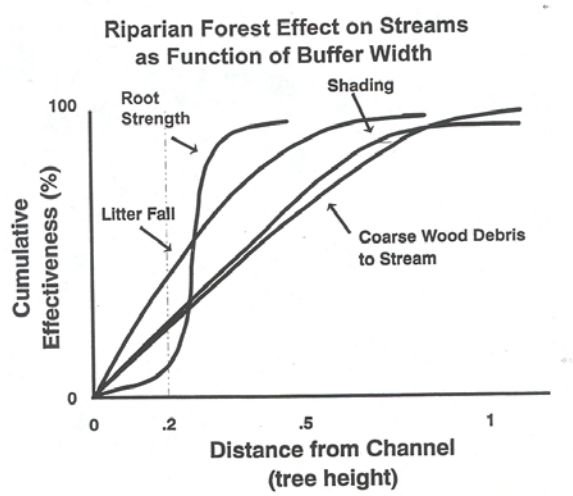


Figure V-12. Generalized curves indicating percent of riparian ecological functions and processes occurring within varying distances from the edge of a forest stand.

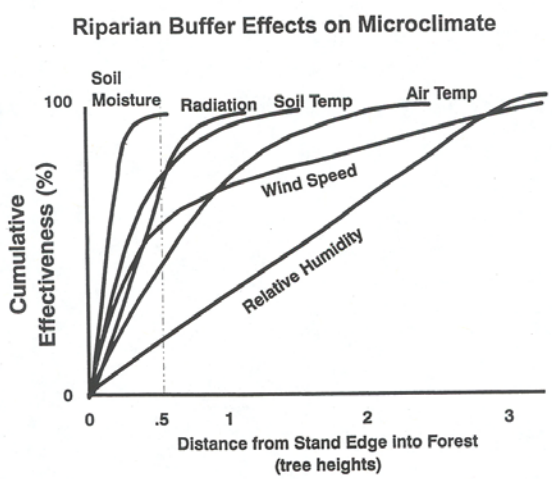


Figure V-13. Generalized curves indicating percent of microclimatic attributes occurring within varying distances of the edge of a riparian forest stand (after Chen, J 1991).

Riparian Reserve Widths as They Relate to Terrestrial Dispersal Needs

The Watershed Analysis update team reviewed the landscape condition in the area of Iko, Indigo, Chuckle, and Shadow springs, no definitive benefit could be positively stated as to why dispersal or upland connectivity would be enhanced by widening these buffer widths. Therefore, these widths were not recommended for change.

8. *Verify previous harvest rates in relation to hydrologic recovery (ARP). Are the standards used to determine the ARP ratings consistent and appropriate?*

Functional Relationship – Hydrologic Recovery, Current/Trend ARP Ratings

In recent years additional research examining the issue of effects of clearcut harvesting and road construction on peak flows has been published (Jones and Grant 1996, Thomas and Magahan 1998, and Beschta et al. 2000). Results of these studies is generally consistent in predicting increases in peak flows in small watersheds for runoff events with 0.4 to 5 year return intervals. Differences in interpretation of results appear in these studies relating to the effects of forest harvest and roads in large watersheds and for large magnitude events. The results of Thomas and Megahan (1998) and the results from Beschta et al. (2000) do not support the conclusion that there is clear evidence that regeneration harvest and roads increase the magnitude of peakflow events in large watersheds. In addition the latter two studies do not support the conclusion that forest practices increase the size of large magnitude events in either large or small watersheds. Jones (2000) suggests that in at least three of the 100 percent clearcut basins in her study of H.J. Andrews, increases in peak flows associated with large rain-on-snow events appear to be smaller than the percent increase in size of smaller events.

Related Key Questions

4. Where and to what extent have management practices influenced erosion processes, hydrologic recovery, and channel processes?

Response- Hydrologic Recovery, Current/Trend ARP Ratings

In November of 1997, watershed specialists from the Willamette National Forest met to develop a common methodology for calculating hydrologic recovery to be used for the entire Willamette National Forest. Aggregate Recovery Percentages (ARP) calculated using the revised methodology are displayed in Table 2. One of the significant differences between the method used in the 1996 watershed analysis and that currently used is how natural openings are considered. In addition to young stands and roads, the 1996 watershed analysis categorized as hydrologically unrecovered areas including “natural” openings such as

rock outcrops, wetlands, meadows, etc. The revised methodology for ARP calculations considers these natural openings as 100 percent recovered.

In addition to the revised methodology, the values displayed in Table 2 incorporate improved stand age information, particularly in subwatershed 23 6 Echo Creek (Simpson – north). This area contains 5,971 acres of private land (45 percent of the Simpson – north subwatershed). A large portion of this area was clearcut harvested since 1996. Also in the summer of 1996, a portion of this subwatershed experienced a stand replacement fire. These events have resulted in a reduced stand ages and a corresponding reduction in the ARP value for subwatershed 23 6 Echo (Simpson – north). In all other subwatersheds, current ARP values range from being equal to mid-point values to ten percentage points above the mid-point value.

New Aggregate Recovery Percentage Levels

Aggregate Recovery Percentage values for the year 2001 and beyond do vary to some extent from those projected in the 1996 watershed analysis for the year 2001 (see Table 25 in 1996 watershed analysis and Table 8-1 and 8-2). With the exception of subwatershed 23 6 (both Simpson-north and Echo-south), current subwatershed ARP values indicate higher values for the year 2001 when compared to values presented in Table 25 of the 1996 watershed analysis. The primary reasons for the differences include better timber stand age data, recent timber harvest, and changes in ARP calculation methodology to provide consistency between different districts of the Willamette National Forest. In contrast to the previous 1996 ARP analysis, the current methodology considers all natural openings or naturally low stocked stands as 100 percent recovered.

The mid-point ARP values can be considered thresholds of concern. When ARP values are lower than mid-point values, an intensive cumulative effects analysis should be conducted including field surveys to determine the risk of adverse effects to stream channels from increases in peak flows. Current ARP calculations indicate all subwatersheds except 23 6 Echo Creek (Simpson-north) are at or above mid-point values (see Table 8-1). The 1996 watershed analysis suggested recovery periods of 15 and 10 years for subwatersheds 23 4 (Indigo Springs) and 23 5 (Swift) respectively to facilitate functioning of hydrologic processes. However the revised ARP calculations result in values for these subwatersheds at or above mid-point values. Revised ARP calculations result in a current value for subwatershed 23 6 Simpson-north of 18 points below the mid-point. An intensive cumulative effects analysis should be considered for subwatershed 23 6 Simpson-north before any projects that could affect peak streamflows are implemented.

Table 8-2 displays ARP values projected at 5 year intervals beginning in the year 2001 and extending to the year 2016. The values presented in Table 8-2 include the effects of past harvest and harvest that is likely to occur in the future including sales sold and not yet harvested, and planned sales that have not been sold or awarded to a purchaser. Timber sales included in this analysis that are considered likely to be harvested in the future include: Upper Liz (sold and awarded), Staley (sold and awarded), Happy Bird (planned but not sold), and Simco (sold but not awarded). In addition, harvest in the Tumbler timber sale has been completed and was included in this analysis. The values in this tables 8-1 and 8-2 do not include the effects of any potential timber sales not yet planned or the possible effects of catastrophic events such as extensive blow-down from major windstorms or large stand replacement fires.

Table 8-1. Aggregate Recovery Percentages

Subwatershed	**Reference Hydrologic Recovery (estimate)**	**Current Hydrologic Recovery**	**Change Current from Reference**	**Mid-Point ARP***	**Comparison Mid-Point from Current**
23 1 Staley Cr.	73	72	-1	67	+5
23 2 Tumblebug Cr.	73	78	+5	68	+10
23 3 Paddy's Valley	73	74	+1	69	+5
23 4 Indigo Springs	73	78	+5	70	+8
23 5 Swift Cr.	73	66	-7	66	0
23 6 Echo Cr. (Simpson - north)	73	52	-21	70	-18
23 6 Echo Cr. (Echo - south)	73	70	-3	68	+2
Total Watershed Weighted Average	73	70	-3	68	+2

* Mid-point ARP values based on weighted average mid-point values of Planning Subdrainages identified in Appendix E of the Willamette National Forest Land and Resource Management Plan.

Table 8-2. Current and Projected Aggregate Recovery Percentages *

Subwatershed	**Current Hydrologic Recovery (year 2001)**	**Year 2006**	**Year 2011**	**Year 2016**
23 1 Staley Cr.	72	77	83	85
23 2 Tumblebug Cr.	78	82	86	89
23 3 Paddy's Valley	74	80	84	87
23 4 Indigo Springs	78	83	88	91
23 5 Swift Cr.	66	74	81	87
23 6 Echo Cr. (Simpson - north)	52	61	72	81
23 6 Echo Cr. (Echo - south)	70	74	81	85

* Includes all past, current, and reasonably forseeable future actions (Simco, Staley, Upper Liz, Tumbler, and Happy Bird Timber Sales)

9.) Update and map areas of high, medium and low risk for slope failure using a combination of parameters such as percent slope, soil type, concave/convex headwater areas, and/or drainage network.

Functional Relationship – Slope Failure Parameters

Related Issues and Key Questions

Issue: Density, Location and Use of Roads

Q1: Where and to what extent has road density, condition, location and use influenced erosion, hydrologic, and channel processes?

Issue: Vegetation Condition and Patterns

Q4: Where and to what extent have management practices influenced erosion processes, hydrologic recovery, and channel processes?

The 1996 Upper Middle Fork Watershed Analysis assessed the risk of slope failure by delineating areas with a greater likelihood of slope movement (SRI landforms with steep ground and shallow soil, and active earthflows) and overlaying the transportation system and harvest units which were clearcut after 1980. The intent was to give a visual image of the location of landforms that have some potential for slope movement and where roads and harvest units may have an effect of the natural stability of the slopes. In addition, air photos covering a 50-year period were analyzed to document slope movements both in a forested setting and potentially tied to management activities.

Response- Delineate Slope Failure Zones

As described in Item 3 of this update, areas were identified which have a greater chance of cause-effect relationships of terrestrial processes and aquatic response processes in areas containing high quality habitat for Bull Trout and Spring Chinook. These areas include the Swift Creek drainage, the Upper Middle Fork in the vicinity of Chuckle, Indigo, and Iko Springs, and Paddy's Valley, and the confluence of Staley Creek and the Middle Fork Willamette River. These areas should be treated as "Emphasis Areas" for field evaluation, road maintenance, reconstruction or decommissioning during the ATM process and other funding opportunities as they become available.

An Aquatic Risk Rating method was applied to the transportation system within the Upper Middle Fork watershed. After field reconnaissance, it was apparent that the analysis technique has limitations when making the transition from the general to the specific. It is likely that this is because the databases that were used in this analysis (or any similar Risk Rating analysis) have limitations that can't easily be washed out by even more sophisticated or elaborate analysis techniques. Therefore, it was decided that an update to the risk ratings for this watershed would have limited value to site specific or local decisions.

10.) Identify potential conflicts and/or opportunities of meeting both aquatic and terrestrial objectives within the riparian and late successional reserves.

Functional Relationship- Terrestrial and Aquatic Conflicts

The desired future condition for both riparian reserves and late successional reserves are late successional forest stand types. This includes stand characteristics like deep crowns, large tree crowns, large diameter trees (8 tpa > 36”dbh), shade tolerant understories, downed woody debris >21 ”dbh (15 tons/ac.), snags, and vertically layered vegetation (PNW447). There is no conflict in and of itself, in meeting late successional objectives in *both* riparian reserves and late successional reserves, the desired future conditions are the same.

Different philosophies exist how to best develop and maintain late successional forest characteristics in these areas of riparian reserves and late successional reserves. One philosophy basically assumes that by retaining maximum forest leaf area all the time and relying on self-thinning processes over long time periods, late successional objectives can best be met. A second philosophy relies on the mounting evidence of science and field research plots that supports the theory that old-growth forests are a product of disturbances, and by judiciously using silvicultural practices that disturb the forest, managers can accelerate development of old-growth characteristics. In the later case, tools used are typically density management prescriptions. Basically, it is the differences in these two philosophies that define the cornerstone of this conflict.

Many variables play a role in how, or even if, old-growth forest structure is attained on a forest site. Both random events (fires, seed sources, diseases, etc.), and subtle hard wired variables such as genetic height growth characteristics, resistance to ice storms, bark thickness, and seed size play a role in how a stand develops into old-growth. Each of these hard-wired characteristics, when exposed to random selection pressures, leads to different vegetation successional pathways, some of which end in an old-growth forest condition.

Related Key Question:

Where and to what extent have management practices influenced landscape patterns, such as seral stage distribution, and course woody material? *(UMFWA-25).*

Response: Terrestrial and Aquatic Conflicts

Seven important axioms need to be recognized by resource managers in order to achieve desired late successional objectives for these reserves, these include:

1. The type and seasonality of the disturbance controls the kinds and density of forest vegetation that captures a forest site. Disturbances temporarily set back stand stocking and crown closure, only to enhance stand structure in the long run. This is because trees need open space to expand their crowns and grow in diameter.

2. Different floristics of the vegetation species determines which species gets the competitive advantage and may ultimately determine the outcome of stand structure hundreds of years later.

3. Intermediate stand disturbance (managed or natural) on the site are selection pressures that select on the stand and thin the species which first get established on the site.

4. Initial natural or managed reforestation density plays a large roll in how quickly forest sites become fully occupied and how early competition slows down tree and stand development (Emmingham, OSU). If large mature trees are desired in the future, they need a happy childhood with growing space to get big.

5. As is true in all population dynamics, basic biological size/density relationships apply to forest stands. Biological maximums of size/density relationships guide growth. Densities today control forest structure types tomorrow.

6. Periodic negative feedback, in terms of stand density reduction; provide forest stability. Positive feedback in terms of increased size, increased stand densities and stand growth, result in forest instability. Instability first shows as height/diameter imbalances, later on, these high stand densities manifest themselves in decreased vigor, decreased resistance to disease, insects, and blow-down. These all create fuel ladders, and risk for stand replacement fire (Agee). Stand replacement fire is the largest threat to riparian and late successional reserves in the Upper Middle Fork Watershed. (See stand replacement fire history map, Question 5).

7. Short term reductions in crown closure (stand density reduction) leads to long term gains in stand structure, stability, tree size, and resistance to disturbance.

History

It is important to understand the history of land management in these reserve areas. When portions of these reserve areas were first harvested, they were not part of any reserve system. At this point in history, managers did not recognize the current interpretation of ecosystem functions in riparian reserves. These lands were part of a land base that incorporated growth and yield, and fiber production objectives; and managers were told to meet these objectives. As such, the goal for these lands was a per acre volume production of wood. Consequently, these lands which are reserves today, were typically broadcast burned, planted with 650 trees per acre, and left to rapidly capture the site with conifer vegetation.

In 1994, under the new Northwest Forest Plan land allocations, the objectives for these lands changed from <u>stand growth</u> to <u>stand structure</u> development and <u>individual mean tree growth</u>. Even to this day, very high stocking levels that fit the old model exist on the landscape. It is imperative that managers and readers of this watershed analysis recognize that these two objectives are a dichotomy. Stated simply, the early management regime philosophy was, “just enough room to grow but none to waste”, utilizing up to six light thinning entries to retain full site occupancy nearly all the time, yet, capture imminent mortality. The current management objectives are the opposite of those in early objectives; the objective now is to grow big trees fast and enhance forest structure without regard to total stand volume. This requires that stands be managed at much lower densities than those considered under the old forest management regime. The two

graphs below (Figure 10-1), illustrates the differences between these philosophies. The top figure shows that by maintaining high stocking levels, the volume per acre yield go up; the lower figure shows that as stocking levels go down, individual tree growth goes up. The unit of measure for comparison is Stand Density Index, SDI (Reineke). SDI is a size/density relationship. Several key SDI threshold values exist; at 15% SDI the tree crowns are touching, at 25% SDI is the onset of competition, at 35% is the lower limit of full site occupancy, at 60% SDI is the onset of self thinning, at 100%SDI is the maximum size density relationship.

Before 1994 stands were managed to remain in zone III of the diagrams below, now, with a new stand structure/individual tree growth objective, riparian and late successional should ideally, during early stages of growth, be managed in zone I.

These graphs illustrate the basic trade-off between stand growth on an area basis (top) versus individual tree growth (bottom).

Figure 10-1 Mean Tree Growth versus Stand Growth

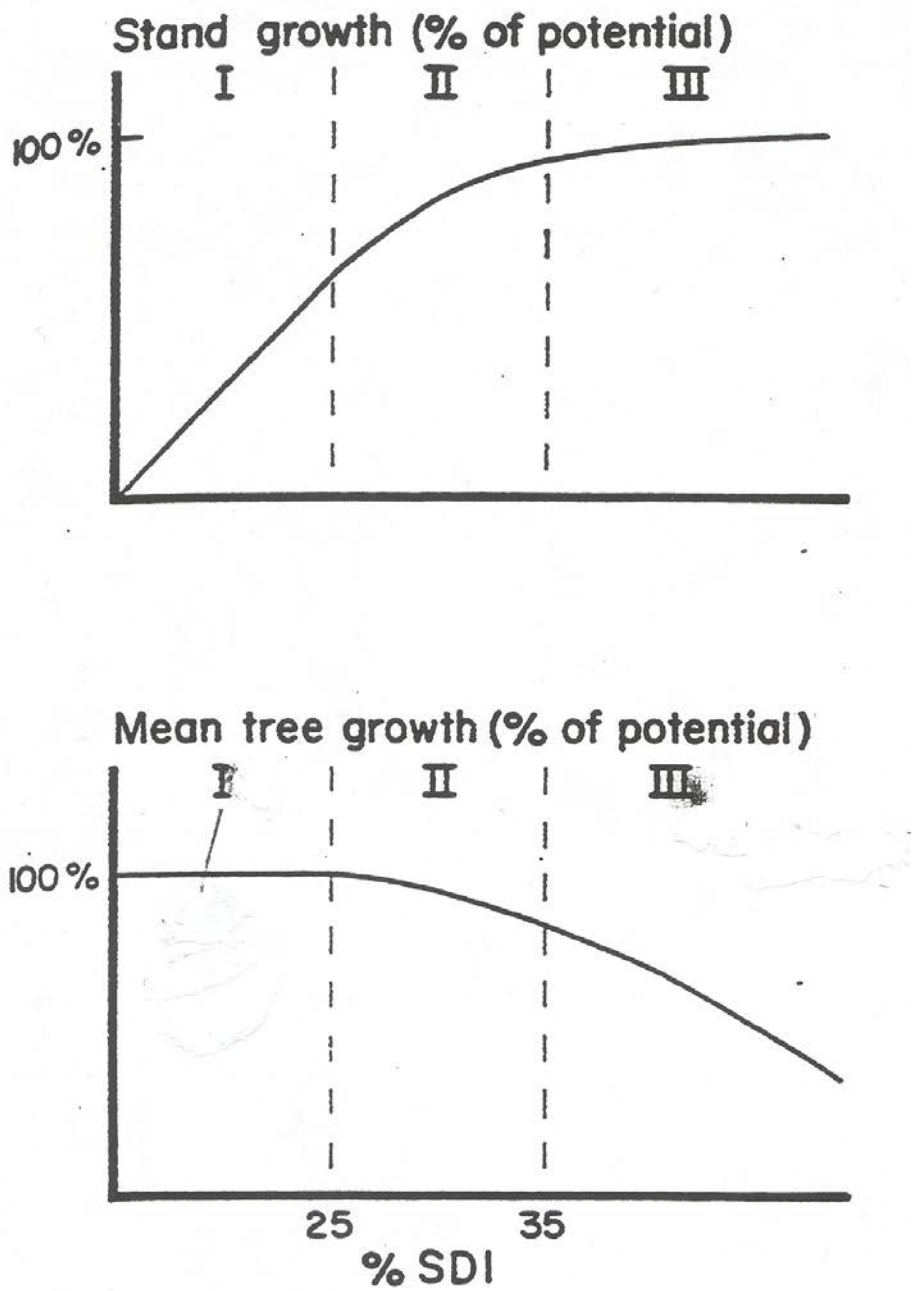


Figure 2. Current annual stand and individual tree growth as related to growing stock. % SDI is the actual SDI expressed as a percent of the species maximum SDI. Potential growth is dependent on species, site quality and stand age. (after Langsaeter 1941).

Conflict:

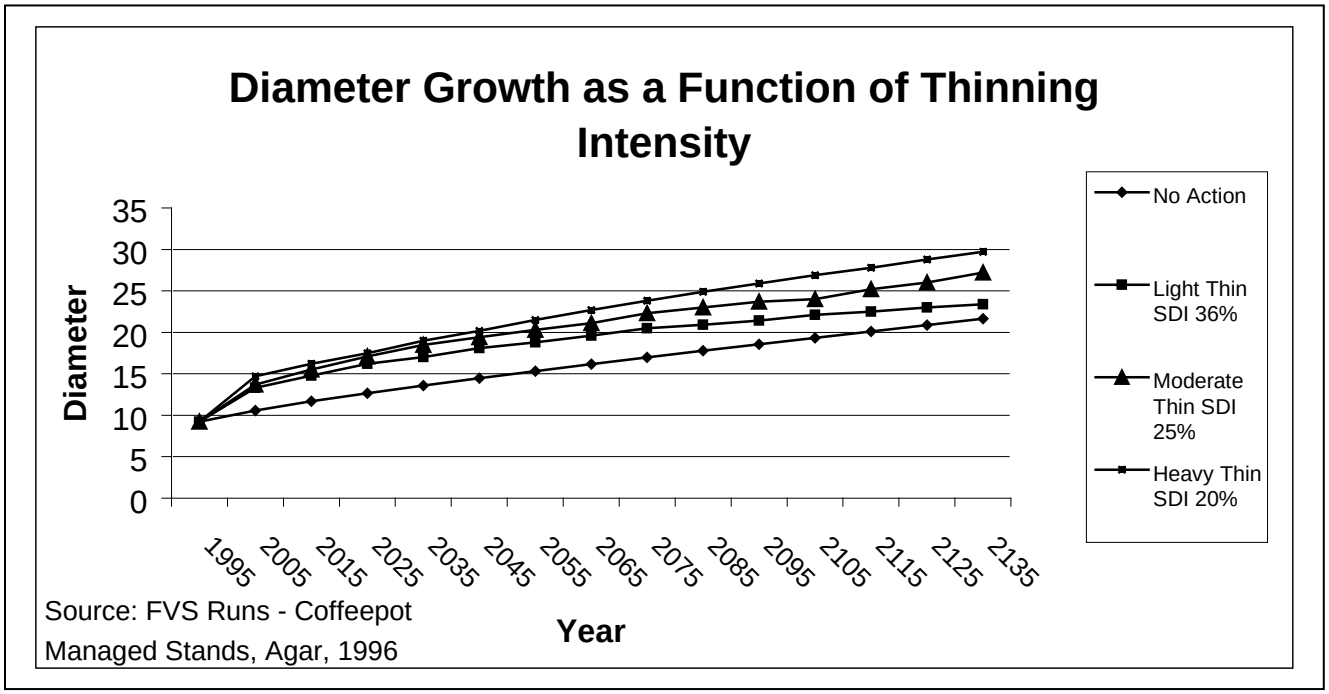
From the above curves, there is a need to be managing in zone I in late successional and riparian reserves. This will require maintenance of open forest stands <35% SDI. Nearly all stands greater than 30 years of age are at densities >35% SDI, and as such need to be thinned back to zone I, generally <40% crown closure or SDIs near 20%. As a result, crown closures could go below 40%; this diverges from direction in management of riparian reserves and late successional forests. This direction in reserves is to "maintain or enhance" late successional stand characteristics (ROD C-12). *In this sense, there is some conflict with needed density management treatments and development of long term habitat structure.* Wide spacing silvicultural prescriptions are generally needed for development of shade tolerant understories (Emmingham). This conflict limits the flexibility to prescribe for thinning that truly put stands on a trajectory towards late successional forest.

Solution:

In order to maintain high levels of tree growth, trees need a high percentage of live crown ratio. As a minimum, a 40% live crown ratio is needed to maintain acceptable growth rates (Long 1985), and 60% is needed for vigorous diameter growth (Chen). This relationship is important, and shows the need to thin stands back to SDIs of 25% to get live crown ratios of >60% for vigorous diameter growth.

Several stands have been modeled for diameter growth given different initial stand density management levels on the Middle Fork District. This stand model used was the Forest Vegetation Simulator, the model was calibrated to local forest site conditions, and local stand exam information was used (Agar, 1996). Diameter growth was modeled out to stand age 200 years under different thinning densities. The graph below shows the diameter growth response (large wood potential), for different thinning densities.

Figure 10-2 Modeled Diameter Growth as a Function of Thinning Intensity



The results of this modeling show that target diameters (21”) can be attained *with intensive thinning in roughly half the time* that a self-thinning, no-action approach reaches a target 21” diameter. The target 21” was chosen, because this is the target diameter for large wood in riparian areas in the Northwest Forest Plan.

Conflict:

Development of understories is a desired condition of riparian and late successional reserves. Development of understories is dependent on delivery of enough light via openings in the overstory. Growth of shade tolerant species requires that periodic reduction in overstory crown closure occur, to support growth of shade tolerant conifers (Chan, Emmingham, 1996). Heavy thinning is needed in many of these areas for fuels reduction, large wood growth, and understory growth. Thinning densities of SDIs of 15% to 20% are required to open up stands enough for understory growth (Chan, Emmingham, 1996). This equates to crown closures of 20-30%, far below what is generally considered acceptable in riparian or LSRs or riparian reserves (ROD C-12).

Solution:

Short term affects to habitat need to be incurred to gain long term habitat stability in reserves. These reserve stands must be thinned heavily if understories are cultured, again this conflicts with riparian and LSR direction of maintaining 40% crown closure.

Computer modeling corroborates this fact. Modeling of the understory shows that thinning to 20% SDI will release shade tolerant understory species and allow them to move up into co-dominant crown positions. Modeling done on Coffepot Creek on climax cedar/hemlock sites indicate that heavy thinning is needed to meet long term riparian and LSR objectives for understory growth. If stands are heavily thinned to 20% SDI (70 TPA, Avg. DBH 14”), at age 40, planted with shade tolerant understory species, and grown to stand age 200, it is predicted that an overstory of 27” DBH Douglas-fir with an understory of 14” shade tolerant red-cedar can be attained. Comparing this management scenario with no action, at age 200 the same stand would have an average diameter of 2.8” for shade tolerants and 17.8” DBH for Douglas-fir. Two vastly different outcomes are predicted for the same stand based on different density management regimes.

This scenario outlined above would allow enough open and free growth in riparian and late successional stands so that they approach old-growth conditions at stand age 180 years. Deep crowned multi-storied stands could be attained in approximately 140 years from today.

Below is a visual illustration of stand growth computer model outputs. These two treatments show how understories would develop in reserves under different thinning densities over a total of 200 years. Note the difference between the no action understory condition versus heavy thin condition. Heavy thinning puts the stand on a vigorous trajectory toward old-growth.

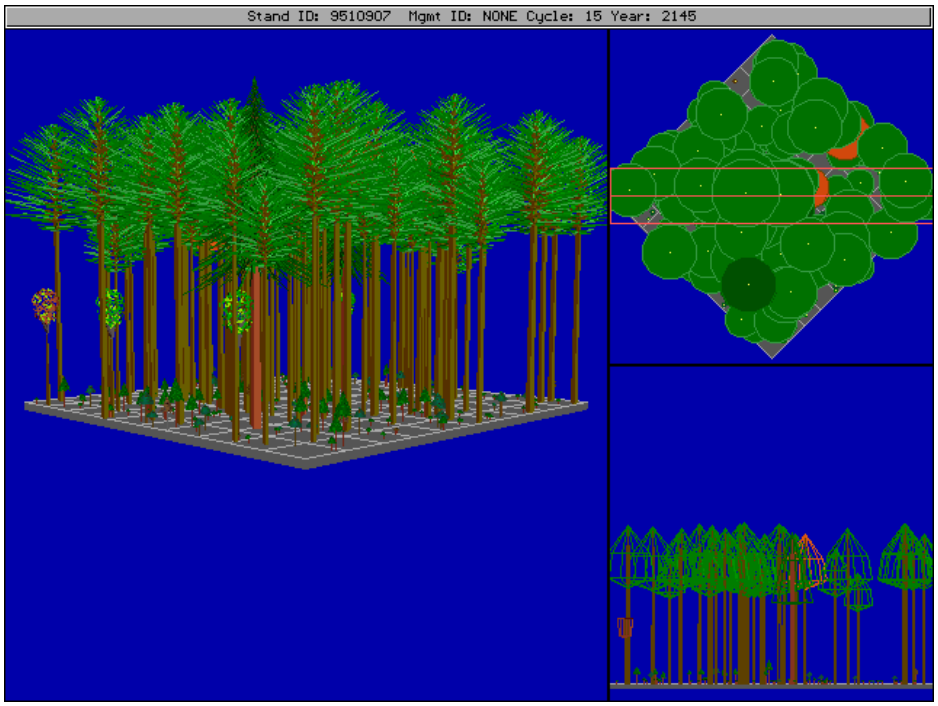
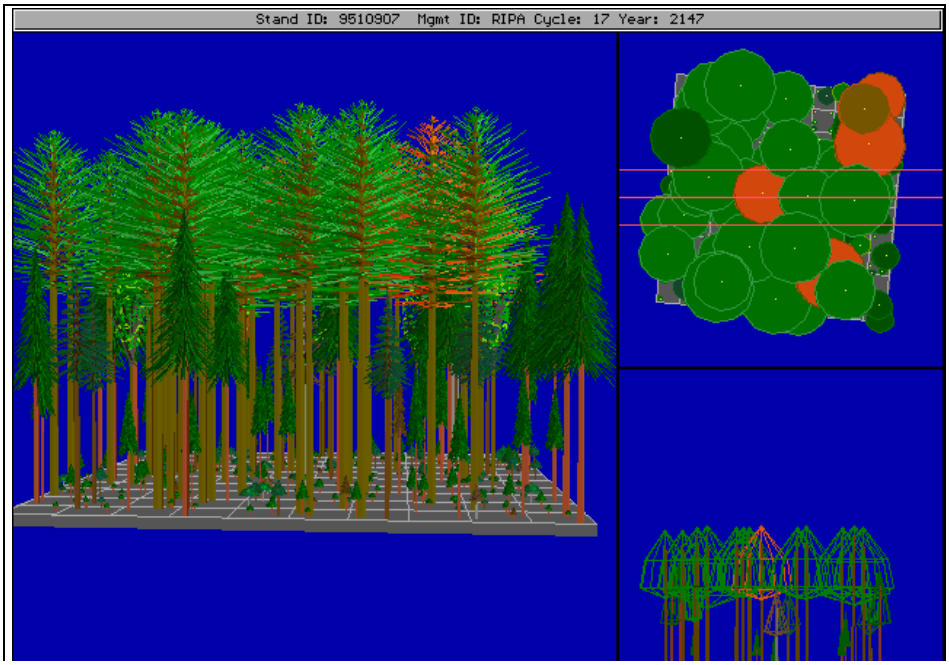


Figure 10-3 No Action *Alternative, Stand Age 198*

Figure 10-4 Heavy Thin 20% SDI Alternative, Age 200



Conflict:

If a no-action approach is taken to control densities in these reserves, the decision can become an irreversible commitment of resources. Trees with a H/D ratio of 80 or more represent an unstable situation and a likley-hood for blowdown (Emmingham, 1986).

Many stands in the Upper Middle Fork are maturing at very high densities and competition levels. Height/Diameter relationships increase as stands mature. As stand densities stands develop (>60% SDI), live crown ratios of <40% are attained, this leads to weak stems as saplings grow in height but only marginal diameter. Trees can become out of balance and subject to blowdown when the ratio of height to diameter exceeds threshold levels of 80 (Emmingham, 1996). This relationship is an indication of stability of the forest stand to withstand wind stress and resistance to blowdown. Height growth is a function of forest site and diameter growth is a function of crowding. Height/diameter ratios of 80 and more develop in forest stands that are densely stocked. The longer stands are left dense and thick with high levels of competition for light and nutrients, the higher these H/D ratios become. Snow loading on trees is common in the Cascades with plentiful, heavy, wet, snowfall. This can accumulate in a snow pillow as dense stands collect snow, lifting the center of gravity in a stand, and can pull over large patches of trees up to an acre (Agar, 1996). This snow-down affect can create habitat for Douglas-fir beetle that first inhabit green downed material, then, later emerge in year 2 and attack standing green forest. Together, this snow down and bark beetle activity combine to create large accumulations of slash that become fuel beds for stand replacement type of fires (Reservoir Thin E.A.).

Avoiding density management treatments in riparian reserves is a classic cumulative affect. The no-action approach in managed stands of riparian reserves and late successional reserves has definitive consequences, namely large, irregular pulses of snow down, and development of fuel ladders. A no action approach favors fuels accretion. Fuels build up may produce fire intensities that are the antithesis of desired long term forest cover, that is; contiguous fuel ladders can support a crown fire in many areas of managed stands in riparian reserves (Graham, Harvey, Jain, and Tonn, 1999). For the Upper Middle Fork, this concern cannot be ignored, with the extensive legacy of fire history.

Solution:

Thinning can ameliorate this blowdown problem by creating open space between trees so that snow can be shed and is not suspended in the tree crown. Moderate or heavy thinning creates a porous forest canopy that can then pass snow, instead of suspending the weight in the upper crowns of the trees. The active density management approach achieves the same objectives, in a shorter period of time, without the lasting legacy of pole wood and sapling fuel loading.

Conflict:

There is concern that reduced crown closures via commercial thinning will lead to increases in stream temperatures.

Solution:

Most prescriptions for riparian thinning involve no cut treatment areas. This varies from 10'-25'for class IV streams and 50' from the edge of the active channel for class III streams in the Upper Middle Fork. Modeling average stand growth, on low site lands, a 75' tall tree is attained by age 40, casting a 43' shadow at peak summer solstice. Except for the main stem of the Middle Fork of the Willamette, a 43' shadow would cover nearly all of the stream surface area of tributaries to the Middle Fork. Therefore, a standard riparian buffer of 50' on class III streams will protect stream temperatures. On class IV streams, a 10'-25' buffers will protect steam temperatures because these streams do not flow during peak solar heating periods.

Conflict:

Riparian and late successional reserves overlay a diverse and unique mixed conifer vegetation type in the Upper Middle Fork watershed. Stands in this type represent a legacy of forest type left over from a drier, warmer period just after the little ice age. Thick, platy barked ponderosa pine, sugar pine, and incense cedar dominate this type in the overstory, with Oregon white oak, Douglas-fir, pacific madrone, and grand fir occupying a second and third cohort in the stand.

Many old-growth pine in this portion of the watershed are dying from disease and insect attack due to stress related overstocking. Stress related overstocking is a result of unnaturally high basal area levels occurring on these sites due to the removal of fire from the ecosystem. Most stands of this type can typically support up to a limit of 120 $ft.^2$ B.A./ac. -150 $ft.^2$ B.A./ac.. Fire historically removed competing understories, reduced stand densities and exposed mineral soils to favor pine regeneration. Without the fire disturbance agent, the pine stands are now subject to numerous stress related agents. The old-growth pine mortality agents are blister rust, mountain pine beetle, red turpentine beetle, and root rots. Because there is no open growing space or suitable mineral soil seedbed in these stands, there is little if any natural regeneration from legacy trees. This condition represents an ecological and genetic bottleneck for fire climax species. Land allocations exist in this forest type that are administratively withdrawn from programmed timber harvest, these areas will rely on prescribed or natural fire. To a large extent, these administratively withdrawn lands in this type are exempt from all disturbance agents except wildfire, which is routinely suppressed.

Contrary to popular thinking, the biological capacity of the dry site climax species in the Upper Middle Fork limit their ability to become multiple layered forests, typical of cedar/hemlock types. This forest type does not have the biological capacity to support the biomass that was conceived in more mesic, LSR forest types under the current forest plan. Without the use of fire or other disturbance elements, chances are these sites will covert to Douglas-fir or Grand fir, then burn in a stand replacement event. This represents an inherent conflict with riparian and LSR objectives.

Solution:

For this unique mixed conifer type, it is recommended that the standards to be relaxed from a policy of short term neutral and long term beneficial Northwest Forest Plan ROD (ROD B-9), to one that promotes *future* natural biodiversity and even incurs some short term sacrifices in old-growth stand structure for long term forest health and stability. This different forest type and the relatively sparse, natural, low levels of downed wood needs to be incorporated into LSR vegetation management projects.

An objective should be to create open growing space and suitable seedbed conditions for natural regeneration of pine to occur, across riparian and late successional reserves. A principle goal of this forest type in these reserves should be conservation of legacy sugar and ponderosa pine for seed source and genetics conservation, including full tree crowns for seed production. To achieve this would involve the use of fire and even mechanical removal of trees to reduce competition on the site for better old-growth ponderosa pine survival and better regeneration of pine understories. Maintenance of unevenaged character using group selection forest practices is an excellent way to promote pine and oak dry site species.

Mechanical treatment (thinning, gap cuts) will probably be necessary to achieve some of these objectives. This includes thinning, logging of trees, piling, burning slash; followed by repeated prescribed burning.

There is opportunity here on these sites to manage for both dry site species and produce commodities from these harsh sites, on a longer rotation, (215 years). Managing for pine and oak is not exclusionary to management for Douglas-fir, both can be obtained using more frequent cutting entries on a longer rotation. Oak and pine should be managed for in matrix land in this vegetation type within a context of producing commercial wood products.

In this forest type, conservation does not exclude management or disturbance. Quite to the contrary, moderate levels of ground disturbing and canopy disturbing agents serve to perpetuate the fire climax species. A no action approach is not an option, and land allocations in this type that prophesize this are generally putting the open mixed conifer forest at risk. Given no action and fire suppression, these sites will convert to grand fir or even hemlock in some situations, and may likely stand replace when there is a fire. Management that disturbs this vegetation type needs to be encouraged across all land allocations.

11). *Develop a long-term monitoring plan which includes continued coordination and partnerships with ODFW (surveys, fish transport, etc.), the Oregon state Police (fisheries regulations, law enforcement), USFWS (recovery goals and effects to listed species), and other government and/or private cooperators.*

Functional Relationship – Monitoring Plan

The primary purpose of monitoring the upper Middle Fork Willamette bull trout population at the District level is to assess the overall success of the reintroduction program and to determine the current distribution boundaries of bull trout habitat. Since 1998, the monitoring effort has consisted of night snorkel surveys in the reintroduction sites and the mainstem Middle Fork Willamette. In 2000 through 2001 a rotary screw trap has been set from mid-summer to early fall in an effort to capture juvenile and sub-adult bull trout migrating to Hills Creek Reservoir. In 2001, a mark and re-capture population estimated was completed in Iko Springs and the Swift Creek side-channel reintroduction sites. The Forest Service and Oregon Department of Fish and Wildlife intend to continue quarterly snorkel surveys in all bull trout release areas to further understand the distribution, dispersal rate, growth rate, and life history stage requirements of reintroduced bull trout.

Related Key Question and Response

From its inception the Middle Fork Willamette bull trout reintroduction has used a monitoring plan template outlined by a variety of Federal, State and private interests that make up the Upper Bull Trout Working Group. The initial plan specified that the Oregon Department of Fish and Wildlife would work in concert with the Forest Service to monitor all reintroduced populations. Additional monitoring actions have been specified in the U.S. Fish and Wildlife Service; Bull Trout Recovery Plan. Some of the actions from the recovery plan specific to the Middle Fork Willamette reintroduction population are described below (See Draft Bull Trout Recovery Plan for complete list of monitoring actions).

1). Develop and implement tasks to protect, restore, and maintain suitable habitat conditions for all bull trout life-history stages and strategies.

- Identify areas where the importance of bull trout habitats and factors affecting the quality and contribution are uncertain. Implement tasks to alleviate uncertainty and address factors negatively affecting habitats.

- Conduct additional field sampling to confirm presence/absence of bull trout in suspected tributaries using the AFS sampling protocol.

- Continue reintroduction of bull trout into the Upper Middle Fork Willamette River and identify conflicts with the reintroduction program.

- Assess habitat conditions and capacity in Salmon, Salt, and North Fork of the Middle Fork Willamette River.

- Determine reservoir use by bull trout to help reduce negative effects of reservoir operations.

4). Develop and implement tasks to characterize, conserve, and monitor genetic diversity and gene flow among local populations of bull trout.

- Develop genetic management plans and guidelines for possible use in the future where transplantation and artificial propagation may be found appropriate for bull trout recovery.

- Propose and gain approval for specific reintroductions, monitoring, and criteria for evaluating results that follow state and federal guidelines for public process, donor stocks, disease factors, impacts on other native species, genetic concerns, etc.

5). Conduct research and monitoring to facilitate implementation and evaluation of bull trout recovery activities consistent with an adaptive management approach using results of implemented, site-specific recovery tasks.

- Design and implement a standardized monitoring program to assess the effectiveness of recovery efforts affecting bull trout and their habitats.

- Design and implement statistically sound population monitoring programs for local bull trout populations.

- Produce coordinated reports.
- Conduct research evaluating relations among bull trout habitat , and recovery tasks.
- Evaluate effectiveness of active and passive habitat restoration techniques in restoring watershed function and to recover local bull trout populations.
- Determine suitability of temperature regimes in potentially restorable bull trout habitat.
- Determine range of temperature tolerances for bull trout life stages in various habitats. Use results of ongoing temperature studies to address the adequacy of existing State rules.
- Conduct evaluations of the adequacy and effectiveness of current and past BMP's in maintaining and achieving habitat conditions conducive to bull trout recovery.
- Collect periodic sediment samples in bull trout spawning tributaries to track levels of fine sediment.
- Collect temperature monitoring in various bull trout habitats to further understand bull trout life history needs and distribution.
- Develop and conduct research and monitoring studies to improve information concerning the distribution and status of bull trout.
- Conduct periodic surveys where bull trout re-colonization is anticipated.
- Develop and maintain a centralized database for all bull trout distribution and monitoring.
- Conduct physical and biological surveys to determine current abundance of populations and factors precluding or limiting productivity.
- Coordinate and standardize inventories and evaluations; compile and analyze data, prepare databases and reports to facilitate sharing at regional level.
- Identify evaluations needed to improve understanding of relations among genetic characteristics, phenotypic traits, and local populations of bull trout.
- Determine life history characteristics and habitat requirements of local resident and migratory bull trout populations.
- Determine consequences of genetic fragmentation/isolation due to human-made barriers.
- Assess severity of threat due to hybridization with brook trout.
- Evaluate site-specific impacts of predation on different life stages of bull trout.

- Define habitat parameter limits affecting bull trout use, by life history stage. Evaluate food web interactions in drainages most affected by introduced fishes, Mysis sp., reservoir operations, etc.

6). Use all available conservation programs and regulations to protect and conserve bull trout and bull trout habitats.

- Use partnerships and collaborative processes to protect, maintain, and restore functioning core areas for bull trout.

- Participate in efforts by local watershed groups and others to accomplish site-specific protection/restoration activities.

- Coordinate with other agencies, research scientists and conservation organizations to a) identify and facilitate activities necessary to accomplish tasks at basin and sub-basin levels; b) implement prioritization and scheduling of projects (surveys, habitat restoration, reintroduction, etc.); and c) solicit participation of organizations.

In addition to the monitoring specified in the recovery plan the Forest Service also follows guidelines addressed in the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (ROD) and the Willamette National Forest, Land and Resource Management Plan (LMRP). The ROD specifies that monitoring should occur on populations of fish species and stocks that are listed under the Endangered species Act or are considered sensitive or at risk by land management agencies. In addition, rare and declining species will be monitored over time. The ROD also mandates that monitoring programs for rare and declining species will help to 1) identify perceived present and future threats; 2) increase future possibilities of discovering new locations; 3) track their status and trends over time; 4) ensure that, in times of limited agency resources, priority attention will be given to species most at risk. The LMRP outlines a collaborative monitoring effort for bull trout between the Oregon Department of Fish and Wildlife, Oregon State University and the U.S. Fish and Wildlife Service to a) determine if existing and potential bull trout areas are being maintained or improved and b) are existing populations of bull trout stable or increasing.

12.) The region is currently in the process of developing a suitable lynx habitat map which is based on plant association groupings (PAGs) rather than elevation or snow depth. The map should be verified with confirmed lynx locations to insure that PAGs used are appropriate for the west side of the Cascades (i.e. include the cold silver fir and mountain hemlock series). The map may be completed and available for use in the WA update.

Functional Relationship-Lynx Habitat Mapping

Direction guiding identification and management of potentially suitable lynx habitat on the west side of the Cascades has received a considerable amount of attention since the Canada lynx was proposed for listing as a threatened species under the Endangered Species Act (ESA) by the U.S. Fish and Wildlife Service (FWS) in July 1998. Since that time a series of documents and events has brought lynx habitat management west of the crest of the Cascades to the point where it is today. The following is a brief chronology of documents or events that have addressed lynx ecology and shaped the interpretation and implementation of appropriate conservation measures on Federal lands.

- July 1999. USFS Region 6 memo released providing direction for initial mapping of suitable lynx habitat on Forests within the Region.
- October 1999. USDA Forest Service General Technical Report (RMRS-GTR-30WWW) titled Ecology and Conservation of Lynx in the United States first made available to the public, and subsequently published in 2000 by the University Press of Colorado as a book with the same title.
- December 1999. The Biological Assessment of the Effects of National Forest Land and Resource Management Plans and Bureau of Land Management Land Use Plans on Canada Lynx was released.
- January 2000. First edition of the Canada Lynx Conservation Assessment and Strategy (LCAS) was released.
- February 2000. The Canada Lynx Conservation Agreement between the U.S. Forest Service and U.S. Fish and Wildlife Service was signed.
- March 2000. The Canada lynx (*Lynx canadensis*) was listed by FWS as threatened in the contiguous United States throughout its former range (including Oregon) with an effective date for listing of April 24, 2000.
- July 2000. USFS Region 6 Regional Forester letter was sent to FWS Regional Director requesting concurrence that lynx habitat is not present and application of the LCAS was not warranted on National Forest land west of the crest of the Cascades.
- August 2000. Second edition of the Canada Lynx Conservation Assessment and Strategy was released.
- August 2000. An interagency memo was released providing revised direction for mapping suitable lynx habitat on Forests within the Region.
- October 2000. The FWS released its Biological Opinion on the Effects of National Forest Land and Resource Management Plans and Bureau of Land Management Land Use Plans on Canada Lynx in the contiguous United States.

Based on the July 1999 direction for initial mapping of suitable lynx habitat on Forests within USFS Region 6, maps were created that displayed lynx habitat on the Willamette National Forest. This mapping effort

showed suitable lynx habitat occurred within the Upper Middle Fork of the Willamette Watershed. Table 12-1 displays the amount and distribution of lynx habitat within the watershed that was identified through initial mapping following the July 1999 direction.

Table 12-1 Modeled Lynx Habitat in Watershed 23 under July 1999 Mapping Direction

Lynx Habitat (all types)* in 5th Field Watershed 23	
6th Field	Total Acres
23-1	2018
23-2	1525
23-3	3465
23-4	290
23-5	1397
23-6	1098
23 sum	9793
* primary & secondary denning/security/foraging	
Based on 7/99 mapping direction	

Questions that arose from the initial habitat mapping effort and during implementation of the LCAS were addressed at a meeting of biologists and scientists in July 2000. As a result of that meeting the Lynx Biology Team made certain recommendations to the Lynx Steering Committee that were accepted and resulted in the August 2000 revised habitat mapping direction. Table 12-2 displays the amount and distribution of lynx habitat within the watershed that was identified through revised mapping following the August 2000 direction.

Table 12-2 Modeled Lynx Habitat in Watershed 23 under August 2000 Mapping Direction

Lynx Habitat* (all types) in 5th Field Watershed 23	
6th Field	Total Acres
23-3	220
23 sum	220
* Based on 8/00 mapping direction	

The reason for the significant difference in acreage displayed in Tables 12-1 and 12-2 lies in the fact that habitat mapping under 7/99 direction included select Pacific silver fir and mountain hemlock plant association groups (PAGs) whereas 8/00 direction did not. The 8/00 mapping direction incorporated the following recommendation from the Lynx Biology Team for Oregon: *"2) Because of the uncertainty as to*

whether Pacific silver fir/mountain hemlock constitutes primary vegetation, do not identify these vegetation types as lynx habitat. Also, do not delineate LAUs or apply the LCAS west of the crest of the Cascades unless subalpine fir vegetation types occur in amounts and distribution great enough to establish an LAU."

Summary Pertaining to FWS Terrestrial Concern # 12.

Acceptance of the Lynx Biology Team recommendation and current direction results in exemption from conservation measures listed in the LCAS as they may have applied to the small amount of acreage that otherwise met the criteria for lynx habitat within watershed 23 or elsewhere on the Forest. However if the presence of a lynx is confirmed, consultation will be initiated with FWS to ensure protection of the individual under provisions of the ESA.

FWS Terrestrial Concern – *original*

13.) *The amendment should also address opportunities and/or potential conflicts of land allocations and proposed management activities on potential suitable lynx habitat. Fire management, pre-commercial thinning, release and site preparation, and LSR objectives have the potential to affect high elevation lynx foraging and denning habitat. A map and/or table highlighting conflicts and potential habitat improvement opportunities may be helpful. Lynx habitat management activities should also be addressed in the recommendations section of the WA (p. 98).*

Because of reasons described under 12. above, this recommendation provided by FWS as it pertains exclusively to lynx management issues is no longer considered valid. However, due to changed circumstances pertaining to other rare native forest carnivores the wording of FWS Terrestrial Concern/question #13. has been revised to read as follows:

FWS Terrestrial Concern – *reinterpreted*

13.) *The amendment should also address opportunities and/or potential conflicts of land allocation Standard and Guidelines, and proposed management activities on potentially suitable habitat for rare native forest carnivores. Transportation system, vegetation manipulation, and recreation management all have the potential to affect habitat suitability – particularly denning habitat – for rare native forest carnivore species such as fisher and wolverine. A map and/or table highlighting potential conflicts and habitat improvement opportunities may be helpful. Carnivore habitat management activities should also be addressed in the recommendations section of the WA.*

Functional Relationship – Forest Carnivors

The Upper Middle Fork of the Willamette Watershed (Watershed 23) is within the recognized historic and current range for both the fisher (*Martes pennanti*) and wolverine (*Gulo gulo (luscus)*) which were

petitioned for federal listing under the Endangered Species Act (ESA) in November and July 2000 respectively. Due to funding, personnel, and priorities the U.S. Fish and Wildlife Service (FWS) has not issued a finding regarding either of these petitions. Both of these species have previously been petitioned for ESA listing. Both the 1990 and 1994 petitions to list the fisher were rejected by FWS on technicalities. The 1994 petition to list the wolverine was found to be "not warranted" by FWS.

Taxonomy can lead to confusion when assessing the status of these two species and their historic or current potential occurrence in this watershed. Common names such as "Pacific fisher" and "California wolverine" are found in sighting records and frequently applied to these rare native forest carnivores. However, the validity of such nominal subspecies has been questioned or is not recognized throughout much of the published literature devoted to addressing these species (Banci 1994, Heinemeyer and Jones 1994, Johnson and O'Neil 2001, Powell 1993, Powell and Zielinski 1994, Verts and Carraway 1998). Therefore further references to fisher and wolverine in this document are intended to be interpreted as *Martes pennanti* and *Gulo gulo* respectively.

The fisher is among a number of species recently added to the USFS Region 6 Regional Forester's Sensitive Animal List (updated 11/15/00) and is presently listed by the Oregon Department of Fish and Wildlife as a sensitive species under the "Critical" category. With the recognition of fisher as "sensitive" in Region 6, the species is now listed as a sensitive species by the Forest Service in all Regions where it occurs.

Records show that the wolverine has been listed on the Regional Forester's Sensitive Animal List for at least the past fifteen years. The wolverine was one of the original species classified as threatened by the Oregon Fish and Wildlife Commission in 1975. The status of the species was reviewed in 1988 (Marshall 1988) and as a result of that review wolverine are currently listed as threatened under the Oregon Endangered Species Act.

A large block of literature has been published in the past decade pertaining to the biology, ecology, and management of both fisher and wolverine (Banci 1994, Claar et al. 1999, Copeland 1996, Heinemeyer and Jones 1994, O'Neil et al. 2001, Powell 1993, Powell and Zielinski 1994, Verts and Carraway 1998). This is not meant to suggest that all aspects of the ecological relationships between these species and their environment are well understood. On the contrary, some relationships such as responses to human disturbance are just beginning to be understood based on a scientific rather than anecdotal context (Joslin and Youmans 1999). The following is a gross summary of fisher and wolverine ecology considered pertinent to the presence of these species in Watershed 23. The reader is strongly encouraged to reference the literature for a more thorough understanding of these species. The species account and following sections respond to the Issue and Key Questions pertaining to rare native forest carnivores by addressing fisher and wolverine separately, or if appropriate in combination.

<u>Fisher</u>

The fisher is the largest of the terrestrial mustelids having an elongated body form and also the most sexually dimorphic. It is not uncommon for males to be 25 percent larger, and two to three times heavier than females.

O'Neil et al. (2001) list the fisher as associated with 19 forest structural conditions, 11 habitat types, 23 habitat elements, and as serving 17 key ecological functions within Oregon forests. Even with the low degree of confidence attached to many of these associations, identifying the potential combinations of these

factors to define suitable habitat for fisher in this watershed is a complex task. Many of O'Neil's associations are also based on data extrapolated from studies conducted outside the Pacific Northwest.

Fishers in different regions may have different ecologies (Powell and Zielinski 1994) and, as is true with most field study data, caution should be exercised when extrapolating results from studies conducted in one region to another. However it is commonly suggested in published literature that fisher in the Western states are closely associated with late-successional conifer forests and riparian habitats possessing an interior forest component and abundant structural diversity – particularly for use as denning habitat (Banci 1989, Heinemeyer and Jones 1994, Olson et al. 2001, Powell and Zielinski 1994, Sallabanks et al. 2001). A spatial and seral mixture of forest habitats may represent the most optimal environment for the species because of its reportedly diverse diet and large home range for an animal its size (range = 7.3mi^2 - 30.5mi^2 for adult male). The late-successional reserves, old-growth grove, special wildlife habitat, and wilderness areas displayed on the original Upper Middle Fork Watershed Analysis' Figure 8, as well as Figures 22 and 24 which depict the distribution and amount of late-seral and old-growth stands plus mature interior habitat respectively can be referenced to provide an example of suitable fisher forage and denning habitat in this watershed.

Overall habitat composition and connectivity, especially comprised of riparian coniferous and mesic forest types, plus security from disturbance for reproductive females may be two key factors to address in considering management of habitat with the welfare of fishers in mind.

Fisher – occurrence

Habitat conditions in the watershed during the reference era favored the likelihood of occupancy by fisher as it is located well within the historic range for this species, and would have been relatively free from human disturbance – especially during the breeding season. Then, as now, population densities would be expected to have been low given our current understanding of fisher ecology.

The USDA Forest Service Fiscal Year 1958 Annual Wildlife Statistical Report for the Willamette National Forest lists the fisher as having occasional abundance and a stationary population trend. Suitable habitat existed in Watershed 23, and if fisher were indeed present during that time the species would likely have occupied habitat in the watershed. Maj and Garton (1994) mapped observation records for fisher from 1961 through 1982, which show a cluster of sighting locations in/near Watershed 23. They also mapped records from 1983 through 1993, which show a sharp decline for sightings in the same location. Occurrence and breeding status data presented by O'Neil et al. (2001) show that fisher both occurs and breeds in Oregon. A review of local records for sightings reported between 1979 and 1999 revealed 9 reports of fisher sightings in the Middle Fork Ranger District, 2 of which occurred in Watershed 23. There is no current confirmation that this species occupies habitat in the watershed.

Wolverine

The wolverine has been referenced as the largest-bodied terrestrial mustleid (Banci 1994) with a body weight three to four times greater than the fisher despite having a similar overall body length. Its robust appearance allows adults to be described as resembling a small bear.

O'Neil et al. (2001) list the wolverine in Oregon as associated with 26 forest structural conditions, 11 habitat types, 17 habitat elements, and as serving 5 key ecological functions within the identified

associations. Overall data do not support any statistical association between the species and a particular vegetative community – a fact reflected by O'Neil in attaching a low confidence to all associations listed for structural conditions and habitat types. Forested habitats used by wolverines appear to vary geographically and seasonally in areas where they have been studied (Claar et al. 1999). Habitat preferences have been linked to areas based on the availability of food and low human occurrence. The most specific habitat need of wolverines may be for female denning habitat secure from human disturbance (Copeland 1996).

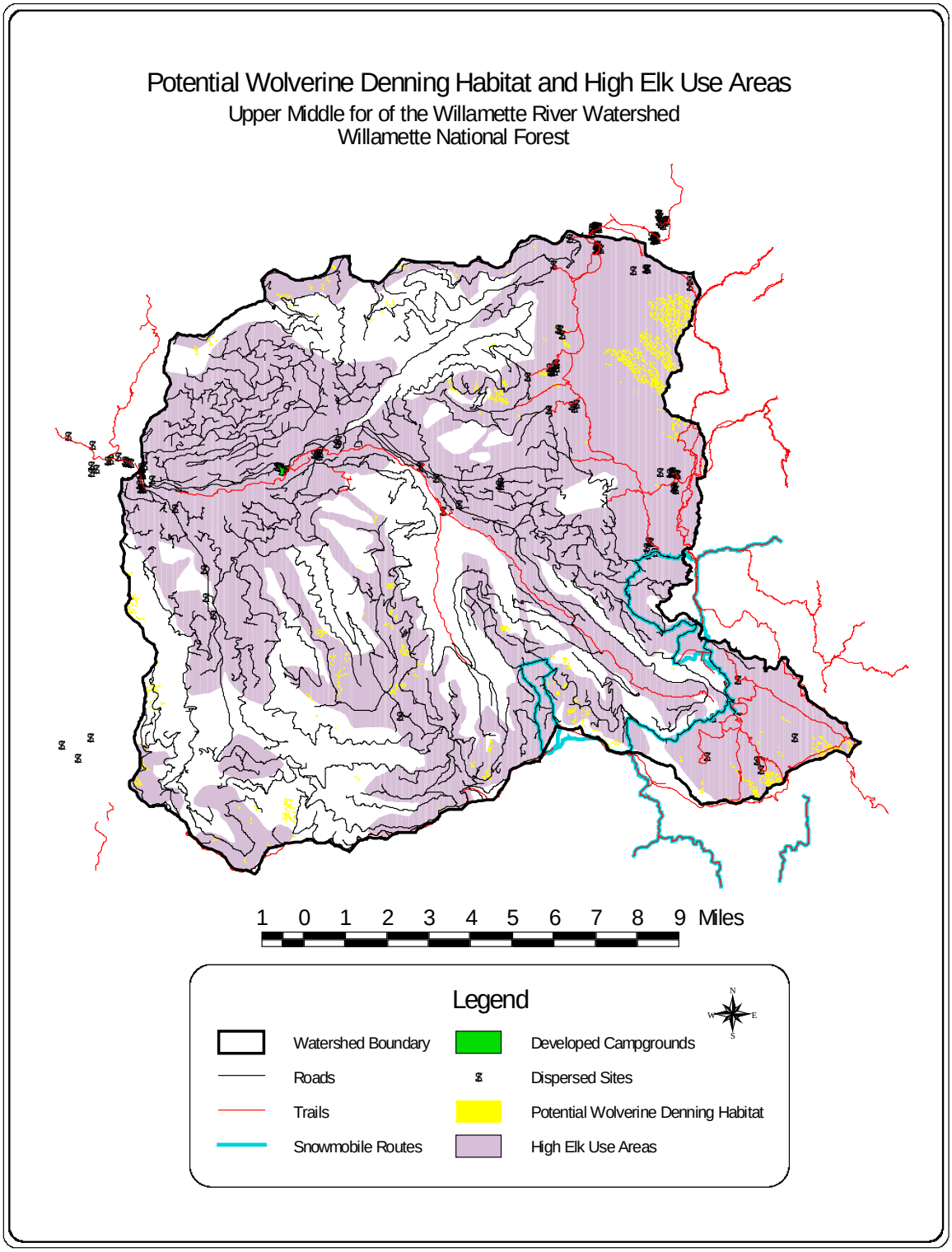
Current definition and subsequent identification of suitable wolverine habitat has evolved largely from Copeland's (1996) study of a wolverine population in central Idaho. There seems to be scientific consensus that identification of female denning habitat is key to managing for this species where it is likely (or known) to occur. Following that logic the Willamette National Forest created a GIS layer in 1998 based on criteria provided by the Regional Office in an effort to identify potential denning habitat. Habitat generally described as areas having a northerly aspect for higher elevation cirque landscape features with a large boulder/talus component and a relatively open canopy was mapped across the Forest. Approximately one percent of the watershed acreage fit this description and is identified as potential wolverine natal denning habitat. The amount of potential denning habitat, and the overall percentage of Watershed 23 that is identified as denning habitat is shown in Table 13-1.

Table 13-1. Amount of potential wolverine natal denning habitat in Watershed 23 and distribution of the habitat in High Elk Use Areas.

Watershed 23 Potential Wolverine Natal Denning Habitat - Analysis of Habitat Within Identified High Elk Use Areas (HEUA)					
6th Field	Total WA Acres (Ac)	Ac Habitat in WA	% of WA in Habitat	Ac Habitat in HEUA	% Habitat in HEUA
23-1	25,950	122	0.5	33	27
23-2	10,552	82	0.8	80	98
23-3	25,750	240	0.9	201	84
23-4	11,419	9	0.1	9	100
23-5	16,836	560	3.3	542	97
23-6	22,877	61	0.3	46	75
23 sum	113,384	1074	0.9	911	85

Wolverine are generally described as opportunistic omnivores in summer and primarily scavengers in winter while they utilize extremely large home ranges in proportion to their body size. Adult wolverine home range sizes average 148mi^2 for females and 610mi^2 for males (Copeland 1996). Virtually all studies that have investigated food habitats for the species have shown wolverine to be closely associated with a dependency upon the availability of large mammal carrion to balance its energy budget during critical periods of its lifecycle. Figure 13-1 shows potential denning habitat in Watershed 23 and how it relates spatially to portions of the watershed identified as High Elk Use Areas (HEUA) as well as existing transportation and recreation infrastructure. The amount of potential denning habitat located in HEUA, and the overall percentage of denning habitat within HEUA is shown in Table 13-1.

Figure 13-1 Potential Wolverine Denning Habitat in Watershed 23



Responding to the widely published concern regarding the sensitivity of wolverines to human disturbance at natal den sites (Banci 1994, Claar et al. 1999, Copeland 1996, Krebs and Lewis 1999, Lyon et al. 1994, Youmans 1999a), a spatial analysis of potential denning habitat in Watershed 23 was conducted to assess the proximal relationship between the habitat and existing transportation and recreation features within the watershed. Results of that analysis are displayed in Tables 13-2 and 13-3 with the data visually represented in Figure 13-2.

Table 13-2 Potential wolverine natal denning habitat within Watershed 23 in relation to nearby recreation sites, trails, and roads.

Potential Wolverine Denning Habitat Acres in Watershed 23 Within 0.5, 1.0, 1.5 and 2.0 Miles of Receation Sites and Transportation Routes								
	Ac Within Buffered Dispersed Rec. Sites				Ac Within Buffered Developed CGs*			
6th Field	0.5 mi	1.0 mi	1.5 mi	2.0 mi	0.5 mi	1.0 mi	1.5 mi	2.0 mi
23-1		14	28	80				
23-2								
23-3	86	142	171	185	41	88	114	146
23-4		11	101	234				14
23-5	186	200	454	617				
23-6				2	11	12	20	26
	Ac Within Buffered Trails				Ac Within Buffered Snowmobile Routes			
6th Field	0.5 mi	1.0 mi	1.5 mi	2.0 mi	0.5 mi	1.0 mi	1.5 mi	2.0 mi
23-1	51	89	124	124				
23-2	15	32	107	144	16	54	80	94
23-3	198	232	357	459	48	69	87	167
23-4	38	59	165	293				
23-5	228	254	526	678				
23-6		2	3	3				
	Ac Within Buffered Roads					Total Ac of Potential Denning		
6th Field	0.5 mi	1.0 mi	1.5 mi	2.0 mi		Habitat Within the Watershed		
23-1	166	193	215	227		23-1	122	11%
23-2	117	146	182	189		23-2	82	8%
23-3	71	74	110	210		23-3	240	22%
23-4	46	69	77	113		23-4	9	1%
23-5	81	97	105	178		23-5	560	52%
23-6	121	142	159	162		23-6	61	6%
* CGs = Campgrounds						23 sum	1074	100%

Table 13-3. Recreation sites, trails, and roads in proximity to potential wolverine natal denning habitat within Watershed 23.

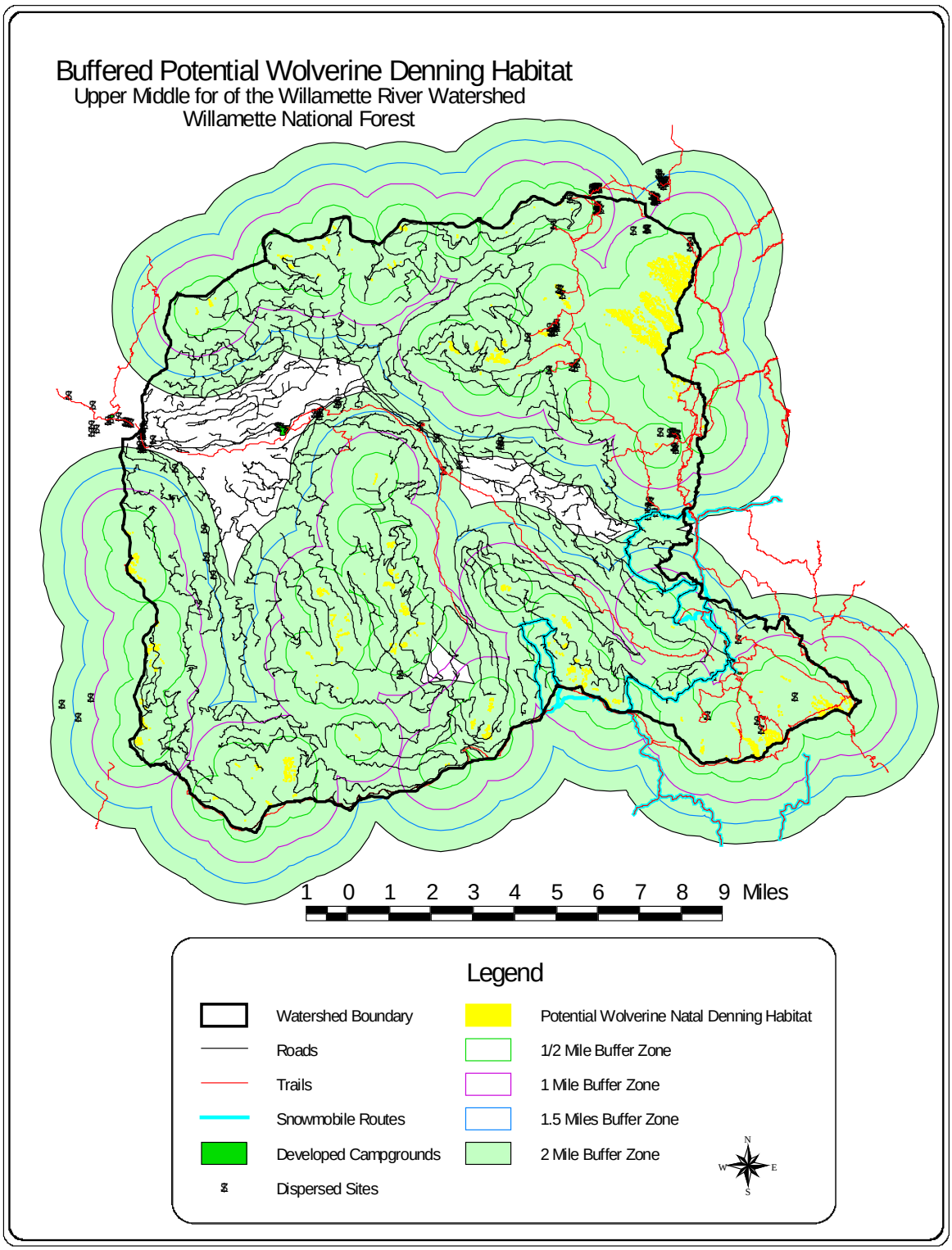
Watershed 23 Potential Wolverine Denning Habitat Buffer Analysis of Recreation Sites and Transportation Routes Within 0.5, 1.0, 1.5 and 2.0 Miles of Mapped Habitat								
	# of Dispersed Rec. Sites				# of Developed Campgrounds			
6th Field	0.5 mi	1.0 mi	1.5 mi	2.0 mi	0.5 mi	1.0 mi	1.5 mi	2.0 mi
23-1		1	1	5				
23-2								
23-3	12	13	18	20	1	2	3	3
23-4	1	4	4	10				1
23-5	15	25	25	25				
23-6				4	1	1	1	1
23 sum	28	43	48	64	2	3	4	5
	# of Trail Miles				# of Snowmobile Route Miles			
6th Field	0.5 mi	1.0 mi	1.5 mi	2.0 mi	0.5 mi	1.0 mi	1.5 mi	2.0 mi
23-1	2.9	3.9	5.9	5.9				
23-2	0.7	2.8	4.6	5.2	1.7	3.4	3.4	3.4
23-3	20.6	38.9	46	48	4.7	10.8	13.5	16
23-4	4.8	6.5	8.6	10.4				
23-5	6.3	11.7	12.3	12.4				
23-6		0.4	1.3	2.1				
23 sum	35.3	64.2	78.7	84	6.4	14.2	16.9	19.4
	# of FS System Road Miles							
6th Field	0.5 mi	1.0 mi	1.5 mi	2.0 mi				
23-1	42.1	85.6	113.3	131.4				
23-2	30.2	53.1	63.9	62.5				
23-3	23.1	49.3	67.3	86.9				
23-4	6.6	15.2	28.2	43.5				
23-5	35.1	53.4	58.1	61.8				
23-6	30.9	51.4	71	95.4				
23 sum	168	308	401.8	481.5				

Wolverine – occurrence

Habitat conditions in the watershed during the reference era favored the likelihood of occupancy by wolverine as it is located well within the historic range for this species, and would have been relatively free from human disturbance – especially during the breeding season. Then, as now, population densities would be expected to have been low given our current understanding of wolverine ecology.

The USDA Forest Service Fiscal Year 1958 Annual Wildlife Statistical Report for the Willamette National Forest lists the wolverine as having occasional abundance and a stationary population trend. Suitable

Figure 13-2 Wolverine Denning Habitat as Affected By Disturbance Buffers



habitat existed in Watershed 23, and if wolverine were indeed present during that time the species would likely have occupied habitat in the watershed. Maj and Garton (1994) mapped observation records for wolverine from 1961 through 1982, which show a cluster of sighting locations in/near Watershed 23. They also mapped records from 1983 through 1993, which show a sharp decline for sightings in the same location. Occurrence and breeding status data presented by O'Neil et al. (2001) show that wolverine both occurs and breeds in Oregon. A review of reported wolverine sightings on the Willamette National Forest conducted in May 2001 revealed 33 records of sightings between 1965 and 1999 on or adjacent to the Forest boundary, and included sightings in watersheds adjacent to Watershed 23. There is no current confirmation that this species occupies habitat in the watershed and late-winter aerial surveys around denning habitat conducted from 1998 through 2001 have not detected the presence of wolverine in this watershed.

Interpretation/Synthesis/Recommendations- Forest Carnivores

Original WA Issue:

- The density and condition of roads in the watershed has influenced landscape processes.

Original Key Question:

- (none applicable to terrestrial wildlife)

Revised WA Issue:

- The density, condition, use, and location of roads and trails in the watershed has influenced landscape processes and use of wildlife habitats.

New Key Question:

- Where and to what extent has the presence, pattern, and use of roads and trails influenced the potential distribution and habitat use of terrestrial wildlife species such as rare native forest carnivores?

Concerns about the effects the type of roads in this particular watershed have on forest carnivores generally need not be associated with the road itself. Cumulatively, the estimated 470 miles of roads in Watershed 23 do contribute to a degree of habitat fragmentation, particularly in the mid to lower elevations where road densities tend to be highest, but likely not to a degree that would preclude occupancy by fisher or wolverine. Roads currently within the watershed are of the type that may not present movement barriers or significant mortality risks for forest carnivores (Ruediger et al. 2000). The negative influence of roads in the watershed on wildlife such as fisher and wolverine is more associated with human use of the roads.

The potential effectiveness of otherwise appropriate habitat for fisher and wolverine, as well as natural prey species they depend on, is diminished by human use of areas associated with roads and trails. Such use is normally directly proportional to the density of open roads and trails in an area. Open road densities greater than 2 miles per square mile of habitat have potential to significantly reduce elk use in an area (Thomas and Toweill 1982). The average open road density for Watershed 23 is approximately 2.65 miles per square mile. The spatial relationship between wolverine denning habitat, HEUA, and roads and trails is shown in Figure 13-1.

Human disturbance associated with roads and trails is known to frighten game animals from distances ranging between 0.4 and 0.8 miles. The zone of disturbance for forest carnivores such as the wolverine has been suggested to be much greater (Copeland 1996, Krebs and Lewis 1999) and disturbance can be either directly or indirectly related to the activity. Sensitivity to human generated disturbance can be seasonally

influenced for many animals and has been documented for forest carnivores (Ruggiero et al. 1994). Data in Tables 13-3 and 13-4 reveal the significance of the proximal relationship between roads and trails and wolverine denning habitat within the watershed. The amount of denning habitat affected by the presence of roads within two miles is highest associated with 6th field 23-1 and lowest for 23-4, however 23-4 contains only one percent of the denning habitat identified in Watershed 23. The spatial relationship between habitat and transportation system features is shown in Figure 13-2.

The road and trail system in Watershed 23 has spatially influenced and supported the increasing trends for a variety of human uses as described in the 1996 analysis of Watershed 23 (pp25, 43-45). Areas of particular interest (with respect to forest carnivores) where an improved road and trail system has encouraged increasing use are the dispersed recreation sites within or adjacent to riparian areas and the roads and trails which support access into the Oregon Cascades Recreation Area (OCRA). The former having more potential for negative impacts to fisher, the latter for wolverine. Negative impacts could be considered especially likely during the breeding seasons for these two species. Further discussion on impacts of human activity in forest carnivore habitat can be found in the response to the issue and questions pertaining to recreation and habitat suitability for these species.

<u>Recommendations pertaining to roads and trails</u>

- ✓ Evaluate future transportation projects (road and trail) following a process such as that outlined by Youmans (1999) as a step towards reducing the potential for adverse impacts to rare forest carnivores.
- ✓ Incorporate considerations regarding impacts to rare native forest carnivore habitat into the ATM process when evaluating transportation systems in the watershed.
- ✓ Because of the importance of large mammals as principle prey species in the diet of rare native forest carnivores (particularly wolverine), follow through on recommendations made in the 1996 Watershed 23 Analysis pertaining to road closures necessary to meet current elk emphasis area Standards and Guidelines.

Original WA Issue:

- The density and pattern of vegetation manipulation has influenced landscape processes.

Original Key Question:

- Where and to what extent have management practices influenced distribution and conditions of terrestrial species and their habitats?

The August 1996 analysis for Watershed 23 (pp 46-66) presents a narrative and data pertaining to reference and current vegetation conditions and patterns that can be used to assess the potential extent management practices may have influenced the condition and distribution of suitable habitat for rare native carnivore species such as fisher and wolverine. As stated previously in this document, habitat in this watershed likely to be most important to support fisher occupancy is both terrestrial and riparian mature/old-growth habitat, whereas wolverine would be most dependent on undisturbed female denning habitat and habitat that supported big game populations.

It is estimated that 55% of the mature/old-growth habitat throughout the watershed has been modified from historic conditions thought to exist. This represents a significant reduction in habitat most important for the fisher. However, the remaining mature/old-growth habitat (approximately 36% of Watershed 23) may still

be considered sufficient in amount and distribution to support fisher but the species may be more vulnerable to disturbance in and near this remaining habitat.

Current management practice restricts most habitat modification and disturbance activities in and near suitable spotted owl habitat throughout much or all of the species' breeding season. Seasonal restriction to avoid disturbance to spotted owls during the early portion of their breeding season (March 1- July 15) should also benefit female fishers when they are likely to have litters and be more sensitive to negative effects from disturbance in mature/old-growth habitat.

Figures, Tables, and narrative on pages 49 through 66 in the August 1996 analysis for Watershed 23 include analysis of the mature/old-growth vegetation condition described as important to fisher in this portion of their range. Seventy-one percent of Watershed 23 is currently under a land use allocation that does not allow programmed timber harvest. Thirty-nine percent of the remaining watershed acreage classified as suitable and available (for harvest) is currently mature/old-growth habitat, which represents approximately 30% of all mature/old-growth habitat estimated to remain in Watershed 23.

Because larger forest carnivores such as the wolverine depend on big game as a food source throughout periods of the year when other foods are less available, management practices that have affected the vegetative condition in Watershed 23 may have indirectly benefited this species. The elk population has responded favorably to the degree of habitat modification in this watershed by steadily increasing in size from the reference era to the point where it is believed to be stabilizing as it approaches carrying capacity. Harvest activity may have affected forested habitat in close proximity to potential denning habitat but probably not to a large extent, and to little or no extent for denning habitat in 6th fields 23-3, 23-4, and 23-5, which have the largest amounts of habitat in no-harvest allocation acreage.

<u>Recommendations pertaining to vegetation management</u>

- ✓ With respect to management practices that would result in long-term beneficial effects for rare native forest carnivores such as fisher and wolverine, continue to consider the recommendations presented in the 1996 Watershed 23 analysis (pp 103-106) pertaining to stand characteristics, fragmentation and interior forest habitat, upslope and interdrainage connectivity, riparian reserves, terrestrial large woody material, non-forested special habitats and wildlife species.
- ✓ Consider and incorporate management practices that recognize specific habitat requirements of prey species for fisher and wolverine in future vegetation management planning.

Original WA Issue:

- (none applicable relative to recreation and effects to forest carnivores)

New WA Issue:

- There is a concern for how existing and proposed developed and dispersed recreation may affect habitat suitability for rare native forest carnivores.

New Key Question(s):

- 1. What are potential impacts from current recreation use on potential occupancy by, and habitat suitability for, rare native forest carnivores within the watershed?
- 2. How would expanding future recreation opportunities within the watershed affect potential occupancy by, and habitat suitability for, rare native forest carnivores within the watershed?

1. Concerns associated with human recreation activities and the potential they have to disturb wildlife including rare native forest carnivores such as fisher and wolverine have been widely acknowledged (Banci 1994, Carlton et al. 2000, Claar et al. 1999, Copeland 1996, Greenwald et al. 2000, Martin 2001, Powell and Zielinski 1994). Despite the acknowledgement, specific direct and indirect effects from disturbance to fisher and wolverine remain poorly understood and based largely on empirical data and anecdotal evidence. The many potential outcomes resulting from human recreation activities into areas with the potential to result in disturbance to wildlife at critical periods in their life cycle are complex and remain largely untested (Youmans 1999) however Heinemeyer et al. (2001) recently concluded that some winter recreational use may be having potentially severe localized habitat impacts on wolverines.

In light of scientific uncertainty pertaining to disturbance and in the absence of specific knowledge of habitat requirements for rare native species such as fisher and wolverine, consideration of recreational activities on public lands should err on the side of requirements of reproductive females of these species, focusing on habitat and energy requirements throughout the breeding season (Claar et al. 1999). Addressing recreation impacts to fisher and wolverine will therefore focus on adult females during their breeding seasons.

Fisher

Recreation may negatively affect fishers through direct or indirect responses to the disturbance. If such disturbance occurs regularly on particular trails or roads it can directly result in loss (through abandonment) and fragmentation of habitat. Habitat loss also occurs as a result of recreational infrastructure such as developed or dispersed recreation sites, particularly when located in mature/old-growth riparian habitat. Indirect responses to disturbance can arise when a recreation activity disrupts foraging behavior by adversely affecting normal prey behavior and by reducing hunting success.

Most of the estimated eighty dispersed campsites in Watershed 23 are within or adjacent to riparian areas in mature/old-growth habitat settings. Many of these recreation sites are in lower to mid elevation portions of the watershed where fisher would be more likely to occur. Recreational activity throughout the watershed has been shown to be increasing (with trends suggesting it will continue to do so) and occurs year-round. It could be said however that current activity in habitat most likely to be used by fishers peaks during the summer and fall, and may be lower during the fisher's breeding season (February – May).

Wolverine

If protection of natal denning habitat from human disturbance is critical for the persistence of wolverine in an area, the species may indeed already be absent from Watershed 23. Data listed in Tables 13-3 and 13-4 show the spatial relationship between denning habitat and recreation sites along with the transportation system that supports their use throughout Watershed 23. Figure 13-2 displays this relationship that is qualified by potential disturbance zones – a concept considered but not yet found documented in literature – around mapped denning habitat. The data reveal effects of recreational activities as a potential source of disturbance appear to be greatest in 6th fields 23-3 and 23-5.

Habitat in these two 6th fields represents 74% of all mapped potential denning habitat in Watershed 23. Other physical qualities of 23-3 and 23-5 such as lower road densities, larger blocks of habitat not subject to harvest activity, and a high percentage in HEUA support recognition of these two 6th fields as areas within Watershed 23 having the highest potential of supporting wolverine occupancy. However these areas are subject to a wide variety of late winter/early spring recreational activities, which is the heart of the

wolverine breeding season. Both motorized and non-motorized activities can and do occur in these areas during this time particularly in 6th field 23-3, much of which is within the Oregon Cascades Recreation Area (OCRA).

The OCRA was established under the Oregon Wilderness Act of 1984 (U.S. Public Law 98-328) and covers 157,000 acres along the crest of the Cascades between Crater Lake National Park to the south and the Diamond Peak Wilderness on the north. The area is divided into seven administrative zones of which Zone 2 (Timpanogas Basin) is within 6th field 23-3. Zone 2 falls under either of two Willamette National Forest Management Areas: 2a) semi primitive motorized use, or 2b) semi primitive non-motorized use. Standards and guidelines regulating use in these two management areas were derived from provisions in the Act, however are based on objectives that do not appear compatible. For example, MA-2a-04 allows motorized vehicle access to recreation sites via a trail network throughout much of the upper portions of 23-3 within 0.5 mile of almost 200 acres of potential wolverine denning habitat whereas MA-2a-07 directs implementation of management activities in such a way so as to "minimize adverse effects on wolverine habitat". Of equal or greater concern regarding disturbance to wolverine during the breeding season is MA-2b-04, which prohibits off-road and off-trail vehicle in this non-motorized allocation yet allows unrestricted motorized over-the-snow use. The non-motorized OCRA allocation also includes a standard and guideline that directs implementation of management activities in such a way so as to "minimize adverse impacts to wolverine habitat" (MA-2b-06). Both allocations also specifically authorize "habitat improvements, including vegetation management, to benefit wolverine" (MA-2a-08, MA-2b-07).

Given the extent of the spatial and temporal possibilities for disturbance to occur at wolverine denning habitat throughout the breeding season from human recreation activities, it is difficult to be optimistic regarding the potential for the species to successfully occupy otherwise suitable habitat within Watershed 23 as well as all, or portions of numerous adjacent watersheds.

2. Expanding future recreation opportunities within the watershed would contribute to the degradation of remaining suitable habitat for rare native forest carnivore species such as fisher and wolverine, and further compromise the potential for habitat occupancy and species viability.

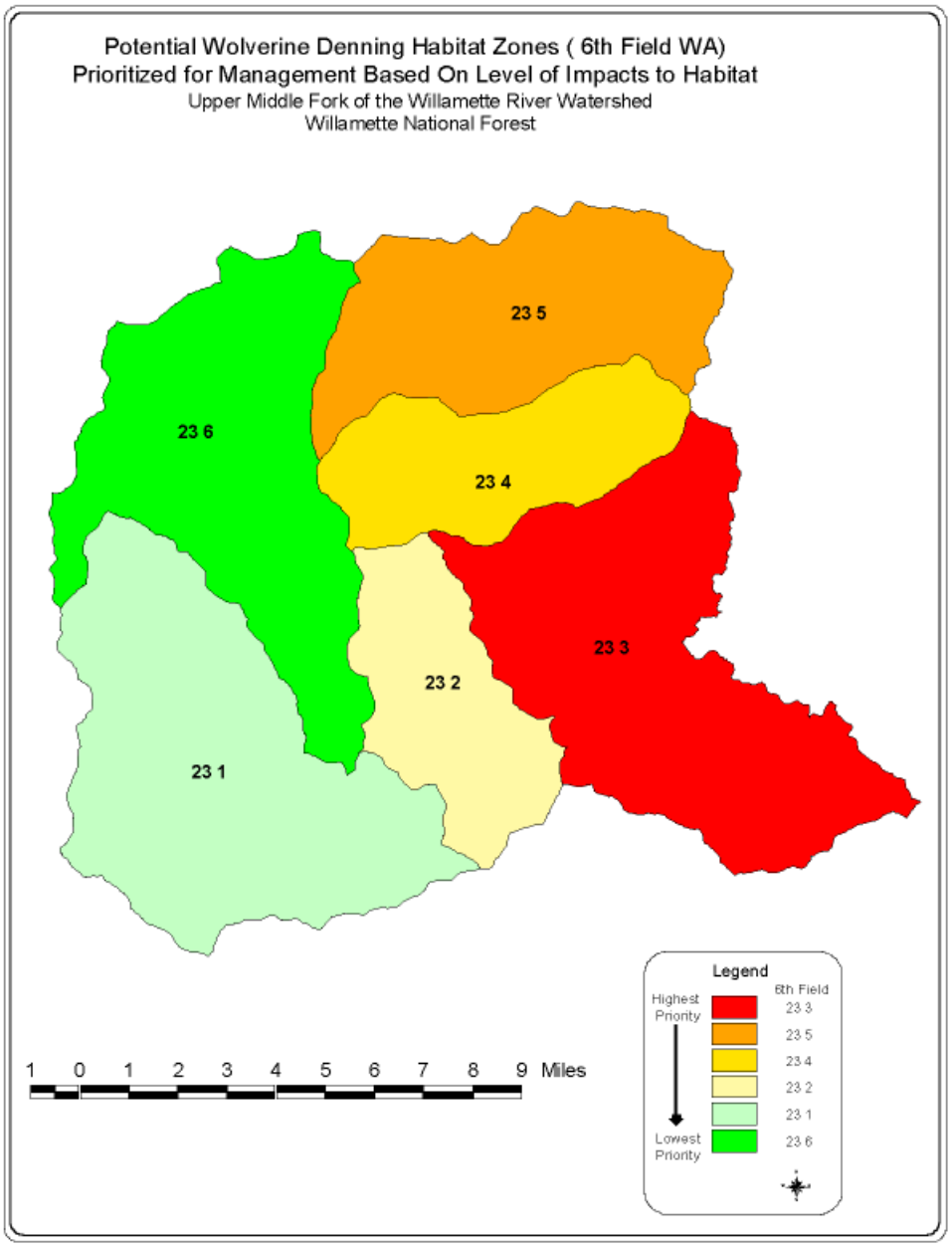
Based on data presented in Tables 13-2 and 13-3, 6th field watersheds were ranked according to their standing for each individual evaluation criteria. Point values were assigned to the 6th fields under each evaluation criteria then point values were summed and averaged to reveal the ranking of a 6th field with respect to the overall level of assessed impacts to habitat (Table 13-4).

Table 13-4. Watershed 23 6th field ranking based on assessed impacts to potential natal denning habitat.

Watershed 23 6th Field Ranking Based on Asessed Impacts to Potential Wolverine Natal Denning Habitat		
Overall Rank	Prioritized 6th Field	Averaged Ranking Score
1	23-3	5.08
2	23-5	3.5
3	23-4	3.08
4	23-2	2.83
5	23-1	2.67
6	23-6	2.08

This analysis shows that 6th field 23-3 is identified as having the highest priority for management consideration that addresses wolverine based on the current overall level of impacts to potential denning habitat. Figure 13-3 displays this prioritized relationship between 6th fields in Watershed 23.

Figure 13-3. Watershed 23 6th field ranking based on assessed impacts to potential natal denning habitat.



Recommendations pertaining to recreation

- ✓ Management supporting the viability of rare native forest carnivore species such as fisher and wolverine cannot be accomplished within a single 5th field watershed such as the Upper Middle Fork of the Willamette. Because these species have extremely large home ranges in proportion to their body size, and considering that the largest ranges may occur in the poorest quality habitat (Powell and Zielinski 1994), effective management for these species will ultimately require a coordinated ecosystem approach across the landscape. It is recommended that managers better address this approach through a strategy such as that presented by Heinemeyer and Jones (1994) or Lyon et al. (1994) by integrating a planning process modeled on Youmans (1999) that is responsive to applicable regulation and policy (Joslin 1999).
- ✓ It is recommended that surveys to detect the presence of fisher and wolverine be initiated in order to establish a current understanding of occupancy by these rare native forest carnivores in Watershed 23.
- ✓ It is recommended that a review be conducted of existing Willamette National Forest Standard and Guidelines for Management Areas 2a and 2b, as well as OCRA Management Plan Direction, and action taken to resolve conflicting objectives with respect to wolverine habitat management.
- ✓ Evaluate future recreation projects following a process such as that outlined by Youmans (1999) as a step towards reducing the potential for adverse impacts to rare forest carnivores.
- ✓ A prioritized approach to future management activities within Watershed 23 is recommended that would respond to the rank of potential wolverine denning habitat zones (6th field watersheds) based on the current assessed level of impacts to habitat.
- ✓ Limits of Acceptable Change (LAC) inventories of dispersed recreation sites throughout Watershed 23 (particularly in 6th fields 23-3 and 23-5) should be completed and reviewed to identify where potential negative impacts to rare native forest carnivores may exist. It is recommended that an interdisciplinary review of LAC inventories identify potential areas for obliterating as a step towards reducing the potential for human disturbance near fisher and wolverine denning habitat

14. The WA states that, of the 43 owl activity sites (AC's) in the drainage, 70% are located in matrix with 100 acre cores (Mid-Willamette WA, p. 65). What percentage of these owl sites are within designated critical habitat? Will the adjacent LSR's provide adequate protection for the known owl activity sites over the long term given the current management within critical habitat in the matrix?

Is a strategy in place which would provide temporary or alternate protection areas for 100 acre core LSR's that are lost due to fire or other catastrophic events? Are there opportunities to overlap aquatic and terrestrial protection objectives in these cases?

Functional Relationship- Owl Habitat, CHU Overlap, and Additional Protection Strategies

US Fish and Wildlife Service Issue: "The high levels of harvest activities in matrix and designated critical habitat for owls is being raised as an issue. The mid-Willamette LSR Assessment identified the need to address management activities within reserves and CHU's in the watershed analysis (MWLSRA, p. 89), as well as at the provincial scale. Although approximately 60% of the area is currently classified as suitable owl habitat, the Mid-Willamette Late-Successional Reserve Assessment identified the Hills Creek LSR (RO221) as having low levels of functional interior habitat and high road densities (Mid-Willamette LSRA, p. 65-67). The huge LSR which overlaps the Staley Creek drainage and continues south to the Umpqua and Rogue National Forests (RO222) was also identified as being deficient in interior forest habitat and currently has approximately 43% late seral habitat".

Original WA Issue: Vegetation Condition and Patterns:

Timber harvest, fire suppression and roads have altered landscape patterns and vegetation conditions within the watershed, altering both the spatial arrangement and relative abundance of seral stages across the landscape. Additionally, fire suppression since the turn of the century has changed stand characteristics in many locations.

Key Questions-Original WA:

1. Where and to what extent have management practices influenced landscape patterns, such as seral stage distribution, and coarse woody material?
2. Where and to what extent have management practices influenced distribution and condition of terrestrial species and their habitats?

Key Question-New:

1. As harvest of suitable spotted owl habitat is planned and implemented (including in designated critical habitat) in the future in this watershed, will habitat be maintained for the owl in the short and long term? How will habitat be maintained?

Response: Owl Habitat, CHU Overlap, and Additional Protection Strategies

The Northern spotted owl has been listed as threatened throughout its range since 1990. In the original Upper Middle Fork WA, 43 spotted owl activity centers were documented in the watershed. One in wilderness, 12 in LSR RO222, and 30 in matrix which are protected with 100 acre core LSRS's. The WA also identified potential trends for non-native species and that the forest fragmentation vegetation patterns may provide favorable habitat for the barred owl over time. This could lead to genetic cross-breeding with the spotted owl and possible dilution of the gene pool and displacement of the threatened spotted owl with the more generalist barred owl. Table 14-1, below updates owl activity centers within the watershed and distribution by land allocation. It also displays current condition of habitat within 1.2 miles of each AC to assess "Take" condition. This updated information reflects discovery of additional activity centers since the original WA was completed and a district-wide process of re-evaluating accuracy of suitable owl habitat (OHAB) which reflected minor changes in OHAB acres in the watershed.

Table 14-1. Number of AC's by Land Allocation and Condition of Habitat of AC's by % habitat within 1.2 miles of center.

	Matrix (no 100 ac. core protection	**Matrix (100 ac. core protection)**	**CHU OR-28**	**LSR RO222**	**Admin. Withdrawn**	**TOTALS**
Less than 40% suitable w/in 1.2 mi	1	2	2*	0	2	5 (10%)
40%-50% suitable w/in 1.2 mi	3	8	5*	2	0	13 (25%)
Greater than 50% suitable w/in 1.2 mi	3	20	28*	9	1	33 (65%)
TOTALS	**7 (14%)**	**30 (59%)**	**35* (68%)**	**11 (21%)**	**3 (6%)**	**51**

*- Reflects how many AC's are within critical habitat but not reflected in allocation totals.

Table 14-2. Acres of overlap matrix, protected allocations and designated critical habitat.

Total Analysis Acres	Matrix Acres	CHU Acres	CHU/Matrix Acres	LSR Acres	CHU/LSR Acres
113,383	33,464* (55,768-gross)	50,893	16,984* (28,307-gross)	19,726	18,391

*- Reflects an adjustment of estimated harvest acres by reducing gross acres by 40% due to Riparian Reserves.

Of the 33,464 matrix acres in the watershed, about 50% are also within designated critical habitat. Of the 50,893 acres of CHU within the watershed, 56% are within matrix, 36% are within LSR RO222 and the remaining 8% overlaps other no-harvest allocations (Table 14-2).

Current habitat condition within the provincial home ranges of the 51 AC's within the watershed is relatively healthy. Sixty five percent of the AC's currently have at least 50% suitable habitat within their provincial home range and 90% of the AC's have at least 40% suitable habitat. Sixty eight percent (35) of the AC's are also within designated critical habitat where 94% of these CHU AC's currently maintain OHAB above the 40% level within the provincial home range.

The South Cascades Late Successional Reserve Assessment (LSRA,1998) depicts LSR RO222 as having "approximately 43% of the area in late seral conditions (Table 7), but only a small percentage in interior habitat. It does, however, have more interior late seral habitat than the other LSRs within the South Cascade network." The LSRA goes on to state that "fifty nine percent is considered spotted owl nesting, roosting or foraging habitat." The LSR RO222 acres within the Upper Middle Fork Willamette Watershed (23) are comprised of 46% late seral habitat.

The Mid-Willamette Late-Successional Reserve Assessment (1998) depicts LSR RO221 (Hills Creek) as having approximately 9814 acres (59%) as late-successional forest habitat with over 50% of that identified as interior habitat (buffered 120 m.). Also, the Hills Creek LSR has approximately 60.5% suitable spotted owl habitat.

The various land allocations in the watershed reflect a fairly diverse system with many unique habitats and diverse species. Table 14-3 shows the breakdown of Forest plan allocations within the watershed. Designated critical habitat is displayed, although it is not officially a forest plan allocation (Figure 14-1).

Figure 14-1 Current location of Spotted Owl Critical Habitat (CHU) in relation to Late-Successional Reserves within the watershed.

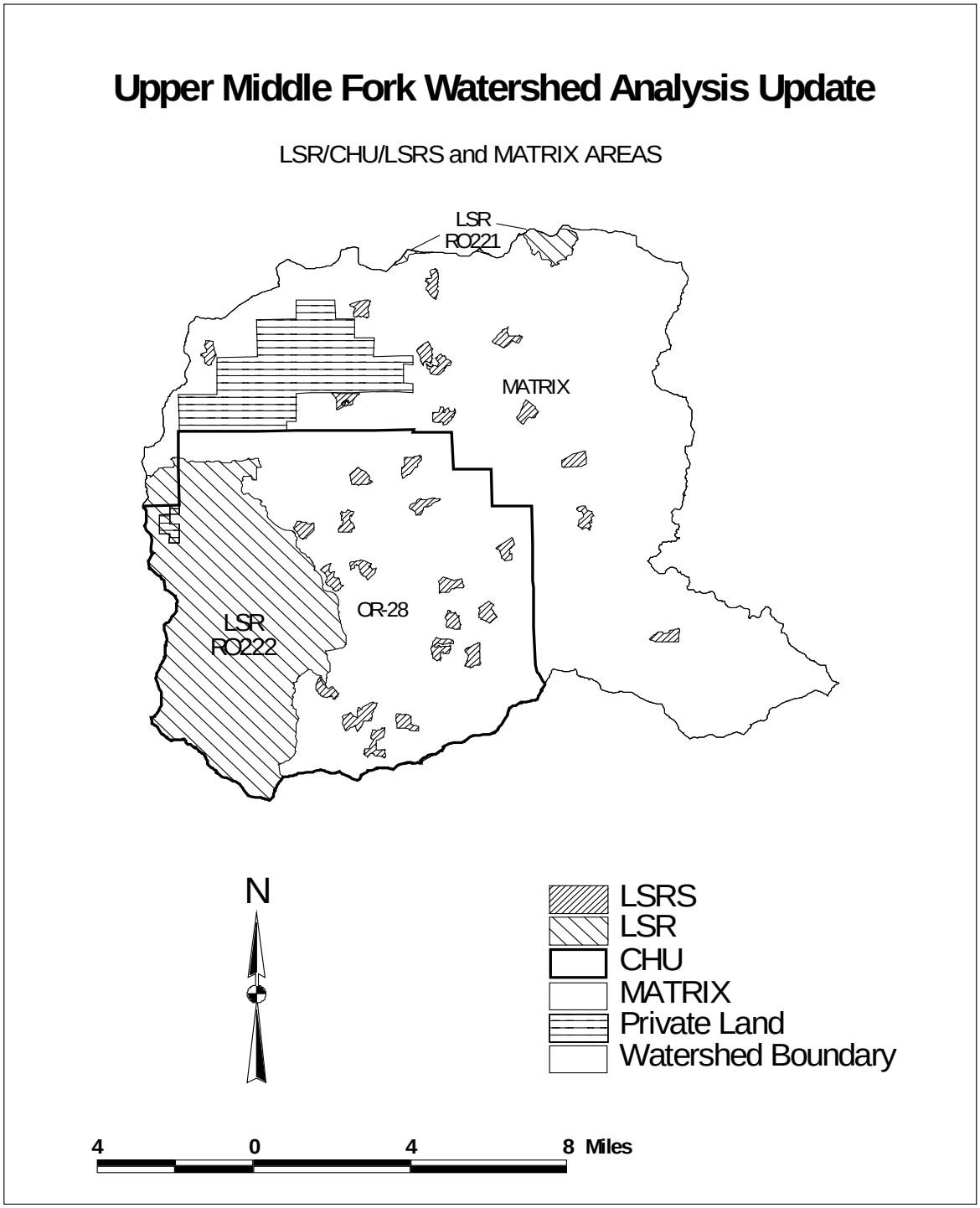
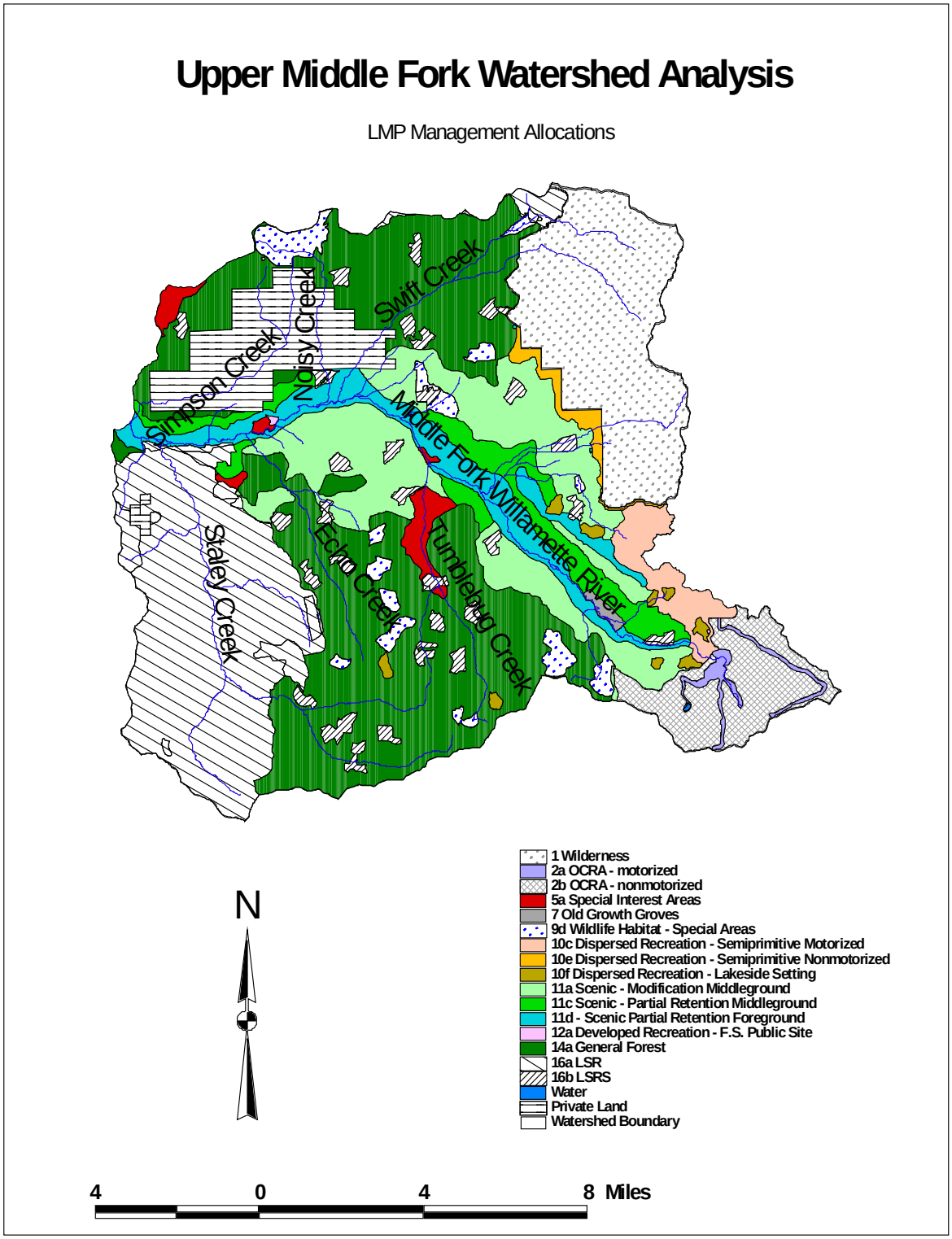


***Table 14-3*. Forest Plan allocations and acres of critical habitat within the fifth field watershed analysis area.**

ALLOCATION NUMBER	ALLOCATION NAME	ACRES (%)	COMMENTS
1	Wilderness	13,493 (11.9%)	NPH*
2A	OCRA-Motorized	676 (.6 %)	“
2B	OCRA-Non-motor.	5,237 (4.6%)	“
5A	Special Interest Area	1,482 (1.3%)	“
7	Old Growth Grove	212 (.2%)	“
9D	Special Wildlife Habitat Area	2,868 (2.5%)	“
10C	Dispersed Recreation Semi-primitive-motorized	2,290 (2.0%)	“
10E	Dispersed Recreation Semi-primitive-non-motorized	814 (.7%)	NPH
10F	Dispersed Recreation-Lakeside	613 (.5%)	“
11A	Scenic-Modification-Middleground	8,092 (7.1%)	
11C	Scenic-Partial Retention Middlegr.	2,662 (2.3%)	
11D	Scenic-Partial Retention Foreground	3,438 (3.0%)	
12A	Developed Recreation	38 (.1%)	NPH
14A	General Forest Matrix	19,272 (17.0%)	
16A	LSR RO221	610 (.5%)	NPH
16A	LSR RO222	18920 (16.7%)	“
16B	LSRS’s (100 ac. Cores)	3,217 (2.8%)	“
	Riparian Reserves	22,309 (19.7%)	40% of gross programmed harvest acres
8000	Private	7,130 (6.3%)	
WA	Water	13 (.01%)	“
Critical Habitat	CHU OR28	50,893 (44.9%)**	16,984 Ac. of programmable harvest in CHU (28,307 x 60%)
TOTALS		**113,383 Ac.**	**55,773 Ac. of programmable harvest in the WAA**

*- Non-programmable harvest **- Not part of Allocation Totals

Figure 14-2- Forest Plan Allocations.



Ninety six percent (108,547 ac.) of the watershed is capable of producing suitable owl habitat over time. Currently, owl habitat makes up 62.7% (71,164 acres) of the watershed. This includes all typed owl habitat including nesting, roosting and foraging (NRF) habitat as well as roosting and foraging habitat (lacking the nesting component). *Nesting, roosting and foraging habitat comprises 41% (46,109 acres) of the watershed. This figure better represents NRF habitat available in the watershed that would provide for all life history needs of the owl.* Figure 14-1 displays spatial distribution of suitable owl habitat in the watershed as it falls within LSR's RO221 and 222 as well as CHU OR28.

Table 14-4 Acres of suitable spotted owl habitat by allocation.

Total Watershed Acres	Total Capable Acres	Total Suitable Acres	LSR Acres	CHU Acres	Matrix Acres	Other Allocation Acres
113,383	108,547	71,164	14,855	19,208	15,342	21,759

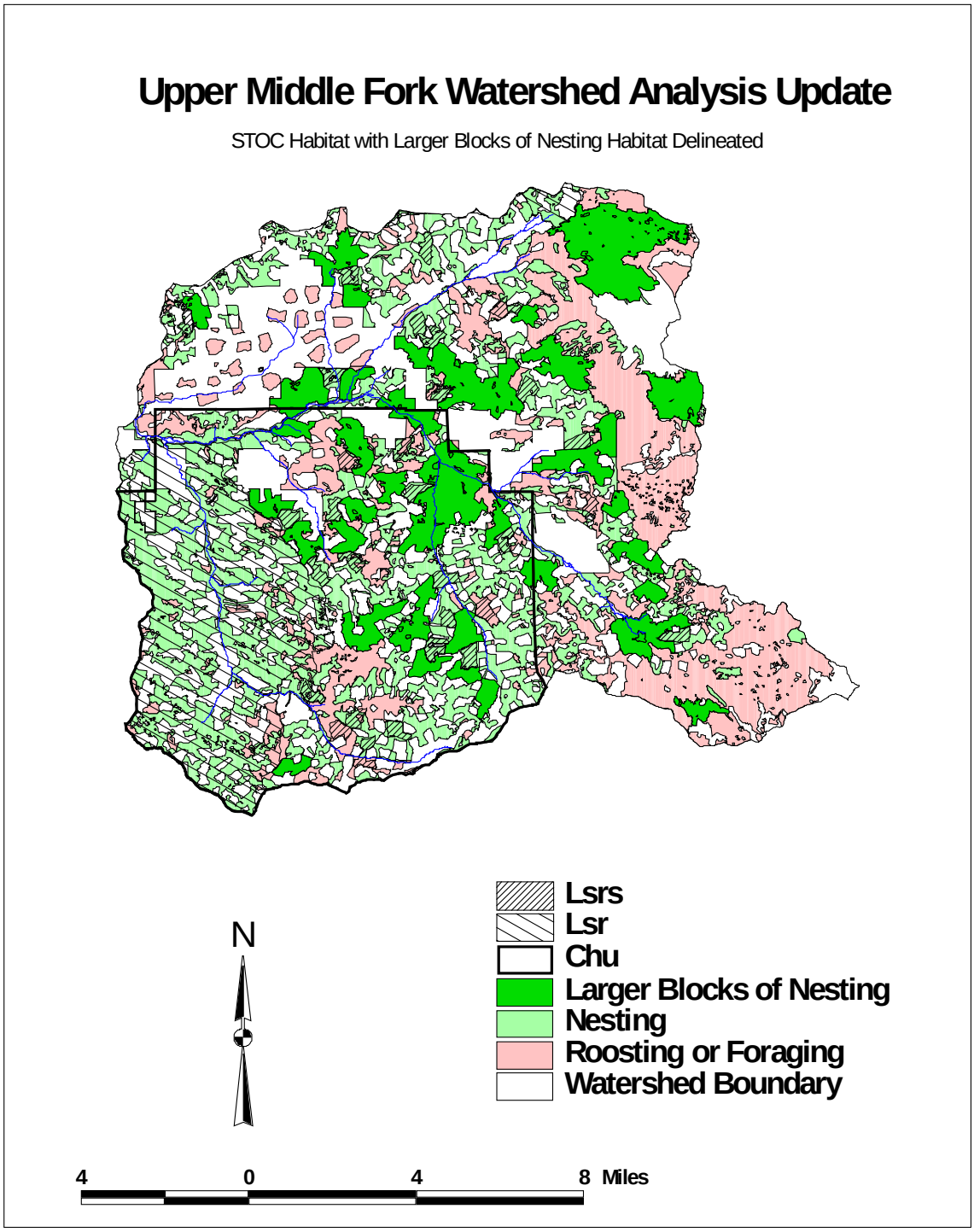
Larger block nesting, roosting and foraging habitat is available within the watershed. Figure 14-3 depicts size and spatial distribution of nesting, roosting and foraging habitat (NRF) blocks that occur within the analysis area. The habitat delineated is suitable owl habitat that includes the nesting component so would provide all habitat and life history needs for the owl. Strictly foraging habitat is not included in these blocks. Currently 16,653 acres exist in larger block (Table 14-5) NRF habitat that is included in 34 blocks that range from 134 to 2650 acres. The blocks have been delineated outside the LSR/LSRS network and are functioning as NRF habitat at this point in time. Criteria for minimum block size was 130 acres with a minimum width at narrowest point of 200 meters.

Table14-5. Summary of NRF habitat blocks that occur within the watershed.

NRF Blocks 134-300 Ac.	NRF Blocks 301-600 Ac.	NRF Blocks 601-900 Ac.	NRF Blocks >900 Ac.	Total
17	9	5	3	34 blocks for 16,653 Ac.

Since inception and signing of the ROD for the Northwest Forest Plan (1994), impacts from catastrophic disturbance to suitable habitat have been minimal in the watershed. The only significant fire activity in the watershed occurred in 1996 when 2300 acres burned. Of all acres burned, only 99 acres burned intense enough to be considered stand replacement fires. And or these acres, 42 acres were within one LSRS core area and 16 acres were within matrix. The remaining 41 acres burned in other allocations. Approximately 24,000 acres or 21% of the watershed occurs within a more mixed conifer vegetation type where fire return intervals have been predicted to be more frequent yet less intense. This pattern has changed over the years with the onset of fire suppression efforts. Current fuel loadings vary within the watershed and are generally higher in the older forest stands where prescribed or natural fire has not occurred for many years.

Figure 14-3. Suitable Spotted owl habitat and distribution of NRF habitat blocks.



LSR condition and potential to support spotted owls

The South Cascades LSRA identifies current condition and desired future condition of the LSR's analyzed in this document. It identifies the desired future condition of LSR RO222 for late seral habitat as being 75%. Currently it has met about 60% of this goal and the watershed itself has met about 61% of this goal (46% late seral habitat). It goes on to say, "as amounts of habitat in the LSR develops into suitable habitat and stabilizes, spotted owl populations are expected to stabilize at levels lower than what occurred naturally" (USDA, 1997).

The Mid-Willamette LSRA estimates 60% late seral habitat occurs within LSR RO221 (Hills Creek). In addition, suitable spotted owl habitat is estimated at 60%.

The two LSRs within and adjacent to the watershed (LSRs RO221-Hills Creek and RO222) are approximately 8 miles direct as the "crow flies". This direct route dissects the larger block of private land in the Simpson Creek drainage. In the Mid-Willamette LSRA, inter-LSR connectivity was addressed and problem areas highlighted. Between RO221 and RO222, no significant issues or barriers were identified that might limit late seral forest habitat connectivity as no-harvest allocations develop into late seral habitat.

INTERPRETATIONS / SYNTHESIS - Spotted Owls

Spotted owl habitat/activity centers-

Currently, there are 71,164 acres of suitable spotted owl habitat within the analysis area This equates to about 66% of the capable acres within the watershed. Figure 14-3 shows spatial distribution of NRF habitat within the analysis area. With about 2/3 of the capable acres currently existing as suitable habitat, conditions are considered better than average for owls to reside and reproduce in the watershed.

Available suitable spotted owl habitat within the provincial home range radius of owl centers indicates that condition of habitat is adequate at this time. Of the 50 activity centers, 46 (90%) have suitable habitat above the 40% level within the provincial home range radius. Sixty five percent of the AC's have habitat levels above 50% level. Extensive fragmentation has occurred through timber harvest and road building activities in past years. This has had an impact on contiguous interior late-successional forest habitat in the watershed, but in looking at the habitat numbers, <u>the majority</u> of the known owl activity centers have enough habitat at this point in time to allow for survival and reproductive success.

Larger NRF block habitat

An analysis was done to determine the size and spatial distribution of larger blocks of NRF habitat currently existing within the watershed. The original Upper Middle Fork WA addressed concerns with forest fragmentation/connectivity and identified three large blocks of late-successional forest habitat that would provide connectivity function from LSR RO222 to the Cascade Crest. These are the Lighthouse Rock area, the Bear Mtn. Area, and the mouth of Tumblebug Cr. Area. Figure 14-3 displays additional larger NRF blocks identified in this analysis that may provide additional habitat options for owls in case of

some loss of current designated 100 acre core LSRSs. The number, size and distribution of these NRF blocks points to numerous alternatives in providing temporary or alternative protection areas. These blocks are still in the matrix land allocation and could eventually be susceptible to timber harvest. Some prioritization of their importance at the project planning level will help in maintaining options in the future until all no-harvest allocations (LSR's, riparian reserves) recover and begin to function as dispersal and eventually foraging habitat.

Currently there are limited options for overlapping aquatic and terrestrial protection objectives for protection of spotted owl habitat. Aquatic concerns are not identified in this watershed where additional protection of habitat beyond what is currently allocated under the NW Forest Plan would be needed. The larger block habitat mentioned above would be an alternative approach to ensuring some options are available in the next 20-30 years.

LSR's RO221 and RO222 and CHU OR28-

LSR analysis and current condition of suitable habitat and late-successional habitat indicate that both LSR's are functioning at levels better than most LSR's in the two analysis areas. As vegetation grows and develops into suitable habitat, spotted owl populations should stabilize in these two LSR's. Barring castastrophic events and loss of larger quantities of suitable spotted owl habitat within these two LSR's, they should provide adequate habitat conditions in the short term for the owl. Long term, impacts to critical habitat may be less than envisioned due to the anticipated extent of the riparian reserve network. The adjacent LSRs, as they develop, will provide contiguous blocks of habitat for nesting, roosting, foraging and dispersing owls and the no-harvest allocations between LSR's should provide habitat conditions for dispersing juvenile owls as they disperse from the LSR's.

Catastrophic losses of habitat from wildfire or other disturbance have been factored into the design and implementation of the NW Forest Plan. These losses from fire within LSRs RO221 and 222 and smaller 100 acre core areas may have an impact on individual LSR function in the long term. Alternatives are limited in providing options for habitat replacement. Previous scientific reports, used extensively to develop the current implemented strategy in the Northwest Forest Plan, realized the probability of catatrophic habitat loss within the LSRs. In the ISC Report (1990) the authors considered extensive habitat loss from fire. "Our hedge against such events causing regional extinction of the spotted owl is the widespread geographic distribution of HCA's recommended in this plan." In the FEMAT Report (1993), a simulation of forest development in the reserves was done starting with current condition. In this simulation a "disturbance correction was applied to the growth output by assuming that 12.5% of the reserved areas would be subject to severe disturbance over 50 years." This would assume that, on the average, about 80% of the lands in the reserves covered with forests greater than 80 years old. This possible scenerio enhances the importance of fuels treatment activities within and adjacent to the large LSR's to reduce potential for catastrophic fire occurrence.

The US Fish and Wildlife Service has been involved in evaluating data reported in Endangered Species Act Section 7 consultations completed from 1994 to the present time on the northern spotted owl and its designated critical habitat (USDI, 2001a). They have issued reports on these baseline findings and proposed adjustments to effects based on tracking and re-evaluation of implemented projects. One of the major reasons for these baseline assessments is to determine whether the trends represented in the effects of actions presented in the various consultations are consistent with range-wide assumptions and

expectations of Forest Plan implementation. One conclusion drawn from this range-wide evaluation was that "potential effects to critical habitat do not impair its ability to provide for conservation across the range of the owl (as anticipated in the 1992 rule and as specified in the 1994 opinion)." In the Environmental Baseline analysis for the Willamette Province (USDI, 2001b), it was estimated that 19,766 acres of NRF habitat "will or have been removed from 26 of the 30 CHU's in the western Oregon Cascades Province." Losses of NRF in CHU's have been well dispersed across the province CHU network and the CHU network in the province "continues to contribute to spotted owl recovery" (USDI, 2001b). Conclusions in this baseline analysis indicate that 1) loss of suitable habitat within LSRs has been minimal, and 2) analysis of loss of 13,316 acres of suitable habitat within CHU's indicates that "agency actions have been sufficiently dispersed so as to avoid compromising the function of the CHU's as a whole" (USDI, 2001b).

Recommendations

The following are recommendations from the Watershed Analysis update team; these correspond with the questions that structure this update

Question #1

- Complete NEPA and repair the Echo Creek culvert. (p.24)
- Conduct annual surveys to identify and map primary Bull Trout spawning and rearing habitat in the Middle Fork from below the gorge to Swift Creek. Monitor spawning populations.
- Conduct a groundwater surveys to identify and map upwelling areas that could be used by Bull Trout in the Upper Middle Fork watershed.

Question #2

The guidance for Bull Trout recovery rests in the USFWS Bull Trout recovery plan. The Middle Fork supports the Draft Recovery Plan from USFWS and will follow that plan with the action items below:.

- Implement the U.S.F.W.S. Bull Trout Recovery Plan.

- Key elements to be implemented on the District include protection of high quality habitat, reduction in road densities, barrier removal, adaptive management, and monitoring.

- Increase efforts in public education through information/interpretation of the Bull Trout fishery with emphasis in the high quality habitat areas.

- Explore opportunities to evaluate special emphasis areas around high quality Bull Trout habitat.

Question #3 and #6 Combined

- Complete an ATM analysis using the map generated in figure 3-1 as a guide prioritizing road systems that are directly tributary to Bull Trout habitat. These are areas delineated in the “High Quality Habitat”, (polygons designated in black, figure 3-1, p.22).

- Develop a road maintenance plan.

- Apply for watershed restoration grants to obtain funding for Bull Trout habitat restoration (pp.17).

- Encourage partnerships and collaborative efforts that facilitate fish passage around the dams located below the watershed.

- Repair two sites on Swift Creek and one on Echo Creek, for fish passage (pp24.). The remaining 9 will be treated to support fish passage in the future. All are scheduled for replacement as funding becomes available.

- Prioritize funding in the sixth field watersheds 23-6, Echo Creek and 23-5 Swift Creek, which have higher road aquatic risk ratings (Table 3-1).

- Conduct annual surveys to identify and map primary spawning and rearing habitat. Continue to monitor to determine if temperature is an issue in these areas (pp28).

- Continue to work cooperatively with state and federal agencies (pp.19).

- Utilize riparian silviculture treatments (density control) to encourage development of future large wood.

- Utilize density management treatments in 35-80 year old stands to encourage stand structural development, complexity (snags and downed wood), favor minor species, under-planting, reduce fire risk, and reduced risk of loss from insect and disease damage.

- Monitor use of the six dispersed recreation sites listed in high quality Bull Trout habitat (pp22).

- Where appropriate, apply riparian silviculture treatments to enhance stream shading vegetation, this can include planting, thinning, and fertilization.

- Complete the Middle Fork water quality restoration plan. (p.22)

- Work collaboratively with other agencies to improve public awareness of bull trout value and habitat restoration by placing interpretive signs at dispersed campsites. (p. 24)

Question #4

- Focus large wood restoration in/around high quality habitat refugia.

Question #5

- Implement large woody in-stream projects that focus on full tree lengths where root wads are attached. Projects to introduce big wood (>24”) are needed in reaches 5, 8, 11, and 14; corresponding to the reaches Staley Creek to Swift Creek, Tumblebug Creek to Middle Fork gorge, and Lower Paddy’s Valley (p. 32).

- Using adaptive management, experiment with different methods to hold wood jams in the Upper Middle Fork river channel.

- Modify upland woody debris levels based on Fire history (p.36) in the Upper Middle Fork watershed, Northwest Forest Plan ROD (ROD C-40). Opportunities to vary the woody debris requirements in the Upper Middle Fork would follow levels outlined in the table below.

Proposed Modification of Large Wood Levels in Upper Middle Fork			
Plant Association	Site Class 1	Site Class 2	Site Class 3&4
PSME/TSME	135 ft./ac.	90 ft./ac.	40 ft./ac
TSHE/ABAM	320 ft./ac.	210 ft./ac.	105 ft./ac.
ABGR	200 ft./ac.	130 ft./ac.	60 ft./ac.

Question #7

- Retain current riparian widths using average forest site tree widths.

Question #8

- Conduct intensive site-specific analysis and cumulative effects analysis when proposing to reduce crown closure within the 23-6 watershed (Willamette National Forest Plan, Appendix E).

Question #9

- At the extensive inventory level; use the 1996 Watershed Analysis mapping that provides a sixth field landscape analysis of the Upper Middle Fork slope stability. This analysis is contained in the Upper Middle Fork WA, 1996, Appendix A. At the intensive project level, complete field inventories of soil stability.

Question #10

- Implement prescriptions that emphasize species diversity and near term development of large wood sources for future in-stream wood in riparian and downed woody in the upland matrix habitat. Habitat structure, vertical diversity, connectivity and late-successional stand characteristics can be enhanced using variable density management prescriptions. (p.54)

- Monitor response of riparian thinning in terms of stand growth, understory development, and vigor. Adjust thinning schedules so that riparian treatments rotate through landscapes as treated stands close canopy. Adjacent stand riparian areas need IDT analysis if treatment is planned within 10 years of each other for cumulative effects.

- Heavy thinning treatments in riparian reserves and late successional reserves need to be considered, (20% RD), where suppressed shade tolerant seedlings and saplings exist, for release of understories.

There may be secondary needs for this heavy thinning treatment, such as across landscapes in designated future connectivity corridors in the upland matrix (Swift Creek, and Pioneer Creek)(pp.56&57).

- Many silvicultural prescription alternatives exist on droughty, Douglas-fir climax sites. This includes mechanical removal of competing Douglas-fir. This could be done in groups or over stands areas or localized around residual ponderosa and sugar pine. A treatment zone of 75' from the drip line of large over story mixed conifer pine in the Upper Middle Fork is a second option in LSRs or scenic areas. This treatment needs to be accomplished across the mixed conifer forest type. A range of 70-120 B.A. $ft.^2$/ac. could be the target stocking where entire stands are treated. In LSRs it may be necessary to cut green trees in the co-dominant and intermediate crown class to get stocking low enough to reduce competition. In riparian reserves, some partial cutting is also judiciously prescribed around over story pine. Repeated under-burning is needed in this type (pp60.).

- Due to elevated fuels accumulation and fuel ladders across the Upper Middle Fork, mechanical removal of green trees and slash will be needed before repeated under-burning can be accomplished. Subsequent thinning of the understory can be accomplished with a drip torch (pp. 60)

Question #11

- Follow the USFWS Draft Bull Trout Recovery plan pertaining to monitoring (p60).

- Continue with inter-agency monitoring, collaborative learning, and public participation efforts (p.18)

Question #12

- Acceptance of the Lynx Biology Team recommendation and current direction results in exemption from conservation measures listed in the LCAS as they may have applied to the small amount of acreage that otherwise met the criteria for lynx habitat within watershed 23 or elsewhere on the Forest. However, if lynx are detected, consultation on that site-specific project will be initiated with FWS to ensure protection of the individual under provisions of the ESA.

FWS Terrestrial Concern – *# 13 reinterpreted*

Question # 13

- Evaluate future transportation projects (road and trail) following a process, such as that outlined by Youmans (1999), as a step towards reducing the potential for adverse impacts to rare forest carnivores. (p.73)

- Incorporate considerations regarding impacts to rare native forest carnivore habitat into the ATM process when evaluating transportation systems in the watershed. (p.73)

- Because of the importance of large mammals as principle prey species in the diet of rare native forest carnivores (particularly wolverine), follow through on recommendations made in the 1996 Watershed 23 Analysis pertaining to road closures necessary to meet current elk emphasis area Standards and Guidelines.

- Increase emphasis for road closures to enhance big game populations and to bring open road densities into compliance with current Forest Plan Standards and Guidelines.

- With respect to management practices that would result in long-term beneficial effects for rare native forest carnivores such as fisher and wolverine, continue to consider the recommendations presented in the 1996 Watershed 23 analysis (pp 103-106) pertaining to stand characteristics, fragmentation and interior forest habitat, upslope and interdrainage connectivity, riparian reserves, terrestrial large woody material, non-forested special habitats and wildlife species.

- Consider and incorporate management practices that recognize specific habitat requirements of prey species for fisher and wolverine in future vegetation management planning.

- Management supporting the viability of rare native forest carnivore species such as fisher and wolverine cannot be accomplished within a single 5th field watershed such as the Upper Middle Fork of the Willamette. Because these species have extremely large home ranges in proportion to their body size, and considering that the largest ranges may occur in the poorest quality habitat (Powell and Zielinski 1994), effective management for these species will ultimately require a coordinated ecosystem approach across the landscape. It is recommended that managers better address this approach through a strategy such as that presented by Heinemeyer and Jones (1994) or Lyon et al. (1994) by integrating a planning process modeled on Youmans' (1999) that is responsive to applicable regulation and policy (Joslin 1999). (p.74)

- It is recommended that surveys to detect the presence of fisher and wolverine be initiated in order to establish a current understanding of occupancy by these rare native forest carnivores in Watershed 23.

- It is recommended that a review be conducted of existing Willamette National Forest Standard and Guidelines for Management Areas 2a and 2b, as well as OCRA Management Plan Direction, and action taken to resolve conflicting objectives with respect to wolverine habitat management.

- Evaluate future recreation projects following a process such as that outlined by Youmans (1999) as a step towards reducing the potential for adverse impacts to rare forest carnivores.

- A prioritized approach to future management activities within Watershed 23 is recommended that would respond to the rank of potential wolverine denning habitat zones (6th field watersheds) based on the current assessed level of impacts to habitat.

- Limits of Acceptable Change (LAC) inventories of dispersed recreation sites throughout Watershed 23 (particularly in 6th fields 23-3 and 23-5) should be completed and reviewed to identify where potential negative impacts to rare native forest carnivores may exist. It is recommended that an interdisciplinary review of LAC inventories identify potential areas for obliterating as a step towards reducing the potential for human disturbance near fisher and wolverine denning habitat.

Question #14

- Continue to assess need and implement projects that would reduce the potential for catastrophic disturbance, especially fire, within LSRs RO221 and 222. These LSRs will be important in the future in providing habitat for the spotted owl, especially as projects continue to alter or remove suitable habitat in matrix lands. From a vegetation standpoint, a significant portion of this watershed exists in mixed conifer stands, more indicative of forest conditions to the south in the Southern Oregon Klamath Province. The ROD identifies the need to take additional measures in those LSRs where levels of risk are particularly high. "Consequently, management activities designed to reduce risk levels are encouraged in those Late-Successional Reserves even if a portion of the activities must take place in currently late-successional habitat (USDA, 1994)." (p.88)

- Assess fuel loadings adjacent to these areas and establish priorities for treatment of those fuels where loadings and risks are high for potential loss of reserved LSRS habitat. Higher priority areas to treat may be in mixed conifer stands with evidence of frequent historic fire occurrence or late-successional forest stands with high fuel loadings. (p.88)

- As site-specific planning is implemented in the watershed, consider silvicultural prescriptions that might degrade instead of downgrade (for instance moving from nesting habitat to foraging habitat); or remove suitable habitat (where it still functions as habitat). Consider these prescriptions as treatments in designated critical spotted owl habitat. (p.89)

- Consider harvest areas that would avoid blocks of nesting habitat as identified in Figure 14-3 in the short term (10-30 years). If entry is necessary in these blocks, consider entry into smaller blocks first, while maintaining the larger, more contiguous nesting habitat as alternative core areas in case of LSRS loss. Consider entry into foraging habitat first and reduce impacts to NRF habitat. Consider maintaining blocks that are immediately adjacent to known spotted owl activity centers as priority. As the riparian reserve system begins to function as intended in the NWFP, maintaining blocks of habitat outside of the RR system may not be as critical in the long run. (p.88)

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Appendix B - Attainment of ACS Objectives with Riparian Density Management

How thinning relates to Northwest Forest Plan Aquatic Conservation Strategy Objectives

This discussion focuses on proposed thinning of young managed stands (from 25 to 50 years of age) created by past clearcut harvest. This past harvest did not treat riparian zones differently than upslope areas and the stands are more or less homogenous across the slope. As of this writing most of the stands in this age range contain moderate to large amounts of large woody debris in and near stream channels as well as in upland areas but they contain essentially no large residual trees or snags. Most of these young stands were planted almost exclusively with Douglas-fir, though other species have naturally established to a greater or lesser extent. These stands were densely planted and those proposed for thinning are quite dense, often to the extent that tree mortality is currently occurring, or soon will, and understory ground vegetation is sparse to non-existent. Tbinning is proposed in the riparian portion of these managed stands generally to create a stand more diverse structurally and biologically, and to assure that riparian stands have comparable stem size distribution and understory composition as adjacent thinned upland stands. How thinning specifically affects the nine Aquatic Conservation Strategy Objectives presented on page B- I I of the Northwest Forest Plan follows below:

1 . Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to assure protection of the aquatic systems to which species, populations and communities are uniquely adapted

Thinning will help to better achieve this objective. Thinning is proposed in these young stands to provide for a more diverse riparian and terrestrial stand by opening up the canopy somewhat such that shade tolerant conifers and ground vegetation can become established or to provide for the more vigorous growth of that which already exists. Thinning will also provide for greater long-term structural diversity by generating larger stem diameters, overall greater variation in stem sizes, a structurally more complex dominant tree crown (deeper, with thicker branches) and future sources of appropriately large snags and down woody material. If these dense, young stands are not thinned there will be, to a large extent, a detrimental impact on aquatic and terrestrial populations and communities in the long-run as these stands may take a very long time to generate large stem calipers and late-successional habitat conditions in general if they remain at their current densities.

2. Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian dependent species.

T'hinning will not affect the connectivity these recovering riparian stands now provide. While there may be some short- term negative effects in terms of micro-climate changes by reducing the current crown

coverage, or in terms of branches and trees tops creating barriers to animal movement, there is an overall benefit in creating more structurally complex habitat for animals to travel through in the future.

3. Maintain and restore the Physical integrity of the aquatic system, including shorelines, banks and bottom configurations.
Yarding systems and harvest prescriptions would be designed to protect and maintain channel stability in all cases including intermittent stream channels. Riparian areas within 10 to 50 feet of stream channels would generally not be thinned. Trees to be removed will not be transported across stream channels unless an analysis shows that additional road construction needed to avoid yarding across streams would be more harmful than a narrow skyline corridor through the riparian area. Skyline yarding corridors across stream channels would be minimized, however where analysis determined that yarding across a stream channel could be accomplished while protecting stream banks and channels.
.
4. Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

Thinning would have a neutral effect on water quality in the short run. In the long run it may have a slightly beneficial effect as thinning will speed up the creation of large stems, some of which will eventually fall into the streams to provide for more stable channels. Retention of all trees within 50 feet of perennial stream channels will provide for shade to maintain cool stream temperatures during critical summer months.

5. Maintain and restore the sediment regime under which aquatic ecosystems evolved.

Elements of the sediment regime include the timing, volume, rate and character of sediment input, storage and transport. See the above discussion; thinning will have neutral effect on sediment regimes as long as road construction effects are balanced with the desire to minimize yarding across stream channels. Thinning would enhance development of course woody material which when incorporated into stream channels has beneficial effects on storage and routing of sediment. No harvest areas adjacent to stream channels will reduce the potential for stream bank erosion.

6. Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

To a large extent thinning can be thought of as an activity that re-structures, rather than reduces, the vegetation occurring on a site. Thinning would also have a long-term positive effect on sediment, nutrient, and wood routing as discussed in objectives 4.and 5.above.

7. Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

Thinning will have a neutral effect on the timing and variability of floodplain inundation and wetland water table levels, similar to the effects on in-stream flows as discussed above.

8. Maintain and restore the species composition and structural diversity of plant communities in riparian

areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration to supply amount and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

The young, previously managed stands proposed for thinning do not currently comprise late-successional habitat. One of the primary objectives of this proposed thinning is to make these dense, young stands more diverse from a structural and species composition perspective. Thinning will ultimately produce a more structurally diverse stand that will provide for development of more diverse plant and animal communities.

9. Maintain and restore habitat to support well-distributed populations of native plants invertebrate, and vertebrate riparian species.

Thinning enhances vertical and horizontal diversity by encouraging understories, growing of crop trees, and deepening crown area and leaf area. These stand structures provide niches for native plants, invertebrates, and vertebrate riparian species.

Appendix C - Historic Documents Citing Chemical Treatment Efforts to Remove Undesirable Species of Fish

Form 249

State Game Commission
State of Oregon

INTER-OFFICE CORRESPONDENCE

To: Ralph Swan
Address: Eugene

Date: February 15, 1961

From: Bob Borovicka
Address: Portland

Subject: Hills Creek.

Personnel of the Army Engineers have informed us that the gates at Hills Creek will probably be closed on the first of August. Along with the closure we are informed that no provisions have been made for minimum flows below Hills Creek to the confluence of Salt Creek, approximately one mile downstream. As it looks from here, there will be a period from the first of August to the first of October that the Middle Fork of the Willamette River from the Hills Creek Dam to the confluence of Salt Creek would be dry.

We will make some recommendations with regard to this problem. Considering the aquatic foods and fish that may be lost, do you have any recommendations with regard to the problem during those months? Possibly you may feel that the area in question is not much of a problem.

With the late closure of the Hills Creek Dam it may be necessary to start another rearing program for the initial stocking of the reservoir. I doubt if we can hold many fish until August for the initial stocking.

Bob

RLB:ae

Form 249

State Game Commission
State of Oregon

INTER-OFFICE CORRESPONDENCE

To: Bob Borovicka
Address: Portland

Date: Feb. 20, 1961

From: Ralph Swan
Address: Eugene

Subject: Hills Creek gate closure

Dear Bob:

When you asked me the other day if I had received your letter, I thought you had reference to another one you had written. The letter you were talking about was waiting for me when I got home.

My first question is, will the drying up of the Will. between the dam and Salt Creek be an annual proceedure, or is it just for the initial filling?

Very little angling takes place in the area affected, although there is no doubt that a considerable amount of food and habitat will be destroyed.

I checked on the Geological Survey water records for the late summer months, and by some subtraction of averages, there appears to be about 100 cfs in Salt Creek at that time. Salmon Creek carries about 160 cfs, and the North Fork slightly more. I don't think there will be a serious problem below the North Fork.

The City of Oakridge may be unhappy because of the lack of water at their Green Waters park.

If they plan to dry up the river every year, I think we should try to obtain a minimum flow - somewhere in the vicinity of 100 cfs, but if it is just for one season, I wonder if we should object too strenously

Form 249

State Game Commission
State of Oregon

INTER-OFFICE CORRESPONDENCE

To: Ralph Swan
Address: Eugene

Date: February 15, 1961

From: Bob Borovicka
Address: Portland

Subject: Hills Creek.

Personnel of the Army Engineers have informed us that the gates at Hills Creek will probably be closed on the first of August. Along with the closure we are informed that no provisions have been made for minimum flows below Hills Creek to the confluence of Salt Creek, approximately one mile downstream. As it looks from here, there will be a period from the first of August to the first of October that the Middle Fork of the Willamette River from the Hills Creek Dam to the confluence of Salt Creek would be dry.

We will make some recommendations with regard to this problem. Considering the aquatic foods and fish that may be lost, do you have any recommendations with regard to the problem during those months? Possibly you may feel that the area in question is not much of a problem.

With the late closure of the Hills Creek Dam it may be necessary to start another rearing program for the initial stocking of the reservoir. I doubt if we can hold many fish until August for the initial stocking.

Bob

RLB:ae

U. S. Army Engineer Contrac
No. DA-35-026-CIVENG-61-10
October 13, 1960

PROGRESS REPORT
HILLS CREEK PROJECT

Introduction

Hills Creek Dam and future reservoir is in Lane County, Oregon, on the Middle Fork of the Willamette River. The project area is about three miles southeast of the community of Oakridge, a short distance from Highway 57. The dam is being constructed by the U. S. Army Engineers primarily for flood control with secondary purposes of hydroelectric power production.

The Middle Fork of the Willamette River and tributaries above the Hills Creek Dam have been an important recreation area for campers and trout fishermen. The river and a few important tributaries are annually stocked with rainbow trout. All tributary streams contain good to excellent populations of native cutthroat trout.

In addition to trout the Middle Fork of the Willamette River and the lower sections of some of the larger tributaries contained populations of fine and coarse-scaled suckers, squawfish, redsided shiners, cottids, and dace. Past experience at several upper Willamette reservoirs has shown that small rough fish populations native to the streams exhibit population explosions when reservoir environment covers natural stream sections. Rough fish populations in the upper Willamette reservoirs have competed with normal game species to the extent that even heavy plantings of legal trout have not provided a sport fishery of magnitude to anglers.

The potential rough fish problem in the Hills Creek Reservoir was recognized by the U. S. Fish and Wildlife Service and the Oregon State Game Commission during the preliminary planning stages of the project. A U. S. Fish and Wildlife Service report recommended the chemical treatment of the river and tributaries to remove undesirable species of fish before the impoundment of water in the basin.

The Oregon State Game Commission entered into a contract with the U. S. Army Engineers to chemically treat problem waters above the Hills Creek Dam before water is stored in 1961. The contract for services was completed on the 5th of August, 1960. The U. S. Army Engineers agreed to pay 40 per cent of the actual costs incurred under the contract, but not to exceed the sum of $24,000. A copy of the contract is attached to the progress report.

Preparation

The Middle Fork of the Willamette River above the Hills Creek Dam site drains an area of approximately 400 square miles. It was determined that over 100 miles of tributary streams would be investigated to find the upstream limits of rough fish. Selected streams were spot-checked with rotenone and cresol to study fish populations during the summer of 1959 and in May and June of 1960. The preliminary work was helpful in determining cost estimates of tributary treatment. An intensive survey was made in July 1960 to determine upstream limits of rough fish in tributary streams.

Several field trips were made to the area to inspect the tributary streams and the Middle Fork of the Willamette River to determine methods and type and extent of specialized equipment needed for the chemical treatment.

A cost estimate for the project was made based on average water flows for streams in the area. The information was presented to the Oregon State Game Commission and approval was obtained for the project. A contract, mutually acceptable to the U. S. Army Engineers and the Oregon State Game Commission, was signed August 5, 1960.

The water flows and velocities through the outlet tunnel and spillway of Hills Creek Dam were of a magnitude to be a complete barrier to upstream migrating fish. The barrier permitted chemical treatment to be schedule for August and September of 1960. The late summer treatment was designed to take advantage of low water flows in the streams and the possibility that construction on the dam would be far enough advanced to permit closing of outlet gates in the fall of 1960.

Bids were accepted to obtain the required amount of liquid rotenone. Miscellaneous supplies and several pieces of specialized equipment were ordered. Equipment and materials were moved to a rented warehouse in Oakridge.

Agencies contacted to explain certain phases of the project were the U. S. Forest Service, State Board of Health, U. S. Geological Survey, Lane County Sanitarian, and the Project Engineer, U. S. Army Engineers. Various sportsmen's organizations were apprised of the project and the reasons for the chemical treatment. Local radio, newspaper, and other public media were notified of the project plans.

A test of two rotenone products was made in the lower portion of Hills Creek.

Arrangements were made to quarter Game Commission personnel at the Kitson Hot Springs located on Hills Creek.

Permanent and part-time employees were transferred from other jobs to work on the Hills Creek Project. An airplane reconnaissance was made of the drainage area to be treated, to check on access routes to tributary streams, locate isolated lakes or potholes, and to obtain a broad view of the project area.

Chemical treatment

The first crew was moved into the area in July. Work was started on the treatment of tributary streams to kill all fish from the known upstream limits of rough fish down to fish barriers near the main river. In many instances it was possible to find natural barriers on dry sections of stream near the mouth of the river. In some cases it was necessary to construct small dams high enough to permit the stream to flow over galvanized metal roofing forming a drop impassable to fish.

Tributary streams were treated by using methods successful on other projects. After the upstream limits of rough fish were determined and a barrier was erected the required amount of liquid rotenone was released from a constant flow drip above the area known to contain rough fish. Crews

with backpack cans containing rotenone would follow the flow of rotenone downstream treating all side pockets, channels, isolated pools, and slow-moving areas. Tributary streams were treated in a systematic manner working on the west and then the east side of the Middle Fork of the Willamette River.

Streams were rechecked to determine the effectiveness of the initial kill and to investigate doubtful areas. Approximately 50 miles of tributary streams were treated with rotenone.

Many isolated pools, potholes, and borrow pits were located along the Middle Fork of the Willamette, both in the upriver and the future reservoir areas.

The sloughs and isolated river channels in upriver areas from the head of the reservoir to Swift Creek were treated with rotenone by personnel using backpack cans.

The reservoir construction area contained many small seeps, potholes and large ponds. A 250-gallon John Bean power spray unit with 200 feet of hose was mounted on a 1/2-ton four-wheel-drive pickup. A crew of three to four men operating the equipment chemically treated the majority of the isolated waters in the reservoir area. The larger ponds and borrow areas were sprayed with power equipment and venturi rotenone units operated from a boat.

Many of the borrow areas contained small seeps and puddles over a wide area and in rugged terrain. In these areas it was necessary to use several treatment crews with backpack cans to distribute the rotenone properly.

Prior to chemical treatment of the river it was necessary to determine the location of the major drip stations for introduction of rotenone. Upstream limit of rough fish in the river was determined by making spot checks with liquid rotenone and observing the kill. Game Commission Scuba divers were used to check deep pools for positive identification of the species of fish killed.

Rotenone drip stations were placed from three to four miles apart to obtain effective fish control in the main river. Eight drip stations were plotted starting at three miles above the dam and ending thirty miles upstream

Wood horses were made out of 2" x 6" boards to hold 55-gallon drums of liquid rotenone. Constant flow drips controlled by a gate and needle valve were constructed.

Information received from the U. S. Geological Survey indicated the Middle Fork of the Willamette River within the treatment area was flowing approximately 345 c.f.s. It was determined that rotenone would be applied at the drip stations at a concentration of 1.5 p.p.m. over a 24-hour period. Each station consisted of an empty 55-gallon drum fitted with a constant-flow drip placed on a wooden horse anchored in the stream channel. The full 55-gallon drums of rotenone were placed adjacent to the drip barrel on a high bank. Rotenone was transferred from the full drums to the drip barrel by gravity flow using a length of 100-foot plastic hose.

September 1, 1960, was designated as the day of chemical treatment in the river. On August 31 a crew of approximately 25 men was moved to the Hills Creek area. After orientation, crews were designated specific jobs.

Two crews started the flow of rotenone from the drip barrels at approximately 12:30 a.m., September 1, 1960. Two man crews with backpack cans worked each side of the river from one drip station to the next. The job of each crew was to introduce rotenone from a backpack can to all isolated pools along the river channel. Backpack crews started at approximately 8:00 a.m., September 1, after kill was effective between all rotenone drip stations.

The majority of the work between stations was completed by 5:00 p.m., September 1, and drip stations were removed. Rotenone was introduced at each station for approximately 17 hours.

The following day, September 2, rechecks were made of the entire area, more potholes in the lower reservoir basin were treated, and crews were used to advantage in locations not worked the first day of treatment. A crew of four men was retained at the project area for a period of three weeks to recheck all areas treated.

A second charge of rotenone was dripped in the river through the reservoir basin approximately three weeks after the initial treatment. No fresh fish kills were observed after the second application of rotenone.

Result of treatment

The tributary streams contained few rough fish. The lower reaches of some streams contained suckers and redsided shiners but no squawfish were observed.

The Middle Fork of the Willamette River contained suckers for at least 30 miles upstream from the dam site. Squawfish and redsided shiners were found in only the lower areas generally within the present reservoir site. Hundreds of large suckers were killed in the Middle Fork of the Willamette River within the reservoir area. Many thousands of suckers, squawfish and redsided shiners were killed in the pothole and borrow areas of the impoundment area.

A spectacular kill of large squawfish and suckers was observed in the Willamette River below Hills Creek Dam down to the backwaters of Lookout Point Reservoir.

From the numbers of rough fish killed in the Hills Creek impoundment area it was evident that the reservoir would have been infested with a large population of rough fish. The chemical treatment prior to storage of water should be of benefit to a future fishery.

Miscellaneous

Crews remained in the area to clean all equipment used on the project and conduct an inventory of all materials, supplies, and equipment.

Hills Creek Project

1. General

Hills Creek Dam and future impoundment is in Lane County, Oregon, on the Middle Fork of the Willamette River. The project area is about three miles southeast of the town of Oakridge, a short distance from Highway 57. The dam is being built by the U. S. Army Engineers primarily for flood control but with secondary purposes of electric power production.

The Middle Fork of the Willamette River and tributaries above the Hills Creek Dam now provide excellent angling for trout. In addition to trout, the main stem stream and most of the tributaries contain small populations of rough fish in the form of squawfish and coarse and fine-scaled suckers.

Past experience with several upper Willamette reservoirs has shown that small rough fish populations native to the streams become abundant in a short time when a reservoir environment displaces the natural stream sections. Rough fish populations in the upper Willamette reservoirs have competed with normal game species to the extent that even heavy plantings of legal trout have not provided a sport fishery of magnitude to anglers. The elimination of rough fish from the Middle Willamette drainage above Hills Creek should effectively reduce competition for game fish species in the future Hills Creek Reservoir.

2. Area of waters

Approximately 105 miles of tributary streams above Hills Creek Dam may contain rough fish and must be treated with rotenone to remove fish populations. The work is planned before water is stored in the reservoir so treatment of a pool is not likely to be involved in the project.

Main tributaries to the Middle Fork of the Willamette River are Hills Creek, Larrison Creek, Staley Creek, Swift Creek, Pioneer Gulch Creek, and Willow Creek. There are numerous small tributaries.

3. Species to be controlled

Coarse and fine-scaled suckers, squawfish and whitefish.

4. Type of control planned

Complete chemical treatment with liquid rotenone of all tributaries known to contain rough fish. Several crews of three men with equipment will treat the tributary streams to the confluence of the Middle Willamette River. Small barriers will be placed at the lower end of each tributary to prevent upstream migration of rough fish after chemical treatment. The main stem of the Middle Willamette River above Hills Creek will be chemically treated after all side tributaries have received applications of rotenone.

Attempts will be made to drain all side channels and pockets adjacent to the Middle Fork of the Willamette River. Rotenone used in the project area will have an effect on fish downstream from Hills Creek Dam, possibly to the confluence with the upper reaches of Lookout Point Reservoir. The section of river contains large populations of rough fish that have moved up from Lookout Point and it is felt no harmful effects can be obtained that may not be mitigated by restocking.

5. Amount of materials

Approximately 7,250 gallons of liquid synergized rotenone will be needed to treat the tributary streams. Other materials include protective gear, containers for rotenone, miscellaneous tools, miscellaneous valves and pipe fittings, chain blocks, backpack cans, specialized spray equipment, and lumber and galvanized sheeting for dams.

6. Management

The project will be total treatment of tributary streams known to contain rough fish.

7. Fish stocking

In addition to normal annual stocking of the Middle Fork of the Willamette and tributaries, the following restocking of the Hills Creek Reservoir and tributary system must be considered:

Species	Size	Number/pound	Number
Rainbow trout	Yearling	5	5,000
Rainbow trout	Fingerling	200	1,500,000

Costs: Costs of restocking are based on an expenditure of $1.05 per pound of fish which includes cost of eggs, hatching, rearing, feeding and transportation to stocking site:

Yearling	1,000 lbs. @ $1.05 =	$1,050.00
Fingerling	7,500 lbs. @ $1.05 =	$7,875.00
	Total	$8,925.00

8. Summary of costs and related data

1. Preliminary costs - $300.00

2. Estimated expenditures: Period July 1, 1960 to November 1, 1961

(a) Salaries and Wages:

Name	Title	Period	Rate	Total
1 man as assigned	Biologist	84 man days	$25/day	$ 2,100.00
3 men as assigned	Treatment personnel	190 man days	$22/day	4,180.00
3 men as assigned	Treatment personnel	63 man days	$22/day	1,386.00
1 man as assigned	Staff specialist	10 man days	$30/day	300.00
Total Salaries and Wages				$ 7,966.00

Appendix D - List of Preparers

IDT Participant	Professional Capacity	Team Capacity	Education	Years Of Experience
Dick Davis	Wildlife Biologist	Wildlife Biologist Writer	B.S. Animal	15
Kirk Lunstrum	Wildlife Biologist	Wildlife Biologist Writer	B.S. Wildlife Biology	20
Mark Leverton	Geotechnical Geologist, Soils, Writer	Geotechnical Geologist, Soils, Writer	B.S. Earth Sciences Galactic Exploration	20
Doug Larson	Fisheries Biologist	Fisheries Biologist, Writer	B.S. Fisheries Management	8
John Agar	Silviculturist/ Planner	Silviculturist/ Planner, Writer, Editor	B.S. Forest Resources Management	20
Al Johnson	Hydrologist	Hydrologist, Writer	B.S. Forest Hydrology	20

Appendix E Access and Travel Management

Aquatic Risk Rating Process

Instructions for Aquatic Risk Ratings

Follow the criteria listed below to determine the total aquatic risk rating for any particular road segment. This rating is useful in determining the priority of a given road segment to close, reconstruct, or maintain relative to other road segments. Those roads that are of high risk would be the first priority for these types of activities, followed by those rated as being of moderate risk. While there is still potential risk with those rated as low, these roads are thought to be less likely to negatively impact the aquatic system and are therefore of the lowest priority when funding for closures, maintenance, etc. is limited. The aquatic risk rating is also helpful to determine the type of road closure for that particular road segment. For example it would **never** be recommended that a road of high or moderate risk to the aquatic system be closed in a passive manner, while there may be instances where such a closure type would be an acceptable risk with a road segment that rated low.

Critical Habitat Areas (Maximum = 12)

Proximity to Fish Stocks

3 = Segment not near (>1 mile) from a fish bearing stream (class I or II) and/or mass failure would have a low potential of negatively impacting fish bearing waters (i.e.. slope flattens significantly before a road-related failure originating from this road segment would impact a stream channel)

6 = Segment relatively close (1/2 to 1 mile) to a fish bearing stream (class I or II), but not directly adjacent (mass failures would have moderate to high potential for reaching fish bearing streams)

9 = Segment is very close (1/4 to 1/2 mile) to a fish bearing stream (class I or II) and it is likely that any mass failures originating on this road segment would directly impact the fish bearing segment below

12 = Segment is directly adjacent (<1/4) to a fish bearing stream (class I or II) and it is likely that any mass failures originating on this road segment would directly impact the fish bearing segment below or will likely impact known refugia (low stream temperature, high quality spawning gravels, high numbers of large woody material, or excellent riparian condition).

Stream Crossings and Surface Type (Maximum = 10)

Surface Type

1 = asphalt/concrete

2 = aggregate

3 = improved

4 = native surface

Stream Crossings (class I-IV) per mile

0 = road segment has no stream crossings

3 = road segment has 1-3 stream crossings/mile

6 = road segment has 4 or more stream crossings/mile or > 25% is located in the riparian

reserves

Geologic/Road Failure Hazard (Maximum = 20)

Debris Failure Risk (Sources of Coarse Grain Sediments - category 3 and 4 soils)

2 = low risk (0-10% of road segment length)

4 = moderate risk (10-50% of road segment length)

6 = high risk (50-75% of road segment length)

8 = very high risk (75-100% of road segment length)

Land Flow Area Risk (Sources of Fine Grain Sediments - category 1 and 2 soils)

1 = low risk (0-10% of road segment length)

2 = moderate risk (10-50% of road segment length)

3 = high risk (50-75% of road segment length)

4 = very high risk (75-100% of road segment length)

Percent of road segment with sideslopes >51%

2 = < 10% of road segment

4 = 10-50% of road segment

6 = 50-75% of road segment

8 = >75% of road segment

Total Rating:

The total aquatics rating characterizes the risk associated with each road segment by summing up the above scores. Those segments scoring within the upper third of the range of scores **(31-42) are considered to be of high aquatic risk** and therefore of high priority to close, reconstruct, or receive regular annual maintenance. Road segments with a rating of **moderate (20-30**) are of moderate risk and road segments receiving a rating of **low (9-19))** are considered to be of relatively low risk to the aquatic system.

Information Needed:

GIS Layers*:* * Stream Class Map (I-IV) * Map of Category 3 and 4 Soil Types (Debris Slides) * Map of Category 1 and 2 Soil Types (Landflows) * Map showing refugia areas (from stream surveys) * Map showing road segments on > 51% Slopes * Map of Transportation Layer

Other Useful Information: *WIN Surveys of other field surveys * Road Logs