Chapter III

Listed Fish Species, Designated Critical Habitat, and Essential Fish Habitat

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LISTED FISH SPECIES, DESIGNATED CRITICAL HABITAT, AND ESSENTIAL FISH HABITAT

Table III - 1. The Evolutionarily Significant Units (ESU), Distinct Population Segments (DPS), and designated or proposed critical habitat, on the Umatilla and Wallowa-Whitman National Forests, considered in this BA.

Species	Status	Determination
Snake River Basin Steelhead DPS	Threatened	MA-LAA
Middle Columbia River Steelhead DPS	Threatened	MA-LAA
Snake River Spring/Summer Run Chinook Salmon ESU	Threatened	MA-LAA
Snake River Fall Run Chinook Salmon ESU	Threatened	MA-LAA
Snake River Sockeye Salmon ESU	Endangered	MA-LAA
Columbia River Bull Trout DPS	Threatened	MA-LAA
Snake River Basin Steelhead DPS Critical Habitat	Designated	MA-LAA
Middle Columbia River Steelhead DPS Critical Habitat	Designated	MA-LAA
Snake River Spring/Summer Run Chinook Salmon Critical Habitat	Designated	MA-LAA
Snake River Fall Run Chinook Salmon Critical Habitat	Designated	MA-LAA
Columbia River Bull Trout DPS Critical Habitat	Designated	MA-LAA
Snake River Sockeye Designated Critical Habitat	Designated	MA-LAA

Environmental Baseline for Aquatic Species

The environmental baseline for this consultation includes descriptions of listing history, critical habitat, life history, threats, distribution, and habitat conditions within the action area of federally listed species.

BROAD-SCALE HABITAT IMPACTS AND EFFECTS

In the discussion below, the hydropower development and habitat alteration sections are relevant to all ESA listed aquatic species. The hatcheries and harvest sections are more relevant to salmon and steelhead, but do have infrequent adverse effects to bull trout.

Hydropower Development

Numerous river systems in Washington and Oregon have been affected by hydropower development. The hydropower development on the Columbia and Snake Rivers are perhaps the best documented and most dramatic example. Numerous aquatic species throughout the basin have been affected. Storage dams have eliminated spawning and rearing habitat for salmon and other species, and altered the natural hydrograph of the Snake and Columbia Rivers – decreasing spring and summer flows and increasing fall and winter flows. Power operations cause flow levels and river elevations to fluctuate – slowing fish movement through reservoirs, altering riparian ecology, and stranding fish in shallow areas. The 13 dams in the Snake and Columbia River migration corridors kill salmonid smolts and adults and alter their migrations. The dams have also converted the once-swift river into a series of slow-moving reservoirs – slowing the smolts' journey to the ocean and creating habitat for predators. Because most of the ESA listed salmon and steelhead in the Columbia River system must navigate at least one, and up to nine major hydroelectric projects during their upstream and downstream migrations (and experience the effects of other dam operations occurring upstream from their ESU/DPS boundary), they experience the influence of all the impacts listed above. Numerous other river systems within the Pacific Northwest contain dams which block migrations or affect habitat for salmon, bull trout, and other aquatic species.

Many dams were constructed without fish passage facilities, and have resulted in a sizeable loss of accessible habitat for salmon and steelhead, and disruption of meta-population connections for some inland fish species. Numerous smaller dams also exist that block migrations on smaller rivers or tributaries. Improvements for some hydropower dams affecting ESA listed fish species in the Pacific Northwest have been and are occurring. Ongoing consultations between NOAA Fisheries and Bonneville Power Administration (BPA), the U.S. Army Corps of Engineers (Corps), USFWS, and the Bureau of Reclamation (BOR) have brought about numerous beneficial changes in the operation and configuration of the Columbia River hydropower system. For example, in most years increased spill at the dams allows smolts to avoid both turbine intakes and bypass systems; increased flow in the mainstem Snake and Columbia Rivers provides better in-river conditions for smolts; and better smolt transportation (through the addition of new barges and by modifying existing barges) helps the young salmonids make their way down to the ocean. In the case of Snake River spring/summer Chinook salmon smolts migrating in river, the estimated survival through the hydropower system is now between 40 percent and 60 percent, compared with an estimated survival rate during the 1970s of 5 to 40 percent. Snake River steelhead have probably received a similar benefit because their life history and run timing are similar to those of spring/summer Chinook salmon. Similar spill modifications are occurring at dams located in a number of river systems throughout the Pacific Northwest that are designed to benefit both inland and anadromous fish species.

In addition, Federal Energy Regulatory Commission (FERC) relicensing of hydropower dams throughout the Pacific Northwest is also likely to result in some operational, structural, or offsite mitigation benefits for ESA listed aquatic species. For example, ongoing FERC relicensing discussions for Pelton Dam on the Deschutes River may result in reconnection of bull trout populations in the lower Deschutes River with a stronger upstream population in the Metolius River.

Human-induced Habitat Degradation

The quality and quantity of fresh water habitat in much of Oregon and Washington have declined dramatically in the last 150 years. Forestry, farming, grazing, road construction, hydropower system development, mining, and housing/urban development have radically changed the historical habitat conditions within the Pacific Northwest. More than 2,500 streams, river segments, and lakes in the Northwest do not meet federally-approved, state, and/or Tribal water quality standards and are now listed as water-quality-limited under Section 303(d) of the Clean Water Act. Tributary water quality problems contribute to poor water quality when sediment and contaminants from the tributaries settle in mainstem reaches and the estuary. Water quality problems are caused by a variety of activities such as urban development, forestry, farming, livestock grazing, riparian/channel alteration, road systems, and dams and other types of water management.

Most of the water bodies in Oregon, Washington, and Idaho on the 303(d) list do not meet water quality standards for temperature. High water temperatures adversely affect salmonid metabolism, growth rate, and disease resistance, as well as the timing of adult migrations, fry emergence, and smoltification. Many factors can cause high stream temperatures, but they are primarily related to land-use practices rather than point-source discharges. Some common actions that cause high stream temperatures are the removal of trees or shrubs that directly shade streams, water withdrawals for irrigation or other purposes, and warm irrigation return flows. Loss of wetlands and increases in groundwater withdrawals contribute to lower base-stream flows that, in turn, contribute to temperature increases. Activities that create shallower streams (e.g., channel widening) also cause temperature increases.

Many waterways in Oregon and Washington fail to meet Clean Water Act (CWA) and Safe Drinking Water Act (SDWA) water quality standards due to the presence of pesticides, heavy metals, dioxins and other pollutants. These pollutants originate from both point - (industrial and municipal waste) and non-point (agriculture, forestry, urban activities, etc.) sources. The types and amounts of compounds found in runoff are often correlated with land use patterns: Fertilizers and pesticides are found frequently in agricultural and urban settings, and nutrients are found in areas with human and animal waste. People contribute to chemical pollution within the Pacific Northwest, but natural and seasonal factors also influence pollution levels in various ways. Nutrient and pesticide concentrations vary considerably from season to season, as well as among areas with different geographic and hydrological conditions. Natural features (such as geology and soils) and land-management practices (such as storm water drains, tile drainage and irrigation) can influence the movement of chemicals over both land and water. Salmon and steelhead require clean water and gravel for successful spawning, egg incubation, and fry emergence. Fine sediments clog the spaces between gravel and restrict the flow of oxygen-rich water to the incubating eggs. Pollutants, excess nutrients, low levels of dissolved oxygen, heavy metals, and changes in pH also directly affect the water quality for salmon, steelhead, and bull trout.

Many locations within Oregon and Washington are productive agricultural areas. At least 35 economically important crops are grown, including grass seed, wheat and other grains, several vegetables, various berries, fruits, nuts, and Christmas trees and other nursery products (Anderson et al. 1996, Jenkins et al., 1999, Washington Department of Ecology, 2004). Approximately 250-300 different pesticides are applied in Oregon, with a total of about 13.4 million pounds of active ingredient applied annually during 1990-1996 (Jenkins et al., 1999). These totals do not include pesticides applied in urban areas, rangelands, along road right-of-ways, or forestry uses. Insufficient information is available regarding fate and transport of these chemicals to make a reasonable assessment of how much of the pesticides were delivered to aquatic habitat. However, given the sheer quantity of pesticide applications, it is very likely that exposure of ESA listed species to these chemicals occurs. The U.S. Geological Service (USGS) confirmed that many different pesticides can be found in small Willamette Valley streams in Oregon and are consistently making their way into the aquatic environment, and degrading water quality; therefore, it is assumed that many pesticides also make their way into the Snake and Columbia River systems (Anderson et al., 1996; Wentz et al., 1998).

Pollutant content of urban runoff can vary considerably, but generally includes organic compounds, metals, sediments, nutrients, and microbes. Organic compounds can include oils, grease, phthalates, chlorinated hydrocarbons, pesticides, and other compounds. Metals often found in urban runoff include lead, copper, and zinc. Sediment in urban runoff can be particularly problematic due to the fact that many other pollutants are delivered to the aquatic environment via adsorption to eroded sediments. Nutrients typically included are nitrogen and phosphorus. A wide variety of microbes can be delivered in urban runoff, including many different types of bacteria, protozoa, and viruses.

Chemical use in state, federal, and private forest lands have resulted in the introduction of pollutants to headwater stream segments (Norris et al., 1991). The three major categories of forest chemical used are pesticides, fertilizers, and fire retardants. While pesticide use in all forest ownership types was extensive during the 1970's and 1980's, application rates on National Forest System lands peaked in the mid 1980's, and have decreased considerably since (Norris et al., 1991).

Water quantity problems are also a significant cause of habitat degradation and reduced fish production. Millions of acres in Washington and Oregon are irrigated. Although some of the water withdrawn from streams eventually returns as agricultural runoff or groundwater recharge, crops consume a large proportion of it. Withdrawals affect seasonal flow patterns by removing water from streams in the summer (mostly May through September) and restoring it to surface streams and groundwater in ways that are difficult to measure. Withdrawing water for irrigation, urban consumption, and other uses increases temperatures, smolt travel time, and sedimentation. Return water from irrigated fields can introduce nutrients and pesticides into streams and rivers. Deficiencies in water quantity have been a problem in the major production subbasins for some ESUs that have seen major agricultural development over the last century. Water withdrawals (primarily for irrigation) have lowered summer flows in nearly every stream in the basin and thereby profoundly decreased the amount and quality of rearing habitat. In fact, in 1993, fish and wildlife agencies, Tribal, and conservation group experts estimated that 80 percent of 153 Oregon Columbia River tributaries had low-flow problems, two-thirds of which was caused (at least in part) by irrigation withdrawals (OWRD, 1993). The Northwest Power Planning Council (NWPPC, 1992) found similar problems in many Idaho, Oregon, and Washington tributaries.

Blockages that stop downstream and upstream fish movement exist at many dams and barriers, whether they are for agricultural, hydropower, municipal/industrial, or flood control purposes. Culverts that are not designed for fish passage also block upstream migration. Being diverted into unscreened or inadequately screened water conveyances or turbines sometimes kills migrating fish. While many fish-passage improvements have been made in recent years, manmade structures continue to block migrations or kill fish throughout basins in the Region.

On the landscape scale, human activities have affected the timing and amount of peak water runoff from rain and snowmelt. Forest and range management practices have changed vegetation types and density that, in turn, affect runoff timing and duration. Many riparian areas, floodplains, and wetlands that once stored water during periods of high runoff have been destroyed by development that paves over or compacts soil, thus increasing runoff and altering natural hydrograph patterns.

Land ownership has also played its part in the area's habitat and land-use changes. Federal lands are generally forested and situated in upstream portions of the watersheds. While there has been substantial habitat degradation across all land ownerships, including Federal lands, in general, habitat in many headwater stream segments is in better condition than in the largely non-federal lower portions of tributaries (Doppelt et al. 1993, Frissell 1993, Henjum et al. 1994, Quigley and Arbelbide 1997). In the past, valley bottoms were among the most productive fish habitats in the basin (Stanford and Ward 1992, Spence et al. 1996). Today, agricultural and urban land development and water withdrawals have significantly altered the habitat for fish and wildlife in these valleys and lower elevation areas. Streams in these areas typically have high water temperatures, sedimentation problems, low flows, simplified stream channels, and reduced riparian vegetation.

As some habitats were being compromised by water withdrawals, water impoundments in other areas dramatically reduced habitat by inundating large amounts of spawning and rearing habitat and reducing migration corridors, frequently to a single channel. Floodplains have been reduced in size, off-channel habitat features have been lost or disconnected from the main channel, and the amount of large woody debris (large snags/log structures) in rivers has been reduced.

Estuary habitat throughout Washington and Oregon has been adversely affected through a variety of processes. The Columbia River estuary, for example, through which all the basin's anadromous species must pass, has been changed by human activities. Historically, the downstream half of the estuary was a dynamic environment of multiple channels, extensive wetlands, sandbars, and shallow areas. Historically, the mouth of the Columbia River was about four miles wide; today it is two miles wide. Previously, winter and spring floods, low flows in late summer, large woody debris floating downstream, and a shallow bar at the mouth of the Columbia River kept the environment dynamic. Today, navigation channels have been dredged, deepened, and maintained; jetties and pile-dike fields have been constructed to stabilize and concentrate flow in navigation channels; marsh and riparian habitats have been filled and diked; and causeways have been constructed across waterways. These actions have decreased the width of the mouth of the Columbia River to two miles and increased the depth of the Columbia River channel at the bar from less than 20 to more than 55 feet. More than 50 percent of the original marshes and spruce swamps in the estuary have been converted to industrial, transportation, recreational, agricultural, or urban uses. Furthermore, water storage and release patterns from reservoirs upstream of the estuary have changed the seasonal pattern and volume of discharge. The peaks of spring/summer floods have been reduced and the amount of water discharged during winter has increased. Many other estuaries throughout the area have experienced some combination of similar effects.

Human-caused habitat alterations have also increased the number of predators feeding on ESA listed species. For example, a population of terns on Rice Island (16,000 birds in 1997) in the Columbia River consumed an estimated 6-25 million emigrating salmonid smolts during 1997 (Roby et al. 1998) and 7-15 million emigrating smolts during 1998 (Collis et al. 1999). Rice Island is a dredged material disposal site in the Columbia River estuary; the Corps created it under its Columbia River Channel Operation and Maintenance Program. As another example, populations of Northern pike minnow (*Ptychocheilus oregonensis*) in the Columbia River have proliferated in the warm, slow-moving reservoirs created by the mainstem dams, and prey heavily on juvenile salmonids. Some researchers have estimated the pike minnow population in the John Day pool alone to be more than one million (Bevan et al. 1994). In other river systems, such as the John Day, Umpqua, and Snake Rivers, non-native predators such as smallmouth bass (and others) have been introduced, prey on a variety of native aquatic species, and thrive in high numbers.

Hatcheries

For more than 100 years, hatcheries in the Pacific Northwest have been used to: (1) produce fish for harvest, and (2) replace natural production lost to dam construction and other development – but, until recently, not to protect and rebuild naturally-produced salmonid (or other native fish) populations. As a result, most salmonid populations in much of the Pacific Northwest are primarily derived from hatchery fish. In 1987, for example, 95 percent of the Coho salmon, 70 percent of the spring Chinook salmon, 80 percent of the summer Chinook salmon, 50 percent of the fall Chinook salmon, and 70 percent of the steelhead returning to the Columbia River basin originated in hatcheries (CBFWA, 1990). Because hatcheries have traditionally focused on providing fish for harvest and replacing declines in native runs (and generally not carefully examining their own effects on local populations), it is only recently that the substantial effects of hatcheries on native natural populations been documented. For example, the production of hatchery fish, among other factors, has contributed to the 90 percent reduction in natural Coho salmon runs in the lower Columbia River over the past 30 years (Flagg et al., 1995).

Hatchery fish can harm naturally-produced salmon and steelhead in four primary ways: ecological effects, genetic effects, overharvest effects, and masking effects. Ecologically, hatchery fish can predate on, displace, and compete with wild fish. These effects are most likely to occur when young hatchery fish are released in poor condition and do not migrate to marine waters, but rather remain in the streams for extended rearing periods. Hatchery fish also may transmit hatchery-borne diseases, and hatcheries themselves may release disease-carrying effluent into streams. Hatchery fish can affect the genetic composition of native fish by interbreeding with them. Humans taking native fish from one area and using them in a hatchery program in another area can also cause interbreeding. Interbred fish are less adapted to the local habitats where the original native stock evolved and may therefore be less productive there.

In many areas, hatchery fish provide increased fishing opportunities. However, when natural fish mix with hatchery stock in these areas, smaller or weaker natural stocks can be overharvested. Moreover, when migrating adult hatchery and natural fish intermix on spawning grounds, the health of the natural runs and the habitat's ability to support them can be overestimated because the hatchery fish mask the surveyors' ability to discern actual natural run conditions.

Bull trout are incidentally affected by hatcheries due to weirs, ladders, and water removal that effect passage and handling of individuals in areas where they overlap with salmon and steelhead.

Harvest

Salmon, steelhead, and several inland fish species have been harvested in the Oregon and Washington areas as long as people have been present. These harvests were a major food source for the native populations, and included non-game fish such as Lost River and shortnose suckers. Commercial salmon (and Lost River sucker) fishing developed rapidly with the arrival of European settlers and the advent of canning technologies in the late 1800s. The development of non-Native American fisheries began in about 1830; by 1861, commercial fishing was an important economic activity. The early commercial fisheries used gill nets, seines hauled from shore, traps, and fish wheels. Later, purse seines and trolling (using hook and line) fisheries developed. Recreational (sport fishing) harvest began in the late 1800's and took place primarily in tributary locations (ODFW and WDFW, 1998).

Salmon and steelhead have formed a major component of recreational fisheries for decades. Conservation concerns for natural salmon and steelhead populations have caused regulations to be put in place in Oregon and Washington that strictly limit the number of fish anglers may catch and the types of gear that may be used in many areas. Incidental catch of bull trout occurs from recreational sport harvest.

Initially, the non-Native American fisheries targeted spring and summer Chinook salmon, and these runs dominated the commercial harvest during the 1800's. Eventually the combined ocean and freshwater harvest rates for Columbia River spring and summer Chinook salmon exceeded 80 percent (and sometimes 90 percent) of the run—accelerating the species' decline (Ricker, 1959). From 1938 to 1955, the average harvest rate dropped to about 60 percent of the total spring

Chinook salmon run and appeared to have a minimal effect on subsequent returns (NMFS, 1991). Until the spring of 2000, when a relatively large run of hatchery spring Chinook salmon returned and provided a small commercial tribal fishery, no commercial season for spring Chinook salmon had taken place since 1977. Present Columbia River harvest rates are very low compared with those from the late 1930's through the 1960's (NMFS, 1991). Although steelhead were never as important a component of the Columbia Basin's fisheries as Chinook, net-based fisheries generally do not discriminate among species, so it can fairly be said that harvest has also contributed to declines in all of the 12 ESUs under discussion in this analysis.

For years, the response to declining catches was hatchery construction to produce more fish. Because hatcheries require fewer adults to sustain their production, harvest rates in the fisheries were allowed to remain high, or even increase, further exacerbating the effects of overfishing on the naturally-produced (non-hatchery) runs mixed in the same fisheries. More recently, harvest managers have instituted reforms including weak stock, abundance-based, harvest rate, and escapement-goal management. As with improvements being made in other phases of salmon and steelhead life history strategies, it will take some time for these (and future) measures to contribute greatly to the species recovery, but the effort has begun.

Ocean harvest for other species has also affected salmon and steelhead populations, though only incidentally and to an essentially unknown degree. For example, at one point it was estimated that unauthorized high seas drift net fisheries harvested between 2 percent and 38 percent of steelhead destined to return to the Pacific Coast of North America (Cooper and Johnson, 1992). However, since drift nets were outlawed in 1987, and enforcement has increased, that percentage has certainly decreased greatly. Therefore, it is indeterminable to what degree by-catch affects any of the listed salmon and steelhead ESUs, but is probably a fairly minor impact in comparison to the effects on these ESUs arising from other anthropogenic sources.

Listed Species Habitat Information

See Appendix E – Aquatics, Tables E-1 and E-2 for additional information regarding the presence of listed species in each subwatershed.

Snake River Fall-Run Chinook ESU

LISTING HISTORY

The Snake River fall Chinook ESU extends into the Umatilla and Wallowa-Whitman National Forests. The Snake River fall Chinook salmon ESU, listed as threatened on April 22, 1992, (57 FR 14653), includes all natural populations of fall Chinook salmon in the mainstem Snake River below Hell's Canyon Dam, and the Tucannon, Palouse (to Palouse Falls), Grande Ronde, Imnaha, Salmon, and Clearwater Rivers. Fall Chinook from the Lyons Ferry Hatchery are included in the ESU but are not listed.

Recovery planning for Snake River fall Chinook is ongoing, and recovery planning status can be reviewed online at: http://research.nwfsc.noaa.gov/trt/trt_columbia.htm

CRITICAL HABITAT

Critical habitat was designated for Snake River fall Chinook salmon on December 28, 1993, (58 FR 68543). Critical habitat for the listed ESU is designated to include river reaches presently or historically accessible (except reaches above impassable natural falls, and Dworshak and Hells

Canyon Dams) to Snake River fall Chinook salmon in the Columbia River from it's mouth upstream to the confluence of the Columbia and Snake Rivers; all Snake River reaches from the confluence of the Columbia River, upstream to Hells Canyon Dam; the Palouse River from its confluence with the Snake River upstream to Palouse Falls; the Clearwater River from its confluence with the Snake River upstream to its confluence with Lolo Creek; the North Fork Clearwater River from its confluence with the Clearwater River upstream to Dworshak Dam. Essential habitat consists of four components: spawning and juvenile rearing, juvenile migration, areas for growth and development to adulthood, and adult migration corridors. Essential features of migration corridors are further defined as: substrate, water quality, water quantity, water velocity, cover/shelter, food (juveniles only), riparian vegetation, space, and safe passage conditions.

LIFE HISTORY

Snake River fall Chinook spawn above Lower Granite Dam in the mainstem Snake River, and in the lower reaches of major tributaries entering that river below Hells Canyon Dam. Adult fall Chinook enter the Columbia River in July and August. The Snake River component of the fall Chinook run migrates past the Lower Snake river mainstem dams in September and October. Spawning occurs from October through November. Juveniles emerge from the gravels in March and April of the following year. Downstream migration generally begins within several weeks of emergence (Becker, 1970, Allen and Meekin, 1973), and juveniles rear in backwaters and shallow water areas through mid-summer before smolting and migrating to the ocean—thus they exhibit an ocean-type juvenile history. Once in the ocean, they spend 1 to 4 years (though usually 3 years) before beginning their spawning migration. Fall returns in the Snake River system are typically dominated by 4-year-old fish.

Fall Chinook returns to the Snake River generally declined through the first half of this century (Irving and Bjornn 1991). In spite of the declines, the Snake River basin remained the largest single natural production area for fall Chinook in the Columbia drainage into the early 1960s (Fulton 1968). Spawning and rearing habitat for Snake River fall Chinook was significantly reduced by the construction of a series of Snake River mainstem dams. Historically, the primary spawning fall Chinook spawning areas were located on the upper mainstem Snake River. Currently, natural spawning is limited to the area from the upper end of Lower Granite Reservoir to Hells Canyon dam and the lower reaches of the Imnaha, Grande Ronde, Clearwater, and Tucannon Rivers.

Adult counts at Snake River dams are an index of the annual return of Snake River fall Chinook to spawning grounds. Lower Granite Dam is the uppermost of the mainstem Snake River dams that allow for passage of anadromous salmonids. Adult traps at Lower Granite Dam have allowed for sampling of the adult run as well as for removal of non-local hatchery returns.

Lyons Ferry Hatchery was established as one of the hatchery programs under the Lower Snake Compensation Plan administered through the USFWS. Snake River fall Chinook production is a major program for Lyons Ferry Hatchery, which is operated by the Washington Department of Fish and Wildlife and is located along the Snake mainstem between Little Goose Dam and Lower Monumental Dam. WDFW began developing a Snake River fall Chinook broodstock in the early 1970s through a trapping program at Ice Harbor Dam and Lower Granite Dam. The Lyons Ferry facility became operational in the mid-1980s and took over incubation and rearing for the Snake River egg bank program.

A major Snake River fall Chinook supplementation effort based upon the Lyons Ferry Snake River fall Chinook broodstock has been implemented in recent years. Acclimation facilities adjacent to major natural spawning areas have been used to acclimate release groups of yearling smolts. Additional releases of sub-yearlings have been made, depending on the availability of sufficient broodstock to maintain the on-station program and the off-station yearling releases. Returns in 2000 and 2001 reflect increases in the off-station plants in recent years as well as improved survival after release.

POPULATION TREND

In the 2003 status review update, NOAA Fisheries modified previous approaches to ESU risk assessment to incorporate Viable Salmonid Population (VSP) criteria (McElhany et al., 2000): abundance, growth rate/productivity, spatial structure, and diversity. The current condition (NOAA Fisheries, 2003) of Snake River "fall-run" Chinook is summarized below:

Abundance:

- 2001 natural returns (2652 adults) up markedly from last 10 years (< 1000 adults/yr)
- 2001 natural returns > interim recovery target of 2500 natural spawners for the ESU
- 2001 total returns (8700 hatchery + wild adults) is in the range of the estimated potential capacity of the area

Productivity:

- Long-term and short-term trends in natural returns per spawner are positive, depending upon assumptions regarding the contribution of hatchery fish
- Trends presumably reflect Pacific decadal oscillation/strong ocean conditions

Spatial Structure:

- ESU comprised of only one population
- Loss of ~80 percent historical spawning habitat

Diversity:

- Improvements in managing straying of non-ESU fish
- Concern that hatchery egg collection below Lower Granite Dam incorporates non-ESU strays

No reliable estimates of historical abundance are available. Because of their dependence on mainstem habitat for spawning, however, fall Chinook salmon probably have been affected by the development of irrigation and hydroelectric projects to a greater extent than any other species of salmon. It has been estimated that the mean number of adult Snake River fall Chinook salmon declined from 72,000 in the 1930s and 1940s to 29,000 during the 1950s. Despite this decline, the Snake River remained the most important natural production area for fall Chinook salmon in the entire Columbia River Basin through the 1950s. The number of adults counted at the uppermost Snake River mainstem dams averaged 12,720 total spawners from 1964 to 1968, 3,416 spawners from 1969 to 1974, and 610 spawners from 1975 to 1980 (Waples et al., 1991).

Counts of returning wild fall Chinook salmon at Lower Granite Dam from 1975 through 1980 averaged 600 fish per year (Waples et al. 1991). From 1985 to 1999 an average of 459 naturally produced fall Chinook salmon reached Lower Granite Dam. In recent years, two fall Chinook satellite hatchery facilities have been operated on the Snake River to increase the numbers of fall Chinook salmon. The facilities are used to acclimate and release one-year smolts from Lyons Ferry hatchery.

The Snake River component of the fall Chinook run has been increasing during the past few years as a result of the hatchery and supplementation efforts in the Snake and Clearwater River basins. Greater than 15,000 adult fall Chinook were counted past the two lower projects with about 12,400 counted above Lower Granite Dam. These adult returns are about triple the 10-year average at these Snake River projects. Detailed information on the current range-wide status of Snake River Chinook salmon under the environmental baseline is described in the Chinook salmon status review (Myers et al., 1998).

The 1999 NMFS Status Review Update noted increases in the Lower Granite Dam counts in the mid-1990s, and the upward trend in returns--the 2001 count over Lower Granite Dam exceeded 8,700 adult fall Chinook--has continued. The 1997 through 2001 escapements were the highest on record since the count of 1,000 in 1975. Wild Chinook returns and hatchery returns from increased production in the Lyons Ferry Hatchery Snake River egg bank stock have provided the bulk of the increase in returns. Returns classified as natural origin exceeded 2,600 in 2001. The 1997-2001 geometric mean natural origin count over Lower Granite Dam was 871 fish. The largest increase in fall Chinook returns to the Snake River spawning area was from the Lyons Ferry Snake River stock component. Returns increased from under 200 per year prior to 1998 to over 1,200 and 5,300 adults in 2000 and 2001, respectively. The increase includes returns from the on-station release program as well as returns from large supplementation releases above Lower Granite Dam.

Both the long-term and short-term trends in natural returns are positive (1.013, 1.188). The short-term (1990-2001) estimates of the median population growth rate are 0.98 with a hatchery spawning effectiveness of 1.0 (equivalent to that of wild spawners) and 1.137 with a hatchery spawning effectiveness of 0. The estimated long-term growth rate for the Snake River fall Chinook population is strongly influenced by the hatchery effectiveness assumption. If hatchery spawners have been equally as effective as natural-origin spawners in contributing to brood year returns, the long-term estimate is 0.899 and the associated probability that is less than 1.0 is estimated as 98.7 percent. If hatchery returns over Lower Granite Dam are not contributing at all to natural production, the long-term estimate of is 1.024. The associated probability that is greater than 1.0 is 25.7 percent, under the assumption that hatchery effectiveness is 0.

Prior to inclusion of the 1999-2001 data, NOAA Fisheries estimated that the median population growth rate (λ) for the Snake River fall Chinook ESU as a whole, from 1980-1997, ranged from 0.94, assuming no reproduction by hatchery fish in the wild, to 0.86, assuming that hatchery fish reproduce in the river at the same rate as wild fish (McClure et al. 2003). Thus, the recent increases in returning adults change the λ estimate from negative to positive.

MAJOR THREATS

The need for an ESA listing of Snake River fall Chinook as “threatened” was attributed to a number of factors. Among them were hydropower development, water withdrawals, irrigation diversions, siltation and pollution, commercial and sport harvest, predators and altered predator dynamics, and influences of hatchery fish. Hydropower development on the Columbia and Snake Rivers has adversely affected migrations. The four Snake River mainstem dams between Pasco, Washington and Lewiston, Idaho have had additional adverse consequences by permanently flooding important spawning and rearing habitat. Water withdrawals, irrigation diversions, and siltation were all important factors affecting spawning and rearing habitat. Predators such as seals and sea lions were contributing factors, as well as altered predator dynamics, such as greatly increased juvenile predation by northern pikeminnow downstream from mainstem Columbia and Snake River dams. Hatchery supplementation had a variety of effects, including genetic introgression, disease introduction, competition, and masking declines in naturally spawning fish.

DISTRIBUTION WITHIN ACTION AREA

The Umatilla and Wallowa-Whitman National Forests are located within the Snake River Fall-Run Chinook ESU. National Forest lands are found within five 4th HUC subbasins identified for this ESU; Imnaha, Lower Grande Ronde River, Lower Snake/Asotin, Lower Snake/Tucannon, and Hells Canyon. There are 22 streams all together in this ESU that have at least five miles of anadromous fish habitat inside National Forest land. Snake River inside Hells Canyon subbasin (53 miles) and Imnaha River inside Imnaha subbasin (45 miles) are the two rivers that have the highest amount of anadromous fish habitat (as shown in the parentheses) within this ESU.

Hells Canyon, approximately 70 percent of which is within Wallowa-Whitman National Forest, has 1 major stream, Snake River, which contains more than five miles of anadromous fish habitat inside the National Forest land. Snake River holds roughly 53 miles of anadromous fish habitat inside the National Forest land.

HABITAT CONDITIONS IN ACTION AREA

The following statements from McClure and Stein (2004) show the trend on the current conditions for streams that hold some areas of Forest Service land. They classified major rivers and streams within the Columbia Basin into 3 categories; one being “highly compromised habitat” with 4-7 tributary habitat factors identified as impaired, two being “moderately compromised habitat” with 1-3 tributary habitat factors identified as impaired, and three being “minimally compromised habitat” with no tributary habitat factors identified as impaired. Tucannon River was labeled as “highly compromised habitat,” Asotin Creek and Big Sheep Creek were labeled as “moderately compromised habitat,” and finally, Imnaha River was labeled as “minimally compromised habitat.”

McClure and Stein (2004) also ranked major streams within the Columbia basin in relation to various habitat factors on a scale of 1 to 10; 1 having the lowest, whereas 10 having the highest probability of being impaired (as shown in the parentheses below). In terms of chemical toxicity, Tucannon River - South (9) had the highest probability for degradation among the Action Area streams followed by Grande Ronde River lower mainstem tributary (7). As far as forest sediment is concerned, Grande Ronde River lower mainstem tributary (7) had the highest probability of being impaired for that population among the Action Area streams.

As stated by McClure and Stein (2004), heavy conversion of historical floodplain area to agriculture/urban land use has occurred on Tucannon River (70-80 percent). As far as the rate of flow diversion for irrigation is concerned, Lower Grande Ronde River (70-80 percent) has seen the most severe withdrawal. In terms of the entrainment potential predicted from the number of diversions encountered, Lower Snake/Tucannon (70-80 percent) had the highest susceptibility. Wenaha River population had 304 diversions. On the other hand, there were streams that had comparatively less impact from flow diversion; for instance, Hell’s Canyon subbasin did not have any flow diverted.

Described below is the summary information of major activities within the seven 4th HUC subbasins mentioned above (NOAA Fisheries 2004). Even though all of the 4th HUC subbasins mentioned here have some degree of FS land, it is not entirely FS land, signifying that some of the effects mentioned here could be related to other landowner activities.

Livestock grazing was identified as a major activity affecting the essential habitats in five out of the five (100 percent) 4th HUC subbasins mentioned above. Past management activities such as livestock grazing, have left the stream reaches in the mainstem Grande Ronde River Basin functioning well below levels that promote healthy salmonid populations.

Timber harvest was identified as a major activity affecting the essential habitats in four out of the five (80 percent) 4th HUC subbasins mentioned above.

Irrigation/water withdrawal was identified as a major activity affecting the essential habitats in four out of the five (80 percent) 4th HUC subbasins mentioned above. Water temperatures throughout many of the major river basins in this ESU area are considerably high during the summer months. This tendency for high temperature during summer periods is abetted by flow diversion and irrigation partly due to the fact that it requires less heat to warm up less amount of water. Also, diverted flow that returns back to a stream usually comes back warmer than it originally was. All of these effects have been instrumental to the decline of Snake River Basin steelhead. Road construction and maintenance was identified as a major activity affecting the essential habitats in three out of the five (60 percent) 4th HUC subbasins mentioned above.

Invasive species was identified as a major activity affecting the essential habitats in three out of the five (60 percent) 4th HUC subbasins mentioned above. Water temperatures throughout many of the major river basins in this ESU area are considerably high during the summer months. This tendency for high temperature, especially during summer periods, is conducive to many invasive/exotic species that prefer warm water habitats. Disturbance such as these has caused both adult and juvenile Chinook salmon to migrate to and depend on cool refuge areas as observed by spawning and snorkeling surveys.

River traffic, agriculture, and urbanization were identified as a major activity affecting essential habitats in up to three (60 percent) 4th HUC subbasins mentioned above.

Channel modification was identified as a major activity affecting the essential habitats in one out of the five (20 percent) 4th HUC subbasins mentioned above. Past management activities such as splash dams, LWD and rock removal from the channel all lead to channelization, leaving the stream reaches in the mainstem Grande Ronde River Basin functioning well below levels that promote healthy salmonid populations. A lack of LWD, channel sinuosity, and pools characterize many of the rivers throughout this ESU area, such as mainstem Grande Ronde River.

Recreation was identified as a major activity affecting the essential habitats in one out of the five (20 percent) 4th HUC subbasins mentioned above. Past management activities such as recreational vehicle use, have left the stream reaches in the Snake River ESU functioning well below levels that promote healthy salmonid populations.

Damming was identified as a major activity affecting the essential habitats in one out of the five (20 percent) 4th HUC subbasins mentioned above. Snake River spring/summer Chinook must migrate past a series of mainstem Snake and Columbia River hydroelectric dams on their migrations to and from the ocean. The Tucannon River population must migrate through six dams; all other major Snake River drainages supporting spring/summer Chinook production are above eight dams.

Water temperatures throughout many of the major river basins in this ESU area are considerably high during the summer months. This tendency for high temperature during summer periods has a lot to do with dams in the Snake River basins. Dams can impound as well as slow down a profuse amount of water, which then becomes vulnerable to more heating by the sun and as a result creates artificial warm water environment that invasive/exotic species prefer to inhabit. These impacts are one of the major attributions to the decline of Snake River Basin steelhead.

Fire activity and disturbance was identified as a major activity affecting the essential habitats in one out of the five (20 percent) 4th HUC subbasins mentioned above.

Snake River Spring/Summer-Run Chinook ESU

LISTING HISTORY

The Snake River spring/summer Chinook salmon ESU extends into the Umatilla and Wallowa-Whitman National Forests in Oregon. The Snake River spring/summer Chinook salmon ESU, listed as threatened on April 22, 1992 (57 FR 14653, 57 FR No. 107 23458), includes all natural-origin populations in mainstem Snake River and the following subbasins: Tucannon, Grande Ronde, Imnaha, and Salmon Rivers. Some or all of the fish returning to several of the hatchery programs are also listed including those returning to the Tucannon River, Imnaha, and Grande Ronde hatcheries, and to the Sawtooth, Pahsimeroi, and McCall hatcheries on the Salmon River. This ESU includes production areas that are characterized by spring-timed returns, summer-timed returns, and combinations from the two adult timing patterns. Runs classified as spring Chinook are counted at Bonneville Dam beginning in early March and ending the first week of June; runs classified as summer Chinook return to the Columbia River from June through August. Returning fish hold in deep mainstem and tributary pools until late summer, when they emigrate up into tributary areas and spawn. In general, spring type Chinook tend to spawn in higher elevation reaches of major Snake River tributaries in mid- through late August, and summer run Snake River Chinook spawn approximately 1 month later than spring-run fish.

Recovery planning for Snake River spring/summer Chinook is ongoing, and recovery planning status can be reviewed online at: http://research.nwfsc.noaa.gov/trt/trt_columbia.htm

CRITICAL HABITAT

Critical habitat was designated for Snake River spring/summer Chinook salmon on December 28, 1993 (58 FR 68543). Critical habitat is designated to include river and tributary reaches presently or historically accessible (except reaches above impassable natural falls, and Dworshak and Hells Canyon Dams) to Snake River spring/summer Chinook salmon in the Snake River basin. Migratory habitat in the Columbia River mainstem from the mouth to the Snake River confluence is also included. Essential habitat consists of four components: spawning and juvenile rearing, juvenile migration, areas for growth and development to adulthood, and adult migration corridors. Essential features of migration corridors are further defined as: substrate, water quality, water quantity, water velocity, cover/shelter, food (juveniles only), riparian vegetation, space, and safe passage conditions.

LIFE HISTORY

The Snake River spring/summer Chinook ESU includes current runs to the Tucannon River, the Grand Ronde River system, the Imnaha River, Mainstem Snake River and the Salmon River (Matthews and Waples 1991). Some or all of the fish returning to several of the hatchery programs are also listed, including those returning to the Tucannon River, Imnaha River, and Grande Ronde River hatcheries

Spring and summer Chinook from the Snake River basin exhibit stream type life history characteristics (Healey, 1983). Most SR spring/summer Chinook salmon enter individual subbasins from May through September. Eggs are deposited in late summer and early fall, incubate over the following winter and hatch in late winter/early spring of the following year. Juvenile SR spring/summer Chinook salmon emerge from spawning gravels from February through June (Peery and Bjornn 1991). Typically, after rearing in their nursery streams for about one year, smolts begin migrating seaward in April and May (Bugert et al. 1990, Cannamela, 1992). Depending on the tributary and the specific habitat conditions, juveniles may migrate extensively from natal reaches into alternative summer rearing and/or overwintering areas. After reaching the mouth of the Columbia River, spring/summer Chinook salmon probably inhabit nearshore areas before beginning their northeast Pacific Ocean migration. Snake River spring/summer Chinook return from the ocean to spawn primarily as 4 and 5 year old fish, after 2 to 3 years in the ocean. A small fraction of the fish return as 3-year-old 'jacks', heavily predominated by males.

POPULATION TRENDS

Bevan et al (1994) estimated the number of wild adult Snake River spring/summer Chinook salmon in the late 1800s to be more than 1.5 million fish annually. By the 1950s, the population had declined to an estimated 125,000 adults. Escapement estimates indicate that the population continued to decline through the 1970s. Redd count data also show that the populations continued to decline through about 1980.

In the 2003 status review update, NOAA Fisheries modified previous approaches to ESU risk assessment to incorporate VSP criteria (McElhany et al. 2000): abundance, growth rate/productivity, spatial structure, and diversity. The current condition (NOAA Fisheries, 2003) of SR spring/summer Chinook is summarized below:

Abundance:

- Marked increase in 2001 returns for many populations
- 2001 returns for 2 populations encouraging ~ interim recovery target levels
- Remaining populations far below their respective interim targets

Productivity:

- Long term trends, $\lambda < 1$
- Recent trends, buoyed by last two years, λ values are approaching 1

Spatial Structure:

- Widely distributed; much of historic habitat still available (~90 percent)

Diversity:

- Much habitat diversity remains

- No evidence of wide-scale straying by hatchery populations.

Recent Events:

- Removal of Grand Ronde (Rapid River) hatchery stock

Direct estimates of annual runs of historical spring/summer Chinook to the Snake River are not available. Chapman (1986) estimated that the Columbia River produced 2.5 million to 3.0 million spring and summer Chinook per year in the late 1800s. Total spring and summer Chinook production from the Snake Basin contributed a substantial proportion of those returns; the total annual production of Snake River spring and summer Chinook may have been in excess of 1.5 million adult returns per year (Matthews and Waples 1991). Returns to Snake River tributaries had dropped to roughly 100,000 adults per year by the late 1960s (Fulton 1968). Increasing hatchery production contributed to subsequent year's returns, masking a continued decline in natural production.

Aggregate returns of spring-run Chinook (as measured at Lower Granite Dam) showed a large increase over recent year abundances. The 1997-2001 geometric mean return of natural-origin Chinook exceeded 3,700. The increase was largely driven by the 2001 return – estimated to have exceeded 17,000 naturally produced spring Chinook – however, a large proportion of the run in 2001 was estimated to be of hatchery origin (98.4 percent). The summer run over Lower Granite Dam has increased as well. The 1997-2001 geometric mean total return was slightly more than 6,000. The geometric mean return for the brood years for the recent returns (1987-96) was 3,076 (Note: does not address hatchery/wild breakdowns of the aggregate run).

The lowest five-year geometric mean returns for almost all of the individual Snake River spring/summer Chinook production areas were in the 1990s. Sulphur Creek and Poverty Flats production areas had low five-year geometric mean returns in the early 1980s. Many, but not all, production areas had large increases in return year 2001.

In the 1990-2001 data series, long-term trend and long-term growth rate estimates (λ) were below 1 for all natural production data sets, reflecting the large declines since the 1960s. Short-term trends and growth rate estimates were generally positive with relatively large confidence intervals. Grande Ronde and Imnaha data sets had the highest short-term growth rate estimates. Tucannon River, Poverty Flat (did not have 2000 and 2001 included) and Sulphur Creek index areas had the lowest short-term growth rate estimates in the series. Patterns in returns per spawners for stocks with complete age information (e.g., Minam River) show a series of extremely low return rates in the 1990s followed by increases in the 1995-97 brood years (NOAA Fisheries, 2003).

Even though in 2001 and 2002 there were record returns (hatchery and natural origin combined), natural origin fish numbers are in general very low in comparison to historic levels (Bevan et al., 1994). Average returns of adult Snake River spring/summer Chinook salmon (averaging 3,314 over the last 10 years) are also low in comparison to interim target species recovery levels of 41,900 for the Snake River Basin (NMFS, 2002). The low returns amplify the importance that a high level of protection is afforded to each adult Chinook salmon, particularly because a very small percentage of salmon survive to the life stage of a returning, spawning adult, and because these fish are in the final stage of realizing their reproductive potential (approximately 2,000 to 4,000 progeny per adult).

NOAA Fisheries estimates that the median population growth rate for the Snake River spring/summer Chinook ESU as a whole, from 1980-1997, ranges from 0.96, assuming no reproduction by hatchery fish in the wild, to 0.80, assuming that hatchery fish reproduce in the river at the same rate as wild fish (McClure et al., 2003). The proportion of hatchery fish in the Snake River spring/summer Chinook population has been increasing with time; consequently, growth rates for the wild spring/summer Chinook population are overestimated unless corrected for hatchery influence. The degree of hatchery influence is unknown. NOAA Fisheries estimated the risk of absolute extinction considering a range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years is 0.40 for Snake River Chinook (Table B-5 in McClure et al., 2000). At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100 percent), the risk of absolute extinction within 100 years is 1.00 (Table B-6 in McClure et al., 2000).

MAJOR THREATS

The need for an ESA listing of Snake River spring/summer Chinook as “threatened” was attributed to a number of factors. Among them were hydropower development, water withdrawals, irrigation diversions, siltation and pollution, commercial and sport harvest, predators and altered predator dynamics, and influences of hatchery fish. Hydropower development on the Columbia and Snake Rivers are the most well known hydropower factors, but smaller dams, some of which no longer exist (e.g. Lewiston dam on the Clearwater River and Sunbeam dam on the upper Salmon River), also played a role. Water withdrawals, irrigation diversions, and siltation were all important factors affecting spawning and rearing habitat. Predators such as seals and sea lions were contributing factors, as well as altered predator dynamics, such as greatly increased juvenile predation by Northern Pike minnow (*Pytchocheilus oregonensis*) downstream from mainstem Columbia and Snake River dams. Hatchery supplementation had a variety of effects, including genetic introgression, disease introduction, competition, and masking declines in naturally spawning fish.

DISTRIBUTION WITHIN ACTION AREA

National Forest lands are found within seven 4th HUC subbasins identified for this ESU: Imnaha, Lower Grande Ronde River, Lower Snake/Asotin, Lower Snake/Tucannon, Hells Canyon, Upper Grande Ronde River, and Wallowa River. There are 44 streams all together in this ESU that have at least five miles of anadromous fish habitat inside National Forest land. Snake River inside Hells Canyon subbasin (53 miles) and Imnaha River inside Imnaha subbasin (45 miles) are the two rivers that have the highest amount of anadromous fish habitat (as shown in the parentheses) within this ESU.

Imnaha subbasin, approximately 70 percent of which is within Wallowa-Whitman National Forest, has 5 major streams that contain more than five miles of anadromous fish habitat inside the National Forest land, including Imnaha River, Big Sheep Cr., Grouse Cr., Horse Cr., and Lightning Cr. Imnaha River holds roughly 45 miles of anadromous fish habitat inside the National Forest land, but not all of it is currently occupied by spring Chinook salmon.

Lower Grande Ronde River subbasin, approximately 25 percent of which is within Umatilla National Forest and another 25 percent of which is within Wallowa-Whitman National Forest, has 14 major streams that contain more than five miles of anadromous fish habitat inside the National Forest land, including Grande Ronde River, Wenaha River, Butte Cr., Crooked Cr., Joseph Cr., Elk Cr., Swamp Cr., Davis Cr., Cottonwood Cr., Peavine Cr., Mud Cr., McAllister Cr., Tope Cr., and Wildcat Cr. Wenaha River holds roughly 26 miles of anadromous fish habitat inside Umatilla National Forest land and Joseph Cr. holds roughly 26 miles of that inside Wallowa-Whitman National Forest land, but not all of it is currently occupied by spring Chinook salmon.

Lower Snake/Asotin subbasin (with only 70 percent as part of the ESU area, approximately 30 percent of which is within Umatilla National Forest and another 20 percent of which is within Wallowa-Whitman National Forest) has 2 major streams that contain more than five miles of anadromous fish habitat inside the National Forest land, including Snake River and Asotin Creek. Snake River holds roughly 12 miles of anadromous fish habitat inside Wallowa-Whitman National Forest land, and Asotin Creek holds roughly 10 miles of that inside Umatilla National Forest land, but not all of it is currently occupied by spring Chinook salmon.

Lower Snake/Tucannon subbasin, approximately 10 percent of which is within Umatilla National Forest, has 1 major stream, Tucannon River, which contains more than five miles of anadromous fish habitat inside the National Forest land. Tucannon River holds roughly13 miles of anadromous fish habitat inside the National Forest land.

Hells Canyon, approximately 70 percent of which is within Wallowa-Whitman National Forest, has 1 major stream, Snake River, which contains more than five miles of anadromous fish habitat inside the National Forest land. Snake River holds roughly 53 miles of anadromous fish habitat inside the National Forest land.

Upper Grande Ronde River subbasin, approximately 30 percent of which is within Wallowa-Whitman National Forest and another 10 percent of which is within Umatilla National Forest, has 18 major streams that contain more than five miles of anadromous fish habitat inside the National Forest land, including Grande Ronde River, Meadow Cr., Burnt Corral Cr., McCoy Cr., Fly Cr., National Forest Catherine Cr., SF Catherine Cr., Indian Cr., Dark Canyon, Spring Cr., Five Points Cr., Sheep Cr., Clear Cr., Beaver Cr., Limber Jim Cr., Lookingglass Cr., Little Lookingglass Cr., and Phillips Cr. Grande Ronde River holds roughly 22 miles of anadromous fish habitat inside Wallowa-Whitman National Forest land and Lookingglass Cr. holds roughly 7 miles of that inside Umatilla National Forest land.

Wallowa River subbasin, approximately 50 percent of which is within Wallowa-Whitman National Forest, has 4 major streams that contain more than five miles of anadromous fish habitat inside the National Forest land, including Minam River, Little Minam River, Lostine River, and Bear Cr. Minam River holds roughly 33 miles of anadromous fish habitat inside the National Forest land, but not all of it is currently occupied by spring Chinook salmon.

HABITAT CONDITIONS IN ACTION AREA

The following statements from McClure and Stein (2004) show the trend on the current conditions for streams that hold some areas of Forest Service land. They classified major rivers and streams within the Columbia Basin into 3 categories; one being "highly compromised habitat" with 4-7 tributary habitat factors identified as impaired, two being "moderately compromised habitat" with 1-3 tributary habitat factors identified as impaired, and three being "minimally compromised habitat" with no tributary habitat factors identified as impaired. Tucannon River, Wallowa/Lostine River, and Catherine Creek were labeled as "highly compromised habitat," Asotin Creek, Upper Grande Ronde River, and Big Sheep Creek were labeled as "moderately compromised habitat," and finally, Minam River and Imnaha River were labeled as "minimally compromised habitat."

McClure and Stein also ranked major streams within each ESU in the Columbia basin in relation to various habitat factors on a scale of 1 to 10; 1 having the lowest, whereas 10 having the highest probability of being impaired. In relation to chemical toxicity, Asotin Creek (9), Tucannon River (9), and Catherine Creek (9) had the highest probability for degradation among the Action Area streams, followed by Wallowa/Lostine Rivers (8).

As far as forest sediment is concerned, Lookingglass Cr (10) had the highest probability of being impaired for that population among the Action Area streams, followed by Upper Grande Ronde River (9), Catherine Cr. (8), and Asotin Creek (7).

As stated by McClure and Stein (2004), heavy conversion of historical floodplain area to agriculture/urban land use has occurred on Upper Grande Ronde River (90-100 percent) as well as Wallowa River and Tucannon River (70-80 percent). As far as the rate of flow diversion for irrigation is concerned, Wallowa River (90-100 percent) as well as Upper Grande Ronde River and Lower Grande Ronde River (70-80 percent) have seen the most severe withdrawal. In terms of the entrainment potential predicted from the number of diversions encountered, Upper Grande Ronde River (90-100 percent) as well as Wallowa River and Lower Snake/Tucannon (70-80 percent) had the highest susceptibility. On the other hand, there were streams that had comparatively less impact from flow diversion; for instance, Minam River population had only one diversion and Hell's Canyon subbasin did not have any flow diverted. Wenaha River population had 304 diversions, which is actually on the low range compared to all of the other ESU areas.

Since the mid-1990s, small-scale natural stock supplementation studies and captive breeding efforts have been initiated in the Snake River basin. Historically, releases from broodstock originating outside of the basin have constituted a relatively small fraction of the total release into the basin. Concerns for the high incidence of BKD disease in Snake Basin hatchery facilities were also identified (Myers et al. 1998). Tucannon and Asotin Creeks have each seen over 25 percent (5-year average) hatchery-origin fish amongst their natural spawners.

Many of the major rivers that are part of the Action Area in this ESU, such as Grande Ronde River (upper mainstem), Tucannon River, and Catherine Creek, are categorized as highly compromised habitat. Most of them also have impairment issues related to toxic water quality and forest sedimentation. Floodplain conversion for agriculture and urbanization has taken place heavily throughout the ESU area, and the rate of flow diversion is high for many of the major rivers holding sizeable steelhead populations.

Major activities that affect the primary constituent elements (i.e. essential habitats) of this ESU population are the same as those discussed above for the Snake River Fall run Chinook.

Livestock grazing was identified as a major activity affecting the essential habitats in five out of the five (100 percent) 4th HUC subbasins mentioned above. Past management activities such as livestock grazing, have left the stream reaches in the Upper Grande Ronde River Basin functioning well below levels that promote healthy salmonid populations.

Timber harvest was identified as a major activity affecting the essential habitats in four out of the five (80 percent) 4th HUC subbasins mentioned above.

Irrigation/water withdrawal was identified as a major activity affecting the essential habitats in four out of the five (80 percent) 4th HUC subbasins mentioned above. Water temperatures throughout many of the major river basins in this ESU area are considerably high during the summer months. This tendency for high temperature during summer periods is abetted by flow diversion and irrigation partly due to the fact that it requires less heat to warm up less amount of water. Also, diverted flow that returns back to a stream usually comes back warmer than it originally was. All of these effects have been instrumental to the decline of Snake River Basin steelhead.

Agriculture was identified as a major activity affecting the essential habitats in four out of the five (80 percent) 4th HUC subbasins mentioned above.

Road construction/maintenance was identified as a major activity affecting the essential habitats in three out of the five (60 percent) 4th HUC subbasins mentioned above.

Invasive species was identified as a major activity affecting the essential habitats in five out of the five (100 percent) 4th HUC subbasins mentioned above. Water temperatures throughout many of the major river basins in this ESU area are considerably high during the summer months. According to data obtained by the USFS and ODEQ in 1998, temperatures in the mainstem Grande Ronde River upstream of the project site annually exceed 26°C. This tendency for high temperature, especially during summer periods, is conducive to many invasive/exotic species that prefer warm water habitats. Disturbance such as these has caused both adult (Snake River spring/summer) and juvenile Chinook salmon to migrate to and depend on cool refuge areas as observed by spawning and snorkeling surveys.

Urbanization was identified as a major activity affecting the essential habitats in two out of the five (40 percent) 4th HUC subbasins mentioned above.

River traffic was identified as a major activity affecting the essential habitats in three out of the five (60 percent) 4th HUC subbasins mentioned above.

Channel modification was identified as a major activity affecting the essential habitats in two out of the five (40 percent) 4th HUC subbasins mentioned above. Past management activities such as splash dams, LWD and rock removal from the channel all lead to channelization, leaving the stream reaches in the Upper Grande Ronde River Basin functioning well below levels that promote healthy salmonid populations. The formation of large, unstable gravel bars found on Upper Grande River, for example, indicate that sediment routing processes in the area are out of balance. A lack of LWD, channel sinuosity, and pools characterize many of the rivers throughout this ESU area, such as Upper Grande Ronde River.

Recreation was identified as a major activity affecting the essential habitats in one out of the five (20 percent) 4th HUC subbasins mentioned above. Past management activities such as recreational vehicle use, have left the stream reaches in the Upper Grande Ronde River Basin ESU functioning well below levels that promote healthy salmonid populations.

Damming was identified as a major activity affecting the essential habitats in one out of the five (20 percent) 4th HUC subbasins mentioned above. Snake River spring/summer Chinook must migrate past a series of mainstem Snake and Columbia River hydroelectric dams on their migrations to and from the ocean. The Tucannon River population must migrate through six dams; all other major Snake River drainages supporting spring/summer Chinook production are above eight dams.

Water temperatures throughout many of the major river basins in this ESU area are considerably high during the summer months. This tendency for high temperature during summer periods has a lot to do with dams in the Snake River basins. Dams can impound as well as slow down a profuse amount of water, which then becomes vulnerable to more heating by the sun and as a result creates artificial warm water environment that invasive/exotic species prefer to live in. These impacts are one of the major attributions to the decline of Snake River Basin steelhead.

Fire activity and disturbance was identified as a major activity affecting the essential habitats in two out of the five (20 percent) 4th HUC subbasins mentioned above.

Snake River Sockeye ESU

LISTING HISTORY

The only extant population of the anadromous form of Snake River Sockeye is the Redfish Lake population. Neither the Wallowa Whitman nor the Umatilla administer lands are contained within the Snake River Sockeye ESU, which is located in Southwest Idaho. However, the Snake River Sockeye does use Columbia River and Snake River within Oregon and Washington as a migration corridor to and from their ESU area in Idaho. The Snake River sockeye salmon ESU was listed as endangered on November 20, 1991, (56 FR 58619) and includes populations of sockeye salmon from the Snake River basin, Idaho (extant populations occur only in the Salmon River subbasin). Under NOAA Fisheries' interim policy on artificial propagation (58 FR 17573), the progeny of fish from a listed population that are propagated artificially are considered part of the listed species and are protected under ESA. Thus, although not specifically designated in the 1991 listing, Snake River sockeye salmon produced in the captive broodstock program are included in the listed ESU. Recovery planning for Snake River sockeye is ongoing, and recovery planning status can be reviewed online at: http://research.nwfsc.noaa.gov/trt/trt_columbia.htm

CRITICAL HABITAT

Designated critical habitat (58 FR 68543, December 28, 1993) extends from the mouth of the Columbia River upstream to the Snake River confluence, up the Snake River to the Salmon River confluence, and up the Salmon River mainstem and tributaries to the five lakes still accessible (Stanley, Redfish, Yellow Belly, Pettit, and Alturas), and includes the lakes and their inlet creeks. Essential habitat consists of four components: spawning and juvenile rearing, juvenile migration, areas for growth and development to adulthood, and adult migration corridors. Essential features of migration corridors are further defined as: substrate, water quality, water quantity, water velocity, cover/shelter, food (juveniles only), riparian vegetation, space, and safe passage conditions. Adult Snake River sockeye salmon enter the Columbia River in late spring and early summer and reach the spawning lakes in late summer and early fall. Smolts begin emigration in April, and are present in the Columbia River estuary through the early summer months.

LIFE HISTORY

Sockeye salmon occur in two forms: the anadromous sockeye and the nonanadromous kokanee. Kokanee originated as residual sockeye that did not emigrate to the ocean or undergo smoltification (Meehan and Bjornn 1991). Kokanee spend their entire lives in the lake environment, although some can produce anadromous offspring. In the case of Snake River sockeye, adults typically enter fresh water during June and July. Arrival at Redfish Lake, which now supports the only remaining run of Snake River sockeye salmon, peaks in August, and spawning occurs primarily in October (Bjornn et al. 1968). Eggs hatch in the spring between 80 and 140 days after spawning. Fry remain in the gravel for 3 to 5 weeks, emerge from April through May, and move immediately into the lake. Once there, juveniles feed on plankton for 1 to

3 years before they migrate to the ocean (Bell 1986). Migrants leave Redfish Lake during late April through May (Bjornn et al. 1968) and travel almost 900 miles to the Pacific Ocean. Smolts reaching the ocean remain inshore or within the influence of the Columbia River plume during the early summer months. Later, they migrate through the northeast Pacific Ocean (Hart 1973, Hartt and Dell 1986). Snake River sockeye salmon spend 2 to 3 years in the Pacific Ocean and return in their fourth or fifth year of life.

POPULATION TRENDS

In the 2003 status review update, NOAA Fisheries modified previous approaches to ESU risk assessment to incorporate VSP criteria (McElhany et al., 2000): abundance, growth rate/productivity, spatial structure, and diversity. The current condition (NOAA Fisheries, 2003) of SR sockeye is summarized below:

Abundance:

- 16 naturally produced adults in the last decade
- Captive broodstock program initiated in 1991 has provided temporary rescue from extinction

Productivity:

- Return of 257 hatchery adults in 2000, while hatchery returns in 2000 and 2001 averaged about 25
- Natural population trends are not encouraging

Spatial Structure:

- Historically occurred in 4 lakes within the Stanley Basin, and up to 3 additional lakes across Snake River drainage
- Redfish Lake is the only extant population

Diversity:

- Residual-type sockeye in Redfish Lake
- Possible remnant gene pools in Stanley and Petit Lakes

Escapement of sockeye salmon to the Snake River has declined dramatically in the last several decades, primarily because the construction of hydropower dams made it difficult for sockeye salmon to have access to traditional spawning areas (Gustafson et al., 1997). Adult counts at Ice Harbor Dam declined from 3,170 in 1965 to zero in 1990 (ODFW and WDFW, 1999). The Idaho Department of Fish and Game counted adults at a weir in Redfish Lake Creek during 1954 through 1966; adult counts dropped from 4,361 in 1955 to fewer than 500 after 1957 (Bjornn et al., 1968). A total of 16 wild sockeye salmon returned to Redfish Lake between 1991 and 1999. During 1999, seven hatchery-produced, age-3 adults returned to the Sawtooth Hatchery. Three of these adults were released to spawn naturally, and four were taken into the IDFG captive broodstock program. In 2000, 257 hatchery-produced, age-4 sockeye salmon returned to the Stanley basin (weirs at the Sawtooth Hatchery and Redfish Lake Creek). Adults numbering 243 were handled and redistributed to Redfish (120), Alturas (52), and Pettit (28) lakes, with the remaining 43 adults incorporated into the IDFG captive broodstock program. In 2001, 36 adult sockeye were counted at Lower Granite Dam (FPC, 2002).

Low numbers of adult Snake River sockeye salmon preclude a quantitative analysis of the status of this ESU. However, because only16 wild and 264 hatchery-produced adult sockeye returned to the Stanley basin between 1990 and 2000, and although 257 hatchery adults returned in 2000, only 26 hatchery adults returned in 2001 and 22 in 2002. NOAA Fisheries considers the status of this ESU to be dire under any criteria.

Sockeye survival from smolt to adult has declined by an estimated 74-81 percent since the early 1960's, correlated with hydropower development. NOAA Fisheries has not estimated the risk of absolute extinction for the Snake River sockeye salmon (though the estimates were made for the other listed species, see below) because this ESU is currently at extremely low abundances and maintained through a captive broodstock program (McClure et al., 2000).

THREATS

Snake River sockeye salmon have declined dramatically as a result of fishery management policy, overharvest, hydropower-caused mortality, and irrigation water withdrawals.

DISTRIBUTION WITHIN ACTION AREA

The only extant population of anadromous form of Snake River Sockeye is the Redfish Lake population. Although the Action Area for this BA is outside the Snake River Sockeye ESU, migratory habitat in the Snake River is within the Action Area. Sockeye salmon pass Bonneville Dam from June 1 to July 31, and Lower Granite Dam from June 25 to August 30, on their almost 900-mile migration to spawning grounds of the upper Salmon River.

Middle Columbia River Steelhead DPS

LISTING HISTORY

Wallowa-Whitman, Umatilla, and Malheur, National Forests are located within the Middle Columbia River Steelhead DPS in Oregon and Washington. The Middle Columbia River steelhead DPS was listed as threatened on March 25, 1999 (64 FR 14517). The Middle Columbia River DPS encompasses Columbia River basin and tributaries upstream from and exclusive of the Wind River in Washington and the Hood River in Oregon, to and including the Yakima River in Washington.

Recovery planning for Middle Columbia River steelhead is ongoing, and recovery planning status can be reviewed online at: http://research.nwfsc.noaa.gov/trt/trt_columbia.htm

CRITICAL HABITAT

Critical habitat was designated for Middle Columbia River steelhead on February 16, 2000 (65 FR 7764), but was vacated by court order on April 30, 2002. Critical Habitat for this species was proposed again on December 14, 2004 (69 FR 74572) and designated on September 2, 2005 (70FR 52630) with an effective date of January 2, 2006.

LIFE HISTORY

Major drainages in this DPS are the Deschutes, John Day, Umatilla, Walla-Walla, Yakima, and Klickitat river systems. Almost all steelhead populations within this DPS are summer-run fish, the exceptions being winter-run components returning to the Klickitat and Fifteen Mile Creek watersheds. A balance between 1- and 2-year-old smolt emigrants characterizes most of the populations within this DPS. Adults return after 1 or 2 years at sea.

Most fish in this DPS smolt at two years and spend one to two years in salt water before re-entering fresh water, where they may remain up to a year before spawning. Age-2-ocean steelhead dominate the summer steelhead run in the Klickitat River, whereas most other rivers with summer steelhead produce about equal numbers of both age-1- and 2-ocean fish. Juvenile life stages (i.e., eggs, alevins, fry, and parr) inhabit freshwater/riverine areas throughout the range of the DPS. Parr usually undergo a smolt transformation as 2-year-olds, at which time they migrate to the ocean. Subadults and adults forage in coastal and offshore waters of the North Pacific prior to returning to spawn in their natal streams. A non-anadromous form of *O. mykiss* (redband trout) co-occurs with the anadromous form in this DPS, and juvenile life stages of the two forms can be very difficult to differentiate. In addition, hatchery steelhead are also distributed within the range of this DPS.

Recent estimates of the proportion of natural spawners of hatchery origin range from low (Yakima, Walla Walla, and John Day Rivers) to moderate (Umatilla and Deschutes Rivers). Most hatchery production in this DPS is derived primarily from within-basin stocks. The John Day River system is a large river basin supporting an estimated five steelhead populations. The Yakima River system also includes four to five populations.

POPULATION TRENDS

In the 2003 status review update, NOAA Fisheries modified previous approaches to DPS risk assessment to incorporate VSP criteria: abundance, growth rate/productivity, spatial structure, and diversity. The current condition (NOAA Fisheries, 2003) of Middle Columbia River steelhead is summarized below:

Abundance:

- Large increases 2000-2002
- Deschutes, Upper John Day in excess of their interim recovery targets
- Umatilla nearing its interim recovery target
- Yakama (major drainage and historical production center) only 10 percent of interim recovery targets
- Residents very abundant (> anadromous)

Productivity:

- Long-term trends for most populations declining

- Long-term productivity is below replacement for 66 percent of populations
- Short-term productivity is above replacement for 42 percent of populations

Spatial Structure:

- Historical production center (Yakama) still depressed.

Diversity:

- Unknown what proportion of natural spawners are out-of-DPS strays

With some exceptions, the recent 5-year average (geometric mean) abundance for natural steelhead within this DPS was higher than levels reported in the 1999 status review. Returns to the Yakima River, the Deschutes River, and to sections of the John Day River system are up substantially in comparison to 1992-1997. Yakima River returns are still substantially below interim target levels and estimated historical return levels, with the majority of spawning occurring in one tributary, Satus Creek (Berg, 2001). The recent 5-year geometric mean return of the natural-origin component of the Deschutes River run has exceeded interim recovery target levels (NMFS, 2002). Recent 5-year geometric mean annual returns to the John Day basin are generally below the corresponding mean returns reported in previous status reviews. However, each of the major production areas in the John Day system has shown upward trends since the 1999 return year.

Recent year (1999-2001) redds-per-mile estimates of winter steelhead escapement in Fifteen Mile Creek are also up substantially relative to the annual levels in the early 1990s.

Returns to the Touchet River are lower that the previous 5-year average. Trend or count information for the Klickitat River winter steelhead run are not available but current return levels are believed to be below interim recovery target levels (NOAA Fisheries, 2002).

NOAA Fisheries (2003) reports the median annual rate of change in abundance since 1990 to be +2.5 percent, with individual trend estimates ranging from -7.9 percent to +11 percent. The same basic pattern is also reflected in population growth rate estimates for the production areas. The median short-term (1990-2001) annual population growth rate estimate was 1.045, assuming that hatchery fish on the spawning grounds did not contribute to natural production. Assuming that potential hatchery spawners contributed at the same rate as natural-origin spawners resulted in lower estimates of population growth rates. The median short-term growth rate under the assumption of equal hatchery/natural origin spawner effectiveness was 0.967.

Long-term trend estimates were also calculated using the entire length of the data series available for each production area. The median estimate of long-term trend over the 12 indicator data sets was -2.1 percent per year (-6.9 to +2.9), with 11 of the 12 being negative. Long-term annual population growth rates were also negative. The median long-term growth rate was 0.98 under the assumption that hatchery spawners do not contribute to production, and 0.97 under the assumption that both hatchery and natural origin spawners contribute equally.

All of the production area trends available for this DPS indicate relatively low escapement levels in the 1990s. For some of the data sets, earlier annual escapements were relatively high compared to the stream miles available for spawning and rearing. In those cases, it is reasonable to assume that subsequent production may have been influenced by density-dependent effects. In addition, there is evidence of large fluctuations in marine survival for Columbia River and Oregon coastal steelhead stocks (Cooney, 2000, Chilcote, 2001). Spawner return data sets for Mid-Columbia production areas are of relatively short duration. As a result of these considerations, projections based on simple population growth rate trends or on stock recruit relationships derived by fitting recent year spawner return data should be interpreted with caution.

THREATS

The Middle Columbia River steelhead “threatened” listing has been attributed to a number of factors. Among them are dams, recreational and incidental commercial fishing, habitat modification, hatchery influences, and non-point source pollution.

Hydropower and other dams on the mainstem Columbia, Deschutes, White Salmon River and smaller river systems disrupt both upstream and downstream migrations and reduce historically available habitat. Impacts from inland recreational fishing can be important, particularly during low flow or drought periods, when reduced habitat availability concentrates fish. Steelhead are not generally targeted in commercial fisheries, but incidental harvest in mixed-stock sport and commercial fisheries in the Columbia River may exceed 30 percent of some listed populations. Agriculture, cattle grazing, and to a lesser degree, mining, and forestry have degraded and simplified habitat.

Hatchery facilities are located in a number of drainages within the geographic area of this DPS, although there are also subbasins with little or no direct hatchery influence. One recent area of concern is the increase in the number of Snake River hatchery (and possibly wild) steelhead that stray and spawn naturally within the Deschutes River subbasin. In addition, one of the main threats cited in NOAA Fisheries’ listing decision for this species was the fact that hatchery fish constituted a steadily increasing proportion of the natural escapement in the Middle Columbia River steelhead DPS (FPC, 2000; Brown, 1999).

The John Day system has not been supplemented with hatchery steelhead, and out-of-basin straying is believed to be low. Hatchery production in the Yakima system was relatively limited historically and has been phased out since the early 1990s. The Umatilla, the Walla-Walla, and the Deschutes river systems each have ongoing hatchery production programs based on locally derived broodstocks.

DISTRIBUTION WITH ACTION AREA

National Forest lands are found within five 4th HUC subbasins identified for this DPS: Walla Walla, Umatilla, North Fork John Day, Middle Fork John Day, and Lower John Day. There are 65 streams all together in this DPS that have at least five miles of anadromous fish habitat inside the National Forest land. The North Fork John Day River inside North Fork John Day subbasin is the river that has the highest amount of anadromous fish habitat within the action area.

The Walla Walla subbasin, of which approximately 10 percent is within Umatilla National Forest, has four major streams that contain more than five miles of anadromous fish habitat inside the National Forest land, including National Forest Walla Walla River, SF Walla Walla River, National Forest Touchet River, and Mill Cr. The SF Walla Walla River holds roughly 13 miles of anadromous fish habitat inside the National Forest land.

The Umatilla subbasin, of which approximately 15 percent is within Umatilla National Forest, has six major streams that contain more than five miles of anadromous fish habitat inside the National Forest land, including National Forest Umatilla River, SF Umatilla River, Ryan Cr., Meacham Cr., National Forest Meacham Cr., and Pearson Cr. Meacham Cr. holds roughly 15 miles of anadromous fish habitat inside the National Forest land.

The North Fork John Day subbasin, of which approximately 50 percent is within Umatilla National Forest, another 10 percent is within Wallowa-Whitman National Forest, and another 5 percent is within Malheur National Forest, has 20 major streams that contain more than five miles of anadromous fish habitat inside the National Forest land, including National Forest John Day River, Big Wall Cr., Wilson Cr., Skookum Cr., Ditch Cr., Mallory Cr., Potamus Cr., Camas Cr., Fivemile Cr., Hidaway Cr., Granite Cr., Clear Cr., Olive Cr., Lake Cr., Crane Cr., Desolation Cr., SF Desolation Cr., EF Meadow Brook Cr., Winam Cr., and Big Cr.

National Forest John Day River holds roughly 33 miles of anadromous fish habitat inside Umatilla National Forest land and 10 miles inside Wallowa-Whitman National Forest land.

Lower John Day subbasin, less than 5 percent of which is within Umatilla National Forest or Ochoco National Forest, does not have any major streams that contain more than five miles of anadromous fish habitat inside the National Forest land.

HABITAT CONDITIONS WITHIN ACTION AREA

Many of the major rivers that are part of the Action Area in this DPS, such as Umatilla River, Walla Walla River, and Touchet River, are categorized as highly compromised habitat. Most of them also have impairment issues related to toxic water quality and forest sedimentation. Floodplain conversion for agriculture and urbanization has taken place heavily throughout the DPS area, and the rate of flow diversion is high for many of the major rivers holding sizeable steelhead populations.

Middle Columbia River Steelhead DPS contains as many as 11 major activities that affect the primary constituent elements (i.e. essential habitats) of the DPS populations. Those are timber harvest, road building/maintenance, fire activity, livestock grazing, agriculture, irrigation/water withdrawal, channel modification, urbanization, mineral mining, damming, and river traffic, in order of frequency that they appear in the basin. Recreation was added to the discussion of “major effects from the past” because the literature (other BAs, WA, etc.) supports their attribution as well.

The degradation of spawning and rearing habitat has also had a major impact on the declining Spring steelhead populations. High summer water temperatures limit juvenile steelhead distribution here.

Streams in the middle and upper North Fork John Day drainage generally have good channel structure, riparian and instream cover, and water quality and quantity. Consequently, the subbasin contains approximately 72 miles of spring Chinook spawning and rearing habitat and 700 miles of steelhead habitat.

In the last two decades, in recognition of effects of timber harvest on stream resources, techniques have changed to reduce direct impacts to the ground. Recent amendments to the Forest Plans provide for riparian focus buffers for all types of streams. Since May 1992, clear-cutting has been eliminated as a timber harvest method, and partial cutting has been modified to reserve additional medium and large-sized trees to enhance biodiversity.

Forest managers recognize the potential impacts of forest management and design practices to reduce impacts because of new operations. However, unique or previously impacted areas may be intolerant to any additional increases in sediment or reductions in forest canopy. Impacts from previous activities (legacy effects) may limit current management options.

Historical road building and road system development created detrimental impacts to stream systems and fish habitats and may have played a role in declines of steelhead by affecting spawning gravel habitats through siltation. However, increased awareness and policy changes coupled with improved technology and methods to reduce siltation from road systems have been a great improvement in minimizing impacts the last several years. From a historical perspective, there has been substantial improvement and efforts have been made to find and implement ways to minimize and/or reduce sedimentation and other impacts related to roads. In addition, road densities have been decreased throughout the Forest. Culvert installations are better maintained and improved to minimize siltation and from becoming barriers to fish passage. The road situation as it existed historically, when steelhead declines occurred, has been improved since.

Present day grazing practices utilizing new research techniques in riparian systems have provided the knowledge to greatly reduce riparian impacts and to provide methods to improve riparian ecosystems within grazing systems. These activities will require analysis and mitigation measures which will result in reduced effects.

Between 1965 and 1970 range monitoring data indicated range condition recovery. By 1980, these allotments had updated allotment management plans with new range analysis confirming upward trend on both uplands and meadow areas. In the early 1990s the Forests shifted its strategy to corridor fence on selected portions of streams to help mitigate cattle disturbance on areas of unacceptable condition.

The following statements from McClure and Stein (2004) show the trend on the current conditions for streams that hold some areas of Forest Service land. They classified major rivers and streams within the Columbia Basin into three categories; one being “highly compromised habitat” with 4-7 tributary habitat factors identified as impaired, two being “moderately compromised habitat” with 1-3 tributary habitat factors identified as impaired, and three being “minimally compromised habitat” with no tributary habitat factors identified as impaired. Umatilla River, Walla Walla River, and Touchet River, were labeled as “highly compromised habitat,” North Fork John Day River, and Rock Cr. were labeled as “moderately compromised habitat.”

McClure and Stein also ranked major streams within each DPS in the Columbia basin in relation to various habitat factors on a scale of 1 to 10; 1 having the lowest, whereas 10 having the highest probability of being impaired (as shown in the parentheses below). In relation to chemical toxicity, Walla Walla River (10) and Touchet River (10) had the highest probability for degradation among the Action Area streams, followed by the Umatilla River (9). As far as forest sediment is concerned, the North Fork John Day River (9) had the highest probability of being impaired for that population among the Action Area streams.

As stated by McClure and Stein (2004), heavy conversion of historical floodplain area to agriculture/urban land use has occurred on the Walla Walla and the Umatilla rivers. As far as the rate of flow diversion for irrigation is concerned, the Umatilla and Walla Walla have seen the most severe withdrawal. In terms of entrainment potential predicted from the number of diversions encountered, the Umatilla and Wallowa Rivers (70-80 percent) had the highest susceptibility. In addition, Walla Walla had as many as 964 diversions. Umatilla River has one of the greatest proportions of stream kilometers completely blocked by anthropogenic barriers.

John Day River (25 percent of which is Forest Service land) summer run steelhead are composed entirely of native stocks. However, hatchery fish do occasionally stray into the John Day River basin from the Columbia River. The Middle Fork John Day River has historically contributed approximately 23 percent of the total John Day River basin run. This John Day River steelhead run is considered the healthiest wild run in the Middle Columbia DPS. Steelhead use most moderately sized tributaries to the Middle Fork John Day River for both spawning and rearing. Consequently, the North Fork John Day River subbasin contains approximately 700 miles of steelhead habitat.

Floods in the Middle Columbia River basin area result from two different occurrences. The most common is from spring snow melt runoff, affected to varying degrees by rains. This high runoff varies in time by specific location, elevation, and temperatures, but usually occurs during the period of April and May on the main rivers and in June on small creeks in the higher mountains. The second cause of flooding is cloud burst storms that, while relatively infrequent, can be extreme events on a local scale.

Fire activity and disturbance was identified as a major activity affecting the essential habitats in eleven out of the eleven (100 percent) 4th HUC subbasins mentioned above. Fire suppression along with other activities has played a critical role in alteration of the FS land in Middle Columbia Basin. Later successional stages of forests have been greatly increased by the elimination of natural fire from the ecosystem. As a result, shade tolerant later successional species such as grand fir, subalpine fir, Engelmann spruce, and Douglas fir increased in frequency and coverage, at the expense of shade intolerant species such as ponderosa pine, western larch, and lodgepole pine. Past management activities and successful wildfire control have caused a shift in forest species composition and stocking levels, predisposing them to large scale mortality. Recent recurrent drought conditions have further disposed these forests to increased wildfire incidence and intensity, resulting in significant negative impacts on water quality and fish habitat.

Timber harvest was identified as a major activity affecting the essential habitats in eleven out of the eleven (100 percent) 4th HUC subbasins mentioned above. Logging along with other activities has played a critical role in alteration of the FS land in Middle Columbia Basin. Later successional stages of forests have been greatly increased by the high-grade and selective harvesting which took place between 1950 and the early 1970's. As a result, shade tolerant later successional species such as grand fir, subalpine fir, Engelmann spruce, and Douglas fir increased in frequency and coverage, at the expense of shade intolerant species such as ponderosa pine, western larch, and lodgepole pine. More recently, regeneration timber harvesting and subsequent reforestation plantings have favored ponderosa pine, Douglas fir, and western larch. Areas of weed infestation are often associated with timber regeneration cuts. Increased logging in the forested uplands probably has contributed partially to the declining steelhead populations in the North Fork John Day Subbasin (60 percent under FS land).

Timber has been managed for the past several decades in the subbasin. Timber harvest on National Forest land has occurred as part of the historic mining activities since the 1800's. Timber was used to provide mine timber and lumber for support facilities. The majority of timber harvest activity has occurred from the 1970s to the present. An estimated 14,000 acres have been harvested with sales of various sizes from 1987 to 1997. While management direction has changed through time, in general, past management has sought to harvest mature trees, reduce individual stand stocking, favor certain tree species over others, and salvage damaged and high-risk trees. Other timber management activities that have occurred throughout the subbasin are:

noncommercial thinning, pruning, site preparation, tree planting, animal control, and tree improvement.

Road building/maintenance was identified as a major activity affecting the essential habitats in eleven out of the eleven (100 percent) 4th HUC subbasins mentioned above. Areas of weed infestation are often associated with road construction. Road building in the forested uplands probably have contributed partially to the declining steelhead populations in the North Fork John Day Subbasin (60 percent under FS land). Open and closed roads total 1,203 miles within this Subbasin. The total road density for the National Forest is 2.6 miles per square mile (3.9 miles per square mile in the non-Wilderness). Historical road building and road system development created detrimental impacts to stream systems and fish habitats and may have played a role in declines of steelhead by affecting spawning gravel habitats through siltation.

Livestock grazing was identified as a major activity affecting the essential habitats in eleven out of the eleven (100 percent) 4th HUC subbasins mentioned above. Cattle and sheep grazing along with other activities have played a critical role in alteration of the Middle Columbia Basin. Heavy grazing by horses, sheep, and cattle at the turn of the century tended to increase the early stages of forbs and grasses. Due to this, over the last century, the floristic composition of the forest has changed greatly. Areas of weed infestation are often associated with past grazing practices.

Portions of the National Forest System lands are available for domestic livestock grazing under the direction of the Forest Plans. The North Fork John Day subbasin contains all or portions of twenty-four grazing allotments for domestic cows and sheep that are administered by the Umatilla, Malheur, and Wallowa-Whitman National Forests. Domestic livestock grazing on National Forest allotments has occurred since the late 1800s. By 1965 these allotments had management plans with objectives focused on upland vegetation only. Between 1965 and 1970 range monitoring data indicated range condition recovery. By 1980, these allotments had updated allotment management plans with new range analysis confirming upward trend on both uplands and meadow areas. In the early 1990s the Forests shifted its strategy to corridor fence on selected portions of streams to help mitigate cattle disturbance on areas of unacceptable condition.

Agriculture was identified as a major activity affecting the essential habitats in eleven out of the eleven (100 percent) 4th HUC subbasins mentioned above. Irrigation/water withdrawal was identified as a major activity affecting the essential habitats in nine out of the eleven (82 percent) 4th HUC subbasins mentioned above.

Channel modification was identified as a major activity affecting the essential habitats in six out of the eleven (55 percent) 4th HUC subbasins mentioned above. Many systems exhibit impacts from historical activities such as splash damming, skidding and debris removal, which often operated within the stream channel.

Urbanization was identified as a major activity affecting the essential habitats in six out of the eleven (55 percent) 4th HUC subbasins mentioned above.

Mineral mining was identified as a major activity affecting the essential habitats in four out of the eleven (36 percent) 4th HUC subbasins mentioned above. Euro-American settlement and exploitation of the area began in the mid 1800's and intensified during the 1860's with the discovery of gold. Locally heavy alteration to the landscape and hydrology occurred due to hydraulic mining and attendant ditch building and use, later followed by hard rock mining and dredging. Mineral extraction and other activities, such as improved transportation, led to relatively large settled human populations. Areas of weed infestation are often associated with activities that expose mineral soils.

In the Granite Creek system (90 percent under FS land), a tributary to North Fork John Day River, past mining operations have left their imprint, heavily impacting many acres. Some locations remain unproductive today because these impacts occurred on steep or uneven terrain, which has been left without topsoil or vegetation. Water quality continues to be affected by leaking and leaching of toxic effluent from inactive mines. Some historically productive spawning and rearing habitat remains degraded from dredging, which took place in the 1930s.

The Granite Mining District has produced significant amounts of gold and silver. About 45 percent of the production has been from placer deposits and 55 percent from lode mines. Placer mining probably started in the 1860's and intensive lode mining probably began in the 1880's. About 50 miles of the North Fork John Day River and its tributaries have been extensively placer mined; small-scale placer mining continues today. The Wallowa-Whitman administered portion of the North Fork John Day Watershed has mines that were all hydraulically mined. Past and present aggregate mining within the watershed has included rock quarries, sand and gravel pits, and borrow pits located on Forest Service, State, County, BLM, and private lands.

The greatest impacts to the land were from the floating bucket line dredges and smaller land based "doodle bugs." These represent some of the most visible alterations to the landscape, and are a major factor in the changed riparian condition present today. The riparian potential of some dredged streams remains severely limited due to the loss of trees, shrubs, soil, and the degree of stream channel entrenchment.

Today, there are hundreds of active mine operations. More than fifty of them use mechanized equipment in addition to hand tools and dredges. There is only a small percentage of ground involved in present day operations that was not impacted historically.

The minerals program consisting of locatable, leaseable, and salable mining, quarries, recreational extraction, and drilling operations occur mostly in uplands. Quarries are used mostly for road maintenance and construction needs. Quarry activity occurs year round. Recreational extraction includes rock-hounding, gold panning, and dredging. New exploration proposals must be consulted on separately.

Mining actions that include suction dredging, pick and shovel, and mechanized within a RHCA can have adverse effects to steelhead population levels. The pick and shovel operations can have adverse effects because there is no federal regulations currently governing time of year and location they can operate. Suction dredging can cause young steelhead to be attracted to the operation as food sources are stirred from the gravel. Other forms and locations of mining operations are covered with operating plans or some form of permit regulatory control and/or bonding. There are some mining actions that can degrade population indicators and these have been ongoing actions for many years.

Damming was identified as a major activity affecting the essential habitats in two out of the eleven (18 percent) 4th HUC subbasins mentioned above. Declines in spring Chinook production within North Fork John Day River subbasin are primarily attributable to dam mortality. The Pete Mann ditch starts in West Fork Clear Creek and crosses other creeks. The ditch is a physical barrier for fish movement throughout the subwatersheds. The John Day River remains one of the least restricted of the major northwest rivers, because fish have to pass only three dams on the Columbia before entering the mouth of the John Day River.

River traffic was identified as a major activity affecting the essential habitats in one out of the eleven (9 percent) 4th HUC subbasins mentioned above.

Recreation was not identified as a major activity affecting the essential habitats in any of the eleven 4th HUC subbasins mentioned above, yet effects of recreation persist. Poaching activities in the forested uplands probably have contributed partially to the declining steelhead populations in the North Fork John Day Subbasin (60 percent under FS land). A high percentage of dispersed recreation occurs in or adjacent to riparian areas and meadows in Ochoco National Forest and Deschutes National Forest.

Snake River Basin Steelhead DPS

LISTING HISTORY

Umatilla and Wallowa-Whitman National Forests are located within the Snake River Basin Steelhead DPS inside Oregon and Washington. The Snake River steelhead DPS, listed as threatened on August 18, 1997 (62 FR 43937), includes all natural-origin populations of steelhead in the Snake River basin of southeast Washington, northeast Oregon, and Idaho. None of the hatchery stocks in the Snake River basin are listed, but several are included in the DPS.

Recovery planning for Snake River steelhead is ongoing, and recovery planning status can be reviewed online at: http://research.nwfsc.noaa.gov/trt/trt_columbia.htm

CRITICAL HABITAT

Critical habitat was originally designated for Snake River steelhead on February 16, 2000 (65 FR 7764), but was administratively withdrawn on April 30, 2002. Critical Habitat for this species was proposed again on December 14, 2004 (69 FR 74572) and designated on September 2, 2005 (70FR 52630) with an effective date of January 2, 2006.

LIFE HISTORY

The Snake River historically supported more than 55 percent of total natural-origin production of steelhead in the Columbia River Basin. It now has approximately 63 percent of the basin's natural production potential (Mealy, 1997). The Snake River steelhead DPS is distributed throughout the Snake River drainage system, including tributaries in southwest Washington, eastern Oregon and north/central Idaho (NMFS, 1997a). Snake River steelhead migrate a substantial distance from the ocean (up to 1,500 km) and use high elevation tributaries (typically 1,000-2,000 m above sea level) for spawning and juvenile rearing. Snake River steelhead occupy habitat that is considerably warmer and drier (on an annual basis) than other steelhead DPSs. Snake River basin steelhead are generally classified as summer run, based on their adult run timing patterns. Summer steelhead enter the Columbia River from late June to October. After holding over the winter, summer steelhead spawn during the following spring (March to May). Managers classify up-river summer steelhead runs into to groups based primarily on ocean age and adult size upon return to the Columbia River. A-run steelhead are predominately age-1 ocean fish while B-run steelhead are larger, predominated by age-2 ocean fish.

With one exception (the Tucannon River production area), the tributary habitat used by Snake River steelhead DPS is above Lower Granite Dam. Major groupings of populations and/or subpopulations can be found in (1) the Grande Ronde River system; (2) the Imnaha River drainage; (3) the Clearwater River drainages; (4) the South Fork Salmon River; (5) the smaller mainstem tributaries before the confluence of the mainstem; (6) the Middle Fork salmon production areas, (7) the Lemhi and Pahsimeroi valley production areas and (8) upper Salmon River tributaries.

The A-run populations are found in the tributaries to the lower Clearwater River, the upper Salmon River and its tributaries, the lower Salmon River and its tributaries, the Grand Ronde River, Imnaha River, and possibly the Snake River's mainstem tributaries below Hells Canyon Dam. B-run steelhead occupy four major subbasins, including two on the Clearwater River (Lochsa and Selway) and two on the Salmon River (Middle Fork and South Fork); areas that are for the most part not occupied by A-run steelhead. Some natural B-run steelhead are also produced in parts of the mainstem Clearwater and its major tributaries. There are alternative escapement objectives of 10,000 (Columbia River Fisheries Management Plan) and 31,400 (Idaho) for B-run steelhead. Therefore B-run steelhead represent at least 1/3 and as much as 3/5 of the production capacity of the DPS.

B-run steelhead are distinguished from the A-run component by their unique life history characteristics. B-run steelhead were traditionally distinguished as larger fish with a later run timing. The recent review by the U.S. v. Oregon Technical Advisory Committee (TAC), a group that monitors adult salmon and steelhead escapement in the Snake River Basin, indicated that different populations of steelhead do have different size structures with populations dominated by larger fish (i.e., greater than 77.5 cm) occurring in the traditionally defined B-run basins. Larger fish occur in other populations throughout the basin, but at much lower rates. Evidence suggests that fish returning to the Middle Fork Salmon River and Little Salmon River have a more equal distribution of large and small fish. B-run steelhead also are generally older. A-run steelhead are predominately 1-ocean fish, whereas most B-run steelhead generally spend 2 or more years in the ocean before spawning. The differences in ocean age are primarily responsible for the differences in the size of A- and B-run steelhead. However, B-run steelhead are also thought to be larger at any given age than A-run fish. This may be due, at least in part, to the fact that B-run steelhead leave the ocean later in the year than A-run steelhead and thus have an extra month or more of ocean residence when growth rates are thought to be greatest.

Historically, a distinctly bimodal pattern of freshwater entry could be used to distinguish A-run and B-run fish. A-run steelhead were presumed to cross Bonneville Dam from June to late August, whereas B-run steelhead entered from late August to October. The U.S. v. Oregon TAC reviewed the available information on timing and confirmed that most large fish still have a later timing at Bonneville; 70 percent of the larger fish crossed the dam after August 26, the traditional cutoff date for separating A- and B-run fish. However, the timing of the early part of the A-run has shifted somewhat later, thereby reducing the distinction that was so apparent in the 1960s and 1970s. The timing of the larger, natural-origin, B-run fish has not changed. No recent genetic data are available for B-run steelhead populations in the South and Middle Forks of the Salmon River. The Dworshak National Fish Hatchery (NFH) stock and natural populations in the Selway and Lochsa Rivers are, thus far, the most genetically distinct populations of steelhead in the Snake River Basin (Waples et al., 1993). In addition, the Selway and Lochsa River populations from the Middle Fork Clearwater River appear to be very similar to each other genetically, and naturally produced rainbow trout from the North Fork Clearwater River (above Dworshak Reservoir) clearly show an ancestral genetic similarity to Dworshak NFH steelhead. The existing genetic data, the restricted geographic distribution of B-run steelhead in the Snake (Columbia) River Basin, and the unique life history attributes of these fish (i.e., larger, older adults with a later distribution of run timing compared to A-run steelhead in other portions of the Columbia River Basin) clearly support the conservation of B-run steelhead as a biologically significant component of the Snake River DPS.

POPULATION TRENDS

In the 2003 status review update, NOAA Fisheries modified previous approaches to DPS risk assessment to incorporate Viable Salmonid Population criteria (McElhany et al., 2000): abundance, growth rate/productivity, spatial structure, and diversity. The current condition (NOAA Fisheries 2003) of SR steelhead is summarized below:

Abundance:

- Uncertainty given paucity of data for adult spawners
- Dam counts are currently 28 percent of the interim recovery target for the Snake River Basin (52,000 natural spawners)
- Joseph Creek exceeds interim recovery target

Productivity:

- Mixed long- and short-term trends in abundance and productivity

Spatial Structure:

- Populations remain in 6 major geographic areas

Diversity:

- B-run steelhead particularly depressed
- Displacement of natural fish by hatchery fish (declining proportion of natural-origin spawners)
- Homogenization of hatchery stocks within basins, and some stocks exhibiting high stray rates

Although direct historical estimates of production from the Snake basin are not available, the basin is believed to have supported more than half of the total steelhead production from the Columbia basin (Mallet, 1974). There are some historical estimates of returns to portions of the drainage. Lewiston Dam, constructed on the lower Clearwater, began operation in 1927. Counts of steelhead passing through the adult fish ladder at the dam reached 40-60,000 in the early 1960s (Cichosz et al., 2001). Based on relative drainage areas, the Salmon River basin likely supported substantial production as well. In the early 1960s, returns to the Grande Ronde River and the Imnaha River may have exceeded 15,000 and 4,000 steelhead per year, respectively (ODFW, 1991). Extrapolations from tag/recapture data indicate that the natural steelhead return to the Tucannon River may have exceeded 3,000 adults in the mid-1950s (WDF, 1993).

With a few exceptions, more recent annual estimates of steelhead returns to specific production areas within the Snake River are not available. Annual return estimates are limited to counts of the aggregate return over Lower Granite Dam. Returns to Lower Granite remained at relatively low levels through the 1990s. The 2001 run size at Lower Granite Dam was substantially higher relative to the 1990s. Annual estimates of returns are available for the Tucannon River, sections of the Grande Ronde River system and the Imnaha River. The recent geometric mean abundance was down for the Tucannon relative to NOAA Fisheries' 1998 status review. Returns to the other areas were generally higher relative to the early 1990s (NOAA Fisheries, 2003).

Updated analyses of parr density survey results through 1999 by the Idaho Department of Fish and Game (IDFG) conclude that "generational parr density trends, which are analogous to spawner to spawner survivorship, indicate that Idaho spring-summer Chinook and steelhead with and without hatchery influence failed to meet replacement for most generations completed since

1985 (IDFG 2002). These data, however, do not reflect the influence of increased returns in 2001 and 2002.

According to NOAA Fisheries (2003), the median long-term population growth rate estimate to be 0.998, assuming that natural returns are produced only from natural origin spawners, and 0.733 if both hatchery and wild potential spawners are assumed to have contributed to production. Short-term estimates are higher, 1.013, assuming a hatchery effectiveness of 0, and 0.753, assuming hatchery and wild fish contribute to natural production in proportion to their numbers.

THREATS

The Snake River steelhead "threatened" listing has been attributed to a number of factors. Among them are dams, recreational and incidental commercial fishing, habitat modification, hatchery influences, and non-point source pollution. Hydropower and other dams on the mainstem Columbia and Snake Rivers disrupted both upstream and downstream migrations. Smaller irrigation and domestic water dams reduced or eliminated historically accessible habitat. Impacts from inland recreational fishing can be important, particularly during low flow or drought periods, when reduced habitat availability concentrates fish. Steelhead are not generally targeted in commercial fisheries, but incidental harvest in mixed-stock sport and commercial fisheries in the Columbia River may exceed 30 percent of some listed populations. Forestry, agriculture, mining, and urbanization have degraded, simplified, and fragmented habitat. Hatchery programs have strongly influenced populations by masking declines in naturally spawning fish, creating unrealistic sport harvest expectations, and stock transfers within and between DPSs. Implementation of the Federal Clean Water Act have not been effective at adequately protecting fishery resources from non-point pollution.

DISTRIBUTION WITH ACTION AREA

National Forest lands are found within seven 4th HUC subbasins identified for the Snake River Basin Steelhead DPS: Imnaha, Lower Grande Ronde River, Lower Snake/Asotin, Lower Snake/Tucannon, Hells Canyon, Upper Grande Ronde River, and Wallowa River. A total of 44 streams within the DPS have at least five miles of anadromous fish habitat within National Forest lands. Snake River (53 miles) and Imnaha River (45 miles) have the highest amount of anadromous fish habitat.

Imnaha subbasin, approximately 70 percent of which is within Wallowa-Whitman National Forest, has 5 major streams that contain more than five miles of anadromous fish habitat inside the National Forest land, including Imnaha River, Big Sheep Cr., Grouse Cr., Horse Cr., and Lightning Cr. Imnaha River holds roughly 45 miles of anadromous fish habitat inside National Forest lands.

Lower Grande Ronde River subbasin, approximately 25 percent of which is within Wallowa-Whitman National Forest and another 25 percent of which is within Umatilla National Forest, has 14 major streams that contain more than five miles of anadromous fish habitat inside the National Forest land, including Grande Ronde River, Wenaha River, Butte Cr., Crooked Cr., Joseph Cr., Elk Cr., Swamp Cr., Davis Cr., Cottonwood Cr., Peavine Cr., Mud Cr., McAllister Cr., Tope Cr., and Wildcat Cr. Wenaha River holds roughly 26 miles of anadromous fish habitat inside Umatilla National Forest land and Joseph Cr. 26 miles inside Wallowa-Whitman National Forest land.

Lower Snake/Asotin subbasin (with only 70 percent as part of the DPS area, approximately 30 percent of which is within Umatilla National Forest and another 20 percent of which is within

Wallowa-Whitman National Forest) has two major streams that contain more than five miles of anadromous fish habitat inside the National Forest land, including Snake River and Asotin Creek. Snake River holds roughly 12 miles of anadromous fish habitat on Wallowa-Whitman National Forest land, and Asotin Creek has ten miles inside the National Forest land.

Lower Snake/Tucannon subbasin, approximately 10 percent of which is within Umatilla National Forest, has one major stream, Tucannon River, which contains more than five miles of anadromous fish habitat inside the National Forest land. Tucannon River holds roughly 13 miles of anadromous fish habitat inside the National Forest land.

Hells Canyon subbasin, approximately 70 percent of which is within Wallowa-Whitman National Forest, has 1 stream, Snake River, which contains more than five miles of anadromous fish habitat inside the National Forest land. Snake River holds roughly 53 miles of anadromous fish habitat inside the National Forest land.

Upper Grande Ronde River subbasin, approximately 30 percent of which is within Wallowa-Whitman National Forest and another 10 percent of which is within Umatilla National Forest, has 18 major streams that contain more than five miles of anadromous fish habitat inside the National Forest land, including Grande Ronde River, Meadow Cr., Burnt Corral Cr., McCoy Cr., Fly Cr., National Forest Catherine Cr., SF Catherine Cr., Indian Cr., Dark Canyon, Spring Cr., Five Points Cr., Sheep Cr., Clear Cr., Beaver Cr., Limber Jim Cr., Lookingglass Cr., Little Lookingglass Cr., and Phillips Cr. Grande Ronde River holds roughly 22 miles of anadromous fish habitat inside Wallowa-Whitman National Forest land and Lookingglass Cr. holds roughly seven miles of that inside Umatilla National Forest land.

Wallowa River subbasin, approximately 50 percent of which is within Wallowa-Whitman National Forest, has four major streams that contain more than five miles of anadromous fish habitat inside the National Forest land, including Minam River, Little Minam River, Lostine River, and Bear Cr. Minam River holds roughly 33 miles of anadromous fish habitat inside the National Forest land.

HABITAT CONDITIONS WITHIN ACTION AREA

Many of the major rivers that are part of the Action Area in this DPS, such as Grande Ronde River (upper mainstem), Tucannon River, and Asotin Creek, are categorized as highly compromised habitat. Most of them also have impairment issues related to toxic water quality and forest sedimentation. Floodplain conversion for agriculture and urbanization has taken place heavily throughout the DPS area, and the rate of flow diversion is high for many of the major rivers holding sizeable steelhead populations.

Snake River Basin Steelhead DPS contains as many as 13 major activities that affect the primary constituent elements (i.e. essential habitats) of the DPS populations. Those are livestock grazing, timber harvest, irrigation/water withdrawal, agriculture, road building/maintenance, urbanization, invasive species, river traffic, channel modification, recreation, fire activity and disturbance, damming, and mineral mining, in order of frequency that they appear in the basin.

Snake River steelhead migrate a substantial distance from the ocean (up to 1,500 km) and use high elevation tributaries (typically 1,000-2,000 m above sea level) for spawning and juvenile rearing. Snake River Steelhead occupy habitat that is considerably warmer and drier (on an annual basis) than other steelhead DPSs. Consequently, compared to other DPSs or salmon species, Snake River steelhead is more dependent upon upland habitats, a substantial portion of which is Forest Service land. Hence, the quality of habitats located on FS land becomes critical to realize successful recovery for this DPS.

The following statements from McClure and Stein (2004) show the trend on the current conditions for streams that hold some areas of Forest Service land. They classified major rivers and streams within the Columbia Basin into 3 categories; one being "highly compromised habitat" with 4-7 tributary habitat factors identified as impaired, two being "moderately compromised habitat" with 1-3 tributary habitat factors identified as impaired, and three being "minimally compromised habitat" with no tributary habitat factors identified as impaired. Tucannon River, Asotin Creek, and Grande Ronde upper mainstem were labeled as "highly compromised habitat," Grande Ronde lower mainstem, Imnaha River, and Joseph Cr. were labeled as "moderately compromised habitat," and finally, Snake River Hells Canyon tributaries were labeled as "minimally compromised habitat."

McClure and Stein (2004) also ranked major streams within the Columbia basin in relation to various habitat factors on a scale of 1 to 10; 1 having the lowest, and 10 having the highest probability of being impaired (as shown in the parentheses below). In relation to chemical toxicity, Asotin Creek (10) had the highest probability for degradation among the Action Area streams, followed by Tucannon River (9), Wallow/Lostine Rivers (8), Grande Ronde - lower mainstem tributaries (7), and Grande Ronde - upper mainstem (7). As far as forest sediment is concerned, Grande Ronde upper mainstem (9) had the highest probability of being impaired for that population among the Action Area streams, followed by Grande Ronde lower mainstem tributaries (7).

As stated by McClure and Stein (2004), heavy conversion of historical floodplain area to agriculture/urban land use has occurred on Upper Grande Ronde River (90-100 percent) as well as Wallowa River and Tucannon River (70-80 percent). As far as the rate of flow diversion for irrigation is concerned, Wallowa River (90-100 percent) as well as Upper Grande Ronde River and Lower Grande Ronde River (70-80 percent) have seen the most severe withdrawal. In terms of the entrainment potential predicted from the number of diversions encountered, Upper Grande Ronde River (90-100 percent) as well as Wallowa River and Tucannon River (70-80 percent) had the highest susceptibility. On the other hand, there were streams that had comparatively less impact from flow diversion; for instance, Minam River population had only one diversion and Hell's Canyon subbasin did not have any flow diverted. Wenaha River population had 304 diversions, which is actually on the low range compared to all of the other DPS areas.

Water temperatures throughout many of the major river basins in this DPS area are considerably high during the summer months. According to data obtained by the USFS and ODEQ in 1998, temperatures in the mainstem Grande Ronde River upstream of the project site annually exceed 26°C. This tendency for high temperature during summer periods has caused adult SR steelhead to migrate to and depend on cool refuge areas as observed by spawning and snorkeling surveys.

Some of the effects mentioned here could be related to off-Forest land activities. The more degraded the neighboring private lands are, the more dependant the DPS populations become on the adjacent Forest Service land to survive.

Livestock grazing was identified as a major activity affecting the essential habitats in five out of the five (100 percent) 4th HUC subbasins mentioned above. Past management activities, such as livestock grazing, have left the stream reaches in the Upper Grande Ronde River Basin functioning well below levels that promote healthy salmonid populations.

Timber harvest was identified as a major activity affecting the essential habitats in four out of the five (80 percent) 4th HUC subbasins mentioned above.

Irrigation/water withdrawal was identified as a major activity affecting the essential habitats in four out of the five (80 percent) 4th HUC subbasins mentioned above. Water temperatures throughout many of the major river basins in this DPS area are considerably high during the summer months. This tendency for high temperature during summer periods is abetted by flow diversion and irrigation partly due to the fact that it requires less heat to warm up less amount of water. Also, diverted flow that returns back to a stream usually comes back warmer than it originally was. All of these effects have been instrumental to the decline of Snake River Basin steelhead.

Agriculture was identified as a major activity affecting the essential habitats in three out of the five (60 percent) 4th HUC subbasins mentioned above.

Road construction/maintenance was identified as a major activity affecting the essential habitats in three out of the five (60 percent) 4th HUC subbasins mentioned above.

Invasive species was identified as a major activity affecting the essential habitats in five out of the five (10 percent) 4th HUC subbasins mentioned above. Water temperatures throughout many of the major river basins in this DPS area are considerably high during the summer months. According to data obtained by the USFS and ODEQ in 1998, temperatures in the mainstem Grande Ronde River upstream of the project site annually exceed 26°C. This tendency for high temperature, especially during summer periods, is conducive to many invasive/exotic species that prefer warm water habitats. Disturbance such as these has caused both adult and juvenile steelhead to migrate to and depend on cool refuge areas as observed by spawning and snorkeling surveys.

Urbanization was identified as a major activity affecting the essential habitats in two out of the five (40 percent) 4th HUC subbasins mentioned above.

River traffic was identified as a major activity affecting the essential habitats in two out of the five (40 percent) 4th HUC subbasins mentioned above

Channel modification was identified as a major activity affecting the essential habitats in two out of the five (40 percent) 4th HUC subbasins mentioned above. Past management activities such as splash dams, LWD and rock removal from the channel all lead to channelization, leaving the stream reaches in the Upper Grande Ronde River Basin functioning well below levels that promote healthy salmonid populations. The formation of large, unstable gravel bars found on Upper Grande River, for example, indicate that sediment routing processes in the area are out of balance. A lack of LWD, channel sinuosity, and pools characterize many of the rivers throughout this DPS area, such as Upper Grande Ronde River.

Recreation was identified as a major activity affecting the essential habitats in one out of the five (20 percent) 4th HUC subbasins mentioned above. Past management activities such as recreational vehicle use, have left the stream reaches in the Upper Grande Ronde River Basin DPS functioning well below levels that promote healthy salmonid populations.

Damming was identified as a major activity affecting the essential habitats in one out of the five (20 percent) 4th HUC subbasins mentioned above. Water temperatures throughout many of the major river basins in this DPS area are considerably high during the summer months. This tendency for high temperature during summer periods has a lot to do with dams in the Snake River basins. Dams can impound as well as slow down a profuse amount of water, which then becomes vulnerable to more heating by the sun and as a result creates artificial warm water environment where invasive/exotic species prefer to live. These impacts are one of the major attributions to the decline of Snake River Basin steelhead.

Columbia River Bull Trout

The draft Bull Trout Recovery Plan provides information on the distribution and abundance of bull trout in all Distinct Population Segments (DPS) in the conterminous United States, and offers the most recent status information for the species by recovery unit (USDI, 2002). Of the 23 recovery units for bull trout, 16 extend into National Forest lands. Chapters 2, 5 to 14, and 20 to 24 of the Draft Recovery Plans describe the current distribution and abundance of the recovery units considered in this BA. Reasons for decline for each recovery unit are identified within draft Bull Trout Recovery Plans.

Detailed accounts of life history, taxonomy and behavior can be found in the final rule listing the Columbia River and Klamath River populations of bull trout as threatened (U.S. Fish and Wildlife Service, 1998b), and in the determination of threatened status for bull trout in the conterminous United States (U.S. Fish and Wildlife Service, 1999a) for Coastal-Puget Sound, and the Status of Oregon's bull trout; distribution, life history, limiting factors, management considerations, and status (Buchanan et al., 1997).

The FWS has draft recovery plans for the Columbia River and Klamath River DPSs (U.S. Fish and Wildlife Service, 2002a) and the Coastal-Puget Sound DPS (U.S. Fish and Wildlife Service, 2004c). Although subpopulations were an appropriate unit upon which to base the 1998 bull trout listing decision, the recovery plan has revised the biological terminology to better reflect the current understanding of bull trout life history and conservation biology theory. Therefore subpopulation terms will not be used. In the recovery plan there are populations of bull trout within a core area. Core areas represent a combination of habitat that provides all elements for the long-term security of bull trout and the presence of bull trout inhabiting core habitat. Thus, core areas form the basis on which to gauge recovery within a recovery unit. Thus, a core area, by definition, is considered habitat occupied by bull trout and serves as a biologically discrete unit upon which to base bull trout recovery. Within core areas, groups of bull trout or local populations which spawn in various tributaries are generally characterized by relatively small amounts of genetic diversity within a tributary but high levels of genetic divergence between tributaries (Chapter 1, recovery plan). Individual local populations may come and go or expand and contract over time, but the focus of the draft recovery plan is maintaining all existing core areas.

The U.S. Fish and Wildlife Service (Service) recently completed its 5-year review of bull trout. The outcome of this review is posted on the FWS website: http://www.fws.gov/pacific/bulltrout . The 5-year review makes two recommendations: 1) Retain "threatened" status for the species as currently listed throughout its range in the coterminous United States for the time being, and (2) Evaluate whether distinct population segments (DPSs) exist and merit the protection of the Endangered Species Act. This effort will require an update on bull trout status by core area which is on-going. After the DPS task is completed the Service anticipates finalizing recovery plans.

LISTING HISTORY

Only the Columbia River population is included within the action area covered in this BA. On June 10, 1998, the FWS issued a final rule listing the Columbia River and Klamath River populations of bull trout as threatened under the authority of the Endangered Species Act of 1973 (63 FR 31647). This decision conferred full protection of the Endangered Species Act on bull trout occurring in four northwestern States. Five populations of bull trout are listed as distinct population segments (DPS), i.e., they meet the joint policy of the FWS and NOAA Fisheries regarding the recognition of distinct vertebrate populations (U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration 1996). The Klamath River and Columbia River DPS bull trout were listed on June 10, 1998 (63 FR 31647). The Jarbidge River population was listed as threatened on April 8, 1999 (U.S. Fish and Wildlife Service, 1999b). The Coastal-Puget Sound and St. Mary-Belly River populations were listed as threatened on November 1, 1999 (U.S. Fish and Wildlife Service, 1999a), which resulted in all bull trout in the coterminous United States being listed as threatened.

CRITICAL HABITAT

Critical habitat was designated by the FWS for the Klamath River and Columbia River DPS bull trout on October 6, 2004 (69 FR 59996) (U.S. Fish and Wildlife Service, 2004e) (Table III - 2). Lands not designated as critical habitat for Columbia River and Klamath River basin bull trout include those that do not meet the requirement of needing special management or protection and are excluded due to the exercise of the Secretary of Interior's Authority under section 4(b)(2) of the ESA. Areas related to the scope of this BA and exempt from designated critical habitat are National Forest lands with stream reaches regulated under PACFISH/INFISH.

The Service issued a new final rule for bull trout critical habitat for the coterminous United States on September 26, 2005. The critical habitat designation includes approximately 2,708 miles of streams for the Columbia River population.

Table III - 2. Approximate area designated as critical habitat for the Columbia River DPS of the bull trout by critical habitat unit.

Critical Habitat Unit	Miles of Streams	Acres of Reservoirs or Lakes
Clark Fork River Basin (Unit 2)	1,136	49,755
Kootenai River Basin (Unit 3)	56	1,384
Willamette River Basin (Unit 4)	111	-
Hood River Basin (Unit 5)	30	-
Deschutes River Basin (Unit 6)	78	2,713
Umatilla-Walla Walla River Basins (Unit 9)	218	-
Grande Ronde River Basin (Unit 10)	308	-
Imnaha-Snake River Basins (Unit 11)	92	-
Hells Canyon Complex (Unit 12)	125	-
Malheur River Basin (Unit 13)	38	-
Coeur d'Alene Lake Basin (Unit 14)	124	27,296
Lower Columbia River Basin (Unit 19)	94	-
Middle Columbia River Basin (Unit 20)	188	-
Northeast Washington River Basins (Unit 22)	25	-
Snake River Basin in Washington (Unit 23)	68	-
Snake River (Unit 25)	17	-
Total	**2,708**	**81,148**

Critical habitat extends from the bankfull elevation on one side of the stream channel to the bankfull elevation on the opposite side. Adjacent floodplains are not proposed as critical habitat. The lateral extent of proposed lakes and reservoirs is defined by the perimeter of the water body as mapped on standard 1:24,000 scale maps.

The Service used the best scientific and commercial data available to designate critical habitat, giving consideration to those physical and biological features that are essential to bull trout survival. Within the designated critical habitat areas, the primary constituent elements (PCE's) for bull trout are those habitat components that are essential for the primary biological needs of foraging, reproducing, rearing of young, dispersal, genetic exchange, or sheltering. The PCE's are as follows:

1. Water temperatures that support bull trout use. Bull trout have been documented in streams with temperatures from 0 to 22 ° C (32 to 72 ° F) but are found more frequently in temperatures ranging from ranging from 2 to 15 ° C (36 to 59 ° F). These temperatures ranges may vary depending on bull trout life history stage and form, geography, elevation, diurnal and seasonal variation, shade such as that provided by riparian habitat, and local groundwater influence. Stream reaches with temperatures that preclude bull trout use are specifically excluded from designation;
2. Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures;
3. Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. This should include a minimal amount of fine substrate less than 0.63 cm (0.25 in) in diameter.

4. A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, currently operate under a biological opinion that addresses bull trout, or a hydrograph that demonstrates the ability to support bull trout populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation: This rule finds that reservoirs currently operating under a biological opinion that addresses bull trout provides management for PCE's as currently operated;
5. Springs, seeps, groundwater sources, and subsurface water to contribute to water quality and quantity as a cold water source;
6. Migratory corridors with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows;
7. An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish; and
8. Permanent water of sufficient quantity and quality such that normal reproduction, growth and survival are not inhibited.

DISTRIBUTION

The historical range of the bull trout includes major river basins in the Pacific Northwest at about 41 to 60 degrees North latitude, from the southern limits in the McCloud River in northern California and the Jarbidge River in Nevada to the headwaters of the Yukon River in the Northwest Territories, Canada (Cavender, 1978; Bond, 1992). To the west, the bull trout's range includes Puget Sound, various coastal rivers of British Columbia, Canada, and southeast Alaska (Bond, 1992). Bull trout occur in portions of the Columbia River and tributaries within the basin, including its headwaters in Montana and Canada. Bull trout also occur in the Klamath River basin of south-central Oregon. East of the Continental Divide, bull trout are found in the headwaters of the Saskatchewan River in Alberta and Montana and in the MacKenzie River system in Alberta and British Columbia, Canada, (Cavender, 1978; Berwin et.al., 1997).

LIFE HISTORY AND HABITAT DESCRIPTION

Bull trout exhibit both resident and migratory life-history strategies (Rieman and McIntyre 1993). Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. Migratory bull trout spawn in tributary streams where juvenile fish rear one to four years before migrating to either a lake (adfluvial form), river (fluvial form) (Fraley and Shepard,1989, Goetz, 1989), or in certain coastal areas, to saltwater (anadromous) Cavender, 1978; McPhail and Baxter, 1996; WDFW et al., 1997). Resident and migratory life-history forms may be found together but it is unknown if they represent a single population or separate populations (Rieman and McIntyre, 1993). Either form may give rise to offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993). The multiple life-history strategies found in bull trout populations represent important diversity (both spatial and genetic) that help protect these populations from environmental stochasticity.

The size and age of bull trout at maturity depends upon the life-history strategy and habitat limitations. Resident fish tend to be smaller than migratory fish at maturity and produce fewer eggs (Fraley and Shepard, 1989; Goetz, 1989). Resident adults usually range from 150 to 300 millimeters (6 to 12 inches) total length (TL). Migratory adults however, having lived for several years in larger rivers or lakes and feeding on other fish, grow to a much larger size and commonly reach 600 millimeters (24 inches) TL or more (Pratt 1985, Goetz, 1989). The largest verified bull trout was a 14.6-kilogram (32-pound) adfluvial fish caught in Lake Pend Oreille, Idaho, in 1949 (Simpson and Wallace, 1982). Size differs little between life-history forms during their first years of life in headwater streams, but diverges as migratory fish move into larger and more productive waters (Rieman and McIntyre, 1993).

Ratliff (1992) reported that bull trout under 100 mm (4 inches) in length were generally only found in the vicinity of spawning areas, and that fish over 100 mm were found downstream in larger channels and reservoirs in the Metolius River basin. Juvenile migrants in the Umatilla River were primarily 100-200 mm long (4 to 8 inches) in the spring and 200-300 mm long (8 to 12 inches) in October (Buchanan et al., 1997). The age at migration for juveniles is variable. Ratliff (1992) reported that most juveniles reached a size to migrate downstream at age 2, with some at ages 1 and 3 years. Pratt (1992) had similar findings for age-at-migration of juvenile bull trout from tributaries of the Flathead River. The seasonal timing of juvenile downstream migration appears similarly variable. Bull trout normally reach sexual maturity in 4 to 7 years and may live longer than 12 years. The species is iteroparous (i.e., can spawn multiple times in their lifetime) and adults may spawn each year or in alternate years (Batt 1996). Repeat-spawning frequency and post-spawning mortality are not well documented (Leathe and Graham 1982; Fraley and Shepard 1989; Pratt 1992; Rieman and McIntyre 1996) but post-spawn survival rates are believed to be high.

Bull trout typically spawn from late August to November during periods of decreasing water temperatures (below 9 degrees Celsius/48 degrees Fahrenheit). Redds are often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz, 1989; Pratt 1992; Rieman and McIntyre, 1996). Migratory bull trout frequently begin spawning migrations as early as April and have been known to move upstream as far as 250 kilometers (km) (155 miles) to spawning grounds in Montana (Fraley and Shepard 1989; Swanberg 1997). In Idaho, bull trout moved 109 km (67.5 miles) from Arrowrock Reservoir to spawning areas in the headwaters of the Boise River (Flatter, 1998). In the Blackfoot River, Montana, bull trout began spring spawning migrations in response to increasing temperatures (Swanberg, 1997). Depending on water temperature, egg incubation is normally 100 to 145 days (Pratt, 1992), and after hatching, juveniles remain in the substrate. Time from egg deposition to emergence of fry may surpass 220 days. Fry normally emerge from early April through May, depending on water temperatures and increasing stream flows (Pratt, 1992; Ratliff and Howell, 1992).

Bull trout are opportunistic feeders, with food habits primarily a function of size and life-history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macro-zooplankton, and small fish (Boag, 1987; Goetz, 1989; Donald and Alger 1993). Adult migratory bull trout feed on various fish species (Leathe and Graham, 1982; Fraley and Shepard 1989; Brown, 1992; Donald and Alger, 1993). In coastal areas of western Washington, bull trout feed on Pacific herring (Clupea pallasi), Pacific sand lance (*Ammodytes hexapterus*), and surf smelt (*Hypomesus pretiosus*) in the ocean (Washington Department of Fish and Wildlife et al., 1997).

HABITAT AFFINITIES

Bull trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre, 1993). Habitat components that influence the species' distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrate, and availability of migratory corridors (Fraley and Shepard, 1989; Goetz, 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Howell and Buchanan 1992; Pratt 1992;

Rieman and McIntyre, 1993, 1995; Rich, 1996; Watson and Hillman, 1997). Watson and Hillman (1997) concluded that watersheds must have specific physical characteristics to provide the habitat requirements necessary for bull trout to successfully spawn and rear and that these specific characteristics are not necessarily present throughout these watersheds. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre, 1993), individuals of this species should not be expected to simultaneously occupy all available habitats (Rieman et al., 1997).

Bull trout are found primarily in cold streams, although individual fish are found in larger, warmer river systems throughout the Columbia River basin (Fraley and Shepard. 1989; Rieman and McIntyre. 1993, 1995; Buchanan and Gregory, 1997; Rieman et al. 1997). Water temperature above 15 degrees Celsius (59 degrees Fahrenheit) is believed to limit bull trout distribution, a limitation that may partially explain the patchy distribution within a watershed (Fraley and Shepard 1989, Rieman and McIntyre, 1995).

Spawning areas are often associated with cold-water springs, groundwater infiltration, and the streams with the coldest summer water temperatures in a given watershed (Pratt, 1992; Rieman and McIntyre, 1993; Rieman et al., 1997; Baxter et al., 1999). Water temperatures during spawning generally range from 5 to 9 degrees Celsius (41 to 48 degrees Fahrenheit) (Goetz, 1989). The requirement for cold water during egg incubation has generally limited the spawning distribution of bull trout to high elevations in areas where the summer climate is warm. Rieman and McIntyre (1995) found in the Boise River Basin that no juvenile bull trout were present in streams below 1613 m (5000 feet). Similarly, in the Sprague River basin of south-central Oregon, Ziller (1992) found in four streams with bull trout that "numbers of bull trout increased and numbers of other trout species decreased as elevation increased. In those streams, bull trout were only found at elevations above 1774 m [5500 feet]."

All life-history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Fraley and Shepard, 1989; Goetz, 1989; Hoelscher and Bjornn 1989; Sedell and Everest, 1991; Pratt, 1992; Thomas, 1992; Rich, 1996; Sexauer and James 1997; Watson and Hillman, 1997). Jakober (1995) observed bull trout overwintering in deep beaver ponds or pools containing large woody debris in the Bitterroot River drainage, Montana, and suggested that, because of the need to avoid anchor ice in order to survive, suitable winter habitat may be more restricted than summer habitat. Maintaining bull trout habitat requires stability of stream channels and of flow (Rieman and McIntyre, 1993). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James, 1997). These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel from winter through spring (Fraley and Shepard, 1989; Pratt, 1992; Pratt and Huston, 1993).

Preferred bull trout spawning habitat consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard, 1989). In the Swan River, Montana, abundance of bull trout redds was positively correlated with the extent of bounded alluvial valley reaches, which are likely areas of groundwater to surface water exchange (Baxter et al., 1999). Survival of bull trout embryos planted in stream areas of groundwater upwelling used by bull trout for spawning were significantly higher than embryos planted in areas of surface-water recharge not used by bull trout for spawning (Baxter and McPhail, 1999). Pratt (1992) indicated that increases in fine sediment reduce egg survival and emergence.

Migratory corridors link seasonal habitats for all bull trout life-history forms. For example, in Montana, migratory bull trout make extensive migrations in the Flathead River system (Fraley and Shepard, 1989), and resident bull trout in tributaries of the Bitterroot River move downstream to overwinter in tributary pools (Jakober 1995). The ability to migrate is important to the persistence of bull trout (Rieman and McIntyre, 1993; M. Gilpin, in litt., 1997; Rieman et al., 1997). Migrations facilitate gene flow among local populations when individuals from different local populations interbreed, or stray, to non-natal streams. Local bull trout populations that are extirpated by catastrophic events may also become re-established by migrants.

POPULATION DYNAMICS

Although bull trout are widely distributed over a large geographic area, they exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre, 1993). Increased habitat fragmentation reduces the amount of available habitat and increases isolation from other populations of the same species (Saunders et al., 1991). Burkey (1989) concluded that when species are isolated by fragmented habitats, low rates of population growth are typical in local populations and their probability of extinction is directly related to the degree of isolation and fragmentation. Without sufficient immigration, growth for local populations may be low and probability of extinction high (Burkey, 1989, 1995).

Metapopulation concepts of conservation biology theory have been suggested relative to the distribution and characteristics of bull trout, although empirical evidence is relatively scant (Rieman and McIntyre 1993; Dunham and Rieman, 1999; Rieman and Dunham, 2000). A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meffe and Carroll, 1994). For inland bull trout, metapopulation theory is likely most applicable at the watershed scale where habitat consists of discrete patches or collections of habitat capable of supporting local populations; local populations are for the most part independent and represent discrete reproductive units; and long-term, low-rate dispersal patterns among component populations influences the persistence of at least some of the local populations (Rieman and Dunham, 2000). Ideally, multiple local populations distributed throughout a watershed provide a mechanism for spreading risk because the simultaneous loss of all local populations is unlikely. However, habitat alteration, primarily through the construction of impoundments, dams, and water diversions, has fragmented habitats, eliminated migratory corridors, and in many cases isolated bull trout in the headwaters of tributaries (Rieman et al., 1997, Dunham and Rieman, 1999, Spruell et al., 1999, Rieman and Dunham, 2000). Accordingly, human-induced factors as well as natural factors affecting bull trout distribution have likely limited the expression of the metapopulation concept for bull trout to patches of habitat within the overall distribution of the species (Dunham and Rieman, 1999).

However, despite the theoretical fit, the relatively recent and brief time period during which bull trout investigations have taken place does not provide certainty as to whether a metapopulation dynamic is occurring (e.g., a balance between local extirpations and recolonizations) across the range of bull trout or whether the persistence of bull trout in large or closely interconnected habitat patches (Dunham and Rieman, 1999) is simply reflective of a general deterministic trend towards extinction of the species where the larger or interconnected patches are relics of historically wider distribution (Rieman and Dunham, 2000). Recent research (Whiteley et al., 2003) does, however, provide stronger genetic evidence for the presence of a metapopulation process for bull trout, at least in the Boise River basin of Idaho.

In the rules listing bull trout as threatened, the FWS identified subpopulations (i.e., isolated groups of bull trout thought to lack two-way exchange of individuals), for which status, distribution, and threats to bull trout were evaluated. Because habitat fragmentation and barriers have isolated bull trout throughout their current range, a subpopulation was considered a reproductively isolated group of bull trout that spawns within a particular river or area of a river system. Overall, 187 subpopulations were identified in the five distinct population segments, seven in the Klamath River, 141 in the Columbia River, one in the Jarbidge River, 34 in the Coastal-Puget Sound, and four in the St. Mary-Belly River populations. No new subpopulations have been identified and no subpopulations have been lost since listing. More detailed information on the range-wide trend of the bull trout is currently being developed for the 5-year status review and is not yet available.

In the proposed rule to list the bull trout, the Service had delineated 35 subpopulations (Fish and Wildlife Service 1998a). Upon further review, the Service revised the total number to 34 based upon the conclusion that the Puyallup River Basin had two subpopulations instead of three. The Service made this revision to be consistent with established subpopulation criteria.

THREATS

Since listing, no substantial new threats have been identified. Bull trout distribution, abundance, and habitat quality have and continue to decline rangewide (Bond, 1992; Schill, 1992; Thomas, 1992; Ziller 1992; Rieman and McIntyre, 1993; Newton and Pribyl, 1994; Idaho Department of Fish and Game in litt., 1995; McPhail and Baxter, 1996). These declines result from the combined effects of habitat degradation and fragmentation, the blockage of migratory corridors; poor water quality, angler harvest and poaching, entrainment (process by which aquatic organisms are pulled through a diversion or other device) into diversion channels and dams, and introduced nonnative species. Specific land and water management activities that may depress bull trout populations and degrade habitat include dams and other diversion structures, forest management practices, livestock grazing, agriculture, agricultural diversions, road construction and maintenance, mining, and urban and rural development (Beschta et al., 1987; Chamberlain et al., 1991; Furniss et al., 1991; Meehan, 1991; Nehlsen et al., 1991; Sedell and Everest, 1991; Craig and Wissmar, 1993; Henjum et al. 1994; McIntosh et al., 1994; Wissmar et al., 1994; Montana Bull Trout Scientific Group, 1995a-e; 1996a-f; Light et al., 1996; USDA and USDI 1995, 1996, 1997; Frissell, 1997).

COLUMBIA RIVER DPS

The FWS recognizes 141 subpopulations of bull trout in the Columbia River DPS within Idaho, Montana, Oregon, and Washington with additional subpopulations in British Columbia. Approximately 79 percent are unlikely to be reestablished if extirpated and 50 percent are at risk of extirpation from naturally occurring events due to their depressed status (U.S. Fish and Wildlife Service, 1998b). Many of the remaining bull trout occur as isolated subpopulations in headwater tributaries, or in tributaries where the migratory corridors have been lost or restricted. Few bull trout subpopulations are considered “strong” in terms of relative abundance and subpopulation stability. Those few remaining strongholds are generally associated with large areas of contiguous habitats such as portions of the Snake River Basin in central Idaho, the Flathead River in Montana, the Wenaha River and the Blue Mountains in Washington and Oregon. The listing rule characterizes the Columbia River DPS as generally occurring as isolated subpopulations, without a migratory life form to maintain the biological cohesiveness of the subpopulations, and with trends in abundance declining or of unknown status.

Extensive habitat loss and fragmentation of subpopulations have been documented for bull trout in the Columbia River basin and elsewhere within its range (Rieman and McIntyre 1993).

Reductions in the amount of riparian vegetation and road construction in the Columbia River basin due to timber harvest, grazing, and agricultural practices have contributed to habitat degradation through elevated stream temperatures, increased sedimentation, and channel embeddedness. Mining activities have compromised habitat conditions by discharging waste materials into streams and diverting and altering stream channels. Residential development has threatened water quality by introducing domestic sewage and altering riparian conditions. Dams of all sizes (i.e., mainstem hydropower and tributary irrigation diversions) have severely limited migration of bull trout in the Columbia River basin. Competition from non-native trout (U.S. Fish and Wildlife Service, 1998b) is also considered a threat to bull trout.

Generally, where status is known and population data exist, bull trout populations in the Columbia River DPS are declining (Thomas, 1992; Pratt and Huston, 1993; Schill, 1992). Bull trout in the Columbia River basin occupy about 45 percent of their estimated historic range (Quigley and Arbelbide, 1997). Quigley and Arbelbide (1997) considered bull trout populations strong in only 13 percent of the occupied range in the interior Columbia River basin. Rieman et al. (1997) estimated that populations were strong in 6 to 24 percent of the subwatersheds in the entire Columbia River basin.

The Columbia River bull trout distribution within the Action Area includes recovery units in Oregon and Washington, and the Hells Canyon Complex within the Wallowa Whitman National Forest, Hells Canyon Recreation Area in Idaho. Current known bull trout distribution within Umatilla and Wallowa Whitman National Forests includes portions of five recovery units in Oregon and Washington: John Day River, Umatilla/Walla Rivers, Grande Ronde River, Imnaha-Snake River, Hells Canyon Complex, and Snake River.

John Day River Recovery Unit

The entire John Day basin is contained in this recovery unit, 8,200 square miles, including the John Day mainstem, the North, Middle and South forks of the John Day River. Historically, bull trout were found throughout most of the John Day River basin. Complete distribution is undocumented, but seasonal use of the Columbia River by bull from the John Day River system was likely. Presently, bull trout distribution is limited primarily to headwaters of the North Fork John Day River, Middle Fork John Day River, and upper mainstem John Day River and tributaries, with seasonal use of the mainstem river downstream to the vicinity of the town of John Day. The North Fork has the most bull trout habitat of the three John Day subbasins.

The John Day River Recovery Unit Team has identified one core area and 12 extant local populations in the recovery unit. Overall, bull trout in the John Day River Recovery Unit persist at low abundance. Comprehensive adult population estimates for the John Day River Recovery Unit were not available during the preparation of the draft recovery plan. While both the migratory and resident life history forms persist in the core area, only the migratory form was evaluated relative to effective population size guidance. The John Day River Recovery Unit Team assumed that abundance levels for migratory bull trout in individual local populations was below 100 spawners per year, and therefore are at risk of inbreeding depression. Similarly, the John Day River Recovery Unit Team concluded that the core area currently supported less than 1,000 migratory adults per year and consequently was at risk from genetic drift. Altered hydrology and stream habitat conditions throughout the John Day River basin from past and present land use practices (forestry, mining, agriculture, and livestock grazing) have had the greatest effect on bull trout in this basin.

A discussion of bull trout status within John Day can be found in Chapter 9 of the Draft Bull Trout Recovery Plan (U.S. Fish and Wildlife Service, 2002a).

Final designation of critical habitat excluded the John Day River recovery unit pursuant to section 4(b)(2) of the Endangered Species Act (U.S. Fish and Wildlife Service, 2004e).

Umatilla/Walla Walla Recovery Unit

The Umatilla-Walla Walla Recovery Unit encompasses the entire drainages of the Umatilla and Walla Walla rivers. The Umatilla River basin is located wholly in Oregon, while the Walla Walla River basin includes portions in Oregon and Washington. Two core areas are defined for this recovery unit, one for the Umatilla basin and one for the Walla Walla basin. Currently, there are four known bull trout local populations in this unit, three in the Walla Walla River basin and one in the Umatilla River basin.

Within the Umatilla basin, bull trout local populations in the South Fork Umatilla River and Meacham Creek are considered to be at high risk of extirpation, while the local population in the North Fork Umatilla River is larger but still considered to be depressed. Bull trout in the Umatilla Core Area are classified as at increased risk from deleterious effects of genetic drift.

Within the Walla Walla basin, bull trout local populations are at high risk of extirpation in the North Fork Walla Walla River, at low risk of extirpation in the South Fork Walla Walla River, and of special concern in Mill Creek. The status of bull trout in the Touchet River is largely unknown. Bull trout in the Walla Walla Core Area are not at risk from genetic drift.

Fish habitat in the Umatilla-Walla Walla Recovery Unit has been altered significantly by historic and current land use practices. Land uses affecting bull trout habitat in the Umatilla and Walla Walla basins include water diversions for crop and pasture irrigation, forest management practices, poorly managed grazing practices and urbanization along rivers. Historic fish management practices for bull trout, efforts to eradicate bull trout, and stocking of brook trout have also been factors in the decline of bull trout.

A discussion of bull trout status within Umatilla/Walla Walla Recovery Unit can be found in Chapter 10 of the Draft Bull Trout Recovery Plan (U.S. Fish and Wildlife Service, 2002a). Final designation of critical habitat includes 241 stream miles, but only for non-Federal lands that have greater than ½ mile of river frontage and are located between specific endpoints for the streams. Final critical habitat is designated streams on Meacham Creek, North Fork Meachan Creek, Ryan Creek, Umatilla River, Burnt Fork, Griffin Fork, Lewis Creek, Mill Creek, North Fork Touchet River, North Fork Walla Walla River, Paradise Creek, South Fork Touchet River, South Fork Walla Walla River, Spangler Creek, Touchet River, unnamed creek off Griffin Fork, Walla Walla River, Wolf Fork Touchet River, and Yellowhawk Creek.

Grande Ronde River Recovery Unit

The Grande Ronde River Recovery Unit is located in northeast Oregon and southeast Washington. In the past, bull trout occurred throughout the Grande Ronde River subbasin. Although bull trout were probably never as abundant as other salmonids in the subbasin, they were more abundant and more widely distributed than they are today.

The Grande Ronde River Recovery Unit Team identified two core areas, the Grande Ronde and the Little Minam. Wenatchee Creek (also known as Menatchee Creek) is potentially a core area but lacks sufficient survey data to include as a core area at this time. Nine local populations are identified within this recovery unit. The original local population of bull trout in the Wallowa River complex is believed to have been extirpated (Buchanan et al., 1997). In 1997, 600 bull trout from Big Sheep Creek, a tributary to the Imnaha River, were introduced into the Wallowa River above Wallowa Lake. Currently, these fish are still present in the system, but their exact population numbers are not known. Bull trout in the Grande Ronde River Recovery Unit persist at moderate levels. In the Grande Ronde Core Area, the best estimates are that approximately 4,000 bull trout spawned in each of the past few years. In the Little Minam Core Area the best estimates are that approximately 750 bull trout spawned in each of the past few years. Bull trout in the Grande Ronde and Little Minam core areas are at a diminished risk of genetic drift.

Historic land use activities that have impacted bull trout local populations include construction and operation of dams and roads, forestry practices, and agricultural development. Existing land use activities that contribute to fish habitat problems include riparian road construction and use, riparian grazing, and agricultural development.

A discussion of bull trout status within Grande Ronde River Recovery Unit can be found in Chapter 11 of the Draft Bull Trout Recovery Plan (U.S. Fish and Wildlife Service, 2002a).

Final designation of critical habitat includes 300 stream miles, but only for non-Federal lands that have greater than ½ mile of river frontage and are located between specific endpoints for the streams. Final critical habitat is designated stream segments on Bear Creek, Catherine Creek, Chicken Creek, Deer Creek, Fly Creek, Grande Ronde River, Hurricane Creek, Indian Creek, Limber Jim Creek, Little Bear Creek, Little Fly Creek, Little Lookingglass Creek, Lookingglass Creek, Lookout Creek, Lostine River, Minam River, Mottet Creek, North Fork Catherine Creek, Sheep Creek, South Fork Catherine Creek, Wallowa River, and Wenaha River.

Imnaha-Snake River Recovery Unit

The Imnaha-Snake River Recovery Unit encompasses the entire Imnaha River subbasin located in northeastern Oregon and Sheep and Granite subbasins in Idaho. Three core areas identified for the purpose of bull trout recovery are the Imnaha River, Sheep Creek and Granite Creek. The Imnaha Core Area contains four local populations. Bull trout in the Imnaha Core Area persist at moderate numbers; the best estimates are that approximately 4,000 bull trout have spawned annually for the past few years. The Sheep Creek Core Area contains one local population and Granite Creek Core Area contains one local population. Adult abundance in the Sheep Creek and Granite Creek core areas are unknown.

Overall, adult abundance in the Imnaha River Core Area was estimated at approximately 4,000 adults and is not considered at risk from genetic drift. Abundance estimates in the Sheep Creek and Granite Creek core areas are not available, so the risk to local populations from inbreeding depression and the risk to core areas for genetic drift could not be determined at the time of the publishing of the draft recovery plan.

Within the Imnaha-Snake Rivers Recovery Unit, historical and current land use activities have impacted bull trout local populations. Specific barriers (mostly associated with the Wallowa Valley Improvement Canal) may be inhibiting the recovery of bull trout and are identified in the draft recovery plan as a priority 2 action.

A discussion of bull trout status within Imnaha-Snake Recovery Unit can be found in Chapter 12 of the Draft Bull Trout Recovery Plan (U.S. Fish and Wildlife Service, 2002a).

Final designation of critical habitat includes 87 stream miles, but only for non-Federal lands that have greater than ½ mile of river frontage and are located between specific endpoints for the streams. Final critical habitat is designated stream segments on Granite Creek, Big Sheep Creek, Imnaha River, Little Sheep Creek, and McCully Creek.

Hells Canyon Complex Recovery Unit

The Hells Canyon Complex Recovery unit includes basins in Idaho and Oregon draining into the Snake River and its associated reservoirs from below the confluence of the Weiser River downstream to Hells Canyon Dam. Comprehensive data on bull trout abundance through time in the recovery unit does not exist.

Currently, there are 17 local populations and two areas with potential spawning and rearing habitat within two core areas in the Hells Canyon Complex Recovery Unit. Current local populations exist at low abundance and are considered to be at risk from genetic drift.

Accurate adult abundance estimates for bull trout in the recovery unit were not available at the time the draft recovery plan was published. Consequently, local populations could not be evaluated relative to the risk of inbreeding. The Hells Canyon Complex Recovery Unit Team currently estimates that each core area (Pine-Indian-Wildhorse and Powder River) currently contains less than 500 adult fish per year. These core areas are currently at risk from genetic drift.

Currently, habitat fragmentation and degradation are likely the most limiting factors for bull trout throughout the Hells Canyon Complex Recovery Unit. In the Snake River, large dams of the Hells Canyon Complex lack fish passage and have isolated bull trout among three basins: the Pine Creek and Indian Creek watersheds, Wildhorse River, and Powder River.

A discussion of bull trout status within Hells Canyon Complex Recovery Unit can be found in Chapter 13 of the Draft Bull Trout Recovery Plan (U.S. Fish and Wildlife Service, 2002a).

Snake River Recovery Unit

This Snake River Recovery Unit encompasses selected tributaries of the Snake River from Lower Monumental Dam (river mile 42) upstream to the mouth of the Grande Ronde River (river mile 169). There are two core areas in this recovery unit: the Tucannon River, which contains eight local populations; and Asotin Creek, which contains two local populations. Current knowledge indicates that local populations within the recovery unit consist of migratory and resident life history forms.

In portions of the Snake River Recovery Unit, bull trout have been extirpated from their former habitat. Other local populations may be fragmented and isolated in headwater locations because of natural or manmade barriers. There is not enough current survey data to make a reliable population estimate. The Snake River Recovery Unit Team believes that bull trout in the Tucannon River Core Area are at intermediate risk, while those of the Asotin Creek Core Area are at increasing risk.

Adult abundance in the Tucannon River Core Area was estimated (based on redd counts) at 600 to 700 adult spawners per year in the eight known local populations. Adult abundance in the Asotin Creek Core Area was estimated at less than 300 individuals in two known local populations, based on the results of bull trout surveys. Bull trout in the Tucannon River Core Area were considered at intermediate risk of inbreeding depression and should be considered at risk from genetic drift. Bull trout in the Asotin Creek Core Area were considered at an increasing risk of inbreeding depression and should be considered at risk from genetic drift.

Historical land use practices have degraded bull trout habitat in this area. Dams installed in the early 1900's continue to block migration and may have significantly reduced important bull trout populations. Agricultural and irrigation practices, river channel modifications, improper livestock grazing method, poor forestry practice, urbanization, and competition with nonnative fish species also threaten bull trout.

A discussion of bull trout status within Snake River Recovery Unit can be found in Chapter 24 of the Draft Bull Trout Recovery Plan (U.S. Fish and Wildlife Service, 2002a).

Final designation of critical habitat includes 94 stream miles, but only for non-Federal lands that have greater than ½ mile of river frontage and are located between specific endpoints for the streams. Final critical habitat is designated stream segments on Cummings Creek, Hixon Creek, Little Tucannon River, Tuchannon River, Asotin Creek, Charley Creek, George Creek, and North Fork Asotin Creek.

ACTION AREA INFORMATION

Bull trout are found in the following **fifth field** (sixth field) watersheds on the Umatilla National Forest: For specific information on habitat use, see the Bull Trout Draft Recovery Plan (2005).

- **Asotin Creek** (North Fork Asotin Creek),
- **Big Creek** (Dixson Bar, Big Creek, Corral Creek, Oriental Creek, Texas Bar)
- **Desolation** (North Fork Desolation, Upper Desolation/Battle, Kelsay, Lower Desolation)
- **Grande Ronde River/Grossman Creek** (Elbow Creek, Grande Ronde River/Bear Creek),
- **Granite Creek** (Clear Creek),
- **Lookingglass Creek** (Little Lookingglass Creek, Upper Lookingglass Creek, Lower Lookingglass Creek),
- **Meacham Creek** (Boston Canyon, Camp Creek, North Fork Meacham Creek),
- **Mill Creek** (Upper Mill Creek),
- **Upper Touchet River** (Upper North Fork Touchet River),
- **Upper Tucannon River** (Cummings Creek, Little Tucannon River, Tucannon River Headwaters, Panjab Creek),
- **Upper Camas** (Hidaway, Cable [Currently not occupied, but both are considered for relocation])
- **NF John Day River** (NF John Day River, Baldy Creek, NF John Day River Crane Creek)
- **Upper Umatilla River** (Bear Creek, North Fork Umatilla River, Buck Creek, Ryan Creek, South Fork Umatilla River, Thomas Creek),
- **Upper Walla Walla River** (North Fork Walla Walla River, Upper South Fork Walla Walla River, Middle South Fork Walla Walla River) and
- **Wenaha River** (Upper South Fork Wenaha River, Lower South Fork Wenaha River, Wenaha River/Rock Creek, Lower Butte Creek, Upper Butte Creek, Wenaha River/Cross Canyon, Upper Crooked Creek, Lower Crooked Creek, Lower Wenaha River, First Creek).

Bull trout are found in the following **fifth field** (sixth field) watersheds on the Wallowa-Whitman National Forest:

- **Upper NF John Day River** (NF John Day River Baldy Creek, Trail Creek, NF John Day River Onion Creek, NF John Day River Crane Creek)
- **Granite** (Upper Granite Creek, Beaver Creek, Clear Creek, Lower Granite Creek)
- **Upper Powder River** (Cracker Creek, Deer Creek)
- **Powder River/Rock Creek** (Upper Salmon, Lower Salmon, Muddy Creek)
- **North Powder River** (Lower Anthony Creek, Upper Anthony Creek, Upper North Powder River)
- **Wolf Creek** (Upper Wolf Creek)
- **Powder River/Eagle** (Upper Eagle Creek, West Eagle Creek, Eagle Creek/Bennett Creek, East Fork Eagle Creek, Eagle Creek/Paddy Creek, Little Eagle Creek, Lower Eagle Creek)
- **Pine Creek** (Upper Pine Creek, Clear Creek, Lake Fork Creek)
- **Lower Imnaha River** (Imnaha River/Fence Creek)
- **Middle Imnaha River** (Imnaha River/Summit Creek, Chalk Creek, Deer Creek)
- **Upper Imnaha River** (North Fork Imnaha River, Sough Fork Imnaha River, Imnaha River/Rock Creek, Imnaha River/Dry Creek, Imnaha River/Crazyman Creek)
- **Upper Big Sheep Creek** (Upper Big Sheep Creek, Lick Creek, Big Sheep Creek/Tyee Creek, Big Sheep Creek/Corral Creek, Big Sheep Creek/Marr Creek, Big Sheep Creek/Steer Creek)
- **Lower Big Sheep Creek** (Upper Little Sheep Creek, Big Sheep Creek/Lower Little Sheep Creek, McCully Creek)
- **Upper Grande Ronde River** (Tanner Gulch, Limber Jim Creek, Meadowbrook Creek, Chicken Creek, Lower Fly Creek, Warm Springs Creek)
- **Upper Catherine Creek** (North Fork Catherine Creek, South Fork Catherine Creek, Catherine Creek/Milk Creek, Catherine Creek/Brinker Creek)
- **Grande Ronde/Indian Creek** (Grande Ronde/Imbler Creek, Upper Indian Creek, Lower Indian Creek)
- **Grossman Creek** (Grande Ronde River/Clear Creek)
- **Upper Wallowa River** (Hurricane Creek)
- **Lostine River** (Upper Lostine River, Lostine River/Lake Creek, Lostine River/Silver Creek)
- **Bear Creek** (Upper Bear Creek, Lower Bear Creek)
- **Lower Wallowa River** (Deer Creek, Wallowa River/Water Canyon, Wallowa River/ Fisher Creek)
- **Minam River** (Upper Minam River, Minam River/China Cap Creek, North Minam River, Minam River/Chaparral Creek, Little Minam River, Minam River/Trout Creek, Lower Minam River)

Effects Analysis

This section discusses the potential effects to threatened and endangered fish species and their habitats found within the action area. Much of the effects discussion is incorporated from Risk

Assessments and the Fisheries BA completed for the Region 6 2005 Final Environmental Impact Statement for the Regional Invasive Plant Program and associated documents.

HERBICIDE RISK ASSESSMENTS AND LAYERS OF CAUTION

Because herbicides have the potential to adversely affect the environment, the U.S. Environmental Protection Agency (EPA) must register all herbicides prior to their sale, distribution, or use in the United States. In order to register herbicides for outdoor use, the EPA requires the manufacturers to conduct a safety evaluation on aquatic organisms including toxicity testing on representative species of freshwater fish, aquatic invertebrates, and aquatic plants. An ecological risk assessment uses the data collected to evaluate the likelihood that adverse ecological effects may occur as a result of herbicide use.

The Forest Service conducts its own risk assessments, focusing specifically on of herbicides used in forestry applications. The FS contracted with Syracuse Environmental Research Associates, Inc. (SERA) to conduct human health and ecological risk assessments for herbicides that may be proposed for use on National Forest System lands. The information contained in this BA and in the forests' EISs relies on these risk assessments. All toxicity data, exposure scenarios, and assessments of risk are based upon information in the FS/SERA risk assessments unless otherwise noted. FS/SERA risk assessments use peer-reviewed articles from the open scientific literature and current EPA documents, including Confidential Business Information. Specific methods used in preparing the FS/SERA risk assessments are described in SERA, 2001-Preparation.

The risk assessments considered worst-case scenarios including accidental exposures and application at maximum label rates. The R6 2005 FEIS added a margin of safety to the SERA Risk Assessments by making the thresholds of concern substantially lower than normally used for such assessments. Although the risk assessments have limitations (see R6 2005 FEIS pages 3-95 through 3-97), they represent the best science available.

Table III - 3 displays risk assessments accessible via the Pacific Northwest Region website at http://www.fs.fed.us/r6/invasiveplant-eis/Risk-Assessments/Herbicides-Analyzed-InvPlant-EIS.htm.

Table III - 3- Risk Assessments for Herbicides Considered in this BA

Herbicide	Date Final	Risk Assessment Reference
Chlorsulfuron	November 21, 2004	SERA TR 04-43-18-01c
Clopyralid	December 5, 2004	SERA TR 04 43-17-03c
Glyphosate	March 1, 2003	SERA TR 02-43-09-04a
Imazapic	December 23, 2004	SERA TR 04-43-17-04b
Imazapyr	December 18, 2004	SERA TR 04-43-17-05b
Metsulfuron methyl	December 9, 2004	SERA TR 03-43-17-01b
Picloram	June 30, 2003	SERA TR 03-43-16-01b
Sethoxydim	October 31, 2001	SERA TR 01-43-01-01c
Sulfometuron methyl	December 14, 2004	SERA TR 03-43-17-02c
Triclopyr	March 15, 2003	SERA TR 02-43-13-03b
NPE	May 2003	USDA Forest Service, R-5 (Bakke 2003)

THREAT TO AQUATIC HABITATS AND SPECIES

The risk assessments prepared by SERA (1998, 2001, 2003) contains detailed analysis of the potential effects of each herbicide. They include detailed descriptions of factors influencing exposure and dose, use of surrogate species for toxicity data, field studies, and analysis results for each individual herbicide. When enough data was available for a particular type of animal, an exposure scenario was developed, and a quantitative estimate of dose received by the animal type in the scenario was calculated (SERA, 2001). The quantitative estimates of dose were compared to available toxicity data to determine potential adverse impacts. The most sensitive response (i.e. a sub-lethal effect that occurred at the lowest dose) from the most sensitive species was used to determine the "toxicity indices" for each herbicide. For example, the levels of concern for hazard quotients are based on 1/20th of the LC50 for federally listed fish species because of the concern for subtle non-lethal effects.

Measured chronic no-observable-effect-concentration was used (NOEC) where the value was lower than the 1/20th of the acute LC50 (imazapic, metsulfuron methyl, and sulfometuron methyl). Doses that are protective in chronic exposures are more certain to be protective in acute exposures.

Acute exposures are short-term while chronic exposures occur over time. Both acute and chronic exposures to the most sensitive representatives of the aquatic community at the most sensitive NOEC value were evaluated.

Adverse affects to fish can affect their ability to locate and/or capture food, avoid predators, or reproduce. The following analysis relies on these types of effects, when sufficient data exists, rather than directly lethal doses, to determine the potential for doses to cause an "adverse effect" to fish and their habitat.

The estimated dose (from the scenarios) was divided by the "toxicity index" and the result is known as the Hazard Quotient. When the Hazard Quotient is less than 1.0, the dose is less than the toxicity index. Potential effects from doses calculated to be below the toxicity indices are insignificant. When a calculated dose was greater than the toxicity index, we stated that there was a potential for adverse effects. Threshold values (e.g. chronic NOEC values used for acute exposures, Risk Assessment scenarios, the toxicity indices) are what form the protective approach. This very protective approach constitutes a "worst-case" analysis for potential effects of herbicides.

Whenever sufficient data were available to determine the dose that resulted in no observable adverse effects level (NOAEL), the NOAEL was used as the toxicity index. If data were not sufficient to determine a NOAEL, other endpoints of toxicity were used, such as the lowest-adverse-effect level (LOAEL), or the dose that was lethal to 50 percent of the test population (LD50). When a LOAEL or LD50 was used as the toxicity index, standard EPA methods for applying an uncertainty factor to the toxicity index to determine a level of concern were used. The standard EPA method for listed fish species is to take 1/20th of the LC50 (EPA/OPP 2004), which is the protocol used in this analysis when a NOAEL is not available.

The likelihood that an animal will experience adverse effects from an herbicide depends on: (1) the inherent toxicity of the chemical, (2) the amount of chemical to which an animal is exposed, (3) the amount of chemical actually received by the animal (dose), and (4) the inherent sensitivity of the animal to the chemical.

The amount of chemical to which an animal may be exposed is influenced by several factors, such as environmental conditions, and foliar interception of spray. When an animal is exposed to a chemical, only a portion of the chemical applied or ingested is actually absorbed or taken in by the animal (the dose).

HERBICIDE MIXTURES

Any herbicide mixtures in the proposed action will follow the herbicide mixture analysis identified in the R6 FEIS Fisheries BA in order to comply with Regional standards. Standard #16 of the R6 FEIS limits mixtures to three herbicides or fewer and requires the use of a dose addition analysis at the project scale to determine if a particular mixture may be used. Under specified conditions, dose addition analysis is believed to provide a reasonable estimate of the cumulative toxicity of chemical mixtures. The hazard index (HI) method of assessing dose addition is relatively simple and straightforward. The approach is used or recommended by a number of agencies, including EPA, National Academy of Sciences, National Research Council, and Occupational Health and Safety Administration (ATSDR, 2004).

The individual herbicides in each mixture are analyzed to determine estimated dose, which is then divided by the respective "toxicity index" to produce a hazard quotient (HQ). When the HQ is less than 1.0, then the dose is less than the toxicity index. The HI is calculated by adding all the HQ's for the herbicides in the mixture. This is known as dose addition. If the HI is < 1.0, then an acceptable level of mixture toxicity risk is assumed to be present. See Appendix X for tank mixture analysis method.

Dose addition is considered most appropriate for mixtures with components that affect the same endpoint by the same mode of action, and are believed to behave similarly with respect to uptake, metabolism, distribution, and elimination (Choudhury et al., 2000). The precise toxic mechanism(s) in aquatic organisms are not known for all of the herbicides contained in the proposed action. Effects to the fish and fry are typical endpoints.

Dose addition analysis is also a reasonable assumption when analyzing mixtures of chemicals with different or unknown toxicity mechanisms, when expected doses will be below known toxic levels (ATSDR, 2004). This is also supported by data from Feron et al. (1995), as cited in EPA (Choudhury et al., 2000), which showed interaction when mixture chemical components were present in concentrations at or near their respective LOAELs.

No interaction was observed between chemical components when present at concentrations 1/10 or 1/3 or their respective LOAELs.

The dose addition analysis described in the R6 FEIS Fisheries BA is believed to produce conservative estimates of mixture toxicity for several reasons. First, the assumption of dose addition in itself is conservative; the dose addition protocol assumes an additive response for all chemicals in the mixture, when in fact some chemicals may produce independent, non-additive responses. For example, the EPA description of dose addition analysis in Choudhury et al. (2000) states that separate dose addition analyses should be performed for each affected organ.

The protocol in Standard #16 utilizes one HI that includes all herbicides, regardless of toxicity site, potentially resulting in a higher HI value than if mixture components were analyzed in smaller groups by affected organ.

Also, by requiring the HI for the mixture to be less than 1.0, the Hazard Quotients of each component in the mixture must be below known toxic levels and will meet the criteria cited in ATSDR (2004) and Choudhury et al. (2000).

The primary sources of uncertainty in utilizing dose addition analysis in the proposed manner are the lack of mixture analysis studies utilizing more than two chemicals. The risk of adverse effects, with respect to the lack of information on mixtures involving more than two chemicals, increases with the number of mixture components. In an effort to minimize these risks, the proposed action states that mixtures will contain no more than three active herbicide ingredients.

RISK ASSESSMENT UNCERTAINTIES AND DATA GAPS

Generally, active ingredients have been tested on only a limited number of species and mostly under laboratory conditions. While laboratory experiments can be used to determine acute toxicity and effects to reproduction, cancer rates, birth defect rates, and other effects that must be considered, laboratory experiments do not account for aquatic organisms in their natural environments. Environmental stressors can increase the adverse effects of contaminants, but the degree to which these effects may occur for various herbicides is largely unknown. Various aquatic organisms may also be more or less sensitive to a particular herbicide than laboratory organisms. This leads to uncertainty in the risk assessment analysis. Additional discussion of incomplete and unavailable information can be found in the R6 2005 FEIS.

THE USE OF SURROGATE SPECIES

Most toxicity testing utilizes surrogate species. Surrogate species serve as a substitute for the species of interest, because all species of interest could not be tested. Surrogate species are typically organisms that are easily tested using standardized methods, are readily available, and inexpensive. The physiological requirements for some organisms prohibit their use in toxicity testing because these requirements cannot be met within the test system. Rare or Federally listed species are not used for a variety of reasons, including legal restrictions and having only a limited numbers of individuals available. On the rare occasions when data can be obtained from federally listed species, the limited conditions under which they are taken may bias the results (e.g. see Wiemeyer et al., 1993).

Even when desired species are available (e.g. salmon), researchers may choose a surrogate, like zebrafish (*Danio rerio*) (aka zebra danio), because test results are more easily discerned with the surrogate, and reproductive capacity allows testing of large numbers of individuals, among other reasons (Scholz, unpub. proposal, 2003).

However, caution should to be taken when addressing ecological risk and the use of surrogates when analyzing those ecological risks. Some herbicides demonstrate more variation than others in effects among different species, and very limited numbers of species have been tested.

Because of the variation of responses among species, and the uncertainty with regard to how accurately a surrogate species may represent other aquatic organisms, the FS/SERA risk assessments use the most sensitive endpoint from the most sensitive species tested as the toxicity index for all aquatic organisms. This does not alleviate concerns over interspecies variations in response

MODEL ASSUMPTIONS

Streams and other waterbodies can be contaminated from runoff, as a result of leaching from contaminated soil or from a direct spill. Two estimates for the concentration of herbicides in ambient water were completed for the R6 FEIS risk assessments; acute/accidental exposure from an accidental spill and longer-term exposure to herbicides in ambient water that could be associated with the application of the herbicide to a 10 acre block that is adjacent to and drains into a small stream or pond. Water contamination estimates were based on the GLEAMS (Groundwater Loading Effects of Agricultural Management Systems).

GLEAMS is a root zone model that can be used to examine the fate of chemicals in various types of soils under different meteorological and hydrogeological conditions. As with many environmental fate and transport models, the input and output files for GLEAMS can be complex. The general application of GLEAMS model and the use of the output from this model to estimate concentrations in ambient water are detailed in SERA (2003).

Using the GLEAMS models, the default assumptions used to calculate plausible (mathematically possible) herbicide exposures for the R6 2005 FEIS were:

- 0.25 acre pond, 1 meters deep, with a 0.01 sediment fraction. 10 acre square field (660' by 660') with a root zone of 60 inches and four soil layers,
- Stream with base flow rate of 4,420,000 L/day with a flow velocity of 0.08 m/second (1.8 cfs) or 6912 meters/day. Stream width of 2 meters (about 6.6 feet') and depth of about 1 foot. 10 acre square field (660' by 660') adjacent to stream, with a root zone of 60 inches and four soil layers,
- Broadcast spray application on sparse grass vegetation cover on 10% slope, which assumes that there is no herbicide taken up by vegetation,
- Worst combination of soil and rainfall (different for each herbicide), with rainfall timing of once every 10 days, with rain event beginning immediately after treatment,
- Assumes entire herbicide used reaches water at one point,
- The most sensitive no observable effect concentration value for the most sensitive species were used to derive the toxicity thresholds,
- For estimates of exposures, we used the upper exposure limits from the SERA risk assessment worksheets instead of the central and lower limits, and assessed impacts at the high application rates,
- Steady delivery of herbicide into a stream over 90 days for fish and 21 days for invertebrates, algae, and aquatic plants.

The aggregate risks of exposure to TCP (a major metabolite; 3,5,6-trichloro-2-pyridinol) from the breakdown of both triclopyr and chlorpyrifos (an insecticide) are considered in SERA risk assessment for triclopyr due to toxicity to mammals and other species. The most conservative estimate of exposure to TCP is reflected in the applications of triclopyr and chlorpyrifos, which are spaced in such a way as to result in the maximum possible concentrations of TCP in water (SERA 2003).

GLEAMS MODEL ESTIMATES FOR BLUE MOUNTAINS ECOTYPE

The R6 FEIS Fisheries BA considered whether ecosystem conditions associated with a variety of bioregions (ecotypes) might affect herbicide concentrations/hazards predicted using the GLEAMS model.

The BA found that risk assessment modeling tends to estimate water contamination rates adequately for managed forested vegetation types within the Blue Mountains ecotype (Umatilla and Wallowa Whitman National Forests fit this ecotype). Modeling an agricultural field would more adequately model the other vegetation types and would tend to underestimate water contamination rates in these circumstances. At higher stream flows (larger stream channels or wet season flow conditions), risk assessment model predictions tend to overestimate the herbicide concentration in most local streams. For smaller streams, other factors considered have a more pronounced effect than for larger streams.

Based on the modification of the SERA GLEAMS stream herbicide concentration predictions by local factors in the Canyon Creek area, results in the R6 2005 FEIS identified the potential for increase in concern with picloram, glyphosate, and triclopyr for fish. There was also an increase in concern for aquatic macrophytes with chlorsulfuron, glyphosate, imazapic, metsulfuron methyl, triclopyr and picloram; for invertebrates with glyphosate and triclopyr, and for aquatic plants with chlorsulfuron, glyphosate (with surfactant only), metsulfuron methyl, picloram and triclopyr. The R6 2005 Record of Decision (ROD) specifically limited triclopyr to spot and hand methods (no broadcast of triclopyr allowed as per standard 16) to avoid scenarios of concern related to triclopyr.

In general, situations that increased concern for potential effects to aquatic species from the level of risk stated in the SERA risk assessments occurred for smaller stream channels with steeper side slopes, with risk increasing at higher altitudes. Conversely, risk lower than that stated in the risk assessments was identified for larger stream channels at lower elevations, and possibly in smaller stream channels with sideslopes less than 10 percent.

Slopes in the Canyon Creek watershed are generally the 10 percent modeled, and herbicide delivery to streams could be expected to increase significantly. Local soil types do not appear to markedly change expected herbicide delivery for most herbicides likely to be applied in the watershed, except in disturbed areas using highly soluble herbicides that do not bind well with soil particles, such as picloram and chlorsulfuron.

Because the action avoids broadcasting within 50-100 feet of any stream (dry or wet) depending upon type of chemical used, the GLEAMS model would still overestimate the amount of herbicide that would enter water, because:

- Spot and selective methods would only be used within 0-150 feet of streams, depending upon type of chemical used. These methods substantially reduce potential for off site impacts, drift, and other herbicide delivery mechanisms to water (runoff, leaching). Applicators can immediately respond to site conditions to ensure PDFs are followed as planned.

- The model does not account for vegetation uptake of herbicide (the entire label rate is assumed to be subject to run off). The herbicides allowed for use within the riparian areas are rapidly taken up by plants and/or bind to soil and would not be available for runoff soon after application.

LAYERS OF CAUTION INTEGRATED INTO HERBICIDE USE

There are several layers of caution that are integrated into herbicide use in the Pacific Northwest Region (Region Six). First, label requirements, federal and state laws, and the EPA approval process provide an initial level of caution regarding chemical use. Next, the SERA Risk

Assessments disclosed hazards associated with worst-case herbicide conditions (maximum exposure allowed by the label).

The R6 2005 FEIS included an additional margin of safety by reducing the level of herbicide exposure considered to be of concern to fish, wildlife, and people. The R6 2005 ROD adopted standards to minimize or eliminate risks to people and the environment. The Umatilla and Wallowa-Whitman National Forests Invasive Plants Treatment Project is designed to comply with the R6 2005 ROD standards. The Umatilla and Wallowa-Whitman National Forests allows for additional layers of caution to be integrated into herbicide use locally by:

Treatment methods have been limited to those necessary to eradicate, control, or contain invasive plants on the Umatilla and Wallowa-Whitman National Forests. Higher risk projects such as aerial and/or broadcast application are limited by the buffers prescribed in the PDF. No aerial application would occur within 300 feet of wet streams and wetlands. Broadcast application would not occur within 100 feet of wet streams or wetlands (including wet roadside ditches) and chemicals rated as high risk would not be used on roadsides within RHCAs.

Project Design Features (PDFs) limit the rate, type, and method of herbicide application sufficiently to eliminate exposure scenarios that would cause concern, based on the site conditions at the time of treatment.

The implementation planning and monitoring and adaptive management processes described in Proposed Action would ensure that effective treatments are completed according to PDFs, and undesired effects are indeed minimized. Further analysis would be required if a new infestation would not be treated effectively according to the PDFs (for instance, the herbicides available for use near streams were not effective for a new infestation).

Each state may also have its own separate registration process, which may be more stringent than the EPA's registration process. Washington and Oregon States' registration procedure follows EPA registration. It requires that the applicant submit a copy of the market label and a copy of the confidential statement of formula. These submittals are reviewed for compliance with state and federal requirements.

Research on previous ESA consultations related to buffer widths was conducted in order to fully develop the proposed action for purposes of meeting standards #19 and #20 of the R6 FEIS. Where there was not enough information, such as the case for dry intermittent streams, a conservative approach was taken from the interdisciplinary team in developing buffers using knowledge of herbicide properties and level of risk to aquatic organisms.

HERBICIDE PROPERTIES AND RISK ASSESSMENT FINDINGS

Fish and other aquatic organisms have the potential to be adversely affected by contact with concentrations of herbicide that exceed levels of concern in water. For example, herbicides applied near a stream could inadvertently contact aquatic invertebrates that rely on terrestrial plants to fulfill their life cycle and thus reduce the availability of food for fish. Herbicides can alter the structure and biological processes of both terrestrial and aquatic ecosystems; these effects of herbicides may have more profound influences on communities of fish and other aquatic organisms than direct lethal or sublethal toxic effects (Norris et al. 1991). Herbicides used for aquatic invasive plant control have been shown to affect aquatic ecosystem components, however concentration of herbicides coming in contact with water following land-base treatments are unlikely to be great enough to cause such changes (ibid).

Sublethal effects can include changes in behaviors or body functions that are not directly lethal to the aquatic species, but could have consequences to reproduction, juvenile to adult survival, or other important components to health and fitness of the species. Or, sublethal effects could result from effects to habitat or food supply.

Residues in food from direct spraying are likely to occur during and shortly after application. Drift from herbicides considered for use may affect aquatic vegetation at low concentrations; however they show little tendency to bioaccumulate and are likely to be rapidly excreted by organisms as exposure decreases (Norris et al. 1991). Therefore, while the herbicides considered for use in this project may kill individual aquatic plants, aquatic habitats and the food chain would not be adversely impacted because the amount of herbicide that could be delivered is relatively low in comparison with levels of concern from SERA Assessments and the duration to which any non-target organism (including aquatic plants) would be exposed is very short-lived and impacts to aquatic plants would be very localized.

The application rate and method, along with the behavior of the herbicide in the environment, influence the amount and length of time an herbicide persists in water, sediment, or food sources. Once in contact, the herbicide must be taken up by the organism and moved to the site of biochemical action where the chemical must be present in an active form at a concentration high enough to cause a biological effect (Norris et al. 1991).

Herbicides vary in their environmental activity and physical form. Some may be oil- or water-soluble molecules dissolved in liquids or attached to granules for dry application to soil surface. Herbicides may move from their location of application through leaching (dissolved in water as it moves through soil), volatilization (moving through air as a dissolved gas), or adsorption (attached by molecular electrical charges to soil particles that are moved by wind or water). In soil and water, herbicides may persist or decompose by sunlight, microorganisms, or other environmental factors. Soil properties, rainfall patterns, slope, and vegetative cover greatly influence the likelihood that an herbicide will move off-site, once applied.

In combination with other site and biological factors, these characteristics influence both the probability of meeting site-specific goals for invasive plant control, and the potential of impacting non-target components of the environment.

The effects from the use of any herbicide depends on the toxic properties (hazards) of that herbicide, the level of exposure to that herbicide at any given time, and the duration of that exposure. Risk to aquatic organisms can be reduced by choosing herbicides with lower potential for toxic effects when exposure may occur.

Exposure of federally listed fish to herbicides can be greatly reduced or increased depending on site-specific implementation techniques and timing used in herbicide application projects. Exposure can be reduced by such methods as streamside buffer zones, timing applications to avoid sensitive seasons, varying application methods used, and combining herbicide treatments with non-herbicide treatments to reduce overall use. Project design features included in the proposed action are expected to minimize potential exposures to federally listed fish.

The hazards associated with each herbicide active and inert ingredients, impurity or metabolites were determined by a thorough review of available toxicological studies. For a background discussion of all toxicological tests and endpoints considered in Forest Service Risk Assessments, refer to SERA, 2001.

Herbicides are not pure compounds; they contain active ingredients, impurities, adjuvants, inert ingredients, and may also contain surfactants. The movement, persistence, and fate of an herbicide in the environment determine the likelihood and the nature of the exposure fish and other aquatic organisms will receive. Stream and lake sediments may be contaminated with herbicides by deposition of soils carrying adsorbed herbicides from the land or by adsorption of herbicides from the water (Norris et al. 1991). Persistence of the herbicide is the predominant factor affecting its presence in the soil. Stream and lake sediments may be contaminated with herbicides by deposition of soils carrying adsorbed herbicides from the land or by adsorption of herbicides from the water (Norris et al. 1991).

RISK ASSESSMENT SUMMARY FOR ACTIVE HERBICIDE INGREDIENTS

The most sensitive effect from the most sensitive species tested was used to determine the toxicity indices for each herbicide (Table III - 4). Quantitative estimates of dose from each exposure scenario were compared to the corresponding toxicity index to determine the potential for adverse effect. Doses below the toxicity indices resulted in discountable effects.

Table III - 4- Toxicity Indices for Fish Used for the Effects Analysis in this BA

Herbicide	Duration	Endpoint	Dose	Species	Effect Noted at LOAEL (Lowest Observable Adverse Effect Level)
Chlorsulfuron	Acute	NOEC *	2 mg/L (1/20th of LC50)	Brown trout	LC50 at 40 mg/L
	Chronic	NOEC[1]	3.2 mg/L	Brown trout	rainbow trout length affected at 66mg/L
Clopyralid	Acute	NOEC	5 mg/L (1/20th of LC50)	Rainbow trout	LC50 at 103 mg/L
	Chronic				none available
Glyphosate (no surfactant)	Acute	NOEC	0.5 mg/L (1/20th/LC50)	Rainbow trout	LC50 at 10 mg/L
	Chronic	NOEC	2.57 mg/L[2]	Rainbow trout	Life-cycle study in minnows; LOAEL not given
Glyphosate with POEA surfactant	Acute	NOEC	0.065 mg/L (1/20th of LC50)	Rainbow trout	LC50 at 1.3 mg/L for fingerlings (surfactant formulation)
	Chronic	NOEC	0.36 mg/L	salmonids	estimated from full life-cycle study of minnows (surfactant formulation)
Imazapic	Acute	NOEC	100 mg/L	all fish	at 100 mg/L, no statistically sig. mortality
	Chronic	NOEC	100 mg/L	fathead minnow	No treatment related effects to hatch or growth
Imazapyr	Acute	NOEC	5 mg/L (1/20th LC50)	trout, catfish, bluegill	LC50 at 110-180 mg/L for North American species
	Chronic	NOEC	43.1 mg/L	Rainbow	"nearly significant" effects on early life stages at 92.4 mg/L
Metsulfuron methyl	Acute	NOEC	10 mg/L	Rainbow	lethargy, erratic swimming at 100 mg/L
	Chronic	NOEC	4.5 mg/L	Rainbow	standard length effects at 8 mg/L

Herbicide	Duration	Endpoint	Dose	Species	Effect Noted at LOAEL (Lowest Observable Adverse Effect Level)
Picloram	Acute	NOEC	0.04 mg/L (1/20th LC50)	Cutthroat trout	LC50 at 0.80 mg/L
	Chronic	NOEC	0.55 mg/L	Rainbow trout	body weigh and length of fry reduced at 0.88 mg/L
Sethoxydim	Acute	NOEC	0.06 mg/L (1/20th LC50)	Rainbow trout	LC50 of Poast at 1.2 mg/L
	Chronic	NOEC			none available
Sulfometuron methyl	Acute	NOEC	7.3 mg/L	Fathead minnow	No signs of toxicity at highest doses tested
	Chronic	NOEC	1.17 mg/L	Fathead minnow	No effects on hatch, survival or growth at highest doses tested
Triclopyr acid	Acute	NOEC	0.26 mg/L (1/20th LC50)	Chum salmon	LC50 at 5.3 mg/L[3]
	Chronic	NOEC	104 mg/L	Fathead minnow	Reduced survival of embryo/larval stages at 140 mg/L
Triclopyr BEE	Acute		0.012 mg/L	Bluegill sunfish	LC50 at 0.25 mg/L
	Chronic[4]	NOEC	104 mg/L	Fathead minnow	Reduced survival of embryo/larval stages at 140 mg/L
NPE Surfactants	Acute[5]	NOEC	0.2 mg/L (1/20th LC50)	fathead minnow, rainbow trout	LC50 at 4.0 mg/L
	Chronic[6]	NOEC	1.0 mg/L	trout	no LOEL given

1 Chronic value for brown trout was estimated using relative potency in acute and chronic values for rainbow trout, and the acute value for brown trout.
2 Estimated from minnow chronic NOEC using the relative potency factor method (SERA Glyphosate 2003).
3 Using Wan et al. (1989) value for lethal dose.
4 Chronic and subchronic data for triclopyr are limited to triclopyr TEA. No data is available for triclopyr BEE.
5 Exposure includes small percentage of NP and NP1-2E (Bakke, 2003).
6 Chronic exposure is from degredates NP1EC and NP2EC, because NPE breaks down rapidly and NPEC's are more persistent (Bakke, 2003).
Indices represent the most sensitive endpoint from the most sensitive species for which adequate data are available. Numbers in red indicate the toxicity index used in calculating the hazard quotient for exposures to listed fish. Generally, the lowest toxicity index available for the species most sensitive to effects was used. Measured chronic data (NOEC) was used when they were lower than 1/20th of an acute LC50 because they account for at least some sublethal effects, and doses that are protective in chronic exposures are more certain to be protective in acute exposures.
*NOEC = No Observed Effect Concentration

Results of the exposure scenarios as applied to listed fish on the Umatilla and Wallowa-Whitman National Forests are displayed in Table III - 5. The cells that contain a slash and no number mean that there was no exceedence in level of concern (LOC). The LOC exceedences occur when the HQ value exceeds 1. Exceedences in LOC indicate occasions where the expected exposure concentration (EEC) is greater than the no observable effect concentration (NOEC) value used for that aquatic species group, which may lead to an indirect effect to listed aquatic species if conditions were similar to what was modeled in the SERA risk assessments. To calculate an HQ, simply take the ratio of EEC/NOEC values. Two types of indirect effects are possible, those toxic to the listed aquatic species, and those mediated by toxic effects to an ecosystem component that is part of the Primary Constituent Elements (PCE) or associated essential habitat features.

Table III - 5-Hazard Quotient Values for Acute Exposure Estimates for Aquatic Organisms

Aquatic Species Group	Application Rate	Chlorsulfuron	Clopyralid	Glyphosate w/o surfactant8*	Glyphosate w/ surfactant	Imazapic	Imazapyr**	Metasulferon Methyl	Picloram	Sethoxydin	Sulfometeron Methyl	Triclopyr TEA*	Triclopyr BEE	NPE Surfactant
Fish	High	--	--	6	43	--	--	--	5	3	--	15	125	--
	Typical	--	--	2	12	--	--	--	2	2.5	--	1.5	13	--
Aquatic Invertebrates	High	--	--	--	2.5	--	--	--	--	--	--	--	1.8	--
	Typical	--	--	--	--	--	--	--	--	--	--	--	--	--
Algae	High	5	--	--	3.1	--	5	--	--	--	3	9.5	214	--
	Typical	--	--	--	--	--	2	--	--	--	--	--	21	--
Aquatic Macrophytes	High	1064	--	--	--	1.4	8	9	2	--	36	9.5	214	--
	Typical	234	--	--	--	--	3	2	--		4		21	

'--' Predicted concentrations less than or equal to the estimated or measured 'no observable effect concentration' at both typical and high application rates.
'*' Aquatic formulations analyzed in the R6 2005 FEIS.
'**' Although a risk assessment has been completed for aquatic Imazapyr (Habitat), it may not be used until the Washington Office (Forest Service) review is completed for inert ingredients and additives as per Forest Plan standard 18.

The exposure scenarios do not account for factors such as timing of application, animal behavior and feeding strategies, animal presence within a treatment area, or other relevant factors such as site-specific conditions. However, the SERA risk assessments do represent a worst-case scenario that is a good benchmark for assessing true concerns with actual application. Results of triclopyr exposures take into account the strict limitations on use identified in the forest plan standards, which makes the exposure scenarios implausible or impossible. Table III - 4 displays the results of exposure if all "worst-case" conditions reflected in the scenario occur, which is highly unlikely for the Umatilla and Wallowa-Whitman National Forests.

CHRONIC AND ACUTE EXPOSURES

The toxicity metric values (estimated or measured NOEC values) used in the R6 2005 FEIS analysis were selected as the most likely to protect against sub-lethal effects. For assessing potential risk to listed fish, while accounting for uncertainty regarding sub-lethal effects, the 1/20th of the acute LC50 (U.S. EPA 2004) or a lower acute or chronic NOEC value was used for the acute toxicity index. Therefore, a LOC exceedence listed represents a significant risk of sub-lethal effects. The effects analysis tiers to the results of the R6 2005 FEIS for chronic and acute exposures, and analyzes the potential for a significant risk of sub-lethal effects as well as indirect effects from impacts to the food web.

Results of the R6 2005 FEIS analysis indicates that chronic exposures to fish are not likely to occur. Therefore, chronic exposures to fish for the Proposed Action are unlikely to occur. It is safe to assume that it is highly unlikely to reach a LOC for chronic exposures herbicide treatments on the Umatilla and Wallowa Whitman National Forests.

The R6 FEIS identified three herbicides that mathematically exceeded the LOC for aquatic plants: Imazapyr, Metsulfuron, and Chlorsulfuron. The R6 2005 FEIS concluded that exposure of aquatic plants to chronic toxicity concentrations of imazapyr may be mathematically possible, but not plausible. Therefore, it is not plausible for the proposed action to result in chronic toxicity of imazapyr for aquatic plants. For metsulfuron, the peak modeled stream concentration reported in the SERA risk assessment is 0.006 mg/l, which is approximately equal to the 0.005 mg/l that was calculated as the mathematically highest possible average stream concentration (with direct input). This indicates that the true 21 day concentration for non-fish species is likely much lower. Based on this, it is unlikely that exposure to chronic toxicity of metsulfuron to plants will occur for the proposed action, even if there were no buffers.

The risk assessment for chlorsulfuron lists the highest average modeled stream concentration as 0.0022 mg/l, approximately 46 times higher than the estimated acute NOEC of 0.000047 mg/l. However, chronic toxicity to plants is unlikely to occur for the proposed action because of project design features that limit broadcasting chlorsulfuron.

The effects analysis for this BA focus on the probability and magnitude of acute exposures from herbicide treatments based on results from the SERA risk assessments. It must be made clear that the risk categories for herbicides identified in the R6 2005 FEIS Fish BA is risk to aquatic organisms (fish, invertebrates, algae, aquatic macrophytes) among the herbicides analyzed for the R6 2005 ROD. The herbicides analyzed in the R6 2005 FEIS were compared to each other and placed in a risk level category according to results from worst-case acute exposure scenario used in the SERA risk assessments. Herbicides analyzed in the R6 2005 FEIS were displayed in the following category of risk:

Lowest risk: results from SERA risk assessments indicated no risk or a plausible risk to aquatic macrophytes only (includes chlopyralid, imazapic and metsulfuron methyl),

Moderate risk: results from SERA risk assessments indicated a plausible risk to algae or invertebrates, in addition to plants (includes chlorsulfuron, imazapyr and sulfometeron methyl),

Highest risk: results from SERA risk assessments indicated a plausible risk to fish which may or may not be a risk to algae, invertebrates, or macrophytes (includes sethoxydim, picloram, non-aqueous glyphosate and triclopyr).

The lowest risk group contains those herbicides for which LOCs were either not exceeded, or only exceeded the LOC for aquatic macrophytes. The moderate risk group contains those herbicides for which LOCs were exceeded for two aquatic species groups other than fish. The higher risk group contains those herbicides for which LOCs for fish were exceeded.

The ability of herbicides to mobilize in soil depends on complex toxicological properties and environmental parameters. A discussion of herbicide characteristics in soil is discussed in the Watershed Analysis for this project. Understanding how the herbicide reacts in soil helps in understanding the probability of adverse effects to aquatic organisms should the herbicide come in contact with water. These characteristics were considered for the analysis of effects from the proposed action on federally listed fish and their critical habitat.

Direct and Indirect Effects

HERBICIDE TREATMENTS

Herbicide treatments proposed for use may result in some risk of herbicide coming in contact with water where there may be fish present. The Project Design Features (PDFs) and buffers reduce the risk to listed fish species. The Proposed Action would not apply herbicides directly to any stream for purposes of treating aquatic weeds that are floating or submerged in any situation.

An accidental spill could result in concentrations of herbicides that could harm aquatic organisms. The Proposed Action includes Project Design Features that would reduce the likelihood and impact of a spill. The Proposed Action allows only certified applicators that have gone through various courses and training to properly use herbicides in a safe manner.

The Proposed Action includes limitations on the type and application method of herbicides in riparian areas and along roads that have high potential for herbicide delivery to streams such as road ditches that drain directly into waterbodies. The PDFs included in the proposed action apply to known sites and those detected in the future. In both cases, the limitations in the PDFs are expected to reduce the risk that herbicide use will exceed a level of concern for aquatic organisms tested by the SERA risk assessments. No emergent vegetation is proposed for treatment.

Buffers act as a safety zone to limit the potential for herbicides coming in contact with water at concentrations of concern for aquatic resources through leaching, run-off, or drift. The buffers included in the Proposed Action become more restrictive within riparian areas, especially when water is present. PDFs and buffers were developed based on label advisories, SERA "worst case" risk assessments, previous Section 7 Consultation for the R6 2005 FEIS, Neil Berg's 2004 study of broadcast drift and run off to streams, as well as monitoring data from other herbicide applications projects. Localized effects to individual aquatic plants are possible as a result of treatments that occur within the riparian areas.

Spot applications of aquatic formulations of glyphosate and imazapyr are not likely to result in harmful amounts coming in contact with water and harming fish, invertebrates, and algae. Some aquatic plants would be damaged at the immediate spot spray locations. Glyphosate would not be applied directly to water for weed control, but if it does enter the water it is bound tightly to dissolved and suspended particles and to bottom sediments and becomes inactive.

Broadcast application of herbicide is limited to the following situations:

- Outside established buffers for aquatic influence zones along perennial/intermittent streams and other waterbodies. Buffers differ by chemical, based on risk factors
- Outside established buffers when water is present within roadside ditches
- On roads that do not have a high potential for herbicide delivery (see PDF H2 and H4).

These restrictions serve to limit the potential amount of herbicides that may come in contact with water where fish or other aquatic organisms are present, even if an unexpected storm occurred shortly after treatment. The amount of herbicide that would be available for runoff, leaching and/or drift is necessarily limited by these restrictions on broadcast use. Spot and hand/select treatments do not have high potential to deliver herbicide because the treatments are directed at target vegetation and herbicide is quickly taken up by the plant.

With the exception of aquatic labeled herbicides, broadcast applications of all herbicides would not occur within 100 feet of perennial and intermittent streams or on roads that have a high potential for herbicide delivery. The majority of herbicides have 50-foot buffers for spot treatments on wet streams, except for low risk and aquatic labeled herbicides. Spot applications of aquatic labeled formulations of glyphosate and imazapyr may be used up to the water's edge, however spot applications of aquatic labeled triclopyr may not be used within 15 feet of perennial and wet intermittent streams or other waterbodies.

Activities that would need to take place below the ordinary high water mark (i.e., manual/spot/hand applications) would follow in-stream work periods established by the Oregon

Department of Fish and Wildlife (ODFW) as well as the Washington Department of Fish and Wildlife (WDFW) Guidelines for Timing of In-Water Work Periods (January 2005). These guidelines were specifically established to reduce the likelihood of negative impacts to fish and fish habitat during critical life stages (spawning, incubation, emergence). Each watershed and county has specific in-water work periods to match summer low flow periods, thereby reducing impacts from trampling and increasing distance between the water's edge and potential drift from broadcast sprays. Identification of which work windows apply would be accomplished during the implementation and planning process. If the in-stream work windows conflicts with the work period for treating invasive plants, the in-stream work window can be modified as long as there is mutual agreement from the local WDFW and/or ODFW habitat biologist and local Forest Service, US Fish and Wildlife and National Marine Fisheries Service fish biologists. Table III - 6 summarizes herbicide risks and properties and how risks are minimized in the Proposed Action.

Table III - 6- Herbicide Properties, Risks, and Project Design Features in the Proposed Action

Active Ingredient Selected Herbicide Brand Names and Mode of Action	Properties	General Uses/ Known to be Effective on:	Risks	Project Design Features to Minimize Risks
Chlorsulfuron (Telar, Glean, Corsair) Sulfonylurea-Interferes with enzyme acetolactate synthase with rapid cessation of cell division and plant growth in shoots and roots.	*Glean* -Selective pre-emergent or early post-emergent *Telar* – Selective pre- and post-emergent. Both are for many annual, biennial and perennial broadleaf species. Safe for most perennial grasses, conifers. Some soil residue.	Use at very low rates on annual, biennial and perennial species; especially dalmation toadflax and houndstongue.	Moderate concern to aquatic organisms.	Do not use on soils that are finer than loam. These areas will be mapped before project implementation. Do not use on dry, ashy soils. Special care around susceptible non-target vegetation, adjust buffers if needed. Buffers for spot and broadcast treatments ensure that herbicide would not be delivered to water in concentrations that would affect aquatic ecosystems.
Clopyralid (Transline) Synthetic auxin -Mimics natural plant hormones.	A highly translocated, selective herbicide active primarily through foliage of broadleaf species. Little effect on grasses.	Particularly effective on Asteraceae, Fabaceae, Polygonaceae, Solanaceae. Some species include knapweeds, yellow starthistle, Canada thistle, hawkweeds. Provides control of new germinants for one to two growing seasons.	Contains hexachlorobenzene (persistent carcinogen) in amounts below a threshold of concern this substance is ubiquitous in the environment. Highly mobile, but does not degrade in water.	Do not use on soils that are finer than loam. These areas will be mapped before project implementation.
Glyphosate (35 formulations, including RoundUp, Rodeo, Accord XRT, Aquamaster, etc.) Inhibits three amino acids and protein synthesis.	A broad spectrum, non-selective translocated herbicide with no apparent soil activity. Adheres to soil which lessens or retards leaching or uptake by non-targets.	Low volume applications are most effective. Trans-locates to roots and rhizomes of perennials. While considered non-selective, susceptibility varies depending on species. Main control for purple loosestrife, herb Robert, English ivy and reed canary grass. Aquatic labeled formulations can be used near water.	Non-selective. Greatest concern to aquatic organisms.	Except for the aquatic formulation, do not use on soils with a high water table. Buffers for spot and broadcast treatments ensure that herbicide would not be delivered to water in concentrations that would affect aquatic ecosystems

Active Ingredient Selected Herbicide Brand Names and Mode of Action	Properties	General Uses/ Known to be Effective on:	Risks	Project Design Features to Minimize Risks
Imazapic (Plateau) Inhibits the plant enzyme acetolactate, which prevents protein synthesis.	Used for the control of some broadleaf plants and some grasses.	Use at low rates can control leafy spurge, cheatgrass, medusa head rye, toadflaxes and houndstongue	More potential to kill non-target vegetation. Low risk to aquatic organisms.	Follow label directions, common control measures, and buffer accordingly.
Imazapyr (Arsenal, Arsenal AC, Chopper, Stalker, Habitat) Inhibits the plant enzyme acetolactate, which prevents protein synthesis.	Broad spectrum, non-selective pre- and post-emergent for annual and perennial grasses and broadleaved species.	Most effective as a post-emergent. Has been used on cheatgrass, whitetop, perennial pepperweed, dyers woad, tamarisk, woody species, and spartina. Aquatic labeled formulations can be used near water.	More potential to kill non-target vegetation. Moderate concern to aquatic organisms. Human health hazard associated with higher label rates. More mobile.	Do not exceed a rate of 0.70 lb active ingredient (a.i.)/acre with broadcast and spot applications. Except aquatic formulation, do not use on soils with a high water table. Buffers for broadcast treatments ensure that herbicide would not be delivered to water in concentrations that would affect aquatic ecosystems.
Metsulfuron methyl (Escort XP) Sulfonylurea -Inhibits acetolactate synthesis, protein synthesis inhibitor, block formation of amino acids.	Used for the control of many broadleaf and woody species. Most susceptible crop species in the lily family (i.e. onions). Safest sulfonylurea around non-target grasses.	Use at low rates to control such species as houndstongue, sulfur cinquefoil perennial pepperweed plant.	More potential to kill non-target vegetation. Low risk to aquatic organisms.	Do not use on dry, ashy, or light sandy soils. These areas will be mapped before project implementation. Special care around susceptible non-target vegetation, adjust buffers if needed.

Active Ingredient Selected Herbicide Brand Names and Mode of Action	Properties	General Uses/ Known to be Effective on:	Risks	Project Design Features to Minimize Risks
Picloram (Tordon K, Tordon 22K) Restricted Use Herbicide Synthetic auxin - Mimics natural plant hormones.	Selective, systemic for many annual and perennial broadleaf herbs and woody plants.	Use at low rates to control such species as knapweeds, Canada thistle, yellow starthistle, houndstongue, toadflaxes, sulfur cinquefoil, and hawkweeds. Provides control of new germinants for two to three growing seasons.	Most mobile, but persistent in soil. Contains hexachlorobenzene (persistent carcinogen) in amounts below a threshold of concern this substance is ubiquitous in the environment. More potential to kill non-target vegetation. Greatest concern to aquatic organisms. Human health hazard associated with higher label rates.	Do not treat any site more than once in a two year period. No use on wet or saturated soils. Do not use on soils with a high water table, soils with high porosity, and shallow, unproductive, or acidic soils. No use on roadside treatment areas with high potential to deliver herbicide to streams. Do not use near susceptible non-target vegetation, especially SOLI. No broadcast at a rate greater than 0.5 lb a.i./acre. Buffers ensure that herbicide would not be delivered to water in concentrations that would affect aquatic ecosystems.
Sethoxydim (Poast, Poast Plus) Inhibits acetyl co-enzyme, a key step for synthesis of fatty acids.	A selective, post-emergent grass herbicide.	Would control many annual and perennial grasses such as cheatgrass.	Greatest concern to aquatic organisms.	Do not use on soils with a high water table. These areas will be mapped before project implementation. Buffers ensure that herbicide would not be delivered to water in concentrations that would affect aquatic ecosystems.

Active Ingredient Selected Herbicide Brand Names and Mode of Action	Properties	General Uses/ Known to be Effective on:	Risks	Project Design Features to Minimize Risks
Sulfometuron methyl (Oust, Oust XP) Sulfonylurea -Inhibits acetolactase synthase; a key step in branch chain amino acid synthesis.	Broad spectrum pre- and post-emergent herbicide for both broadleaf species and grasses.	Used at low rates as a pre-emergent along roadsides. Known to be effective on reed canary grass, cheatgrass, and medusahead.	Persistent in soil. Toxic to soil organisms. More potential to kill non-target vegetation. Moderate concern to aquatic organisms. Human health hazard associated with higher label rates.	Do not use on soils with a high porosity, high clay content, shallow, unproductive, or acidic soils. Do not use on dry, ashy, or light sandy soils. No broadcast at rate greater than 0.12 lb a.i./acre. Do not use on soils with a high water table. Special care around susceptible non-target vegetation, adjust buffers if needed. Buffers ensure that herbicide would not be delivered to water in concentrations that would affect aquatic ecosystems.
Triclopyr (Garlon 3A, Garlon 4, Forestry Garlon 4, Pathfinder II, Remedy, Remedy RTU, Redeem R&P) Synthetic auxin - Mimics natural plant hormones.	A growth regulating selective, systemic herbicide for control of woody and broadleaf perennial invasive plants. Little or no impact on grasses.	Effective for many woody species such as scotch broom and blackberry. Also effective on English ivy, Japanese knotweed. Amine formulation may be used near water	Greatest concern to aquatic organisms. Exposure may exceed levels of concern for workers and the public.	Use spot and hand/selective treatments only. Except aquatic formulation, do not use on soils with a high water table. Buffers ensure that herbicide would not be delivered to water in concentrations that would affect aquatic ecosystems. Do not apply in areas of known special forest products or other wild foods collection.

Higher Risk Treatment Scenarios on the Umatilla and Wallowa-Whitman National Forests

Higher risk treatment scenarios are defined as situations where herbicide exposure could exceed a level of concern for listed fish. Many treatment areas are within riparian areas and along roads with potential to deliver herbicide to streams. As discussed previously, broadcast treatments would not occur within 100 feet of a wet stream or 50 feet of a dry stream. The treatment methods and herbicides proposed for use within the riparian areas are far less likely to deliver herbicide at levels of concern than broadcasting. Results from the risk assessments far overestimate the amount of herbicide likely to enter surface waters.

SERA Risk Assessment Worksheets

Some streams within road corridors have treatment areas that parallel both the road and the stream with many continuous acres proposed for treatment within the aquatic influence zone. In reality most of these areas have pockets of invasive plants within a much larger assembly of native vegetation along the stream. To model a worst case scenario a few of these areas were modeled for site specific soil types and rainfall with the GLEAMS spreadsheet. In addition, the model was run for the highest rainfall on the Forest with sandy soil, the soil most likely to allow runoff into the stream (Table 10).

National Forest Asotin Creek has up to 81 acres of treatment of scotch thistle on 3.9 miles of the River and tributaries within 100 feet of the stream channel. Modeling limitations include: modeling only the 50 feet closest to the channel and 1.6 miles of stream channel, and assumes broadcast spray, not spot spray.

Within the Forests, precipitation amounts range from15 to 60 inches per year. Table III - 7 displays precipitation amounts from selected sites on the Forests.

Table III - 7-Annual Precipitation amounts from selected sites on the Forests.

Location	Annual Precipitation (inches)
National Forest Asotin Creek	20-24
Little Phillips Creek	32-56
Jubilee Lake	48-56

The levels of concern for listed fish species were exceeded as indicate Table III - 8. It is highly unlikely that the low values modeled in the worksheets would even be approached given that treatment methods within buffers established by PDFs for each herbicide/surfactant are limited to spot and hand/select methods. Hand selective treatment methods have a much less likelihood of herbicides coming in contact with water than spot spray (which far reduces exposure potential compared to broadcast treatment).

Table III - 8 Hazard Quotient values for various soil types based on rainfall at typical and maximum application rates in riparian areas and ditch/dry channels.

		Riparian Application															
		Typical Application Rate						Maximum Application Rate						Ditch/Dry Channel Application			
		Clay		Loam		Sand		Clay		Loam		Sand		Typical Application Rate		Maximum Application Rate	
Herbicide	Rainfall (inch/yr)	Exposure (mg/l)	HQ Value	Exposure (mg/l)	HQ Value	Exposure (mg/l)	HQ Value	Exposure (mg/l)	HQ Value	Exposure (mg/l)	HQ Value	Exposure (mg/l)	HQ Value	Exposure (mg/l)	HQ Value	Exposure (mg/l)	HQ Value
Aminopyralid	15	0.005	0.004	0.002	0.001	0.01	0.01	0.007	0.005	0.002	0.002	0.02	0.01	0.07	0.05	0.10	0.07
	50	0.006	0.004	0.008	0.006	0.02	0.01	0.008	0.006	0.01	0.008	0.03	0.02				
Chlorsulfuron	15	0.0007	0.0003	0.00000	0.0000	0.00000	0.0000	0.003	0.002	0.00000	0.0000	0.00000	0.0000				
	50	0.006	0.003	0.00002	0.0000	0.003	0.0004	0.03	0.01	0.0001	0.0001	0.003	0.002				
Hexazinone	15	0.03	0.005	0.00000	0.00000	0.001	0.0002	0.03	0.01	0.00000	0.00000	0.001	0.0003	1.7	0.14	3.5	0.29
	50	0.3	0.04	0.006	0.001	0.04	0.007	0.3	0.09	0.006	0.002	0.04	0.01				
Clopyralid	15	0.002	0.0003	0.00000	0.0000	0.00000	0.0000	0.002	0.0005	0.00000	0.0000	0.00000	0.0000				
	50	0.004	0.0007	0.002	0.0005	0.006	0.001	0.005	0.001	0.004	0.0007	0.009	0.002				
Glyphosate	15	0.002	0.02	0.005	0.05	0.01	0.1	0.009	0.09	0.02	0.2	0.05	0.5	0.5	4.8	1.9	19
	50	0.04	0.4	0.06	0.6	0.1	1.1	0.1	1.4	0.2	2.2	0.5	4.5				
Imazapic	15	0.00000	0.0000	0.00000	0.0000	0.00000	0.0000	0.00000	0.0000	0.00000	0.0000	0.00000	0.0000	0.09	0.0009	0.2	0.002
	50	0.00005	0.0000	0.00000	0.0000	0.00001	0.0000	0.00009	0.0000	0.00000	0.0000	0.00002	0.0000				
Imazapyr	15	0.00002	0.0000	0.00000	0.0000	0.00000	0.0000	0.00008	0.0000	0.00000	0.0000	0.00000	0.0000	0.4	0.08	1.3	0.3
	50	0.0003	0.0001	0.00000	0.0000	0.00007	0.0000	0.0009	0.0002	0.00000	0.0000	0.0002	0.0000				
Metsulfuron	15	0.00000	0.0000	0.00000	0.0000	0.00000	0.0000	0.00002	0.0000	0.00000	0.0000	0.00000	0.0000				
	50	0.00004	0.0000	0.00000	0.0000	0.00001	0.0000	0.0002	0.0000	0.00001	0.0000	0.00004	0.0000				
Picloram	15	0.004	0.09	0.00000	0.0000	0.007	0.2	0.01	0.3	0.00000	0.0000	0.02	0.5	0.3	7.6	0.9	22
	50	0.03	0.9	0.004	0.1	0.02	0.4	0.1	2.5	0.01	0.3	0.05	1.2				
Sethoxydim	15	0.001	0.02	0.0004	0.007	0.006	0.1	0.002	0.03	0.0007	0.01	0.009	0.1				
	50	0.02	0.3	0.04	0.6	0.03	0.5	0.02	0.4	0.06	1.0	0.04	0.7				
Sulfometuron	15	0.00000	0.0000	0.00000	0.0000	0.00000	0.0000	0.00000	0.0000	0.00000	0.0000	0.00000	0.0000				
	50	0.00002	0.0000	0.00000	0.0000	0.00000	0.0000	0.00002	0.0001	0.00000	0.0000	0.00000	0.0000				
Triclopyr	15	0.02	0.06	0.02	0.07	0.02	0.06	0.2	0.6	0.2	0.7	0.2	0.6	0.9	3.3	8.7	33
	50	0.1	0.5	0.09	0.4	0.05	0.2	1.3	4.8	0.9	3.6	0.5	2.1				

Highlighted cells contain HQ values that exceed 1 which indicates a significant concern for listed fish.

AERIAL HERBICIDE TREATMENTS

Aerial application is proposed for 675 acres on the on the Umatilla National Forest and 875 acres on the Wallowa-Whitman National Forest. The primary overstory in these areas is ponderosa pine with small numbers of lodgepole pine and grand fir, and grasslands. The herbicides most likely to be applied are chlopyralid and picloram. These are selective herbicides that would leave soil cover by not harming nontarget vegetation such as pines, firs and grasses. The dead plants would also be left on site contributing to ground cover. Erosion and associated sediment delivery to streams would be minimal and transitory.

Of more concern is water contamination from drift during aerial spray. Project Design Features were designed to control drift and overspray of headwater streams. PDF E3 requires that fueling occurs at least 150 feet from water. F5 requires that herbicide applications occur when winds are between 2 and 8 miles per hour. F6 requires coarse droplet size to minimize drift. F7 requires that aerial units be ground checked and water features marked and buffered before application. Buffers of 300 feet are required on perennial or wet intermittent streams and wetlands, and 100 feet buffers are required on dry channels. Based on buffer effectiveness documented by Rashin and Graber (1993) and Dent and Robben (2000) concentrations of herbicides reaching streams are expected to be well below concentrations of concern to beneficial uses.

ACCIDENTAL SPILL

Project Design Features would reduce the potential for spills to occur, and if an accident were to occur, minimizes the magnitude and intensity of impacts. An herbicide transportation and handling plan is a project requirement. This plan would address spill prevention and containment.

EDRR

Early Detection Rapid Response (EDRR) allows for newly identified or currently unknown invasive plant infestations to be treated using the range of methods analyzed in the Umatilla and Wallowa-Whitman invasive plant proposed action, on sites similar to those presently proposed for treatment. PDFs would protect aquatic resources by constraining treatment methods according to site specific conditions. Aerial treatments will not occur under EDRR.

For the purposes of this consultation, the following assumptions were used to make a "worst case" assessment for the effects analysis:

- Existing invasive plant infestations on both forests were estimated to about 47,483 acres
- Approximately 25% of existing populations occur in riparian areas.
- If we assume that 25% of the annual increase occurs in riparian areas, this adds 2978 acres of new riparian area infestations annually. See Table III - 9 and Table III - 10 for projected acres by watershed.
- If we treat 100% of the Riparian infestation areas per year (11905 +2978) then the potential exists to treat 14883 Acres of Riparian Areas per year.
- The EISs limit Herbicide treatments to 8000 acres per year so the worst case assumption that 8000 acres of Riparian will be chemically treated per year and 6883 would be treated by other methods.

Table III - 9. Worst case estimate of riparian acres infested by invasive plants for watersheds on the Umatilla National Forest.

Fifth Field Watershed Name	T&E Fish Present*	HUC	Acres	Treated Acres in RHCAs*	Worst Case Weed Infestation Increases
Asotin Creek	SRS, SRC,BT,	1706010302	208,532	380	95
Upper Grande Ronde River	NF	1706010401	133,777	0	0
Meadow Creek	NF	1706010402	116,100	7	1.8
Grande Ronde River/Five Points	NF	1706010404	87,630	13	3.3
Willow Creek	NF	1706010408	53,565	73	18.3
Lookingglass Creek	SRS, SRC, BT	1706010410	60,527	132	33
Grande Ronde River/Cabin Creek	SRS	1706010411	108,389	447	111.8
Grande Ronde River/Grossman Creek	SRS, SRC, BT	1706010601	114,787	129	32.3
Wenaha River	SRS, SRC, BT	1706010603	189,224	155	38.8
Lower Grande Ronde River	SRS, SRC	1706010607	160,794	69	17.3
Pataha Creek	NF	1706010705	118,434	28	7
Upper Tucannon River	SRS, SRC, BT	1706010706	140,811	199	49.8
Upper Walla Walla River	MCS, BT	1707010201	101,385	22	5.5
Mill Creek	MCS, BT	1707010202	76,051	141	35.3
Upper Touchet River	MCS, BT	1706010203	146,115	104	26
Upper Umatilla River	MCS, MCC, BT	1707010301	86,765	239	59.8
Meacham Creek	MCS, MCC, BT	1707010302	114,158	367	91.8
Birch Creek	MCS	1707010306	182,206	176	44
Upper Butter Creek	NF	1707010309	206,658	21	5.3
Upper Willow Creek	NF	1707010401	94,088	176	44
Rhea Creek	NF	1707010403	145,967	0	0
Upper North Fork John Day River	MCS	1707020201	71,525	9	2.3
Granite Creek	MCS, , BT	1707020202	94,513	169	42.3
North Fork John Day River/Big Creek	PL, MCS,	1707020203	105,881	277	69.3
Desolation Creek	MCS, BT	1707020204	69,675	21	5.3
Upper Camas	MCS, BT	1707020205	104,623	297	74.3
Lower Camas Creek	PL, MCS	1707020206	157,015	158	39.5
North Fork John Day River/Potamus Creek	MCS	1707020207	185,288	388	97
Wall Creek	MCS	1707020208	128,327	606	151.5
Lower North Fork John Day River	NF	1707020210	117,016	1	0.3
Camp Creek	NF	1707020302	125,940	344	86
Lower Middle Fork John Day River	NF	1707020305	60,635	0	0
Lower John Day River/Kahler Creek	NF	1707020401	197,919	339	84.8
Upper Rock Creek	NF	1707020411	177,121	74	18.5

Fifth Field Watershed Name	T&E Fish Present*	HUC	Acres	Treated Acres in RHCAs*	Worst Case Weed Infestation Increases
Total				**5560**	**1391.2**

Table III - 10. Worst case estimate of riparian acres infested by invasive plants for watersheds on the Wallowa-Whitman National Forest.

Fifth Field Watershed Name	T&E Fish Present*	HUC	Acres	Treated Acres in RHCAs*	Worst Case Weed Infestation Increases
Bear Creek	SRC, SRS, BT	1706010504	46,300	115	28.8
Big Creek	NF	1705020307	54,896	51	12.8
Birch Creek	MCS	1707010306	182,205	0	0
Burnt River/Auburn Creek	NF	1705020205	60,006	164	41
Burnt River/Big Creek	NF	1705020204	94,102	1	0.3
Burnt River/Canyon	NF	1705020206	54,081	4	1
Camp Creek	NF	1705020203	51,954	65	16.3
Chesnimnus Creek	SRS	1706010604	122,764	66	16.5
Eagle Creek	NF	1705020310	123,643	164	41
Grande Ronde River/Beaver Creek	SRC, SRS, BT	1706010403	131,648	91	22.8
Grande Ronde River/Five Points Creek	SRC, SRS	1706010404	87,632	6	1.5
Grande Ronde River/Indian Creek	SRC, SRS	1706010409	96,033	13	3.3
Grande Ronde River/Mud Creek	SRC, SRS	1706010602	154,202	49	12.3
Granite Creek	MCS, , BT	1707020202	94,513	156	39
Ladd Creek	SRS	1706010406	83,953	34	8.5
Little Malheur River	NF	1705011612	86,434	0	0
Lostine River	SRC, SRS, BT	1706010502	58,035	28	7
Lower Big Sheep Creek	SRC, SRS, BT	1706010204	129,726	125	31.3
Lower Catherine Creek	SRC, SRS, BT	1706010407	83,128	42	10.5
Lower Imnaha River	SRC, SRS, BT	1706010205	147,024	156	39
Lower Joseph Creek	SRS	1706010606	104,789	75	18.8
Lower Powder River	NF	1705020311	61,488	0	0
Lower Wallowa River	SRC, SRS, BT	1706010506	110,421	85	21.3
Mckay Creek	NF	1707010305	127,200	0	0
Meadow Creek	SRC, SRS	1706010402	116,100	225	56.3
Middle Imnaha River	SRC, SRS, BT	1706010202	87,982	1250	312.5
Middle Wallowa River	SRC, SRS	1706010503	85,060	4	1
Minam River	SRC, SRS, BT	1706010505	152,909	60	15

Fifth Field Watershed Name	T&E Fish Present*	HUC	Acres	Treated Acres in RHCAs*	Worst Case Weed Infestation Increases
North Fork Burnt River	NF	1705020201	124,147	229	57.3
North Powder River	BT	1705020305	74,553	38	9.5
Pine Creek	BT	1705020106	193,640	339	84.8
Powder River/Baldock Slough	NF	1705020303	72,489	22	5.5
Powder River/Rock Creek	BT	1705020304	120,776	25	6.3
Powder River/Ruckles Creek	NF	1705020308	166,729	497	124.3
Powder River/Sutton Creek	NF	1705020302	115,885	92	23
Powder River/Wolf Creek	NF	1705020306	109,371	11	2.8
Snake River/Cherry Creek	SRC, SRS, BT	1706010301	88,100	117	29.3
Snake River/Granite Creek	SRC, SRS, BT	1706010101	127,509	25	6.3
Snake River/Indian Creek	BT	1705020107	117,760	7	1.8
Snake River/Temperance Creek	SRC, SRS, BT	1706010102	115,289	740	185
Snake River/Wolf Creek	SRC, SRS	1706010103	103723	116	29
South Fork Burnt River	NF	1705020202	75,183	75	18.8
South Willow Creek	NF	1705011901	65,950	4	1
Upper Big Sheep Creek	SRC, SRS, BT	1706010203	89,358	174	43.5
Upper Camas Creek	MCS, RT	1707020205	104,623	0	0
Upper Catherine Creek	SRC, SRS, BT	1706010405	92,520	4	1
Upper Grande Ronde River	SRC, SRS, BT	1706010401	133,776	187	46.8
Upper Imnaha River	SRC, SRS, BT	1706010201	90,349	332	83
Upper Joseph Creek	SRS	1706010605	125,191	120	30
Upper North Fork John Day River	MCS, BT,	1707020201	71,525	2	0.5
Upper Powder River	BT	1705020301	105,509	154	38.5
Upper Wallowa River	SRC, SRS, BT	1706010501	157,943	6	1.5
Willow Creek	SRS	1706010408	53,565	0	0
Total				**6345**	**1587.3**

NON-HERBICIDE TREATMENT METHODS

All invasive plant treatments can result in some erosion, stream sedimentation, and disturbance to aquatic organisms if carried out over a large enough area. Sedimentation can cover eggs or spawning gravels, reduce prey availability, and harm fish gills. Soil can also become compacted and prevent the establishment of native vegetative cover. All invasive plant treatments can reduce insect biomass, which would result in a decrease in the supply of food for fish and other aquatic organism. Reductions in cover, shade, and sources of food from riparian vegetation could result from herbicide deposition in a streamside zone (Norris et al. 1991).

Riparian vegetation affects habitat structure in several important ways. Roots of riparian vegetation hold soil, which stabilizes banks, prevents addition of soil run-off to water bodies with subsequent increases in turbidity or filling substrate interstices, and helps to create overhanging banks. Riparian and emergent aquatic vegetation can provide hiding cover or refuge for fish and other aquatic organisms where native plants have been replaced.

The presence of people along streambanks could lead to localized sediment/turbidity to fish habitat due to soil sloughing from stepping on banks and removal of invasive plant roots. However, due to the limited number of invasive plant populations proposed for treatment along streambanks sediment introduction to aquatic habitat is expected to be minimal.

Effective invasive plant treatment and restoration of treated sites would improve the function of riparian areas and lead to improved fish habitat conditions.

The Proposed Action would benefit aquatic ecosystems by restoring native vegetation in riparian habitats, especially habitats adjacent to fish bearing streams. The impacts of invasive plants on these habitats can last decades, while the impacts of treatment tend to be short term. Passive and active restoration would accelerate native vegetative recovery in treated sites.

Mechanical treatments related to the Proposed Action utilize hand power tools and includes such actions as mowing, weed whipping, road brushing, root tilling methods, or foaming, steaming, infrared, and other techniques using heat to reduce plant cover and root vigor. Manual methods include the use of non-mechanized approaches, such as hand pulling or using hand tools (e.g., grubbing), to remove plants or cut off seed heads. Manual treatments are labor intensive, effective only for relatively small areas, and would be repeated several times throughout the growing season depending on the species.

Direct and indirect effects of manual and mechanical treatments were analyzed in the R6 2005 FEIS (Appendix M). Public scoping issues about these treatments were not raised. Manual treatments, such as lopping or shearing, cause an input of organic material (dead roots) into the soil. As the roots are broken down in the soil food web, nutrients will be released. Rainfall may cause these nutrients to be lost to surface runoff or to groundwater. Bare soils combined with high nutrient levels provide ideal conditions for the establishment of many invasive species. In lower intensity infestations, non-target vegetation could provide erosion control as well as a seed source for establishing native vegetation. In areas with larger amounts of bare soil, PDFs require restoration activities to reestablish native vegetation. The intent is to re-establish competitive local, native vegetation post-treatment in areas of bare ground.

Removal of plant roots along a streambank will cause some ground disturbance and may introduce some sediment to streams. For example, weed wrenching of scotch broom may loosen soil and cause minor amounts of erosion for approximately one season until vegetation was reestablished. These minor amounts of erosion would be negligible once contact with water is made. Under the Proposed Action, significant removal of riparian invasive species would not occur because of the proposed use of herbicides reducing the potential for significant soil disturbance.

Using mowing equipment on existing roads is not expected to impact soils. Soil compaction eliminates soil pores and so reduces water infiltration, aeration, and the ability of plants to root effectively. However, the limited amount of mechanical treatment proposed eliminates risk of extensive soil impacts.

While the relative amounts of manual and mechanical treatments vary, the differences in terms of effects from such treatments are negligible. Other mechanical treatments, such as the use of motorized hand tools, are expected to have effects similar to manual treatments.

Turbidity and Sediment

Mechanical treatments except for mowing would take place away from water. Mowing would occur only along established roads. Manual treatments are generally cutting, digging or pulling weeds. If seeds are present the weeds are bagged and taken off site. Removal of soil cover would be very small under these circumstances. However there could be small localized areas of erosion and subsequent sediment input to the stream. According to the soil and water analysis, these effects would be transitory and too small to measure.

Pulling weeds along stream banks could also destabilize the banks in highly localized areas. As only 4.4 acres of hand treatments over 10 sites are planned within the aquatic influence zone only localized effects would be expected, last only about one season until vegetation reestablished at these sites. Manual and mechanical treatments within riparian areas could accelerate sediment delivery to streams through ground disturbance. However, most of the treatments areas are previously disturbed roadways and trails so ground disturbance is not a significant concern.

Temperature

Aquatic species have specific needs in terms of water temperature. Increasing water temperature may decrease the dissolved oxygen in water which may affect metabolism and food requirements. Many factors influence water temperature including shade, discharge, channel morphology, air temperature, topography, stream aspect, and interactions with ground water. Shade is the factor that has the potential to be impacted by non-herbicide treatments. Chemical treatments in RHCA's have is risk of impacting non-target plants however the PDF restrict treatment methods that are non-broadcast (i.e. spot spraying and wiping) reduce the risk to non-target species to a discountable threshold.

Manual, mechanical, and restoration treatments of some invasive plant species (such as knapweed) may decrease riparian vegetative shading in some areas, thereby increasing the amount sunlight hitting the water. This may result in a warming effect but many other factors in addition to shade affect water temperature. A substantial amount of shade providing vegetation would need to be removed to change water temperature in the stream. Where native shrubs replace the shorter invasive plants an increase in shading of streams would occur and local temperatures could improve on some streams.

Direct Mortality due to Trampling

People working in water have the potential to impact listed fish by trampling on redds and/or fish. The extent of these impacts depends on the species present, life stage, number of people in the water, and the amount of time spent in the water. Take resulting from trampling of redds or spawning fish is minimized through operations during the instream work window.

Designated Critical Habitat

In the long-term, treatment of invasive weeds on the Umatilla and Wallowa-Whitman National Forests would increase native vegetation growth and successional patterns leading to cover and food. Thus, it improves essential habitat features for federally listed fish species. Potential downstream effects to critical habitat for bull trout are not likely given the PDFs that limit the potential for herbicide concentrations coming in contact with water where fish are present. Information here complements the analysis provided for non-herbicide treatment methods.

In 1996, NMFS developed a methodology for making ESA determinations for individual or grouped activities at the watershed scale, termed the "Habitat Approach". A Matrix of Pathways and Indicators (MPI) was recommended under the Habitat Approach to assist with analyzing effects to listed species. The MPI was used by the Umatilla and Wallowa-Whitman National Forests in previous years to analyze project effects on listed fish species. When using the MPI, project effects to the Pathways (significant pathways by which actions can have potential effects on anadromous salmonids and their habitats) and Indicators (numeric ratings or narrative descriptors for each Pathway) are used to determine whether proposed actions would damage habitat or retard the progress of habitat recovering towards properly functioning condition.

The Sept. 2, 2005 designated critical habitat Primary Constituent Elements (PCEs) pertinent for analysis on the Umatilla and Wallowa-Whitman National Forests' freshwater habitats include spawning sites, rearing sites, and migration corridors. The Habitat Approach's Matrix of Pathways (MPI) has numerous habitat-associated Indicators that closely "cross-walk" with the PCEs of the Sept 2, 2005 designated critical habitat.

Table III - 11 displays a "cross-walk" between the MPI Indicators and steelhead PCEs used to assess effects on designated critical habitat.

Table III - 11- MPI for Steelhead Primary Constituent Elements Crosswalk

Primary Constituent Elements	Matrix of Pathways and Indicators
Spawning Habitat, as defined by water quality, water quantity, substrate	**Water Quality:** Temperature, Suspended Sediment, Substrate, Chemical Contaminants and Nutrients **Flow/Hydrology:** Change in Peak/Base flows **Habitat Elements:** Substrate/Embeddedness
Rearing as defined by adequate water quantity and floodplain connectivity	**Channel Conditions and Dynamics:** Floodplain connectivity **Flow/Hydrology:** Change in Peak/Base flow
Rearing as defined by adequate water quality and forage	**Water Quality:** Temperature, Substrate **Habitat Elements:** Large Woody Debris, Pool Frequency and Quality, Off-channel Habitat
Rearing as defined by adequate natural cover	**Habitat Elements:** Large Woody Debris, Pool Frequency and Quality, Large Pools, Off-channel Habitat
Migration as defined by habitat free of artificial obstructions, and adequate water quality, water quantity, and natural cover	**Habitat Access:** Physical Barriers **Water Quality:** Temperature **Flow/Hydrology:** Change in Peak/Base flow **Habitat Elements:** Large Woody Debris, Pool Frequency and Quality, Large Pools

The following is an analysis of the effects on steelhead Primary Constituent Elements of the Sept. 2, 2005 designated critical habitat, as determined via analysis of MPI indicators. This effects analysis also covers the Essential Habitat Features of Chinook salmon designated critical habitat. Please refer to the hydrology analysis for effects on Riparian Condition and Water Quality, Lakes, Wetlands and Floodplains.

BULL TROUT CRITICAL HABITAT

Critical habitat extends from the bankfull elevation on one side of the stream channel to the bankfull elevation on the opposite side. Adjacent floodplains are not proposed as critical habitat. The lateral extent of proposed lakes and reservoirs is defined by the perimeter of the water body as mapped on standard 1:24,000 scale maps.

The Service used the best scientific and commercial data available to designate critical habitat, giving consideration to those physical and biological features that are essential to bull trout survival. Within the designated critical habitat areas, the primary constituent elements (PCE's) for bull trout are those habitat components that are essential for the primary biological needs of foraging, reproducing, rearing of young, dispersal, genetic exchange, or sheltering. The PCE's are in Table III - 12.

Table III - 12. Primary Constituent Elements for bull trout Designated Critical Habitat

PCE	PCE Habitat Feature	Matrix Pathway	Matrix Indicator
1) Water temperatures that support bull trout use. Bull trout have been documented in streams with temperatures from 0 to 22 ° C (32 to 72 ° F) but are found more frequently in temperatures ranging from ranging from 2 to 15 ° C (36 to 59 ° F). Stream reaches with temperatures that preclude bull trout use are specifically excluded from designation;	Water Quality	Flow/Hydrology	Temperature
2) Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures	Complex Condition	Habitat Elements	Large woody debris
			Pool frequency and quality,
			Large pools
			Off channel habitat
			Refugia
		Channel Conditions and Dynamics	Wetted width/maximum depth ratio
			Streambank condition
			Floodplain connectivity
3) Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. This should include a minimal amount of fine substrate less than 0.63 cm (0.25 in) in diameter.	Suitable Substrate	Water Quality	Sediment
		Habitat Elements	Substrate embeddedness
4) A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, currently operate under a biological	Water Quantity	Flow/Hydrology	Change in peak/base flows

PCE	PCE Habitat Feature	Matrix Pathway	Matrix Indicator
opinion that addresses bull trout, or a hydrograph that demonstrates the ability to support bull trout populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation:			
5) Springs, seeps, groundwater sources, and subsurface water to contribute to water quality and quantity as a cold water source	Floodplain Connectivity	Channel Condition and Dynamics	Floodplain connectivity
	Water Quantity	Flow/Hydrology	Change in peak/base flows
6) Migratory corridors with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows	Migration Corridors Free from Obstruction	Habitat Access	Physical barriers
		Water Quality	Chemical contaminants/nutrients, temperature
		Flow/Hydrology	Change in peak/base flows
7) An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish	Forage	Water Quality, Habitat Elements, Channel Condition and Dynamics, Habitat Access	All 13 associated with these 4 pathways
8) Permanent water of sufficient quantity and quality such that normal reproduction, growth and survival are not inhibited	Water Quality	Water Quality	Temperature
			Sediment
			Chem. Contam./ Nutrients
			Change in Peak/Base Flows
	Water Quantity	Flow/Hydrology	

HABITAT INDICATOR EFFECTS

Pathway: Water Quality

Indicator: Temperature, PCE Crosswalk: Spawning, Rearing, Migration habitat PCEs

Stream temperature is controlled by many variables at each site. These include topographic shading, stream orientation, channel morphology, discharge, air temperature, and interactions with ground water, none of which would be influenced by invasive plant treatments. Treatment of invasive plants using integrated methods, specifically herbicides, along small streams may increase solar radiation at a localized level (i.e. on a small portion of a stream) if invasive plants are the only source of shade. Where invasive plants provide the only source of shade on small streams, removing 100 percent of the shade producing cover can change forest floor microclimates and water temperature at the localized level. However, the precise effects to water temperature from treating invasive plants would depend on the size of the stream, how close to the stream a treatment site is, how much is treated along the stream, and what vegetation is currently available to shade the stream. Removal of invasive plants from the banks of small, intermittent streams would not affect temperature because they are dry during the hottest time of the year, relative size of the infestation is small within context of the watershed, and more than likely there is overstory canopy present. Conditions would have to mimic post wildfire in order to impact stream temperatures.

On larger perennial streams, a significant amount of vegetation would need to be removed to change water temperature and shade would have to be provided only by the invasive plant removed – a situation that is not likely on the Umatilla and Wallowa-Whitman National Forests. One reason treatment of invasive plants is being proposed is to recover vegetation structure and, in time, provide more stream shade with the establishment of native coniferous and deciduous trees. The PDFs prohibit broadcast applications within 100 ft. of wet perennial and intermittent waterbodies, and along roads that have a high likelihood of transporting herbicides to streams to prevent any potential adverse affects to stream channels or water quality conditions. This PDF will protect overhanging vegetation and smaller trees that are currently providing shade closest to the stream and other waterbodies. The treatment of invasive plants outside of the 100 ft buffer should have no affect on stream temperature because it is unlikely that vegetation growing 100 feet from the stream is providing enough shade to influence water temperature.

The US Environmental Protection Agency under the Clean Water Act (CWA) of 1972 requires States to set water quality standards to support the beneficial uses of water. The Act also requires states to identify the status of all waters and prioritize water bodies whose water quality is limited or impaired.

For water quality limited streams (

Table III - 13) on National Forest lands, the Forest Service provides information, analysis, and site-specific planning efforts to support state processes to protect and restore water quality. The Pacific Northwest Region Invasive Plan EIS and the Umatilla and Wallowa-Whitman National Forests Plan both include standards and guidelines and other management measures designed to protect and improve water quality. This project adheres to all of the above protection measures and adds site specific design criteria to further protect water quality, meeting the requirements of the Clean Water Act.

Table III - 13- Streams in the Umatilla and Wallowa-Whitman National Forests in treatment areas on 303d list

STREAM NAME	STATE	LISTING
Umatilla National Forest		
North Fork John Day Subbasin		
Big Wall Creek	Oregon	Temperature and Sediment
Camas Creek	Oregon	Temperature
Ditch Creek	Oregon	Temperature
Granite Creek	Oregon	Temperature
Swale Creek	Oregon	Temperature and Sediment
North Fork John Day River	Oregon	Temperature
Wilson Creek	Oregon	Temperature and Sediment
Lower John Day Subbasin		
Henry Creek	Oregon	Temperature
Willow Creek Subbasin		
Willow Creek	Oregon	Temperature
Asotin Creek Subbasin		
Asotin Creek	Washington	Temperature
Lick Creek	Washington	Temperature
Wallowa-Whitman National Forest		
Brownlee Reservoir Subbasin		
Aspen Creek	Oregon	Temperature
Beecher Creek	Oregon	Temperature
Big Elk Creek	Oregon	Temperature
Clear Creek	Oregon	Temperature
East Pine Creek	Oregon	Temperature
Elk Creek	Oregon	Temperature
Lake Fork	Oregon	Temperature
Meadow Creek	Oregon	Temperature
Okanogan Creek	Oregon	Temperature
Pine Creek	Oregon	Temperature
Trail Creek	Oregon	Temperature
Multiple Subbasins		
Grande Ronde River	Oregon	Temperature
Snake River	Oregon	Temperature
Imnaha Subbasin		
Big Sheep Creek	Oregon	Temperature
Crazyman Creek	Oregon	Temperature
Dry Creek (Imnaha)	Oregon	Temperature
Freezeout Creek	Oregon	Temperature
Grouse Creek	Oregon	Temperature
Gumboot Creek	Oregon	Temperature
Imnaha River	Oregon	Temperature
Lightning Creek	Oregon	Temperature
Little Sheep Creek	Oregon	Temperature
North Fork John Day River Subbasin		
Baldy Creek	Oregon	Sediment

STREAM NAME	STATE	LISTING
Beaver Creek	Oregon	Temperature
Bull Run Creek	Oregon	Temperature
Camas Creek	Oregon	Temperature
Clear Creek	Oregon	Temperature
Crane Creek	Oregon	Temperature
Granite Creek	Oregon	Temperature and Sediment
Onion Creek	Oregon	Temperature
South Trail Creek	Oregon	Temperature
Trail Creek	Oregon	Temperature
Powder Subbasin		
Anthony Creek	Oregon	Temperature
California Gulch	Oregon	Temperature
Dean Creek	Oregon	Temperature
East Fork Goose Creek	Oregon	Turbidity
Elk Creek	Oregon	Temperature
Indian Creek	Oregon	Temperature
North Powder River	Oregon	Temperature
Powder River	Oregon	Fecal Coliform
Silver Creek	Oregon	Temperature
Sutton Creek	Oregon	Temperature
West Fork Sutton Creek	Oregon	Temperature
Wallowa River Subbasin		
Bear Creek (Wallowa)	Oregon	Temperature
Deer Creek (Wallowa)	Oregon	Temperature
Little Bear Creek (Wallowa)	Oregon	Temperature
Minam River	Oregon	Temperature and Sediment
Hells Canyon Watershed		
Deep Creek	Idaho	Temperature

Pathway: Water Quality

Indicator: Sediment/Turbidity, PCE Crosswalk: Spawning habitat PCEs

Herbicide treatment methods that would be utilized within the riparian areas include spot-spray and hand applications. These treatment types are unlikely to produce sediment because very little ground disturbance would take place. Manual and mechanical treatments are also unlikely to contribute sediment. Manual labor such as hand pulling may result in localized soil disturbance, but increases of sediment to streams would likely be undetectable. Not all vegetation in a treated area would be pulled or removed, so some ground cover plants would remain. Not all sediment from pulling weeds along roads would reach a stream because many relief culverts intercept ditch flow and drain it on to the forest floor away from streams. Hand pulling is very labor intensive and costly. Thus, few acres per year could be treated using this technique across a watershed. When compared to the total acres within a watershed, project-related soil disturbance from hand pulling would be negligible. Utilizing a combination of manual, mechanical and herbicide treatments, rather than manual alone, would limit the potential for excessive trampling of streambanks.

Indicator: Chemical Contaminants/Nutrients, PCE Crosswalk: Spawning habitat PCEs

The most likely routes for herbicide delivery to water are potential runoff from a large rain storm soon after application, especially from treated roadside ditches as well as drift from aerial spraying. Project Design Features were designed to control drift and overspray of headwater streams. PDF E3 requires that fueling occurs at least 150 feet from water. F5 requires that herbicide applications occur when winds are between 2 and 8 miles per hour. F6 requires coarse droplet size to minimize drift. F7 requires that aerial units be ground checked and water features marked and buffered before application. Buffers of 300 feet are required on perennial or wet intermittent streams and wetlands, and 100 feet buffers are required on dry channels. Based on buffer effectiveness documented by Rashin and Graber (1993) and Dent and Robben (2000) concentrations of herbicides reaching streams is expected to be well below concentrations of concern to beneficial uses.

Boom or hand broadcast treatments with riparian areas would be limited to herbicides posing low levels of concern for aquatic organisms. The buffers described in Tables 8, 9, and 10 are considered adequate to minimize herbicide concentrations in water.

Glyphosate and imazapyr are the only herbicides used for spot spraying below bankfull along perennial channels. Glyphosate is highly water soluble, but because it adheres tightly to soils, the amount carried into a stream is less than expected from solubility.

This is unlikely to happen during the late spring or summer when herbicides would be applied because there is less rain in the summer and more vegetation growth to hold soil particles in place. Imazapyr is only moderately water soluble and forest field studies have not found it very mobile in soils (Soil and Hydrology Analysis).

Herbicides entering surface water through surface runoff are also expected to be minimal, since targeted spot spraying techniques would be used to apply herbicide within 100 feet of surface water. This would minimize the amount of herbicide reaching the ground surface as well as minimize the potential for herbicide drift. No herbicides considered high risk to aquatic resources would be broadcast within 100 feet of streams and none would be spot sprayed within 50 feet of streams.

The potential risk from accidental spills in RHCAs exists; however, PDF G describes mechanism to minimize the occurrence and restrict highly concentrated chemicals proximity to water.

PDF E2 allows refueling of equipment if RHCAs only if “there is no alternative”. Equipment that might require fueling in RHCAs would include ATVs and weed cutting devices (weed-eaters). Most fueling of ATVs would occur at fueling stations rather than at operation sites; therefore it is unlikely that refueling in RHCAs would be necessary. However, if it occurred, gasoline would probably be poured from a 5-gallon can into the tank of the ATV while parked near the truck on a road. In the event of a spill, gasoline would contact the road and possible flow into the RHCA. For weed-eaters, the maximum quantity of fuel that would be likely to be spilled in an RHCA would be one gallon as that is the size of a storage container for fuel for this device. The water contamination would be of short duration as the fuel would be diluted by water and would evaporate. The maximum quantity would be 5 gallons, a portion of which would penetrate the ground; however, some could flow overland to the water and potentially adversely affect listed fish. The likelihood of this occurring would be minimized by the PDF.

Pathway: Channel Condition & Dynamics

Indicator: Floodplain Connectivity, PCE Crosswalk: Rearing habitat PCE

Some invasive plant treatments can have positive effects on floodplains and streambanks when infestations of invasive plants on valley bottom areas are removed. Valley-bottom infestations often encroach on floodplains where road-related, grazing, or recreational activities have led to the establishment of invasive plant populations. Removal of such infestations is expected to benefit aquatic and terrestrial communities in the long term by increasing floodplain area available for nutrient, sediment and large wood storage, and flood flow refugia. There is no risk of negatively impacting channel condition and dynamics as a result of treating invasive plants.

Pathway: Habitat Access

Indicator: Physical Barriers, PCE Crosswalk: Migration habitat PCE

Invasive plant treatments will not create physical barriers or otherwise degrade access to aquatic habitat.

Pathway: Habitat Elements

Indicator: Substrate/Sediment, PCE Crosswalk: Spawning, Rearing habitat PCEs

Invasive plant treatments are not expected to affect substrate composition. All PDFs that minimize sediment would be implemented, such as no heavy equipment within riparian areas. These practices would reduce, but not eliminate sediment. Some sediment may enter stream channels as a result of extensive manual labor and could result in exposed soils. The amount of sediment that enters a stream is expected to be small, infrequent, of short duration, and at a localized level. Localized increases in fine sediment in gravels or along channel margins may be seen at the immediate treatment site. However, substrate quality would not decrease over time because treatment of invasive plants would not result in a chronic sediment source. Diffuse and spotted knapweed are found along many streams in the Forest.

Lacey et al. (1989) reported higher runoff and sediment yield on sites dominated by knapweed versus sites dominated by native grasses. Therefore reestablishment of native vegetation would provide long-term benefit to sediment levels in aquatic habitat.

Indicator: Large Woody Debris, and Pool Area, Quality and Frequency, PCE Crosswalk: Spawning habitat PCE

Treatment of invasive plants would not impact pool area, quality and frequency. Treatment of invasive plants in RHCAs would not impact current wood debris in streams. The PDF that establishes a 100 ft buffer for broadcast applications provides protection to the recruitment of conifer seedlings within riparian areas which will sustain channel and habitat features in the future. Controlling invasive plants would allow for reestablishment of native vegetation, allowing riparian stands over time to develop larger recruitment trees, increasing the size and quantity of inchannel debris. The use of spot-spray applications of aquatic glyphosate and aquatic imazapyr may result in some minor non-target vegetation impact because of drift. However, the amount of drift, as a result of spot spray applications, necessary to kill trees, which would contribute to large wood accumulation, is highly unlikely and is therefore negligible.

Pathway: Flow/Hydrology

Indicator: Change in Peak/Base Flows, PCE Crosswalk: Spawning, Rearing, Migration habitat PCEs

None of the treatments within the proposed action will not effect peak flows, low flows or water yield. Methods used for treatment would have negligible effect on water infiltration into soil and associated surface runoff. No 5th field watershed has more than 2.5% proposed for treatment and most have less than one percent. This amount is much too small an area to show effects to flows from treatment.

Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur within the action area of the Federal action subject to consultations (50 CFR 402.02). The "reasonably certain to occur" clause is a key factor in assessing and applying cumulative effects and indicates, for example, actions that are permitted, imminent, have an obligation of venture, or have initiated contracts (U.S. Fish and Wildlife Service and National Marine Fisheries Service, 1998). Past and present impacts of non-Federal actions are part of the environmental baseline.

Only the land and roads within the National Forest system would be treated in the proposed action. The Forest, however, is intermingled with other federal, state, county, and private ownerships. Management activities and actions on neighboring lands may contribute to spread or containment of invasive plants on National Forest system lands, and vice versa.

Herbicides are commonly applied on lands other than National Forest system lands for a variety of agricultural, landscaping and invasive plant management purposes.

Herbicide use occurs on tribal lands, state, county and other Federal lands, private forestry lands, rangelands, utility corridors, road rights-of-way, and private property. Only restricted use herbicides have a mandatory reporting requirement to the states. Therefore, accurate accounting of the total acreage of invasive plant treatment for all land ownerships is unavailable. However, risk assessments indicate no measurable amounts would be in the waters adjacent to the treatment area. Project PDFs also are designed to reduce the chance of drift reaching streams minimizing direct and indirect effects. Treatments from this proposed action would not likely result in a measurable change when combined with treatments on private lands.

The proposed action is unlikely to have significant effects to fish and their habitat. It is unlikely that effects from proposed treatments would approach a threshold of concern; therefore, the proposed action would not contribute to significant cumulative effects.

Effects Determinations for ESA Listed Species

The effect determinations below (Table III - 14) are based on effects that have a reasonable probability of occurring due to invasive plant treatments within the action area, and conducted according to the Standards in the R6 FEIS and Project Design Features in the proposed action.

The potential for sublethal effects to fish from herbicide exposure was considered and addressed in the R6 2005 FEIS. Because there is insufficient data on the herbicides included in the Proposed Action to conclude that there may or may not be sublethal effects, the 1/20th of the NOEC values were used in the SERA risk assessments to account for the potential of sub-lethal effects from those herbicides that could potentially reach streams with listed and sensitive fish. The lack of information on sub-lethal effects did not affect our ability to make determinations of effects to listed species because of the degree of risk for herbicides coming in contact with water at levels of concern.

Effects from the proposed action are expected to vary because of proximity to water, species occurrence, life stage present, herbicide properties, and spatial and temporal effects. Some treatments completely outside of the riparian area with no mechanism for herbicide delivery have no detectable effects. Spot treatments up to the water's edge and along intermittent streams have the potential to deliver aquatic glyphosate and aquatic imazapyr to water. These treatments have been designed through the PDF to minimize risks of introducing herbicides and substantial amounts of sediment into aquatic habitats. Toxic levels of herbicides are unlikely to enter streams or lakes due to the ability to select application method, timing, and buffer distance from water, and other project design features. Effects to immediate streamside cover cannot be completely avoided and small droplets of aquatic glyphosate and aquatic imazapyr may come into contact with water. Any treatment method could introduce minor amounts of sediment and/or herbicide into adjoining waters as result of spot/hand applications, manual/mechanical plant removal, stream bank trampling, and planting. Effects from these activities are expected to be minor but exceed the discountable threshold and are therefore likely to adversely affect fish and their habitat.

Table III - 14- Effect Determination for Herbicide Treatment, Non-Herbicide Treatment and EDRR

Species	Status	Determination
Snake River Basin Steelhead	Threatened	MA-LAA
Middle Columbia River Steelhead	Threatened	MA-LAA
Snake River Spring/Summer Run Chinook Salmon	Threatened	MA-LAA
Snake River Fall Run Chinook Salmon	Threatened	MA-LAA
Columbia River Bull Trout	Threatened	MA-LAA
Snake River Sockeye Salmon	Endangered	MA-LAA
Snake River Basin Steelhead Critical Habitat	Designated	MA-LAA
Middle Columbia River Steelhead Critical Habitat	Designated	MA-LAA
Snake River Spring/Summer Run Chinook Salmon Critical Habitat	Designated	MA-LAA
Snake River Fall Run Chinook Salmon Critical Habitat	Designated	MA-LAA
Columbia River Bull Trout Critical Habitat	Designated	MA-LAA
Snake River Sockeye Salmon Critical Habitat	Designated	MA-LAA
NE=No Effect; MA-NLAA = May Affect, Not Likely to Adversely Affect; MA-LAA = May Affect, Likely to Adversely Affect .		

RATIONALE FOR DETERMINATION

- Invasive plant treatments (herbicide and non-herbicide) and site preparation for revegetation can result in small amounts of localized sediment due to trampling and removal of plant roots,
- Some herbicides could be introduced into the water indirectly from spot-spray and may impact aquatic plants, due to drift or overspray, at the immediate site.
- Invasive plant treatments could temporarily reduce streamside vegetation that provides cover for fish. Removal would be localized (plants surrounding target plant) and overstory would still provide cover via shade and future input of woody material.
- The risk for non-aquatic formulations of herbicide entering water is low under the proposed action due to implementation of the PDF.
- Aquatic formulations of glyphosate or imazapyr will be spot sprayed on plants and may be delivered to water. The potential to reach any exposure concentration of concern is minimized by spot application adjacent to water.
- Biological controls will not influence any of the pathways for effects to federally listed fish or their habitat.
- The potential for adverse effects from invasive plant treatments are expected to be low because project design features significantly reduce the potential for herbicides coming in contact with water where there are listed fish present.
- Water flow in streams quickly dilutes herbicide, reducing the potential for herbicide exposure.
- Transitory water quality impact, if any, would be limited to the point of contact with water and not an entire stream reach.
- The risk of effects to listed fish resulting from an accidental spill is minimized by the PDF.
- Exposures from application in intermittent channels and ditches, and within bankfull of occupied fishbearing streams are highly uncertain.
- The risk of exposure from drift due to aerial spraying has been reduced by PDFs (also see Appendix F – Aerial Spray Guidelines).

Essential Fish Habitat (Magnuson-Stevens Act)

The Sustainable Fisheries Act of 1996 (Public Law 104-267) amended the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (PL 94-265). It requires Federal action agencies proposing, authorizing, funding or undertaking any action that may adversely affect essential fish habitat (EFH) identified under the Magnuson-Stevens Act(MSA) for Chinook, Coho, and pink salmon to consult with the Secretary of Commerce. The EFH regulations at CFR section 600.920(e)(l)(i) enable Federal agencies to use existing consultation/environmental review procedures to satisfy EFH consultation.

Pursuant to the MSA the Pacific Fisheries Management Council (PFMC) has designated EFH for federally managed fisheries within the waters of Washington, Oregon, and California. Designated EFH for groundfish and coastal pelagic species encompasses all waters from the mean high water line, and upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon and California, seaward to the boundary of the U.S. exclusive economic zone (370.4 km) (PFMC, 2004, 1998). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable artificial barriers (as identified by the PFMC, 2003), and longstanding, naturally-impassable barriers (i.e., natural waterfalls in existence for several hundred years) (PFMC, 2003). In estuarine and marine areas, designated salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (370.4 km) offshore of Washington, Oregon, and California north of Point Conception to the Canadian border (PFMC, 2003).

EFFECTS OF THE PROPOSED ACTION TO EFH

As described in detail earlier in this chapter, relative to effects on ESA listed species, the proposed activities may result in short-term adverse effects to a variety of stream habitat parameters. The assessment of potential adverse effects from elements of the Proposed Action on EFH is based on information in Section 5.0 of this BA. Since estuarine and ocean habitat are not expected to be affected by the Proposed Action, no effect to EFH for groundfish or coastal pelagic species are expected. Pacific salmon EFH would be impacted in the same manner as ESA Designated Critical Habitat. Most of these potential short-term adverse effects would be avoided through implementation of PDFs described in this BA as part of the Proposed Action. The most likely effects to habitat include:

- Short-term increases in turbidity pursuant to manual and mechanical treatment activities
- Decreased primary productivity, alterations in aquatic macrophyte community, and toxic effects to fish and aquatic invertebrates through herbicide introduction to streams

EFFECTS DETERMINATION FOR EFH

The Proposed Action is expected to adversely affect EFH for Pacific salmon species listed in Table III - 14. These adverse effects, however, are expected to be short-term in nature and avoided or minimized to the extent practicable through application of PDFs. The long-term effects of the Proposed Action are expected to be an improvement in EFH conditions in locations currently infested with invasive plants.