3. Subbasin Assessment

3.1 Subbasin Overview

3.1.1 General Description

Location

The John Day Subbasin is located in northeastern Oregon in the southern section of the Columbia Plateau Ecological Province. Its over five million-acre (approximately 5,067,500 acres, or 8000 mi^2) drainage area is bound by the Columbia River (Lake Umatilla) to the north, the Blue Mountains to the east, the Aldrich Mountains and Strawberry Range to the south, and the Ochoco Mountains to the west. The John Day Subbasin incorporates portions of Grant, Wheeler, Gilliam, Sherman, Wasco, Jefferson, Umatilla, Morrow, Crook, Harney, Baker and Union counties. The towns within the subbasin with the largest populations include John Day, Prairie City and Condon. Populations of these and the other incorporated towns in the subbasin are listed in Table 2. See Figure 1 for a general overview map of the subbasin.

The John Day River flows generally northwest for 284 miles from its origin in the Blue Mountains and joins the Columbia River at river mile (RM) 217 upstream from the town of Rufus. The mainstem portion of the John Day River begins in the Strawberry Mountains in the Malheur National Forest and flows west through the town of John Day (RM 247) and then north from Dayville (RM 212). Major rivers flowing into the mainstem are the North Fork, Middle Fork, and South Fork John Day rivers.

The largest tributary to the John Day River is the North Fork, which originates in the Wallowa-Whitman National Forest in the Blue Mountains at elevations near 8000 feet. The North Fork John Day River flows westerly for 112 miles and joins the mainstem near Kimberly (RM 185), 15 miles below the town of Monument. The Middle Fork John Day River originates south of the North Fork in the Blue Mountains of the Malheur National Forest, flows westerly for 75 miles, and merges with the North Fork about 18 miles above Monument. The South Fork John Day River originates in the southwest portion of the Malheur National Forest and flows 60 miles north until it merges with the mainstem near Dayville.

Upon merging into the mainstem at Kimberly, the John Day River travels through deep canyon country on its way to the Columbia River. Important tributaries on the lower section of the John Day mainstem include Bridge Creek, Butte Creek, Thirtymile Creek, Hay Creek and Rock Creek.

Size

The John Day Subbasin drains a large portion of northeast Oregon (approximately 8000 mi^2), flowing 284 miles from its source in the Strawberry Mountains (9000-foot elevation), to its mouth at RM 217 (200-foot elevation) on the Columbia River. The John Day system contains over 500 river miles and is the second largest undammed tributary in the western United States. Only the Yellowstone River is larger.

The John Day River Subbasin is comprised of four major watersheds (fourth field watersheds, or HUC4s): North Fork John Day, Middle Fork John Day, Upper John Day, and Lower John Day. The Upper John Day watershed includes the upper mainstem and the South Fork John Day River. The Lower John Day watershed includes the mid- and lower mainstem.

North Fork. The North Fork John Day watershed drains approximately 1800 mi^2, with a perimeter of 306 miles. Elevations range from 1830 feet near the mouth of the North Fork to over 8300 feet in the headwater areas.

Middle Fork. The Middle Fork John Day watershed drains 806 mi^2 with a perimeter of 158 miles. Watershed elevations range from 2200 feet near the mouth of the Middle Fork to over 8200 feet in the headwater areas. The North and Middle Forks of the John Day River start in the mineral-rich Blue Mountains.

Upper John Day. The Upper John Day watershed drains approximately 2135 mi^2 above Picture Gorge (RM 205, near the confluence of Mountain Creek), including the South Fork John Day sub-watershed. The watershed perimeter is 304 miles. The South Fork John Day sub-watershed drains approximately 600 mi^2 and ranges in elevation from 2300 feet to 7400 feet.

Lower John Day. The Lower John Day watershed includes the middle and lower sections of the John Day River and drains the areas downstream of the confluence of the mainstem and North Fork John Day rivers at Kimberly (RM 185). The area encompasses 3148 mi^2 with a perimeter of 301 miles. The highest elevation in this fourth field watershed is Mount Pisgah at 6816 feet, while the lowest elevation is at the mouth of the John Day River at 265 feet.

<u>Geology</u>

The John Day Subbasin is characterized by diverse landforms ranging from loess-covered plateaus in the lower sections to alpine peaks in the headwaters. Rock assemblages within the John Day Subbasin include masses of oceanic crust, marine sediments, volcanic materials, ancient river and lake deposits, and recent river and landslide deposits. Major geologic events shaping the subbasin include volcanic eruptions, uplifting, faulting and erosion.

Volcanic activity in the form of lava flows, mudflows and ash fall formed and stratified three key formations in the subbasin over the course of approximately 37 to 54 million years – the Clarno Formation, John Day Formation, and the Columbia River Basalt Group. The Columbia River Basalt Group, a less-erodible formation, resulted from a series of basalt floods 12 to 19 million years ago. Columbia River basalts are the dominant rocks at elevations below 4000 feet. Igneous rocks are exposed in the higher reaches of the subbasin, while the lower subbasin exposures are primarily extrusive rocks, ash and wind-blown loess.

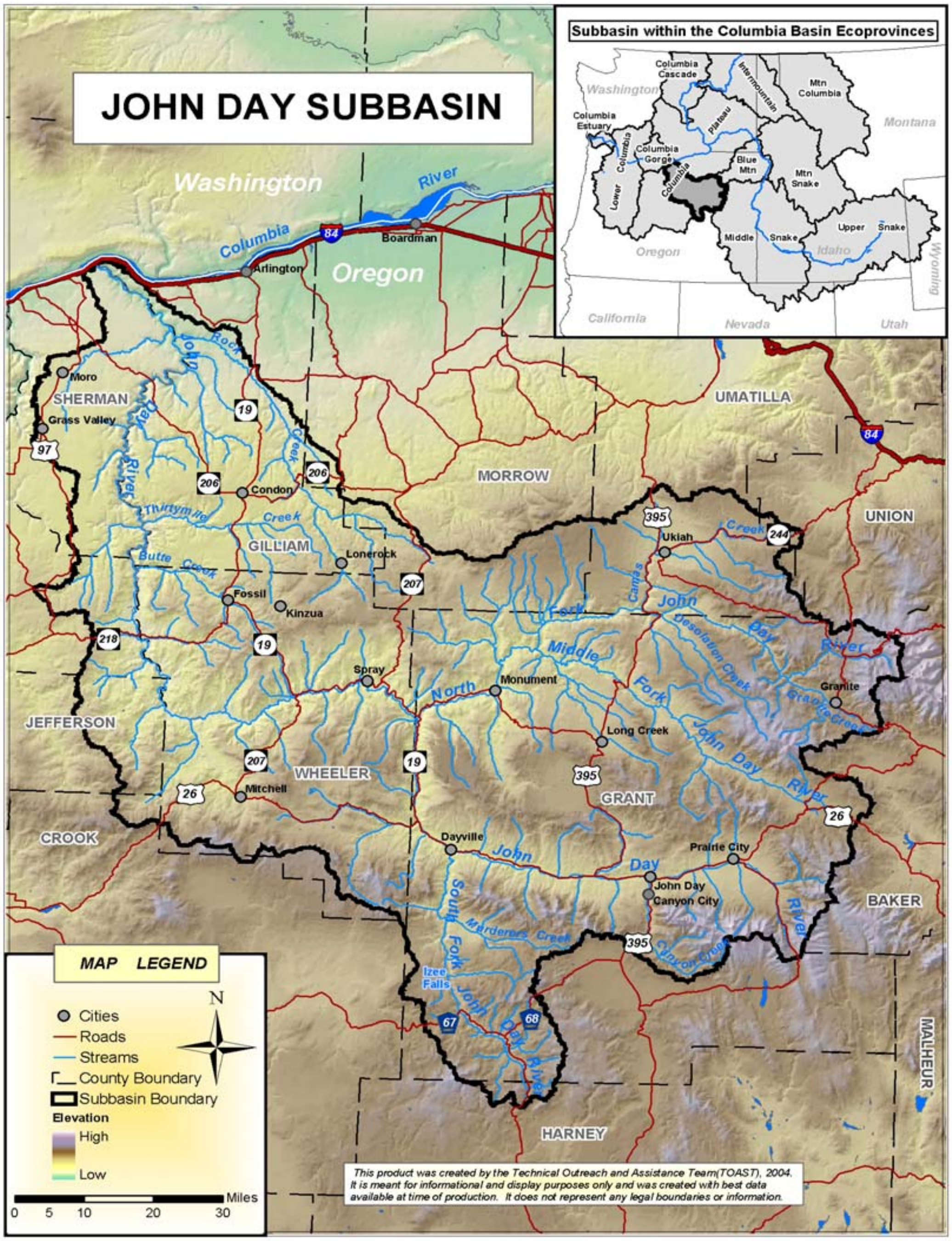

Figure 1. Overview of the John Day Subbasin.

After volcanic activity ceased 10 million years ago, erosion and faulting continued to alter the landscape. The Mascall Formation resulted from waterlaid fine volcanic sediments. The Rattlesnake Formation, a thick sequence of sand and gravel, was deposited in the ancestral John Day Valley. A final layer of predominantly unconsolidated silt, sand, and gravel comprises the Quaternary Alluvium.

Climate and Weather

The John Day Subbasin has a continental climate characterized by low winter and high summer temperatures, low average annual precipitation and dry summers. Climate in the subbasin ranges from sub-humid in the upper subbasin to semi-arid in the lower subbasin. Most precipitation falls between November and March. Less than 10% of the annual precipitation falls as rain during July and August, usually from sporadic thunderstorms. The upper elevations receive up to 50 inches of precipitation annually, mostly in the form of snow; lower elevations receive 12 inches or less of precipitation. The John Day Subbasin receives less precipitation than most portions of the Columbia Basin. See Figure 2 for a precipitation map of the subbasin.

Mean annual temperatures vary inversely with elevation. Mean annual temperature is 38° F in the upper subbasin and 58° F in the lower subbasin. Throughout the subbasin, actual temperatures vary from sub-zero during winter months to over 100° F during the summer. Inflows of moist Pacific air moderate extreme winter temperatures. The average frost-free period is 50 days in the upper subbasin and 200 days in the lower subbasin.

The John Day Subbasin portion of the Deschutes-Umatilla Plateau experiences cold winters and hot summers, with moderated night temperatures. Most precipitation is discharged over the Coast Range and Cascade Mountains before reaching the plateau; therefore, precipitation is low over this physiographic province. The Blue Mountains exhibit a great range of climates because of the diversity of the region. Physical features of the area create microclimates that deviate from the general pattern of warmer lower elevations and colder higher elevations. Eastern Oregon's precipitation is highly influenced by elevation.

Land Cover

The subbasin's vegetation ranges from coniferous forest at higher elevations to perennial grassland at middle elevations to desert shrub-steppe at lower elevations. Riparian habitats are often found along the subbasin's waterways. Irrigated agriculture is undertaken on many floodplain meadows throughout the subbasin, and dryland farming is present to varying degrees (large wheat farms in the lower subbasin and dryland hay in scattered areas throughout the subbasin).

Classifiable plant communities (ecological sites) in the John Day Subbasin are categorized into four basic divisions, according to the topographic position which they occupy: riparian, terrace, upland, and forest-woodland. Grass, shrub, and juniper communities dominate the valley; ponderosa pine, lodgepole pine, Douglas fir and white fir communities dominate higher elevations. Soil diversity also contributes to the variety of vegetation types.

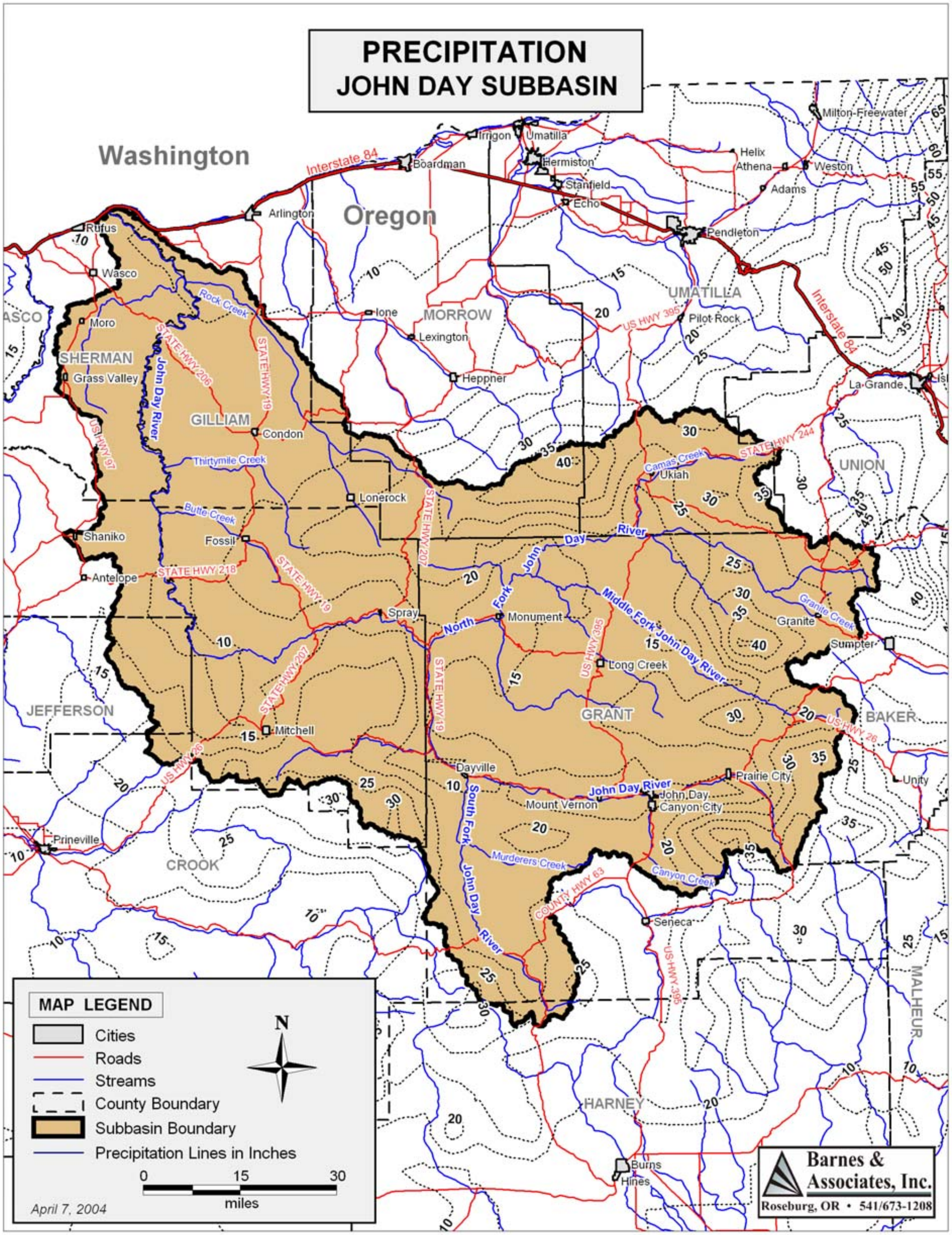

Figure 2. Precipitation map for the John Day Subbasin.

Riparian. Riparian areas are the green corridors of vegetation along perennial streams and around springs and seeps. Riparian zones are comprised of areas of undeveloped soils and developed, well-drained soils. Remnant natural hardwoods include alder, mountain ash, red-osier dogwood, willow, and cottonwood. Kentucky bluegrass and reed canary grass are non-native riparian species.

Riverine Terrace. The riverine terrace zone is formed from abandoned floodplains where soils are drained and subsurface water is diminished. This zone is a transition between riparian and upland vegetation. Primary, secondary and even tertiary terraces are ascribed according to their river proximity. Vegetation is comprised of xeric and non-native plants, including shrub-steppe vegetation.

Upland. The upland zone is characterized by steep slopes with shallow soils on ridges, south and west-facing slopes; and deeper, well-drained soils on north and east-facing slopes. The upper soil layer is sometimes bound by a biological soil crust consisting of algae, fungi, mosses, and lichens. Sagebrush-steppe covers much of the uplands; the various species found (big, low, stiff) is dependent on soil type. Widespread native grasses include: bluebunch wheatgrass and Idaho fescue on north slopes with relatively deep soils, basin wildrye on bottomlands, and sandberg bluegrass on relatively shallow soils.

Forest and Woodland. The John Day Subbasin encompasses about 1.8 million acres of forested lands; half of the subbasin's uplands are forested. The forest and woodland zone is found in higher elevation sites (above 4000 feet) with greater precipitation and cooler temperatures. Soils are generally deeper in this zone, allowing for growth of larger trees. Ponderosa pine is the principal forest cover, dominating south slopes. Moister areas favor Douglas-fir, white fir, grand fir, western larch, lodgepole pine and western white pine. At higher elevations (above 6000 feet), lodgepole pine, Engelmann spruce and subalpine fir are present.

Numerous rare plants are found in the John Day Subbasin. These plants are listed either through the Oregon Natural Heritage Program or under state or federal listings. Non-native plants are an increasing problem in the subbasin.

Land Use, Population and Ownership

Historically, the John Day Subbasin was used by Native Americans, fur trappers and homesteaders. The CTWSRO and the CTUIR have used the subbasin for centuries for gathering and harvesting fish, wildlife and other food stuffs. After the Indian treaties of 1855, homesteads and ranches were established on the river corridor where fertile bottomlands could be farmed and water was available for irrigation and livestock. Gold mining fueled settlement of the upper subbasin starting in the late 1850s, and continued as a significant activity into the early 20th century. Early land uses included wheat farming in the lower subbasin, ranching and associated irrigated hay meadows throughout, and logging in the forests of the subbasin's upper elevations. Small communities were established along the river to provide goods and services for mines, homesteads, and ranches.

Today, the John Day Subbasin is an overwhelmingly rural area with relatively low populations. The population trends for the subbasin can best be characterized by three counties which have a high proportion of their land area and most of their primary towns within the subbasin. These three counties are Grant, Wheeler and Gilliam. These counties' recent population figures according to the U.S. Census Bureau, 1990 and 2000 Census, are shown in Table 1.

Table 1. County populations according to U.S. Census Bureau (USCB 2004).

County	1990 Population	2000 Population	Pop. Change	% Change
Grant	7853	7935	82	1.0%
Gilliam	1717	1915	198	11.5%
Wheeler	1396	1547	151	10.8%
Total	10,966	11,397	431	3.9%

This population is spread between the scattered ranches, farms and homesites of outlying areas; small towns of 100 to 500 people built around a few small service businesses, a post office and perhaps a school (including the towns of Dayville, Fossil, Grass Valley, Long Creek, Mitchell, Monument, Moro, Spray and Ukiah); and the larger towns of 500 to 1821 (including John Day, Prairie City and Condon) which generally serve as county seats, and are home to government offices and numerous service-oriented businesses. Many of these towns were historically sawmill towns. Large mills remain today in John Day and Prairie City. Populations for the towns within the subbasin are shown in Table 2.

Table 2. City populations according to U.S. Census Bureau (USCB 2004).

Town	1990 Population	2000 Population	Pop. Change	% Change
John Day	1836	1821	-15	-0.8%
Prairie City	1147	1080	-67	-5.8%
Condon	635	759	124	19.5%
Canyon City	685	669	-16	-2.3%
Mount Vernon	454	595	141	31.1%
Fossil	416	469	53	12.7%
Moro	284	337	53	18.7%
Ukiah	237	255	18	7.6%
Long Creek	244	228	-16	-6.6%
Grass Valley	181	171	-10	-5.5%
Mitchell	145	170	25	17.2%
Monument	145	151	6	4.1%
Spray	137	140	3	2.2%
Dayville	164	138	-26	-15.9%
Shaniko	37	26	-11	-29.7%
Granite	0	24	24	NA
Lonerock	6	24	18	300.0%
Greenhorn	0	0	0	NA
Total	6753	7057	304	4.5%

The subbasin's population may continue to grow, perhaps at an accelerated rate, if the subbasin's attempts at economic diversification continue to be successful (see the next section on the economy of the subbasin). Increasing human population will result in greater demands for electricity, water, and buildable land as well as an increase in the need for transportation, communication, and other infrastructure. These economic and population demands may affect habitat features such as water quality and quantity, which are important to the survival and recovery of listed species and the health of populations of other non-listed species. Careful planning, management, and mitigation will be required to assure that future development is compatible with the need to maintain and enhance the area's value as fish and wildlife habitat.

Over 95% of the lands within the subbasin are zoned for agriculture and forestry. Private and federal lands are used mainly for livestock grazing and forage production. Urban lands comprise only 0.3% of the land base.

According to data from the Oregon Geospatial Data Clearinghouse (OGDC 2004), the ownership makeup of the John Day Subbasin is 59% private, 31% USFS, 9% BLM/miscellaneous federal and 1% state. Private ownership is focused primarily in the lower subbasin. The ownership makeup of the subbasin has been relatively static for the last decade or more, even though some federal-private exchanges have occurred. See Figure 3 for an ownership map of the subbasin.

The USDA Forest Service manages much of the higher elevations in the subbasin. The Umatilla, Wallowa-Whitman, Malheur and Ochoco National Forest together make up 31% of the subbasin's total area. These forests are managed according to a multiple use philosophy. Wilderness areas, designated roadless areas, and special use zones like riparian conservation areas (RCA) and large game range are managed with the primary emphasis on fish and wildlife values. Wilderness areas include the North Fork John Day Wilderness, Strawberry Wilderness, Black Canyon Wilderness and Bridge Creek Wilderness. Other areas of the forest are managed for multiple uses including grazing, recreation and timber production (though the latter has been much reduced over the last 15 years due to a combination of many factors).

Private forestlands are concentrated in pine and lower elevation mixed-conifer stands. They consist of a mix of large forest industry holdings (though many of these have been sold off in recent years), smaller private woodlots managed for timber and forage production, and recreational properties managed for aesthetics and hunting uses. Clearcutting is rare on private lands, and past logging on private lands in the region has generally resulted in low-to-moderate density stands of younger trees.

Mid-elevation grasslands and shrub-steppe plant communities are primarily in private ownership. Grazing of livestock is the predominant land use, though dryland farming occurs in places, primarily in the lower subbasin, but also in scattered small fields used for hay production on higher elevation ranches in the upper subbasin. Wheat is the primary crop. Recreation is an increasingly important use of these private lands.

In the river corridor and associated floodplains, irrigated agriculture is widespread. A mix of grass, alfalfa and grain hay is the primary product from irrigated lands. Some areas are managed as irrigated pasture; scattered small areas are managed for orchard and specialty crops. The vast majority of the irrigation is from surface waters of the John Day and its tributaries. Riparian areas are typically managed as part of larger agricultural operations, and many have been altered from their natural state by water diversions, channelization, vegetation changes and the like. An increasing number of riparian areas are being managed with an emphasis on protecting fish and wildlife values and water quality through a combination of individual landowner initiatives and contractual agreements associated with incentive programs such as USDA's Conservation Reserve Enhancement Program (CREP) and Conservation Reserve Program (CRP) programs, the riparian fencing programs run by ODFW, the CTWSRO and the CTUIR using BPA funding.

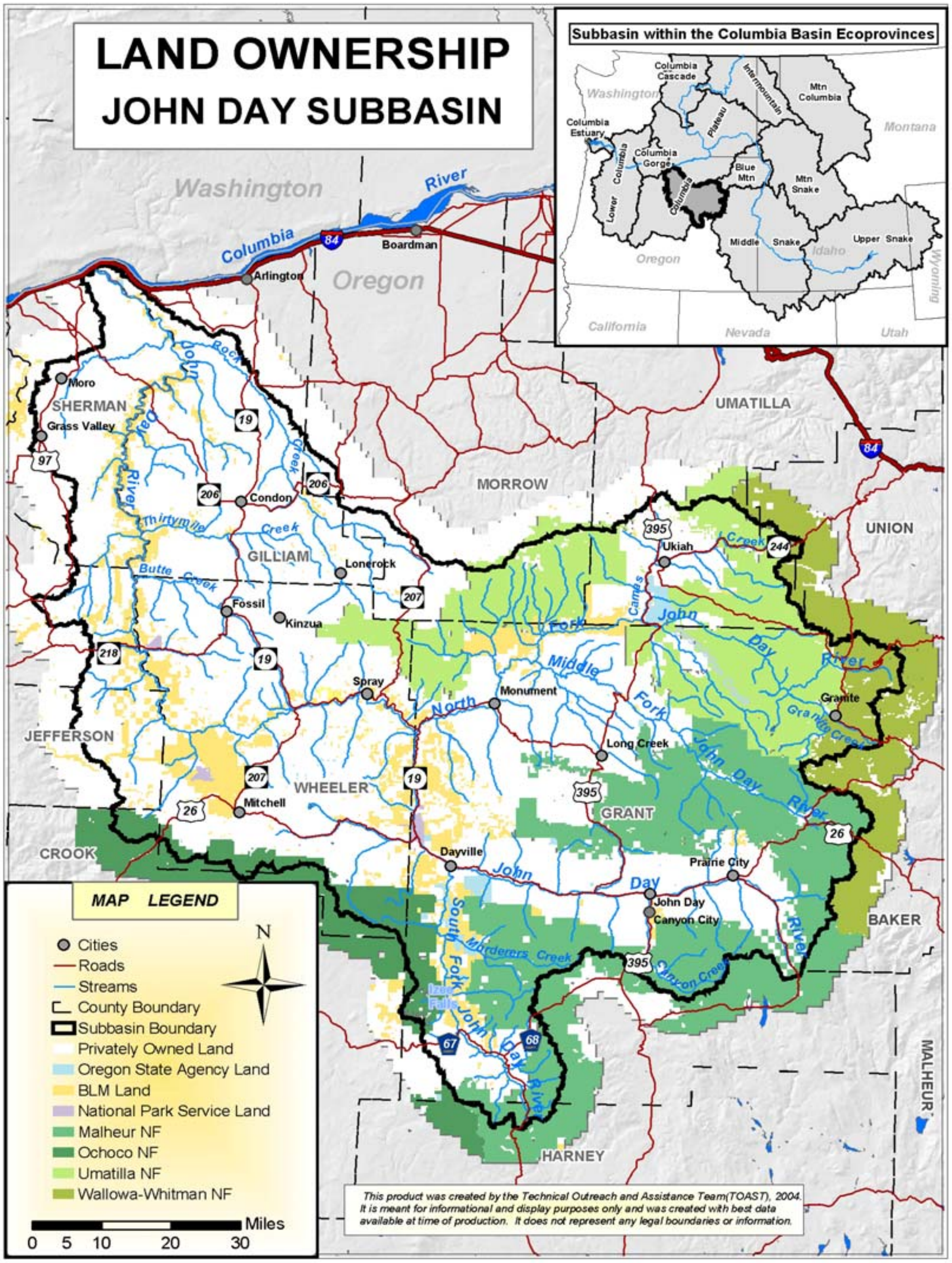

Figure 3. Ownership map for the John Day Subbasin as of June, 2003.

Large portions of the river corridor of the lower mainstem, and portions of the South Fork and the North Fork are managed by the Bureau of Land Management, which also manages scattered upland parcels throughout the subbasin. A recent land exchange program – including the Northeastern Oregon Assembled Land Exchange of 1998 and the changes resulting from the Oregon Land Exchange Act of 2000 - has provided some consolidation of BLM-administered lands in the upper part of the subbasin. The river corridor managed by the BLM is primarily made up of steep, lower elevation canyon country. Primary uses of BLM lands are grazing and recreation - particularly fishing and boating in the river corridors. BLM's management of the river corridor is guided by the 2001 John Day River Management Plan.

Urban lands comprise only a small portion of the land base; residential land use is scattered throughout the private lands of the middle and lower elevations. Residental development is governed by county land use plans and zoning. There is an increasing trend towards fragmentation of large private land holdings and associated rural development ranging from hunting cabins to small subdivisions. Such development has significant long-term ramifications for both terrestrial and aquatic habitat and wildlife. In a few instances conservation easements are being used to keep larger holdings intact and promote conservation goals on private lands.

State-owned lands are mostly wildlife management areas. These include the Bridge Creek Wildlife Area near Ukiah, the Phillip W. Schneider Wildlife Area south of Dayville and the Moon Creek Wildlife Area west of Mt. Vernon. The Bureau of Indian Affairs (U.S. Dept. of Interior) manages about 20 off-reservation trust lands for the CTWSRO, located throughout the subbasin. The CTWSRO either owns or manages approximately 35,000 acres throughout the subbasin. These include the Pine Creek, Oxbow and Forrest Ranches, all acquired by the tribes using BPA funding, and all managed with an emphasis on fish and wildlife conservation.

Three segments of the John Day River system were designated as Federal Wild and Scenic Rivers by the Omnibus Oregon Wild and Scenic Rivers Act of 1988 (Public Law 100-558). Most of the federally-designated Wild and Scenic Rivers in the John Day Subbasin are managed by the BLM according to its 2001 John Day River Management Plan.

The three John Day segments designated as Wild and Scenic are:

- Lower John Day River mainstem from Tumwater Falls upstream to Service Creek, classified as "Recreational" and managed by the BLM.
- North Fork John Day River from Camas Creek upstream to the head waters. One portion of this segment is classified as "Wild," two portions are classified as "Scenic," and two are classified as "Recreational." These segments are primarily managed by the Umatilla and Wallowa-Whitman national forests.
- South Fork John Day River from Smokey Creek upstream to the Malheur National Forest Boundary, classified as "Recreational" and primarily managed by the BLM.

These Wild and Scenic segments total approximately 249 miles.

Four segments of the John Day River system are designated as State Scenic Waterways by the State of Oregon, which restricts development and other activities in the scenic corridor. The program is administered by the Oregon Parks and Recreation Department.

The Oregon Scenic Waterways System was created by a ballot initiative in 1970. The system of rivers was expanded by another ballot initiative in 1988. The four John Day segments designated as State Scenic Waterways include:

- John Day River mainstem from Tumwater Falls upstream to Parrish Creek.
- North Fork John Day River from near Monument upstream to the North Fork John Day Wilderness boundary.
- Middle Fork John Day River from its confluence with the North Fork John Day River upstream to the Crawford Creek Bridge
- South Fork John Day River from the north boundary of the Phillip W. Schneider Wildlife Management Area to County Road 63.

The National Park Service manages the 14,000-acre John Day Fossil Beds National Monument within the John Day Subbasin. This monument, noted for its cultural and paleontologic resources, includes three separate units: Sheep Rock (northwest of Dayville), Painted Hills (northwest of Mitchell), and Clarno (southwest of Clarno).

See Figure 4 for a map showing the aforementioned "reserve areas" in the John Day Subbasin.

Economy

Gold mining fueled settlement of the upper subbasin starting in the late 1850s, and continued as a significant activity well into the early 20th century. The modern economy developed around wheat farming in the lower subbasin, ranching and associated irrigated hay meadows throughout, and logging in the forests of the subbasin's upper elevations. Today the economy is heavily based on government, lumber and wood products manufacturing, retail, agriculture and forestry, telecommunications and tourism. The timber industry is most important in the forested upper portions of the subbasin. Livestock and agriculture are important throughout the subbasin, comprised mostly of cattle and sheep ranching and associated hay crops. Predominant irrigated crops are grass and alfalfa hay. Dry-land production of grain crops is the major economic activity on the plateaus of the lower subbasin. Mining is limited today compared to its historic role, but continues in the form of gravel pits, a bentonite mine near Clarno, and small scale, largely speculative and/or recreational gold mines in the historic mining districts of the upper headwaters. In addition, two of Oregon's three thunderegg mines are located in the subbasin.

Tourism has long been promoted as a growth industry, and many small businesses cater to visitors. Over the past decade, substantial numbers of traditional ranches in the subbasin have become fee hunting preserves, with many offering lodging and guide services to their clients. In Wheeler County alone, more than half of the county's ranches now serve the tourism industry (Don Cossitt, Wheeler County Assessor, personal communication, March 2003). Hunting, fishing, boating, camping, wildlife observation, photography, hiking, swimming and scenic viewing are among the most common recreational activities, but tourism remains limited compared to nearby regions like the Deschutes Subbasin.

The vast majority of the John Day Subbasin – including the counties of Grant, Gilliam, Wheeler, Sherman, Crook, Harney, Jefferson and Morrow - is economically distressed according to the latest data (March 2002) from the Oregon Economic & Community Development Department (OECDD 2004). Many communities have been hard hit by sawmill closures and the decline in forestry jobs over the last thirty years. The historically-large contribution of timber to the subbasin economy has declined in the last decade due to a number of factors including lack of raw materials, environmental litigation (which has contributed to the lack of raw materials), inconsistent domestic lumber markets, and increased domestic imports. Few new industrial opportunities have come along to replace these lost jobs. Expansion of the economy is limited by the small population, isolation from major cities, and limited transportation facilities.

The economic conditions contribute to a larger demographic shift. Many local residents have been forced to leave the area due to lack of economic opportunity, while at the same time retirees and other new emigrants in search of rural living move into the area. The flight of young families combined with the influx of older newcomers is resulting in an increase in the average age, and significant declines in school enrollments in many of the subbasin's towns. Smaller communities struggle to provide public services given limited income bases and high costs per resident. Land values are increasing far faster than commodity prices, limiting the opportunity in many areas of the subbasin for the expansion and/or generational transfer of existing agricultural operations. In addition, consolidation of agricultural operations is reducing overall agricultural employment. An increasing portion of the private land is owned by absentee landowners interested in recreation, land speculation, and retirement.

Despite the economic hardships, the subbasin remains home to vibrant communities with a strong connection to the places they call home. Area communities and residents are pursuing new economic opportunities at the same time that they continue to actively support the agricultural and forest industries around which their communities were founded. Areas of interest include tourism and recreation, small scale manufacturing of easily transportable products (examples include a bowstring manufacturer with a growing business in John Day), value-added agricultural products (including branded beef), value-added forest products (such as the new dowel mill in Seneca and several efforts to promote juniper products), telecommuting (by new immigrants and via efforts like the telemarketing center in John Day and excellent telecom infrastructure as compared to many other parts of rural Oregon). A new golf course and recreational area have recently opened at Arlington (just outside the subbasin on the Columbia River east of the mouth of the John Day River). Wheeler County's first industrial park has already attracted interest from potential occupants. The area's rugged sparsely-settled country continues to provide a wealth of both challenges and opportunities for those that call it home.

Figure 4. Reserved areas of the John Day Subbasin.

Human Disturbances to the Aquatic and Terrestrial Environments

Historically, the John Day River was one of the most significant anadromous fish producing rivers in the Columbia River Basin (CRITFC 1995). The John Day Subbasin is widely held as home to the strongest native runs of spring chinook salmon and summer steelhead in the Columbia Basin. The lower reaches of the John Day River are also home to a relic run of fall chinook. In addition, the entire system supports an unknown number of anadromous Pacific lamprey. Other fish species accorded high interest are resident populations of westslope cutthroat, interior redband and bull trout. Summer steelhead and bull trout have garnered particular interest, as both are federally-listed as threatened under the ESA. Current harvest of anadromous fish is limited within the John Day Subbasin to a small tribal subsistence fishery for spring chinook, but salmon and steelhead produced here contribute to fisheries in the ocean and the lower Columbia River.

Changes in the watershed such as elevated water temperatures, decreased flow and alteration of the hydrograph have in many cases favored introduced (smallmouth bass, channel catfish and carp) or non-salmonid species (northern pikeminnow, chiselmouth and redside shiner) in places that historically were dominated by salmonids. Introduced species – smallmouth bass and channel catfish in particular – have provided a very popular fishery in areas once occupied by salmonids. Some people argue that these introduced species have contributed to declines in salmonids, but ODFW stomach content data suggest that predation by smallmouth bass is not significant (Tim Unterwegner, ODFW, personal communication, April 8, 2004).

Some past and current land use practices have degraded the aquatic resource. Water withdrawals have reduced streamflows, especially during summer, and contributed to higher water temperatures; poorly-managed grazing, mining, timber harvesting, and maintenance of pushup dams have reduced riparian vegetation and shade, also contributing to higher water temperatures and reducing habitat diversity; pushup dams and reduced flows have created physical and thermal obstacles to fish movement. Riparian road construction and use, agricultural and residential development, and recreational use of riparian areas have also contributed to compromised fish habitat.

The John Day Subbasin, particularly along the upper mainstem and South Fork John Day rivers, experienced considerable amounts of intensive stream channelization, flow modifications and drainage (including some tiling of drainage ditches) projects between 1943 and 1951. These projects were encouraged and supported by various agencies to improve crop production. This work was accomplished as "a conservation priority and was considered the stream science at the time" (ODA 2002).

Much of the Columbia Plateau, including much of the lower John Day Subbasin, was once a shrub-steppe environment. This shrub-steppe habitat included bunch grasses, shrubs and numerous wildlife species. Today, much of this area has been converted to dryland wheat. Many of the diverse plant and wildlife communities have been replaced by cropland in a wheat/fallow rotation. Since 1985, there have been an estimated 150,000 acres of farm ground permanently converted to non-native grass cover by way of the USDA's Conservation Reserve

Program (CRP). This program is supported by the Oregon Department of Fish & Wildlife and has provided improved habitat for many game and non-game species.

Noxious weeds and uncontrolled growth of some native species (e.g., juniper) are an intensifying problem within the subbasin. The rapidly-expanding invasion of noxious weeds represents the single greatest threat to native rangeland biodiversity and recovery of less-than-healthy watersheds. The initiation and spread of noxious plants have been furthered by human disturbances such as recreational use, unmanaged grazing and fire suppression. Although many weeds occupy lands in the John Day Subbasin, those causing most concern are diffuse, spotted, and Russian knapweeds; Dalmatian toadflax; yellow starthistle; Scotch thistle; purple loosestrife; rush skeletonweed; leafy spurge; poison hemlock; and, medusahead rye. Native bunchgrasses have been replaced in many areas by western juniper (*Juniperus occidentalis*), sagebrush (*Artemesia sp*.) and exotic annual grasses (e.g., cheatgrass).

In spite of all the disturbances summarized in this section, the aquatic habitat in the John Day Subbasin is healthier than in many other Columbia Basin tributaries due to the absence of large dams and the presence of quality habitat in some federally-owned headwater areas and elsewhere. Further, landowners and others within the subbasin have increased awareness of the negative impacts of some land management practices. Current practices have been, and continue to be improved to minimize these impacts while at the same time furthering the long-term interests of natural resource industries in the subbasin.

The cooperative nature of current programs and coordinating agencies and entities, and the variety of innovative, effective projects on the ground are an asset to the subbasin in implementing recovery and restoration efforts. Improving and expanding on existing, successful efforts – including habitat enhancement, passage improvement, research and monitoring and evaluation activities – are key to meeting restoration goals within the subbasin.

3.1.2 Subbasin Existing Water Resources

The bulk of this discussion on existing water resources was taken from the John Day Subbasin Summary (NWPPC 2001).

Watershed Hydrography

The John Day River Subbasin consists of four U.S. Geological Survey (USGS) fourth field (HUC4) watersheds: the Upper John Day River (USGS cataloging unit 17070201), the North Fork John Day River (USGS cataloging unit 17070202), the Middle Fork John Day River (USGS cataloging unit 17070203), and the Lower John Day River (USGS cataloging unit 17070204). These HUC4 watersheds are further divided into sub-watersheds (fifth field, or HUC5 watersheds) totaling 43 throughout the entire subbasin. See Figure 5 for a map of the fourth and fifth field watersheds in the subbasin.

Hydrologic Regime

Most water in the John Day Subbasin is derived from the upper watershed, primarily in the form of melting snow. Discharge from the free-flowing (no large-scale dams) John Day River is highly variable from peak to low flows.

Flow data in the John Day River Subbasin is currently being collected from 18 stations located on the river and various tributaries. The OWRD operates and maintains 11 streamflow gaging stations, the USGS runs six and the BLM has assumed operation of the last station. Historic gaging station streamflow data for all current stations as well as "real time" streamflows for some stations are available for download as average daily flows from the OWRD website (www.wrd.state.or.us). The USGS also publishes data from some of the stations in its annual report on streamflows in Oregon.

Streamflows in the mainstem John Day River are currently monitored at five locations: McDonald Ferry (RM 21), Service Creek (RM 157), Picture Gorge (RM 205), John Day (RM 253) and Blue Mountain Hot Springs (RM 275). Flows from the North Fork are monitored at a station near Monument (RM 16). Streamflows in the Middle Fork are recorded near Ritter (RM 15). Two stations are active on the South Fork: one near Dayville (RM 7) and the other near Izee (RM 34). Other streams currently being monitored include: Mountain Creek, Lone Rock Creek, Butte Creek, Murderer's Creek, Deer Creek, Canyon Creek, Strawberry Creek, Camas Creek and Bridge Creek.

The USGS-maintained gage at McDonald Ferry, Oregon (gage # 14048000), the oldest gage in the subbasin, has been in operation since December 1904. The discharge measured at this station represents 7580 square miles, or approximately 96% of the entire subbasin. Other long-standing gages in the subbasin include John Day River near John Day (#14038530), North Fork John Day River at Monument (#14046000), and John Day River at Service Creek (#14046500). These gaging stations, as well as the McDonald Ferry station, are shown with their locations and periods of record in Table 3.

Based on the record from the McDonald Ferry station, the John Day River's mean annual discharge into the Columbia River is slightly more than 2000 cubic feet per second (cfs). The average annual discharge ranges from a high of 4818 cfs in 1984 to the low of 603 in 1934.

Table 3. USGS gaging station summary, John Day Subbasin, Oregon.

Gage No.	Gage Name	Lat.	Long.	Area (mi^2)	Elev. (ft)	Period of Record
14048000	McDonald Ferry	45°35'16"	120°24'30"	7580	392	1904-pres.
14038530	John Day	44°5'07"	118°54'19"	386	3130	1968-1994, 1996-pres.
14046000	Monument	44°48'50"	119°25'50"	2520	1959	1925-pres.
14046500	Service Creek	44°7'38"	120°00'20"	5090	1632	1925-1926, 1929-pres.

Peak streamflows in the John Day River usually occur from March through May while the seasonal low flows typically occur from August through October. The highest recorded discharge of the John Day River was 42,800 cfs on December 24, 1964, caused by warm rain melting large amounts of snow. The lowest recorded discharge from the McDonald Ferry station was zero cfs for part of September 2, 1966, August 15 to September 16, 1973, and August 13, 14 and 19 to 25, 1977. Mean annual and mean monthly flows are shown in Figures 6 and 7, respectively. Peak flow at the McDonald Ferry gaging station is typically over 100 times greater than the lowest flows of the same year. From year to year, peak flows can vary as much as 300 to 700%.

The hydrologic curve has shifted from historic times, with peak flows greater than in the past and late season flows more diminished. It is suspected that these effects are due to greatly reduced rates of soil infiltration, reduced capacity for ground water / riparian storage, and diminished in-channel storage in beaver ponds (NWPPC 2001).

Figure 5. Fourth and fifth field watersheds in the John Day Subbasin.

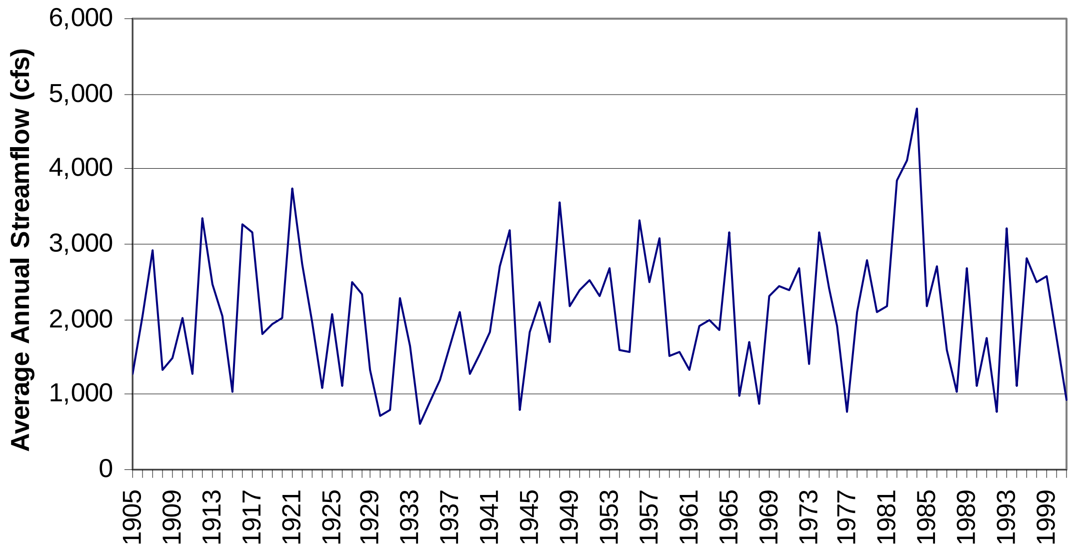

Figure 6. Mean annual flows in the John Day Subbasin (McDonald Ferry gage #14048000).

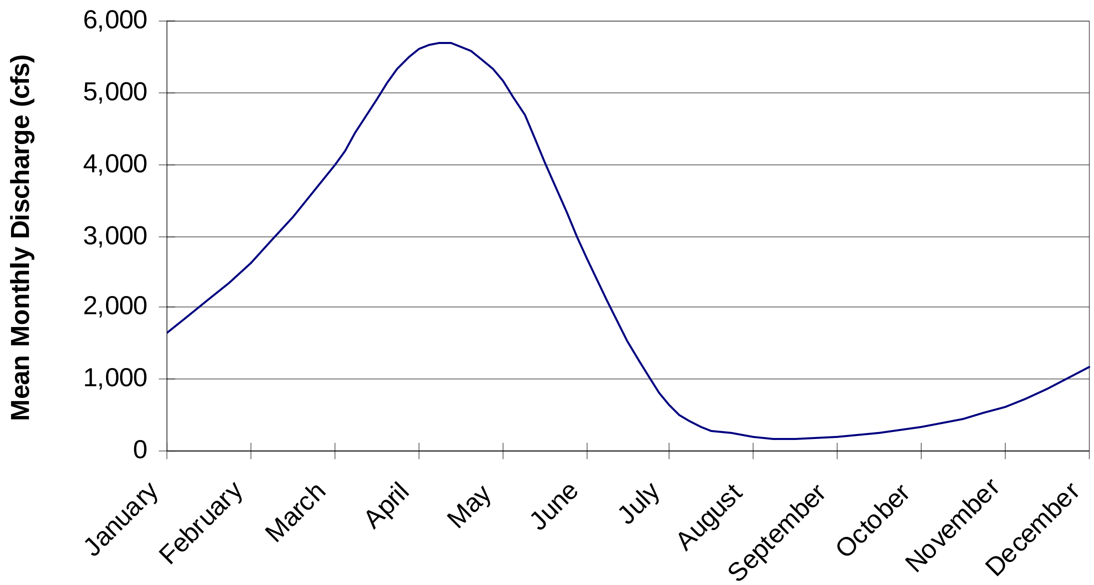

Figure 7. Mean monthly discharge from 1904 to 2002 (McDonald Ferry gage #14048000).

Four types of aquifers comprise each of the four watersheds, as shown in Table 4. The Columbia Plateau aquifer system and the Miocene basaltic-rock aquifer are the two most common. Approximately 31% of the total area has no principal aquifer.

Table 4. Principal aquifers in John Day Subbasin watersheds.

Aquifer Type	Total Miles²	Rock Type	Percent Composition			
			NF	MF	U	L
Columbia Plateau aquifer system	3115	Basalt, volcanic rock	32.3	12.9	0.9	53.9
Volcanic and Sedimentary Rock aquifers	508	Basalt, volcanic rock	42.7	0.6	24.8	31.9
Miocene basaltic-rock aquifers	1391	Basalt, volcanic rock	5.8	10.6	66.5	17.1
Pacific Northwest basin-fill aquifers	483	Unconsolidated sand, gravel	15.3	0.0	57.3	27.3
No Principal Aquifer	2425	N/A	19.4	9.7	32.6	38.4

NF = North Fork John Day, MF = Middle Fork John Day, U = Upper John Day, L = Lower John Day.

Water Quality

Water quality standards are benchmarks established to assess whether river and lake quality is adequate to protect fish and other aquatic life, recreation, drinking, agriculture, industry and other uses. Water quality standards are also regulatory tools used by the Oregon Department of Environmental Quality (ODEQ) and the US Environmental Protection Agency (EPA) to prevent water pollution. States are required to adopt water quality standards by the federal Clean Water Act. Standards are subject to approval by EPA.

The Clean Water Act also requires states to maintain a list of stream segments that do not meet water quality standards. This list is called the 303(d) list because of the section of the Clean Water Act that makes the requirement. The Clean Water Act requires states to develop water quality goals (called Total Maximum Daily Loads or TMDLs) along with an implementation plan and schedule to achieve water quality goals for 303(d) listed water bodies**.** TMDLs for the John Day Subbasin are scheduled for completion in 2006 (http://www.deq.state.or.us/wq/303dlist/TMDLTargestMap.htm).

TMDL monitoring was initiated in 2002 in the North and Middle Fork watersheds and will be contined through the summer of 2004 and possible later. The US Environmental Protection Agency approved Oregon's 2002 303(d) list on March 24, 2003 (http://www.deq.state.or.us/wq/303dlist/303dpage.htm).

The ODEQ has identified some streams in the John Day Subbasin as water quality limited. Many of these streams are habitat areas for spring chinook salmon and summer steelhead. Water quality limited means in-stream water quality fails to meet established standards for certain parameters for all or a portion of the year. Water quality parameters (and standards) of temperature (64° F/55° F, rearing/spawning) and dissolved oxygen (98% saturation) relate to the beneficial use for fish life. Other standards include bacteria (fecal coliform) and pH. Many segments of streams throughout the John Day Subbasin are listed on ODEQ's 303(d) list of affected waters for temperature. Most water quality problems in the John Day Subbasin stem from vegetation disturbance, stream straightening / relocation, year-round livestock grazing, cumulative effects of timber harvest and road building, water withdrawals for irrigation and historical mining and dredging. In the lower subbasin, some dry-land agricultural practices, such as summer fallow, can affect water quality by modifying subbasin hydrology, potentially affecting sediment delivery as well as peak and late season flows (NWPPC 2001).

North Fork John Day. The North Fork has the best chemical, physical, and biological water quality in the John Day Subbasin as compared to ODEQ water quality standards (USDI 2000). Most of the streams in this subbasin are considered in relatively good condition, with the exception of elevated late summer water temperatures that do not meet ODEQ standards. It is recognized that water quality standard thresholds default to natural conditions where the latter prevail. An assessment of potential more-natural conditions is being conducted through the TMDL process, scheduled for completion in 2006. Temperature is the primary water quality limitations for the North Fork (Table 5). The North Fork does not meet PACFISH pool frequency management objectives (USDA and USDI 1994). (Pools serve as cold water refugia for salmon and steelhead when streams become warm.) Because the North Fork (including its primary tributary, Middle Fork) contributes 60% of the flow to the mainstem John Day (OWRD 1986), the influence of the North Fork on temperature is significant, which relates directly to fisheries. Other water quality problems in the North Fork include leaching of toxic mine waste in specific locations and a high degree of stream sedimentation from highly erodable soils. Hot geothermal springs also exist, but their effects on water quality are not fully known.

Table 5. North Fork John Day River watershed 303(d) listed stream segments and water quality parameters of concern (ODEQ 2002).

Waterbody Name	Parameter	Waterbody Name	Parameter
Alder Creek	Sedimentation	Hidaway Creek	Temperature
Baldy Creek	Sedimentation	Hog Creek	Sedimentation
Bear Wallow Creek	Temperature	Indian Creek	Temperature
Beaver Creek	Temperature	Lane Creek	Temperature
Big Creek	Temperature	Mallory Creek	Temperature
Big Wall Creek	Temperature, Sedimentation	Meadow Creek	Temperature
Bowman Creek	Temperature	North Fork Cable Creek	Temperature
Bridge Creek	Temperature	North Fork John Day River	Temperature
Buck Creek	Temperature	Onion Creek	Temperature
Bull Run Creek	Temperature	Owens Creek	Temperature
Cable Creek	Temperature	Porter Creek	Sedimentation
Camas Creek	Temperature	Potamus Creek	Temperature
Clear Creek	Temperature	Rancheria Creek	Temperature
Cottonwood Creek	Biological Criteria	Skookum Creek	Temperature
Crane Creek	Temperature	South Fork Cable Creek	Temperature
Desolation Creek	Temperature	South Trail Creek	Temperature
Ditch Creek	Temperature	Sponge Creek	Temperature
East Fork Cottonwood Creek	Biological Criteria	Stalder Creek	Temperature
Fivemile Creek	Temperature	Swale Creek	Temperature, Sedimentation
Frazier Creek	Temperature	Trail Creek	Temperature
Granite Creek	Temperature, Sedimentation	Wilson Creek	Temperature, Sedimentation

Middle Fork John Day. Water quality in the Middle Fork John Day Subbasin generally exhibits satisfactory chemical, physical, and biological quality as compared to ODEQ water quality standards (USDI 2000). The Middle Fork usually has worse water quality problems than its tributaries, with the most serious water quality problem being elevated summer temperatures (Table 6). Sedimentation from streambank erosion is not a serious problem in the Middle Fork. Season-long cattle grazing contributes to elevated fecal coliform counts during summer. However, agricultural runoff presents a low level of potential impact to water quality. (NWPPC 2001)

Table 6. Middle Fork John Day River watershed 303(d) listed stream segments and parameters of concern (ODEQ 2002).

Waterbody Name	Parameter	Waterbody Name	Parameter
Badger Creek	Temperature	Grub Creek	Temperature
Battle Creek	Temperature	Indian Creek	Temperature
Bear Creek	Temperature	Little Pine Creek	Temperature
Canyon Creek	Temperature	McClellan Creek	Temperature
Corral Creek	Biological Criteria	Mountain Creek	Temperature
Cottonwood Creek	Temperature	Murderers Creek	Temperature
Dads Creek	Temperature	North Fork Deer Creek	Temperature
Dans Creek	Temperature	Pine Creek	Temperature
Deardorff Creek	Temperature	Rail Creek	Temperature
Deer Creek	Temperature	Reynolds Creek	Temperature
Dog Creek	Temperature	Reynolds Creek	Temperature
East Fork Canyon Creek	Temperature	Rock Creek	Temperature
Ennis Creek	Temperature	Slyfe Creek	Temperature
Ennis Creek	Temperature	South Fork John Day River	Temperature
Fields Creek	Temperature	Strawberry Creek	Temperature
Fields Creek	Temperature	Sunflower Creek	Temperature
Flat Creek	Temperature	Tex Creek	Temperature
Flat Creek	Temperature	Tex Creek	Temperature
Grasshopper Creek	Temperature	Tinker Creek	Temperature
Grasshopper Creek	Temperature	Utley Creek	Biological Criteria
		Utley Creek	Dissolved Oxygen

Upper John Day (upstream of Dayville, but including South Fork). Water quality is fair in the upper watershed during most of the year as compared to ODEQ water quality standards (USDI 2000). Low summer flows on the mainstem John Day River above Dayville contribute to elevated temperatures (Table 7); higher streamflows during the winter/spring and streambank erosion contribute to turbidity. Problematic eutrophication (the process whereby excessive growth of algae and aquatic plants increases organic matter in the water, resulting in elevated pH levels and decreased dissolved oxygen, all of which are harmful to aquatic life) in the South Fork and mainstem John Day rivers are a partial result of irrigation return flow (non-point source) and possibly cattle feedlots (point source) (NWPPC 2001).

Table 7. Upper John Day River watershed 303(d) listed stream segments and parameters of concern (ODEQ 2002).

Waterbody Name	Parameter	Waterbody Name	Parameter
Badger Creek	Temperature	Grub Creek	Temperature
Battle Creek	Temperature	Indian Creek	Temperature
Bear Creek	Temperature	Little Pine Creek	Temperature
Canyon Creek	Temperature	McClellan Creek	Temperature
Corral Creek	Biological Criteria	Mountain Creek	Temperature
Cottonwood Creek	Temperature	Murderers Creek	Temperature
Dads Creek	Temperature	North Fork Deer Creek	Temperature
Dans Creek	Temperature	Pine Creek	Temperature
Deardorff Creek	Temperature	Rail Creek	Temperature
Deer Creek	Temperature	Reynolds Creek	Temperature
Dog Creek	Temperature	Reynolds Creek	Temperature
East Fork Canyon Creek	Temperature	Rock Creek	Temperature
Ennis Creek	Temperature	Slyfe Creek	Temperature
Ennis Creek	Temperature	South Fork John Day River	Temperature
Fields Creek	Temperature	Strawberry Creek	Temperature
Fields Creek	Temperature	Sunflower Creek	Temperature
Flat Creek	Temperature	Tex Creek	Temperature
Flat Creek	Temperature	Tex Creek	Temperature
Grasshopper Creek	Temperature	Tinker Creek	Temperature
Grasshopper Creek	Temperature	Utley Creek	Biological Criteria
		Utley Creek	Dissolved Oxygen

Lower John Day (downstream of Dayville). During the summer months from July to September, groundwater provides much of the base flow to the Lower John Day River. Although ODEQ has listed the lower river as water quality limited for temperature, other water quality constituents such as total phosphates, biochemical oxygen demand, and fecal coliform can also limit water quality during late summer when flows are the lowest and water temperatures are the greatest (Table 8). Severe streambank erosion and sedimentation exists in some tributaries to the mainstem. Eutrophication is also active during the low-flow summer months when water temperatures are high. (NWPPC 2001) Total Maximum Daily Loads (TMDLs) are expected to be developed for this portion of the subbasin in 2006.

Table 8. Lower John Day River watershed 303(d) listed stream segments and parameters of concern (ODEQ 2002).

Waterbody Name	Parameter	Waterbody Name	Parameter
Bear Creek	Temperature	John Day River	Temperature
Bridge Creek	Temperature	John Day River	Temperature
Gable Creek	Temperature	John Day River	Fecal Coliform
Grass Valley Canyon	Temperature	John Day River	Dissolved Oxygen
Henry Creek	Temperature	Nelson Creek	Temperature
John Day River	Fecal Coliform	Pine Creek	Biological Criteria
John Day River	pH	Sorefoot Creek	Temperature
John Day River	Temperature	Stahl Canyon	Temperature
John Day River	Temperature	Thirtymile Creek	Temperature
		Thirtymile Creek	Temperature

The Agricultural Water Quality Management Act (Senate Bill 1010) was passed in 1993 to formally organize agricultural efforts to address water pollution in watersheds across the state. Senate Bill 1010 directed ODA to develop watershed-based plans that outline strategies to prevent and control water pollution from agricultural activities and soil erosion.

The Senate Bill 1010 process is triggered in an area when a water quality management plan is required by state or federal law. Area plans identify local water quality problems associated with agricultural lands, conditions in the watershed that need to be addressed to meet water quality standards, and ways to correct those problems. Area rules are established to address those parameters identified in the 303(d) list.

The four Agricultural Water Quality Management Area Plans (AgWQMAP) developed for the John Day Subbasin include:

1. North and Middle Forks John Day AgWQMAP
2. Upper and South Fork John Day AgWQMAP
3. Middle John Day AgWQMAP
4. Lower John Day AgWQMAP

<u>Riparian Resources</u>

The riparian zone is the area that normally receives some degree of inundation (or saturated soil conditions) during the growing season. In most of the John Day Subbasin, the majority of the riparian zone is flooded during part of the growing season and dry during mid to late summer. Several riparian ecological sites have distinct potential plant communities. Some of these sites have the potential for dense riparian plant communities. In areas where the soils are not developed enough to moderate the annual wet-dry cycle, vegetation is either lacking completely or restricted above the normal high water line to plants such as service berry, hackberry, mock orange and various annual and perennial grasses and forbs. The areas where soils are developed and well-drained have more shrubs that are traditionally considered riparian, such as willow and alder. Where water flow is slow or where saturated soil conditions last longer into the growing season, sedges and rushes occupy more of the plant composition.

An ecological site is a particular or unique kind of land with specific physical characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation. Along the John Day River itself there are several ecological sites that have distinct potential plant communities. Some of these sites have potential for riparian plant communities and others do not.

On the lower mainstem John Day River system, seven draft riparian ecological sites have been described which support distinct potential plant communities. The sites vary greatly in their ability to support riparian vegetation (USDI 2000).

Basalt Cliff /Ledge. This site consists of basalt cliffs and ledges. It is generally devoid of soil. Occasionally very sparse vegetation will exist in fractures and crevices.

Colluvium. This site consists of rubble deposited by colluvial means. Fluvial forces have little to do with this landform. Boulders that have rolled into the stream are present adjacent to the site and are evident at low flow levels. Vegetation varies depending on how much fine soil material has accumulated and distance from average water flows. Hackberry is the dominant woody vegetation with mock orange present in wetter sites. Willows are present at all but a few sites. Bunchgrass is typically not present below the mean high water mark. Reed canary grass is common. Some emergent species tend to follow the water level as flows recede in the growing season.

Cobble/Gravel Bar. This site consists of gravel and cobble bars, including mid-channeland point bars. Bar material is highly mobile. Vegetation, when present, is typically emergent and tends to follow the waters edge as it recedes during the growing season. As a result of substrate mobility and the associated shearing action, woody species are seldom found. Some mid-channel bars have willow communities that are becoming established. These bars are in locations relative to channel shape that allow energy and shearing actions to stay in a defined pattern and allow for woody species to become better established.

Terrace Edge. The formation of this site is the result of lateral stream migration into an older terrace landform. The older terrace is a remnant of the holocene period prior to the John Day adjusting to its current elevation. The top or flat part of the terrace contains upland species. This site is variable due to slope of the terrace edge, either vertical or sloping or slumping, and due to parent material of the terrace, either fine textured or coarse or a mixture of both. The substrate material composition is a factor in erosion rate (active cutbank, stable vertical bank, slumping recovering bank) which is a function of spatial location with respect to channel migration. Vegetation varies due mainly to soil texture and flow level fluctuations. Herbaceous and emergent vegetation follows water levels as it recedes during the growing season. Woody species are seldom found.

Non-Riparian Terrace Edge. This site consists of shallow soil terrace underlain by coarse fluvial substrate, typically gravel or cobble. This site is a specific subunit of the previously described terrace edge site. At low flow levels this site typically grades into gravel bars. Vegetation is limited by the lack of fine soil material and by low water holding capacity especially when water levels recede. As a result of substrate mobility and the associated shearing action, woody species are seldom found.

Alluvial Fan. This site forms a confluence with tributaries and canyon features. It is highly variable and groundwater relations are a key component. Coarse materials are deposited from the tributary into the main channel. Some of the coarse material is sheared from the front edge and deposited immediately downstream. Fine materials are deposited from the main channel both upstream and downstream of the coarse fan. The areas of fine soils material are subirrigated by the tributary creating a more stable water regime for plant communities. Vegetation is diverse with both herbaceous and woody vegetation present.

Hillslope. This site consists of shallow stony colluvium. What little fine soil that is included is loamy in texture. Fluvial forces have little to do with this landform and this site is very stable. Boulders that have rolled into the stream are present adjacent to the site and are evident at low flow levels. Vegetation varies depending on how much fine soil material has accumulated and elevation from average water flows. Hackberry is the dominant woody vegetation with mock orange present in wetter sites. Willows have only been found at very few sites. Bunchgrass is typically not present below the mean high water mark. Reed canary grass occurs on some areas. Some emergent species tend to follow the water level as flows recede in the growing season.

<u>Wetland Resources</u>

The John Day Subbasin has numerous wetlands. However, most of these wetlands are small. Many of these wetlands are in complex with stream systems and thus are linear in nature. (Roger Borine, USDA Natural Resources Conservation Service, April 1, 2004).

The U.S. Fish and Wildlife Service's National Wetlands Inventory covers the John Day Subbasin. However, the maps of this inventory are not yet available in electronic format. There have been no Local Wetlands Inventories conducted in the subbasin. These local inventories are typically conducted by municipalities prior to land development efforts (Kevin Herkamp, Oregon Division of State Lands, March 30, 2004).

3.1.3 Hydrologic and Ecologic Trends in the Subbasin

Watershed conditions in the John Day Subbasin have changed significantly over the past 150 years. Water and land use practices contributing to these changes include placer and dredge mining, livestock grazing, timber harvest, certain intensive agricultural practices, road construction, flood events (such as the 1964 and 1996 floods) and stream channelization. These watershed disturbances have caused risks to ecological integrity by reducing biodiversity and threatening riparian-associated species (ICBEMP 2000). Terrestrial habitat areas were irrevocably changed with the introduction of livestock grazing and intensive agricultural conversion. Fire suppression for the past 100 or more years has also changed the structure and composition of forest stands in the subbasin. Nonetheless, habitat conditions on some private lands, in particular those involved in cooperative restoration programs, are generally considered to be improving. In addition, habitat conditions on federally-administered lands are on an upward trend (Federal Caucus 2000).

Historical descriptions of the John Day Subbasin indicate that the John Day River was once a relatively stable river with good summer streamflows and water quality, and heavy riparian cover. Streambanks were covered with dense growths of aspen, poplar, and willow; cottonwood galleries were thick and wide; and beaver were very abundant (Wissmar *et al*. 1994). Large spring and fall chinook salmon migrations and numerous beaver sightings indicated that John Day River waters contained a high degree of in-stream habitat diversity. Terrestrial habitat was noted to have been dominated by native bunchgrasses and sagebrush.

Historic, recent and current land use practices may have altered the hydrologic cycle (the storage, movement and character of the water resource over entire areas of the John Day Subbasin and its tributary system). Changes in the hydrologic cycle are demonstrated by increased runoff, altered peak flow regimes, reduced ground water recharge and soil moisture storage, and low late-season flow. Historic and current land uses, in combination with hydrologic changes, may have resulted in some portions of the John Day Subbasin reflecting marked stream channel instability (i.e., channel widening, downcutting, vertical cut banks, and excessive gully development).

Although riparian habitat has been largely degraded as compared to historic conditions, riparian habitat quality is improving in some areas receiving enhancement and protection. Photo-monitoring and other assessments by BLM show condition variations, but where riparian-oriented management has been implemented, vegetative structure, density, and diversity have increased (USDI 2000). In general, riparian areas in the lower and middle mainstem portion are "functional-at-risk," indicating a functional condition but susceptibility to degradation (USDI 2000). Overall, a moderate level of wetland has been lost. Conversion of the river-bottom areas to agricultural development has effectively reduced the natural meadow habitat historically associated with riverine habitats.

Both the quantity and quality of natural wildlife habitat in the John Day Subbasin have declined since the mid-1800s (USDI 2000). Habitats for wildlife have become increasingly fragmented, simplified in structure, and infringed on or dominated by non-native plants (ICBEMP 2000). The most obvious disturbance in the subbasin is cattle grazing (OWRD 1986). The subbasin is sensitive to overgrazing by cattle because the native grassland vegetation evolved in the absence of large herbivores (Li *et al*. 1994). Historic sheep grazing also played a role in habitat disturbance.

Major habitat changes have also resulted from a century of fire suppression activities/fire exclusion from the forest ecosystem. This practice has resulted in forest stand densities outside the historic range of natural conditions. The resulting dense stands of trees are more susceptible to insect infestation and disease infection. These dense stands are also more likely to experience catastrophic stand replacement fires and their substantial impacts on certain forest habitats, including riparian areas. Fire suppression has also resulted in juniper encroachment into native grasslands. These juniper forests increase water usage through increased evapo-transpiration, thus leading to reduced streamflows.

Past logging activities, inundation of lower river habitat from Columbia River hydropower development, human development, irrigated and dry-land agricultural conversion, drought, recreational activities, road densities and noxious weed encroachment have also affected the natural wildlife habitats in the subbasin (USDI 1998). Habitat quality is variable depending on the degree to which habitats have been converted into other land uses, impacted by human activities or invaded by noxious weeds. Although agricultural development has altered native habitat areas, non-native habitat has increased for adaptable species.

Restoration of certain aspects of watershed function in the John Day Subbasin began long before any species were listed under the ESA. Soil erosion, stream channel instability, and riparian function-oriented projects have been underway in the subbasin in different land use sectors for many years by way of a combination of federal, state, tribal, local, and privately-led efforts. Movement toward conservation tillage in the agricultural sector, improvements in grazing management, and improved timber management practices, while oriented toward their particular sector, also achieve value for salmon in the long run. Improvements in the scientific understanding of species distribution and needs, watershed management, and techniques for watershed restoration are expected to enhance these on-going efforts for additional benefit to fish and wildlife resources.

3.1.4 Regional Context

<u>Relation to Other Geographic Units in the Columbia River Basin</u>

The John Day Subbasin is one of 62 subbasins within the United States portion of the Columbia River Basin. Located in northeastern Oregon in the southern section of the Columbia Plateau Ecological Province, it is one of 11 ecological provinces within the Columbia River Basin (U.S. portion). The John Day Subbasin is bound on two sides by other subbasins within the Columbia Plateau Ecological Province: on the west by the Deschutes Subbasin and on the north by the Lower Middle Columbia (western portion) and the Umatilla (eastern portion) subbasins. Subbasins from the Blue Mountain and Middle Snake ecological provinces bound the John Day Subbasin on the east. The John Day Subbasin contains over five million acres (5,067,500 acres), making it the fourth largest subbasin in Oregon. See Figure 8 for a map of the subbasins and ecological provinces within the Columbia River Basin.

The John Day River is unique – it is the second longest free-flowing river in the continental United States, and its spring chinook salmon and summer steelhead populations are two of the last remaining intact wild populations of anadromous fish in the Columbia River Basin. The John Day River has also been kept relatively free of hatchery influences. Many segments of the John Day River have been designated under the federal Wild Scenic Rivers Act and Oregon's State Scenic Waterways Act. Among other things, these designations recognize the John Day's significant fish and wildlife values.

<u>NOAA Fisheries Evolutionarily Significant Units</u>

NOAA Fisheries has identified more than 50 different Evolutionarily Significant Units (ESUs) of west coast salmon and steelhead in Washington, Oregon, California, and Idaho. An ESU is a geographic delineation of fish used to distinguish individual populations of salmon and steelhead that share common genetic, ecological, and life history traits, but differ in important ways from fish in other ESUs. Within an ESU there may be multiple populations of demographically independent groups of fish that spawn during specific seasons and within specific waterbodies, but do not interbreed with fish from another group.

The interior Columbia River Basin is currently home to 12 different anadromous salmonid ESUs belonging to three different species: chinook salmon (*Oncorhynchus tshawytscha*), sockeye salmon (*O. nerka*), and steelhead trout (*O. mykiss*). Since 1991, seven of these 12 ESUs have been listed as threatened under the ESA because of dramatic declines in abundance and loss of habitat.

The John Day Subbasin is located within the Mid-Columbia River (MCR) steelhead ESU. Other subbasins within the MCR steelhead ESU are the Yakima, Klickitat, Deschutes, Walla-Walla and the Umatilla. See the insert map in Figure 9 for a map of the MCR steelhead ESU and its neighboring ESUs.

The National Marine Fisheries Service's (NMFS) recent Biological Opinion (NMFS 2000) on the federal Columbia River hydropower system recognizes the importance of the John Day Subbasin to fish and wildlife restoration efforts. NMFS – now called NOAA Fisheries – specifically identified the Upper John Day as a priority watershed that will receive immediate attention for habitat and species recovery for the MCR steelhead ESU. NMFS assigned priority status to the Upper John Day watershed because the watershed has significant potential for improvement in productive capacity, contains significant amounts of quality habitat on federal lands to anchor restoration efforts, and has significant numbers of water diversions where immediate and significant gains could be secured by addressing flow, passage and screening problems.

The MCR steelhead was listed as threatened on March 25, 1999 (64 FR 14517); critical habitat was designated on February 16, 2000 (65 FR 7764); and protective regulations were adopted on July 10, 2000 (65 FR 42422). However, On April 30, 2002, the United States District Court for the District of Columbia adopted a consent decree resolving the claims in the National Association of Homebuilders, *et al.* v. Evans, Civil Action No. 00-2799 (D. D.C., April 30, 2002). Pursuant to that consent decree, the court issued an order vacating critical habitat designations for a number of listed salmonid species.

USFWS Designated Bull Trout Planning Units

The U.S. Fish and Wildlife Service has identified five populations of bull trout as Distinct Population Segments (DPSs) for recovery purposes (i.e., the U.S. Fish and Wildlife Service has concluded that these populations meet the requirements of the joint policy with the National Marine Fisheries Service regarding the recognition of distinct vertebrate populations (61 FR 4722)). Bull trout present in the John Day Subbasin are part of the Columbia River DPS, encompassing parts of Oregon, Washington, Idaho and Montana. Other DPSs identified by the USFWS include: Klamath River, Jarbidge River, Coastal-Puget Sound and St. Mary-Belly River populations.

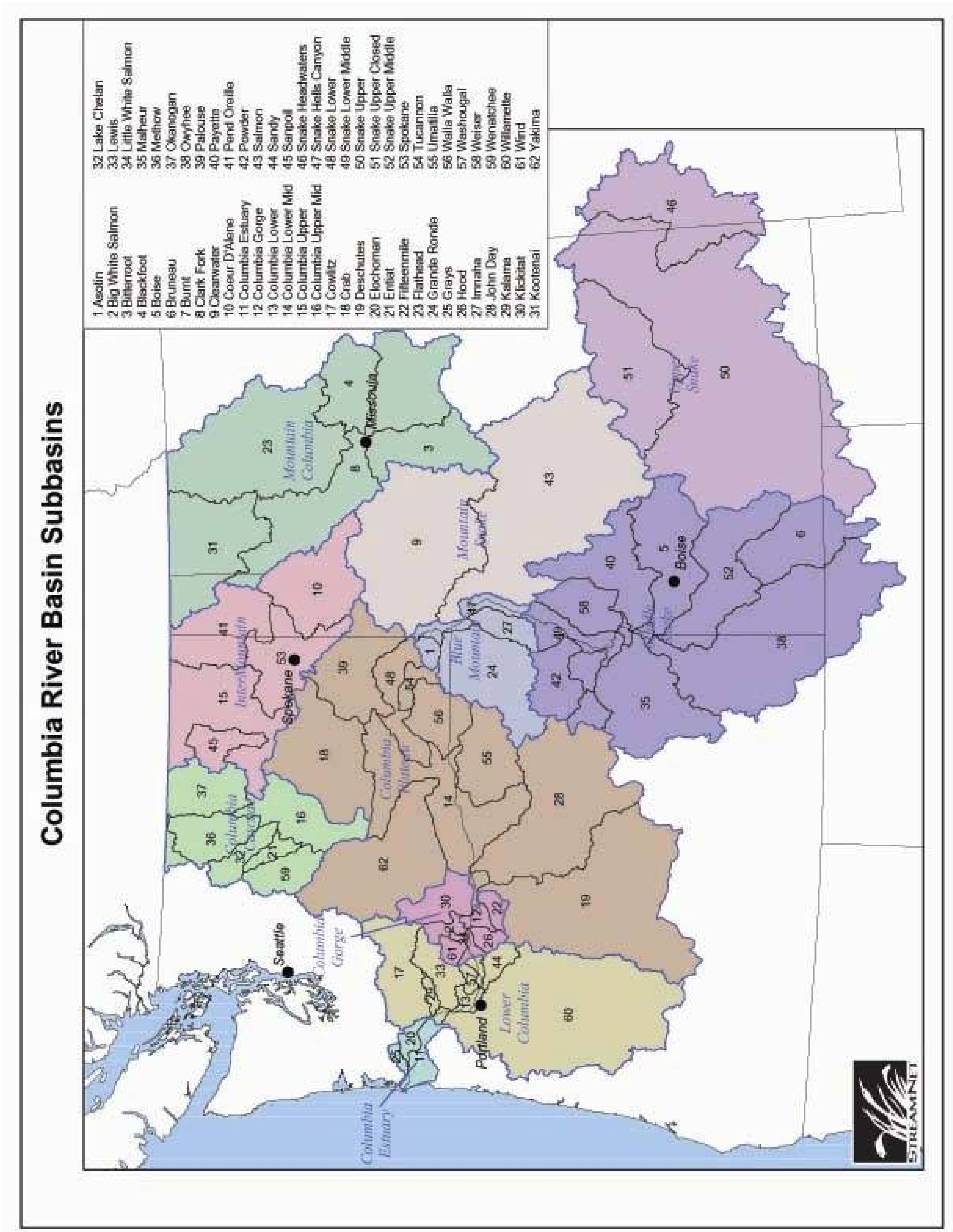

Figure 8. Columbia Basin Ecological Provinces and Subbasins.

The U.S. Fish and Wildlife Service has identified the John Day Subbasin as one of 22 recovery units within the Columbia River Distinct Population Segment (USFWS 2003). Recovery units were identified based on three factors: (1) recognition of jurisdictional boundaries, (2) biological and genetic factors common to bull trout within a specific geographic area, and (3) logistical concerns for coordination, development, and implementation of the recovery plan. The John Day Recovery Unit includes bull trout from three watersheds: the North Fork John Day River, the Middle Fork John Day River and a portion of the Upper Mainstem John Day River. Each of these areas corresponds to a core area for recovery purposes. See the insert map in Figure 20 for a map of the Columbia River DPS and its 22 recovery units.

The U.S. Fish and Wildlife Service issued a final rule listing the Columbia River and Klamath River populations of bull trout (*Salvelinus confluentus*) as a threatened species under the Endangered Species Act on June 10, 1998 (63 FR 31647). The other four populations were listed as threatened later in 1998 and in 1999, resulting in all bull trout in the coterminous United States being listed as threatened.

3.2 Focal Species Characterization and Status

3.2.1 Native/Non-native Wildlife, Plant and Resident/Anadromous Fish of Ecological Importance

<u>Species Designated as Threatened or Endangered</u>

Terrestrial Wildlife. Five wildlife species found in the John Day Subbasin are currently listed as threatened or endangered by Oregon and/or the federal government (Table 9). In addition, three wildlife species found in the John Day Subbasin are federal candidate species, meaning that there is sufficient information on the biological vulnerability of and threats to these species to support proposals to list them as endangered or threatened (Table 10). A similar category at the state level is Oregon's classification of critical sensitive species, which includes species whose listing as threatened or endangered is pending, or for which immediate conservation actions are needed to prevent their listing. The John Day Subbasin has 19 species found on Oregon's critical sensitive species list (Table 11).

In addition to the critical category, Oregon also recognizes sensitive wildlife species that are vulnerable, peripheral or naturally rare, or have an undetermined status. Vulnerable sensitive species are species whose listing as threatened or endangered is not imminent and may be avoided by continued or expanded use of adequate protective measures and monitoring. Peripheral or naturally rare species are sensitive because they are species whose Oregon populations are at the edge of their range, or because they have had historically low population numbers in Oregon because of naturally limiting factors. Species with an undetermined status may also be susceptible to population decline, but need more study to determine their status. The 40 species that fall into one or more of these three categories are also shown in Table 11.

Table 9. Wildlife species of the John Day Subbasin listed as threatened or endangered at the state or federal level (ODFW 2003, USFWS 2003).

Common Name	Scientific Name	Status
bald eagle	*Haliaeetus leucocephalus*	OR and US: Threatened
Canadian lynx	*Lynx canadensis*	US: Threatened
peregrine falcon	*Falco peregrinus*	OR: Endangered
Washington ground squirrel	*Spermophilus washingtoni*	OR: Endangered
wolverine	*Gulo gulo*	OR: Threatened

Table 10. Wildlife species of the John Day Subbasin that are candidates for federal listing (USFWS 2003).

Common Name	Scientific Name
Columbia spotted frog	*Rana luteiventris*
Washington ground squirrel	*Spermophilus washingtoni*
yellow-billed cuckoo	*Coccyzus americanus*

Table 11. Sensitive wildlife species of the John Day Subbasin that fall into one of four categories: critical, vulnerable, peripheral or naturally rare, or of undetermined status (ODFW 1997)

Common Name	Scientific Name	Oregon Sensitive Status
Birds:		
black-backed woodpecker	*Picoides arcticus*	Critical
burrowing owl	*Athene cunicularia*	Critical
common nighthawk	*Chordeiles minor*	Critical
ferruginous hawk	*Buteo regalis*	Critical
flammulated owl	*Otus flammeolus*	Critical
Lewis's woodpecker	*Melanerpes lewis*	Critical
northern goshawk	*Accipiter gentiles*	Critical
northern pygmy-owl	*Glaucidium gnoma*	Critical
red-necked grebe	*Podiceps grisegena*	Critical
sage sparrow	*Amphispiza belli*	Critical
three-toed woodpecker	*Picoides tridactylus*	Critical
upland sandpiper	*Bartramia longicauda*	Critical
vesper sparrow	*Pooecetes gramineus*	Critical
white-headed woodpecker	*Picoides albolarvatus*	Critical
yellow-billed cuckoo	*Coccyzus americanus*	Critical
yellow-breasted chat	*Icteria virens*	Critical
American white pelican	*Pelecanus erythrorhynchos*	Vulnerable
bobolink	*Dolichonyx oryzivorus*	Vulnerable
grasshopper sparrow	*Ammodramus savannarum*	Vulnerable
great gray owl	*Strix nebulosa*	Vulnerable
loggerhead shrike	*Lanius ludovicianus*	Vulnerable
long-billed curlew	*Numenius americanus*	Vulnerable
olive-sided flycatcher	*Contopus cooperi*	Vulnerable
pileated woodpecker	*Dryocopus pileatus*	Vulnerable
pygmy nuthatch	*Sitta pygmaea*	Vulnerable
sage grouse	*Centrocercus urophasianus*	Vulnerable
sandhill crane	*Grus canadensis*	Vulnerable
Swainson's hawk	*Buteo swainsoni*	Vulnerable

western bluebird	*Sialia mexicana*	Vulnerable
willow flycatcher	*Empidonax traillii*	Vulnerable/Undetermined Status
bank swallow	*Riparia riparia*	Undetermined Status
Barrow's goldeneye	*Bucephala islandica*	Undetermined Status
bufflehead	*Bucephala albeola*	Undetermined Status
harlequin duck	*Histrionicus histrionicus*	Undetermined Status
mountain quail	*Oreortyx pictus*	Undetermined Status
spruce grouse	*Falcipennis canadensis*	Undetermined Status
Williamson's sapsucker	*Sphyrapicus thyroideus*	Undetermined Status
black swift	*Cypseloides niger*	Peripheral or Naturally Rare
black-throated sparrow	*Amphispiza bilineata*	Peripheral or Naturally Rare
horned grebe	*Podiceps auritus*	Peripheral or Naturally Rare
tricolored blackbird	*Agelaius tricolor*	Peripheral or Naturally Rare
Mammals:		
Townsend's big-eared bat	*Corynorhinus townsendii*	Critical
fringed Myotis	*Myotis thysanodes*	Vulnerable
American marten	*Martes americana*	Vulnerable
pallid bat	*Antrozous pallidus*	Vulnerable
long-eared Myotis	*Myotis evotis*	Undetermined Status
long-legged Myotis	*Myotis volans*	Undetermined Status
silver-haired bat	*Lasionycteris noctivagans*	Undetermined Status
western small-footed Myotis	*Myotis ciliolabrum*	Undetermined Status
white-tailed jackrabbit	*Lepus townsendii*	Undetermined Status
Amphibians:		
northern leopard frog	*Rana pipiens*	Critical
tailed frog	*Ascaphus truei*	Vulnerable
western toad	*Bufo boreas*	Vulnerable
Columbia spotted frog	*Rana luteiventris*	Undetermined Status
Woodhouse's toad	*Bufo woodhousii*	Peripheral or Naturally Rare
Reptiles:		
painted turtle	*Chrysemys picta*	Critical
sagebrush lizard	*Sceloporus graciosus*	Vulnerable
western rattlesnake	*Crotalus viridis*	Vulnerable
long-nosed leopard lizard	*Gambelia wislizenii*	Undetermined Status

Plants. Table 12 displays threatened, endangered and sensitive plant species with documented or suspected occurrence in the John Day Subbasin as of April 12, 2004. All species on this list are also on the USFS Regional Forester's Sensitive Species list. Any species without a status listing in the status fields (last three columns of table) is on only the USFS Regional Forester's Sensitive Species list.

Table 12. Threatened, endangered and sensitive plant species documented or suspected to occur in the John Day Subbasin (Source: USFS 1999).

Species Name	Common Name	U.S.F.W.S. Status	Oregon Status	BLM Special Status List
Achnatherum hendersonii	Henderson's ricegrass		C	Sens
Achnatherum wallowaensis	Wallowa Ricegrass			Sens
Artemisia ludoviciana ssp. estesii	Este's artemisia	SoC		Sens
Astragalus diaphanus var. diurnus	South Fork John Day (Wats.) Barn milk-vetch	SoC	LT	
Astragalus peckii	Peck's milk-vetch	SoC	LT	
Astragalus tegetarioides	Bastard milk-vetch	SoC	C	Sens
Botrychium ascendens	Upward-lobed moonwort	SoC	C	Sens
Botrychium campestre	Prairie moonwort			
Botrychium crenulatum	Crenulate moonwort	SoC	C	Sens
Botrychium fenestratum	Windowleaf moonwort			
Botrychium lanceolatum	Lance-leaf grapefern			
Botrychium lineare	Skinny moonwort			
Botrychium lunaria	Moonwort grapefern			
Botrychium minganense	Mingan grapefern			
Botrychium montanum	Mountain grapefern			
Botrychium paradoxum	Two-spiked moonwort	SoC	C	
Botrychium pedunculosum	Stalked moonwort	SoC	C	
Botrychium pinnatum	Pinnate grapefern			
Calochortus longebarbatus var. longebarbatus	Longbearded Mariposa lily	SoC		
Calochortus longebarbatus var. peckii	Peck's lily	SoC	C	Sens
Calochortus macrocarpus var. maculosus	Nez Perce Mariposa lily			
Calochortus nitidus	Broad-fruit Mariposa lily	SoC		
Camissonia pygmaea	Dwarf evening primrose		C	Sens
Carex backii	Back's sedge			
Carex crawfordii	Crawford's sedge			
Carex hystericina	Porcupine sedge			
Carex interior	Inland sedge			
Carex nardina	Spikenard sedge			
Carex parryana ssp. idahoa	Idaho sedge			
Carex stenophylla (C. eleocharis)	Narrowleaf/needleleaf sedge			
Cypripedium fasciculatum	Clustered lady slipper	SoC	C	
Cypripedium parviflorum	Yellow lady's slipper			
Erigeron disparipilus	Snake River daisy			

Kobresia bellardii (K. myosuroides)	Bellard's kobresia			
Kobresia simpliciuscula	Simple kobresia			
Leptodactylon pungens ssp. hazeliae	Granite phlox/Prickly phlox	SoC	C	
Listera borealis	Northern twayblade			
Lomatium erythrocarpum	Red-fruit lomatium	SoC	LE	
Lomatium ochocense	Ochoco lomatium			Sens
Lomatium ravenii	Raven's lomatium			
Lomatium salmoniflorum	Salmon River lomatium			
Luina serpentina	Colonial luina	SoC		Sens
Lycopodium complanatum	Ground cedar			
Mimulus clivicola	Bank monkeyflower			
Mimulus evanescens	Dissppearing monkeyflower		C	Sens
Mimulus jungermannioides	Heptic monkeyflower			Sens
Myosurus sessilis	Sessile mousetail			Sens
Pellaea bridgesii	Bridge's cliffbrake			
Penstemon peckii	Peck's penstemon	SoC		Sens
Phacelia minutissima	Dwarf phacelia	SoC	C	Sens
Phlox multiflora	Many flowered phlox			
Pleuropogon oregonus	Oregon Semaphore grass	SoC	LT	
Rorippa columbiae	Columbia cress	SoC	C	Sens
Salix farriae	Farr willow			
Silene spaldingii	Spalding's campion	SoC	LE	
Suksdorfia violacea	Violet suksdorfia			
Thelypodium eucosmum	Arrow-leaf thelypody	SoC	LT	
Thelypodium howellii ssp. howellii	Howell's thelypody			
Trifolium douglasii	Douglas cloves			

Key:
SoC = species of concern, LT = listed as threatened, LE = listed as endangered, C = concern, Sens = BLM sensitive.

Fish. Bull trout were listed as threatened by the U.S. Fish and Wildlife Service (USFWS) in 1998; Mid-Columbia River steelhead were listed as threatened in 1999 by the National Marine Fisheries Service (both listings under the federal Endangered Species Act).

The status of westslope cutthroat trout, interior redband trout, and chinook salmon have all been reviewed by the appropriate regulatory agencies (USFWS for both trout species and NOAA Fisheries for chinook). The agencies have determined none of these species are warranted for listing under the ESA.

Westslope cutthroat and inland redband trout are listed as a sensitive species by the State of Oregon. Designation as sensitive indicates that the species is vulnerable, peripheral or naturally rare, or have undetermined status.

Species Recognized as Rare or Significant to the Local Area

Terrestrial Wildlife. In addition to the above threatened, endangered and sensitive species, there are several other species that are locally significant as components of terrestrial wildlife diversity in the John Day Subbasin. These species include re-established populations of California bighorn sheep from extirpated status, significant strongholds of shrub-steppe obligates and a relatively large representation of landbirds.

Along with the Umatilla/Willow Subbasin, the John Day Subbasin has a high proportion of shrub-steppe habitat, and therefore serves as a stronghold for many species dependent on this high quality shrub-steppe habitat. These shrub-steppe obligates include the long-billed curlew, loggerhead shrike, sage sparrow, grasshopper sparrow, burrowing owl, ferruginous hawk, Swainson's hawk, black-throated sparrow, sagebrush lizard and Washington ground squirrel.

Landbirds are also significant in the local area because they account for a significant portion of the vertebrate biological diversity in the John Day Subbasin. Approximately 207 species of landbirds occur in the subbasin, making up about 69% of the terrestrial vertebrate species in the subbasin. The distribution and abundance of many of these birds have been affected by fire suppression, timber management and resulting changes in the structure and distribution of plant communities (Marcot *et al*. 1997). Landbirds found in the John Day Subbasin that have declined in abundance regionally are shown in Table 13.

Table 13. Landbird species with declining population trends inhabiting the John Day Subbasin.

Species	**Primary Habitat for Breeding**
American kestrel[1]	coniferous forest, grassland
mourning dove[1]	coniferous forest, riparian
Vaux's swift[1]	coniferous forest, riparian
rufous hummingbird[1]	coniferous forest, riparian
belted kingfisher[1]	riparian
Lewis's woodpecker[2]	coniferous forest, riparian
Williamson's sapsucker[1]	coniferous forest, riparian
olive-sided flycatcher[1,2]	coniferous forest
western wood-pewee[1]	coniferous forest, riparian
violet-green swallow[1]	coniferous forest, riparian
barn swallow[1]	riparian
rock wren[1]	grassland, cliff, rock, talus
Swainson's thrush[1]	coniferous forest, riparian
varied thrush[1]	coniferous forest
orange-crowned warbler[1]	riparian
Wilson's warbler[1]	riparian
western tanager[1]	coniferous forest, riparian
chipping sparrow[1]	coniferous forest
white-crowned sparrow[1]	riparian
dark-eyed junco[1]	coniferous forest, riparian
western meadow lark[1,2]	grassland

pine siskin[2]	coniferous forest
American goldfinch[1]	riparian

[1]Species identified as having a significant declining population trend by Andleman and Stock 1994
[2]Species identified as a high concern to management by Saab and Rich 1997

Plants. Sensitive plant species are shown in Table 12 above.

Fish. Westlope cutthroat trout in Oregon are found only in the John Day River Subbasin (Shepard 2002). Historically, westslope cutthroat trout were limited to the Upper John Day River and select tributaries. Today, however, they are found in the North Fork John Day River watershed as well (See Figure 32 for current distribution.). Westslope cutthroat were introduced into Clear and Desolation creeks (North Fork John Day River tributaries) from Deardorff Creek (Upper Mainstem John Day River tributary) in the early 1960s in an effort to re-establish a fishery after extensive spruce budworm spraying eliminated aquatic life in portions of those streams.

Interior redband trout were petitioned for listing by a consortium of several environmental groups in 1995. USFWS determined they were not warranted for listing because they could not demonstrate the petitioned population was distinct from other redband populations, including those in the John Day River Subbasin. Where redband trout and steelhead distributions overlap, they are externally indistinguishable from each other until steelhead undergo smoltification at approximately six inches. Recent studies (Kostow 2003) indicate the different life history patterns of steelhead and redband are not reproductively isolated. Therefore, there is probably no justification for treating them as separate Evolutionarily Significant Units (ESUs). In this subbasin plan, it is assumed that measures for protecting and enhancing steelhead will also benefit redband trout.

The predominant life history strategy for bull trout within the subbasin is currently the resident form, particularly in the Middle Fork. Historically, bull trout exhibited more diverse life history patterns than at present. Larger historic populations of chinook salmon, steelhead, cutthroat and redband would have provided a large forage base for bull trout. A larger forage base would have favored the highly predatory, migratory (fluvial) form, which can grow as large as 20 to 25 inches in length. These larger, fluvial fish were highly regarded as a food source by Native Americans (Buchanan, 1997). Another unique feature of bull trout is their tolerance for and growth rates in cold water. Optimum growth of bull trout fry occurs at 39 to 40° F.

The spring chinook and summer steelhead populations in the John Day River have local as well as regional significance because they are not supplemented with hatchery fish. The John Day River is managed exclusively for wild fish production and may be the only large Columbia River tributary that has no hatchery stocking program for anadromous fish.

Species with Special Ecological Importance to the Subbasin

Terrestrial Wildlife. Several groups of wildlife species have special ecological importance to the John Day Subbasin, including: 1) functional specialists, 2) critical functional link species, 3) species with an association with salmonids, 4) Partners in Flight (PIF) species, 5) managed game species, and 6) species identified in the Habitat Evaluation Procedure (HEP) loss assessment. Each group is discussed briefly below.

Functional Specialists. Functional specialists are those wildlife species that perform very few and very specific ecological roles (IBIS 2003). As such, the persistence of these species depends on the continued existence of the required habitat or resource. One example of a functional specialist in the John Day Subbasin is the turkey vulture, which has the functional role of carrion feeding and little else. Accordingly, a decrease in the availability of carrion will negatively impact this species. Vertebrate species occurring in the John Day Subbasin that have been identified as functional specialists by IBIS are listed in Table 14.

Table 14. Functional specialists occurring in the John Day Subbasin (IBIS 2003).

Common Name	Scientific Name
Birds:	
black swift	*Cypseloides niger*
boreal owl	*Aegolius funereus*
common nighthawk	*Chordeiles minor*
gyrfalcon	*Falco rusticolus*
harlequin duck	*Histrionicus histrionicus*
merlin	*Falco columbarius*
northern pygmy-owl	*Glaucidium gnoma*
peregrine falcon	*Falco peregrinus*
snowy owl	*Nyctea scandiaca*
turkey vulture	*Cathartes aura*
Mammals:	
Canadian lynx	*Lynx canadensis*
wolverine	*Gulo gulo*
Reptiles:	
common kingsnake	*Lampropeltis getula*
ringneck snake	*Diadophis punctatus*

Critical Functional Link Species. A terrestrial species is characterized as a critical functional link species if it is the only species, or one of just a few species, in a particular wildlife habitat type that performs a particular key ecological function (IBIS 2003). The loss of these species may mean the loss of this function in the wildlife habitat type.

Critical functional link species identified by IBIS that occur in the John Day Subbasin are listed in Table 15. One example of a critical functional link species in the John Day Subbasin is the American beaver, which plays a unique role in every habitat in which it occurs by impounding water to create diversions or dams. Several species play multiple unique roles. For example, the black bear eats the bark, cambium, and bole of trees, excavates cavities in snags or live trees, and physically fragments standing wood (IBIS 2003).

Table 15. List of critical functional link terrestrial wildlife species in the John Day Subbasin (IBIS 2003).

Common Name	Scientific Name
Birds:	
black-chinned hummingbird	*Archilochus alexandri*
brown-headed cowbird	*Molothrus ater*
Canada goose	*Branta canadensis*
double-crested cormorant	*Phalacrocorax auritus*
great blue heron	*Ardea herodias*
great horned owl	*Bubo virginianus*
greater scaup	*Aythya marila*
red-breasted sapsucker	*Sphyrapicus ruber*
redhead	*Aythya americana*
rufous hummingbird	*Selasphorus rufus*
Williamson's sapsucker	*Sphyrapicus thyroideus*
Mammals:	
American beaver	*Castor canadensis*
black bear	*Ursus americanus*
bushy-tailed woodrat	*Neotoma cinerea*
common porcupine	*Erethizon dorsatum*
deer mouse	*Peromyscus maniculatus*
dusky-footed woodrat	*Neotoma fuscipes*
fisher	*Martes pennanti*
golden-mantled ground squirrel	*Spermophilus lateralis*
mink	*Mustela vison*
mountain lion	*Puma concolor*
northern pocket gopher	*Thomomys talpoides*
Nuttall's (mountain) cottontail	*Sylvilagus nuttallii*
red squirrel	*Tamiasciurus hudsonicus*
Rocky Mountain elk	*Cervus elaphus nelsoni*
snowshoe hare	*Lepus americanus*
Amphibians:	
Great Basin spadefoot	*Scaphiopus intermontanus*
long-toed salamander	*Ambystoma macrodactylum*

Species Associated with Salmonids. The John Day Subbasin also has numerous species which are linked, in some manner, to salmonids. The wildlife species of the subbasin that have been identified by IBIS as species that eat salmonid eggs, fry, fingerlings, parr, smolts, adults, or carcasses are listed in Table 16.

Table 16. List of wildlife species in the John Day Subbasin that eat different stages of salmonids (IBIS 2003).

Common Name		
Birds:	**Birds:**	**Birds:**
American crow	great egret	varied thrush
American dipper	greater scaup	violet-green swallow
American robin	greater yellowlegs	western grebe
American white pelican	green heron	willow flycatcher
bald eagle	green-winged teal	winter wren
bank swallow	harlequin duck	**Mammals:**
barn swallow	herring gull	American marten
Barrow's goldeneye	hooded merganser	black bear

belted kingfisher	horned grebe	bobcat
black-billed magpie	killdeer	coyote
black-crowned night-heron	mallard	deer mouse
California gull	northern rough-winged swallow	long-tailed weasel
canvasback	osprey	mink
Caspian tern	peregrine falcon	mountain lion
Clark's grebe	pied-billed grebe	northern flying squirrel
cliff swallow	red-breasted merganser	northern river otter
common goldeneye	red-necked grebe	raccoon
common loon	red-tailed hawk	red fox
common merganser	ring-billed gull	striped skunk
common raven	snowy owl	vagrant shrew
common tern	song sparrow	Virginia opossum
double-crested cormorant	spotted sandpiper	water shrew
Forster's tern	spotted towhee	western spotted skunk
golden eagle	tree swallow	white-tailed deer
gray jay	trumpeter swan	**Reptiles:**
great blue heron	turkey vulture	common garter snake

PIF Species. Other species with special ecological importance to the subbasin are Partners in Flight species. Partners in Flight (PIF) is "a cooperative effort involving partnerships among federal, state and local government agencies, philanthropic foundations, professional organizations, conservation groups, industry, the academic community, and private individuals" (PIF 2002). Founded in 1990, the original purpose of PIF was to aid neotropical migratory birds that breed in the Nearctic and winter in the Neotropics. However, the organization now works to conserve most landbirds. PIF produces both national and state lists of species they believe should be considered in land use plans, project planning, impact assessments, research, monitoring, outreach and other activities. A total of 78 species found in the John Day Subbasin are on the Oregon PIF list (Table 17).

Table 17. Common names of the 78 John Day Subbasin bird species on the Oregon PIF list (IBIS 2003).

Common Name		
American dipper	gray flycatcher	sharp-tailed grouse
American kestrel	great gray owl	short-eared owl
American pipit	green-tailed towhee	Swainson's hawk
ash-throated flycatcher	Hammond's flycatcher	Swainson's thrush
band-tailed pigeon	hermit thrush	Townsend's solitaire
bank swallow	horned lark	Townsend's warbler
black swift	house wren	varied thrush
black-backed woodpecker	Hutton's vireo	Vaux's swift
black-headed grosbeak	lark sparrow	veery
black-throated gray warbler	Lewis's woodpecker	vesper sparrow
black-throated sparrow	Lincoln's sparrow	warbling vireo
Brewer's sparrow	loggerhead shrike	western bluebird
brown creeper	Macgillivray's warbler	western meadowlark
Bullock's oriole	Nashville warbler	western tanager
burrowing owl	northern harrier	western wood-pewee
bushtit	olive-sided flycatcher	white-breasted nuthatch
Calliope hummingbird	orange-crowned warbler	white-headed woodpecker
chipping sparrow	pileated woodpecker	white-throated swift

Clark's nutcracker	purple finch	Williamson's sapsucker
common poorwill	red crossbill	willow flycatcher
downy woodpecker	red-breasted sapsucker	Wilson's warbler
dusky flycatcher	red-eyed vireo	winter wren
ferruginous hawk	red-naped sapsucker	yellow warbler
flammulated owl	rufous hummingbird	yellow-billed cuckoo
fox sparrow	sage sparrow	yellow-breasted chat
grasshopper sparrow	sage thrasher	yellow-rumped warbler

Managed Game Species. The John Day Subbasin is also home to many game species. A total of 58 species in the subbasin are classified as managed game species or fur-bearing mammals in Oregon (Table 18). In addition to the species listed in Table 18, other hunted or trapped species in the subbasin include badger, coyote, striped and spotted skunk, long-tailed weasel and ermine. Several ODFW management plans provide guidance for managing game species in the subbasin, including *Oregon's Elk Management Plan, February 2003; Oregon's Bighorn Sheep and Rocky Mountain Goat Management Plan, December 2003; Oregon's Mule Deer Management Plan, February 2003; Oregon's Black Bear Management Plan, 1993 to 1998;* and *Oregon's Cougar Management Plan, 1993 to 1998.*

Table 18. Managed game species and fur-bearing mammals in the John Day Subbasin.

Common Name	Scientific Name
Birds:	
American coot	*Fulica americana*
American crow	*Corvus brachyrhynchos*
American wigeon	*Anas americana*
Barrow's goldeneye	*Bucephala islandica*
blue grouse	*Dendragapus obscurus*
blue-winged teal	*Anas discors*
bufflehead	*Bucephala albeola*
California quail	*Callipepla californica*
Canada goose	*Branta canadensis*
canvasback	*Aythya valisineria*
chukar partridge	*Alectoris chukar*
cinnamon teal	*Anas cyanoptera*
common goldeneye	*Bucephala clangula*
common merganser	*Mergus merganser*
common snipe	*Gallinago gallinago*
Eurasian wigeon	*Anas penelope*
gadwall	*Anas strepera*
gray partridge	*Perdix perdix*
greater scaup	*Aythya marila*
greater white-fronted goose	*Anser albifrons*
green-winged teal	*Anas crecca*
harlequin duck	*Histrionicus histrionicus*
hooded merganser	*Lophodytes cucullatus*
lesser scaup	*Aythya affinis*
mallard	*Anas platyrhynchos*
mountain quail	*Oreortyx pictus*
mourning dove	*Zenaida macroura*
northern pintail	*Anas acuta*

northern shoveler	*Anas clypeata*
redhead	*Aythya americana*
ring-necked duck	*Aythya collaris*
ring-necked pheasant	*Phasianus colchicus*
Ross's goose	*Chen rossii*
ruddy duck	*Oxyura jamaicensis*
ruffed grouse	*Bonasa umbellus*
sage grouse	*Centrocercus urophasianus*
snow goose	*Chen caerulescens*
white-winged scoter	*Melanitta fusca*
wild turkey	*Meleagris gallopavo*
wood duck	*Aix sponsa*
Mammals:	
American beaver	*Castor canadensis*
American marten	*Martes americana*
American mink	*Mustela vison*
black bear	*Ursus americanus*
bobcat	*Lynx rufus*
California bighorn sheep	*Ovis canadensis californiana*
fisher	*Martes pennanti*
mountain lion	*Puma concolor*
mule deer	*Odocoileus hemionus hemionus*
muskrat	*Ondatra zibethicus*
northern raccoon	*Procyon lotor*
northern river otter	*Lontra canadensis*
pronghorn	*Antilocapra americana*
red fox	*Vulpes vulpes*
Rocky Mountain elk	*Cervus elaphus nelsoni*
mountain goat	*Oreamnos americanus*
white-tailed deer	*Odocoileus virginianus ochrourus*
Amphibians:	
bullfrog	*Rana catesbeiana*

HEP Species: Certain species in the Columbia River Basin were selected during the USFWS Habitat Evaluation Procedure (HEP) loss assessment process. These species were used to model impacts from adjacent hydro-electric development. HEP species relevant to the John Day Subbasin are those selected for the John Day and McNary dams. These species are listed in Table 19.

Table 19. HEP species selected for the John Day and McNary dams (IBIS 2003).

Common Name	Scientific Name
Birds:	
spotted sandpiper	*Actitis macularia*
mallard	*Anas platyrhynchgos*
great blue heron	*Ardea herodia*
lesser scaup	*Aytha affinis*
Canada goose	*Branta canadensis*
blue grouse	*Dendragapus obscurus*
yellow warbler	*Dendraica petechia*
California quail	*Callipepla californica*
black-capped chickadee	*Parus atricopillus*
downy woodpecker	*Picoides pubescens*
western meadowlark	*Sturnella neglecta*
Mammals:	
mink	*Mustela vison*
mule deer	*Odocoileus hemionus*

Plants. Noxious plants known to occur in the John Day Subbasin are listed in Table 20. This list of weeds is a subset of those on the Oregon Department of Agriculture's noxious weed list (ODA 2004) made specific to the John Day Subbasin by several local botanists and county weed agents.

Table 20. Noxious weeds found in the John Day Subbasin.

Common Name	Scientific Name
Russian knapweed	*Acroptilon repens*
jointed goatgrass	*Aegilops cylindrica*
quackgrass	*Agropyron repens*
camelthorn	*Alhagi pseudalhagi*
ragweed	*Ambrosia artemisiifolia*
whitetop (hoary cress)	*Cardaria draba*
plumeless thistle	*Carduus alanthoides*
musk thistle	*Carduus nutans*
diffuse knapweed	*Centaurea diffusa*
spotted knapweed	*Centaurea maculosa*
yellow starthistle	*Centaurea solstitialis*
squarrose knapweed	*Centaurea virgata*
rush skeltonweed	*Chondrilla juncea*
Canada thistle	*Cirsium arvense*
bull thistle	*Cirsium vulgare*
poison hemlock	*Conium maculatum*
field bindweed	*Convolvulus arvensis*
common crupina	*Crupina vulgaris*
houndstongue	*Cynoglossum officinale*
leafy spurge	*Euphorbia esula*
St. Johnswort (Klamath weed)	*Hypericum perforatum*
perennial pepperweed	*Lepidium latifolium*
dalmation toadflax	*Linaria dalmatica*

Common Name	Scientific Name
yellow toadflax	*Linaria vulgaris*
purple loosestrife	*Lythrum salicaria*
Scotch thistle	*Onopordum acanthium*
Mediterranean sage	*Salvia aethiopis*
tansy ragwort	*Senecio jacobaea*
milkthistle	*Silybum marianum*
Johnsongrass	*Sorghum halepense*
Austrian peaweed	*Sphaerophysa salsula*
medusahead rye	*Taeniatherum caput-medusae*
saltcedar	*Tamarix ramosissima*
puncturevine	*Tribulus terrestris*

Species Recognized by Native Americans as Culturally or Spiritually Significant

Confederated Tribes of the Umatilla Indian Reservation. All species of fish, wildlife, and plants are significant to the culture and tradition of the CTUIR because of their belief that the Creator designed and brought each species into being. As such, each species is believed to fulfill important roles in the ecosystem. Some examples of these roles in Native American tradition and culture are shown in Table 21.

Table 21. Some examples of the importance of animals and plants in the cultural and spiritual lives of CTUIR Native Americans.

Traditional or Cultural Role	Examples of Animals Involved
regalia	eagle feathers and otter, deer, and elk pelts
instruments/music	eagle whistle, deer hide drum, dew claw rattles
subsistence	salmon, whitefish, mule deer, elk, grouse
medicinal	lamprey
spirit/vision quests	bear, cougar, raven
stories/oral histories	coyote, owl
naming	wolf, eagle
tools	elk/deer antler tools, fish bones

Confederated Tribes of the Warm Springs Reservation of Oregon. The John Day Subbasin lies within the ceded territory of the CTWSRO (see Section 4.1.2 for more information on the CTWSRO treaty with the U.S. government). All of the subbasin's natural resources are important to the CTWSRO, including water, native fish, cultural plants and wildlife. Indigenous species are of tremendous cultural significance. The tribes depend on natural resources for subsistence, medicinal remedies, religious ceremonies and for practical uses such as tool making. Cultural resources are coveted by the CTWSRO and they are considered sacred. Due to the sensitive nature of cultural resources, knowledge of their distribution and utilization is not shared with the general public.

Freshwater mussels and Pacific lamprey have special significance to the Confederated Tribes of Warm Springs Reservation of Oregon and the Confederated Tribes of the Umatilla Indian Reservation. Further details of these two species can be found in Appendix C.

3.2.2 Focal Species Selection

<u>List of Species Selected/Methodology for Selection</u>

Terrestrial Wildlife. The John Day Subbasin wildlife focal species and their associated habitats are listed in Table 22.

Large portions of the text in this terrestrial wildlife section originate from a 2004 draft of the *Southeast Washington Subbasin Planning Ecoregion Wildlife Assessment*, and are used with permission to Carl Scheeler from the authors, Paul Ashley and Stacy Stovall. The text has been slightly modified to fit into the context of the John Day Subbasin.

In contrast to the selection of aquatic focal species (discussed below), terrestrial focal species for the John Day Subbasin were selected using a more holistic approach that emphasizes ecosystem management through the use of focal habitat types while including components of single-species, guild, or indicator species assemblages. This approach is more appropriate for terrestrial than aquatic systems, and is based on the assumption that conservation strategies for terrestrial systems that emphasize critical components of the focal habitats are more desirable than those that emphasize individual species.

By combining the "coarse filter" (focal habitats) with the "fine filter" (focal wildlife species assemblage) approach, subbasin planners believe there is a much greater likelihood of maintaining, protecting and/or enhancing key focal habitat attributes and providing functioning ecosystems for terrestrial wildlife. This approach not only identifies priority focal habitats, but also describes the most important habitat conditions and attributes needed to sustain obligate wildlife populations within these focal habitats. Although conservation and management is directed towards focal species, establishment of conditions favorable to focal species will also benefit other species with similar habitat requirements.

The rationale for using focal species is to draw immediate attention to habitat features and conditions most in need of conservation or most important in a properly functioning ecosystem. These focal species can serve as "representative" species for a given habitat type, helping stakeholders and the public to better relate to the somewhat abstract notion that habitats, not species, are often the primary target of management actions.

John Day Subbasin planners selected 11 focal species (Table 22) from a list of focal candidates that met one or more of the categories indicating ecological importance, as presented in Section 3.2.1. Species accounts for these 11 terrestrial focal species are included in Appendix D. Planners selected species that have life requirements representative of habitat conditions or features that are important within the properly functioning focal habitat types identified in the IBIS database. These habitat types and their relationship to the terrestrial focal species are described in Appendix E. Planners also looked for species to provide a focus for describing desired habitat conditions, attributes and needed management strategies and/or actions. While consideration was given to the value of using focal species for monitoring and evaluation of management strategies, this was not an obligatory consideration, as monitoring and evaluation is likely to be tiered to a more regionally consistent strategy.

Aquatic. The John Day Subbasin aquatic focal species include: summer steelhead, chinook salmon, bull trout, westslope cutthroat trout and redband trout.

Aquatic focal species were selected based upon their importance economically, ecologically and culturally. Another determining factor is that there is more information available regarding population status, life history and habitat requirements for these five species relative to non-focal species.

Prior to steelhead being listed as threatened under the ESA, the John Day River supported a robust sport fishery, with up to 4700 wild fish caught by anglers (ODFW 2001) and harvest rates averaging about 12% of escapement. Since 1996, consumptive catch has been limited to marked, hatchery fish straying into the John Day River from other Columbia River tributaries. However, a catch-and-release fishery for wild fish has been permitted since 1996.

There has been no sport harvest of spring chinook allowed in the John Day River Subbasin since 1976. However, there is a limited tribal subsistence harvest authorized by the Confederated Tribes of the Umatilla Indian Reservation. The tribal harvest is limited to no more than 5% of the estimated number of spring chinook returning to the subbasin. In recent years, that harvest has been restricted to the North Fork John Day River and one of its tributaries, Granite Creek. Prior to authorizing a sport fishery or additional tribal fisheries, an escapement goal of 7000 spring chinook returning to the mouth of the John Day River, as agreed to in U.S. vs. Oregon, must be reached (ODFW 1998).

Redband and westslope cutthroat trout are the two resident salmonid fishes of interest to sport anglers. The three areas with the highest angling effort for resident trout species are the Middle and South forks and the upper portions of the mainstem John Day. The upper mainstem reaches are also occupied by bull trout. However, harvest of bull trout is prohibited because of their listing as "threatened" under the ESA. Very little information regarding harvest rates of resident trout species is available. Catch of westslope cutthroat and redband is limited by Oregon Department of Fish and Wildlife angling regulations.

Similar to terrestrial species, the aquatic focal species can be used as indicators of aquatic ecosystem health. Oregon Department of Environmental Quality uses water temperatures as an indicator of water quality. The water temperature standards used to determine water quality impairment were developed based on needs of native salmonid species. Each species has slightly different habitat needs. For instance, bull trout thrive with cold water temperatures and have optimum fry growth at 39 to 40° Fahrenheit (Buchanan 1997). In contrast, redband trout have adapted to relatively warmer water temperatures, with optimum growth at 55 to 64° Fahrenheit. Different life stages of each species also require different habitat types.

Table 22. Terrestrial focal species selected for the John Day Subbasin.

Common Name	Focal Habitat	Status[1]		Critically Linked	Functional Specialist	Salmon Associated	HEP	PIF	Managed Game Species
		Federal	OR						
pileated woodpecker	montane & eastside mixed conifer forest	n/a	SS-V	No	No	No	No	Yes	No
white-headed woodpecker	ponderosa pine	n/a	SS-C	No	No	No	No	Yes	No
red-naped sapsucker	aspen forest component of eastside interior riparian forest	n/a	n/a	No	No	No	No	Yes	No
ferruginous hawk	western juniper & mountain mahogany woodlands	n/a	SS-C	No	No	No	No	Yes	No
grasshopper sparrow	eastside interior grasslands	n/a	SS-V/PNR	No	No	No	No	Yes	No
California bighorn sheep	interior canyon shrublands	n/a	n/a	No	No	No	No	No	Yes
sage sparrow	shrub-steppe	n/a	SS-C	No	No	No	No	Yes	No
Columbia spotted frog	herbaceous wetlands	C	SS-U	No	No	No	No	No	No
yellow warbler	eastside interior riparian-wetlands	n/a	n/a	No	No	No	Yes	Yes	No
American beaver	eastside interior riparian-wetlands	n/a	n/a	No	No	Yes	No	No	Yes
great blue heron	eastside interior riparian-wetlands	n/a	n/a	Yes	No	Yes	Yes	No	No

[1] Status: C=candidate species; SS-C=sensitive species-critical; SS-V=sensitive species-vulnerable; SS-V/PNR=sensitive species-vulnerable/peripheral or naturally rare; SS-U=sensitive species-undetermined

3.2.3 Model Methods – EDT and QHA

This section discusses the methods and models used to assess the impacts of the John Day Subbasin's aquatic habitat and other environmental factors on populations of the subbasin's fisheries. The Ecosystem Diagnosis and Treatment (EDT) model was used to assess the summer steelhead and spring chinook. The QHA modeling tool was used to assess bull trout habitat in the subbasin. Quantitative assessments were not conducted for the redband and westslope cutthroat trouts.

EDT Methods

The EDT model was used to produce quantitative measures of the potential impact of environmental factors on the abundance and productivity of the anadromous focal species in the John Day Subbasin. The EDT model uses reach-based ratings determined by subbasin planners to identify population limiting factors, restoration and preservation priority areas, and the potential impact of restoration scenarios on abundance and productivity for each focal species population. The EDT model requires that the stream network be parsed into "reaches," or physically similar sections of stream. Reaches can then be rated by subbasin planners for up to 46 different attributes to characterize each reach in both its current and template (historic/reference) status with respect to fish habitat quality and environmental condition. See Appendix F for a description of these 46 attributes. Real measurements and professional estimates/judgements are used to rate each attribute of each reach. Based on these environmental attributes, the EDT model compares estimates of historical abundance and productivity to current estimates and then defines which environmental factors are specifically limiting to current populations. The 46 environmental attributes are rolled up and presented to the EDT model user as 16 "survival" or "limiting" factors (listed below) and are ranked as having high (or large), medium, low, or no impact on focal species survival.

1. Flow
2. Channel stability
3. Habitat diversity
4. Key habitat quantity
5. Obstructions
6. Withdrawals
7. Sediment load
8. Oxygen
9. Chemical toxins
10. Temperature
11. Food
12. Competition (with hatchery fish)
13. Competition (with other species)
14. Predation
15. Pathogens
16. Harrassment/poaching

Additional information regarding the EDT model and its applications can be found at http://www.mobrand.com/MBI/edt.html.

The EDT model relies on a set of biological rules derived from the technical literature to establish the link between a species and its habitat. Each anadromous population within the John Day Subbasin was analyzed individually using the EDT model. Separate runs were completed for summer steelhead for the North Fork, Middle Fork, South Fork, Upper Mainstem, and Lower John Day populations. Delineation between the Upper and Lower population boundaries differ according to the agency defining the populations. NOAA Fisheries makes the break between the two populations at the confluence of the South Fork John Day River. ODFW marks the break for the two populations at the confluence of the North Fork John Day River, approximately 27 miles downriver from the NOAA boundary. The NOAA boundary was used for this analysis in order to maintain consistency with the ESA listing for summer steelhead in the John Day Subbasin. Four separate spring chinook salmon populations were analyzed using the EDT model: North Fork, Middle Fork, Granite Creek, and Upper Mainstem.

The EDT model produces several products for each population run through the model. A baseline report is produced that estimates the capacity, abundance, productivity, and life history diversity of both adults and juveniles in the population. Abundance is commonly measured over an entire generation and is expressed as a calculated effective population size. It is a measure of the number of individual organisms in a population. The productivity of a population is a measure of its ability to sustain itself or its ability to rebound from low numbers. The EDT productivity parameter is one of the parameters in the Beverton Holt production function. It represents a rate of increase at extremely small population levels. Diversity is important for the long-term persistence of salmonid populations, whether it be genetic or phenotypic. EDT outputs a diversity index rating for each population run through the model based on life history trajectories.

A second major product of EDT is the diagnostic report, which defines the habitat limitations that are producing the results in the baseline report on capacity, productivity, and diversity. The diagnostic reports also produce suggestions of which areas (reach or geographical) of the watershed should be considered for restoration and protection value.

The streams in the John Day Subbasin were broken into 1,264 individual reaches; 1,158 of which were used in the EDT model for spring chinook and summer steelhead analysis. See Appendix G for maps showing the stream reach delineations by population area for EDT modeling of summer steelhead. Also see Appendix H for a list of these reaches. The remaining 106 reaches delineate habitat currently available to only resident species, usually above natural and human-made passage barriers. To simplify reporting, the reaches were then rolled up into geographic areas (GA). For the John Day Subbasin, the GAs correspond to the 43 HUC5s currently recognized in the subbasin. EDT model results include priority listings for restoration potential and protection value for each GA for each population. GAs designated with a high restoration potential value may produce the greatest increase in productivity and abundance with restoration, as identified by the EDT model. GAs designated with a high protection value would produce the largest loss of current productivity should habitat conditions deteriorate. The model can also be used to examine the potential impact on focal species according to different restoration scenarios, which could be an important tool to estimate the benefits of specific restoration and protection strategies.

Additionally, the EDT model was used to examine a Properly Functioning Condition (PFC) scenario and its potential impact on populations. PFCs represent the “best” possible state of the environment with respect to the local economic, social, and political constraints on the environment at approximately 70% of the historic, undisturbed habitat conditions.

The large number of reaches delineated in the John Day Subbasin and the unique behavior of the spring chinook salmon in the subbasin proved a challenge to the EDT model. Following is a chronology of the problems and fixes employed to produce the results in this report.

Spring of 2004. Due to the tight timeframe for completing this plan by the May 2004 deadline, the technical team focused efforts on anadromous fish (summer steelhead and spring chinook). Accordingly, approximately 70% (889 reaches) of the 1264 total stream reaches in the John Day Subbasin were initially rated for habitat quality for use with the EDT model. Within this context, 24 of 46 environmental/ecological attributes were routinely rated (Appendix H), yielding a total of approximately 160,000 data entries.

The technical team made the decision to continue assigning reach attributes until February 20, 2004, before submitting the data for analysis. This timeline was set to allow the use of the EDT model to process various scenarios and develop a management plan. Results were expected in early March 2004, but acceptable EDT baseline information was not received until April 19, 2004, and final baseline results were not received until May 3, 2004. This left the team with less than one month to complete the assessment and management plan before the May 28, 2004, plan deadline set forth by the NWPCC.

Approximately 30% of the reaches originally delineated by the technical team were not initially rated due to time constraints and the large number of reaches. Several problems with steelhead and chinook salmon results and initial population numbers from the baseline reports (EDT model runs) were unrealistic. These problems were addressed with several corrections and adjustments to the EDT attribute ratings (for steelhead and chinook) and encoding for holding patterns of steelhead. Mobrand Biometrics Inc. found several data entry problems that were corrected and suggested a reduction of temperature ratings for some of the reaches. See Appendix I for a letter of explanation of the problems.

To reflect observed summer steelhead behavior, the model rules were adjusted to hold steelhead in the Columbia River until spawning, instead of placing them within the John Day Subbasin during prespawning. While this change produced some positive results, steelhead population numbers were still unsatisfactory and it was assumed that the un-rated reaches were a large influence (most of the un-rated reaches were steelhead habitat).

Initial EDT runs were reporting that the run sizes for spring chinook salmon were approximately 1,000 for North Fork, 20 for Granite Creek, and 0 for the other two populations. The adjustments to temperature increased the chinook numbers, but still did not reflect observed numbers; it was assumed that the problem lay in the model structure and how it modeled behavior of juvenile spring chinook rearing.

Most of the spring of 2004 was spent rating reaches and little time was left for checking and correcting model problems. The May 28th deadline did not allow the John Day Subbasin planners time to address the problems of the EDT runs, which were still producing unsatisfactory population results for both steelhead and spring chinook. The assumption by the planners that some of the fault was a result of the incomplete ratings of the 1264 reaches in the John Day (30% had not been rated at all) and that the EDT model was unable to adequately reflect spring chinook salmon use of tributary rearing habitat in the John Day system could not be tested at the time.

Summer of 2004. Several corrections in the EDT model for John Day Subbasin steelhead occurred during the summer of 2004. One of the largest problems discovered by Mobrand Biometrics, Inc. was that the EDT model was characterizing the John Day Subbasin with a historic (template) baseline condition for steelhead at restored levels in the Columbia River, i.e. the model was assuming that all downstream dams had been removed. The original intention of the model was to treat conditions outside of the subbasin as identical between template and current condition, with Columbia River mainstem dams in place. This allowed for a comparison of in-subbasin habitat effects only. Model runs with the error produced very large historical potential abundance in the John Day Subbasin. With the dams in place on the Columbia River, the incorrect historical numbers from EDT in the spring of 2004 dropped by 75% to 79% to more accurately describe recent populations within the subbasin.

Fall of 2004. To address the problems of the EDT model that were discovered and insufficiently answered in previous work, a second effort to properly assess the aquatic focal species with further adjustments and fine-tuning was completed during the response process in the fall and winter of 2004. To accomplish these adjustments, four major goals were assigned to the technical group. They included:

1. Examine the EDT data (889 reaches) for inconsistencies which, if changed, would more closely represent observed fish numbers currently seen in the John Day Subbasin.
2. Examine rule changes for spring chinook salmon that would allow the juveniles to use the cooler, non-natal tributaries for rearing instead of the warmer John Day mainstem.
3. Rate more of the reaches (~390) that were not rated in the spring of 2004.
4. Complete a QHA assessment for bull trout.

The first and second goals were assigned to Larry Lestelle of Mobrand Biometrics, Inc. Mr. Lestelle examined the John Day EDT model patterns and ratings for problems and to address the spring chinook life history patterns in the John Day Subbasin. He concluded that errors in some of the patterns of channel width and flow were causing an underestimation in quantity of habitat. Corrections to the patterns were completed. See Appendix J for an explanation of the corrections.

Concerns about the EDT model's treatment of the spring chinook salmon life history pattern were also examined. It was believed that the model was not capturing the observed movement of juveniles into cooler, non-natal tributaries for rearing. This is the dominant life history pattern for spring chinook in the John Day Subbasin. The approach taken to correct this problem was similar to the way in which the EDT model was designed to handle coho salmon: the existing off-channel attribute was used as a surrogate for non-natal tributary rearing. See Appendix K for a letter explaining the recommended correction.

An additional 280 reaches were rated to satisfy the third goal. This was accomplished by choosing representative reaches that had already been rated during the spring of 2004 and applying the same attribute ratings to associated sets of un-rated reaches. Essentially, unrated reaches with similar characteristics to already rated reaches were assigned similar ratings. The one-to-many application of ratings from a representative reach to a set of unrated reaches was primarily based on local knowledge of similar habitat and the direction of the north or south slope face of the stream. This method was chosen, again, due to time and budget constraints. Two weeks of work were required to assign the ratings and patterns to 280 reaches. The remaining 106 unrated reaches are unavailable to anadromous species due to natural or human-made passage barriers.

After several attempts to complete and refine EDT work in the John Day Subbasin, there are still several issues that will need to be addressed if this model is to continue as a tool for assessment in the John Day Subbasin. Those issues are:

1. Any future EDT analysis in the John Day Subbasin that would include barrier removal scenarios would require that the 106 obstruction and upstream reaches be rated.
2. The 280 reaches that were assigned surrogate ratings in the fall of 2004 should be re-rated with individual inspection of their actual habitat data.
3. Since several attempts to correct spring chinook numbers in the populations have failed to completely correct the problems, it is clear that the past solutions of adjusting the ratings of creating surrogate habitat are just patches and the real solution may lie in the creation of EDT model rules specific to the behavior of spring chinook in the John Day Subbasin, or replacement of EDT with a more appropriate model.
4. Currently the model has created an unrealistic pattern of pre-spawning mortality for spring chinook populations. This causes inaccurate patterns of distribution and low EDT abundance numbers. At this time it is unclear why the model has created this situation. It will require more time and analysis from Mobrand Biometrics to respond to this problem.
5. The large number of reaches delineated in the John Day Subbasin has proved to challenge the capability of the web-based EDT model interface (and possibly the software/hardware). Report requests continually returned errors and greatly slowed the model processing. Mobrand Biometrics, Inc. needed to provide direct assistance to the technical team to furnish John Day Subbasin EDT reports

At the time of this analysis, methodologies appropriate for the John Day Subbasin had not been developed for using the EDT model with non-anadromous species, such as bull trout. A simpler model, the Qualitative Habitat Assessment (QHA), was used instead of EDT to determine limiting factors and priority reaches for bull trout. The QHA assessment for bull trout was completed during the Fall of 2004, in response to the fourth goal outlined above.

QHA Methods

The QHA modeling tool was used to assess bull trout habitat in the John Day Subbasin. A detailed user's manual of QHA can be found at ftp://ftp.streamnet.org/toast/tools/QHA/. The QHA tool requires the user to rate 11 attributes (riparian condition, channel stability, habitat diversity, fine sediment, high and low flow, oxygen, high and low temperature, pollutants, and obstructions) in both the current and reference conditions in each stream reach designated as historic or current bull trout habitat. The user must then develop a hypothesis relating the importance of these attributes to a focal species on a reach-by-reach basis for each of four life stages (spawning/incubation, summer rearing, winter rearing, migration). QHA produces a series of tables that describe the physical habitat and identify where restoration and/or protection activities may be the most productive.

The QHA was designed to minimize the limitations associated with unstructured qualitative assessments. QHA is a "structured qualitative assessment." In other words, it is a systematic and objective assessment of species habitat relationships that relies principally on existing local professional knowledge and judgment. It "structures" the process by: (1) following a logical and replicable sequence, (2) using the best available quantitative data as the basis for decisions, (3) generating a product that is similar in form to products resulting from other more quantifiable approaches, and (4) documenting the decision process.

QHA relies on the same conceptual framework as the more technically sophisticated EDT technique. There are, however, several significant differences. While each of the habitat characteristics used in QHA is also used in EDT, EDT considers many more habitat factors and seeks to link these directly to measurable data. QHA, by contrast, relies on the judgment of knowledgeable professionals to draw this link. EDT uses a series of life history trajectories to model the movement of fish through its environment over several life stages. QHA collapses life history into fewer stages and treats each stream reach or small watershed as a static unit. Again, QHA relies on the knowledge of experts to assess these life history dynamics.

John Day QHA Model Development. For QHA modeling of bull trout habitat, a reach system consisting of 61 reaches (Appendices L and M) was developed by the John Day fisheries technical team and is structured differently from the reaches developed for the EDT model. This reach system encompasses all streams that bull trout presently inhabit, or are believed to formerly inhabit. Reach lengths ranged from 0.6 miles (Salmon Creek in the North Fork) to a 167.6 mile reach in the lower John Day River. The median reach length was 10.6 miles with 73% of the reaches less than 15 miles in length. GIS was used to map these reaches and assess land ownership patterns and how these patterns were related to bull trout habitat use.

The reaches were rated for each of the 11 environmental attributes (Appendix N) under current and reference conditions (Appendices O and P, respectively). These reaches were rated on a scale of 0 to 4 where 4 is "normative" and the other ratings are a percentage of normative (3=75%, 2=50%, 1=25%, 0=0%).

A QHA "species hypothesis" worksheet was filled out (Appendix Q). This worksheet provided the technical team with the opportunity to apply their understanding of biological systems to make decisions regarding the relative importance of each life stage to fish productivity and sustainability. Life stages were rated according to overall importance in the subbasin. QHA required users to rate four life stages: spawning, summer rearing, winter rearing, and migration.

The QHA model determines which attributes are most important in each geographic area in terms of limiting bull trout production. The QHA for bull trout provided a ranking of stream reaches for both habitat protection and habitat restoration. Stream reaches are ranked high for protection where significant loss of bull trout production could occur if the habitat were degraded. Stream reaches ranked high for restoration are reaches where significant gains in fish production could be achieved by restoring habitat to historic conditions. However, it is not assumed nor necessarily intended that habitats will be restored to historic conditions. The QHA methodology simply provides a tool for prioritizing future efforts geographically to restore and protect fish habitat.

To provide more consistency with EDT results for steelhead and chinook, priority reaches (those defined as being in the top quartile for restoration as determined by QHA) were pooled by geographic area (HUC5s).

3.2.4 Aquatic Focal Species Population Delineation and Characterization

Each fish species will be addressed separately in the following order: summer steelhead, spring chinook salmon, bull trout, redband trout and westslope cutthroat trout.

Summer Steelhead *(Oncorhynchus mykiss)*

Steelhead can be divided into two basic run types based on their level of sexual maturity at the time they enter fresh water and the duration of the spawning migration (Burgner et. al. 1992). The *stream-maturing* type, or summer steelhead, enters fresh water in a sexually immature condition and requires several months in fresh water to mature and spawn. The *ocean-maturing* type, or winter steelhead, enters fresh water with well-developed gonads and spawns shortly thereafter (Barnhart 1986). Only summer steelhead are present in the John Day Subbasin. In subbasins with both summer and winter steelhead runs, it appears that the summer run occurs where habitat is not fully utilized by the winter run or a seasonal hydrologic barrier, such as a waterfall, separates them. Summer steelhead usually spawn farther upstream than winter steelhead (Roelofs 1983, Behnke 1992). Coastal streams are dominated by winter steelhead, whereas inland steelhead of the Columbia River Basin are almost exclusively summer steelhead

In the Pacific Northwest, summer steelhead enter fresh water between May and October (Busby *et al.* 1996, Nickelson *et al.* 1992). During summer and fall, before spawning, they hold in cool, deep pools (Nickelson *et al*. 1992). They migrate inland toward spawning areas, overwinter in the larger rivers, resume migration to natal streams in early spring, and then spawn (Meehan and Bjornn 1991, Nickelson *et al*. 1992).

Unlike Pacific salmon, steelhead are capable of spawning more than once before death. However, it is rare for steelhead to spawn more than twice before dying, and most that do spawn more than once are females (Nickelson *et al.* 1992). Steelhead spawn in cool, clear streams with suitable gravel size, depth and current velocity. Intermittent streams may also be used for spawning (Barnhart 1986, Everest 1973). Steelhead enter streams and arrive at spawning grounds weeks or even months before they spawn and are vulnerable to disturbance and predation during that time.

Depending on water temperature, steelhead eggs may incubate for one and a half to four months before hatching. Juveniles rear in fresh water from one to four years, and then migrate to the ocean as smolts. Summer rearing takes place primarily in the faster parts of pools, although young-of-the-year are abundant in glides and riffles. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers (Nickelson *et al.* 1992). Productive steelhead habitat is characterized by complexity, primarily in the form of large and small wood.

Steelhead smolts migrate to the ocean in the spring and summer and typically reside in marine waters for one or two winters before returning to their natal stream to spawn at four or five years of age. Populations in Oregon and California have higher frequencies of age-1-ocean steelhead than populations to the north (Busby *et al.* 1996). For more information on steelhead life histories, see Busby *et al.* (1996).

The species *Oncorhynchus mykiss* in the John Day Subbasin is represented not only by steelhead, but also by redband trout. Redband trout are described in detail elsewhere in this assessment, but the principal difference between redband and steelhead is that redband do not migrate to the ocean. Recent studies (Kostow 2003) indicate the different life history patterns of steelhead and redband are not reproductively isolated. Therefore, there is probably no justification for treating them as separate ESUs. In this assessment, we did not do a separate assessment for redband and will assume that measures for protecting and enhancing steelhead will also benefit redband. Steelhead and redband trout are sympatric (occupying the same range without loss of identity from interbreeding) in all subbasins that contain steelhead. Sympatric populations with different life histories form different populations due to assortative mating, but are not reproductively isolated from each other (Currens 1987). Each morphology appears to be able to produce offspring of the other type. Redband males have been observed to pair with steelhead females, particularly when steelhead populations are small. Redband trout populations also occur above barriers to steelhead.

<u>Middle Columbia Steelhead ESU</u>

Steelhead in the Mid-Columbia River ESU were listed as a threatened species on March 25, 1999. The ESU includes all naturally spawned populations of steelhead in streams from above the Wind River in Washington, and above the Hood River in Oregon (exclusive), upstream to and including the Yakima River in Washington. Excluded are steelhead from the Snake River Subbasin.

A population with adequate spatial structure will include more than one spawning aggregate and will allow the expression of natural patterns of gene flow and life history characteristics.

Steelhead are widely distributed throughout most of the subbasin (Figure 9). The only exceptions are in the South Fork drainage above Izee Falls – an impassible barrier – and in the Lower John Day area where high temperatures and low flows are widespread, restricting the current distribution.

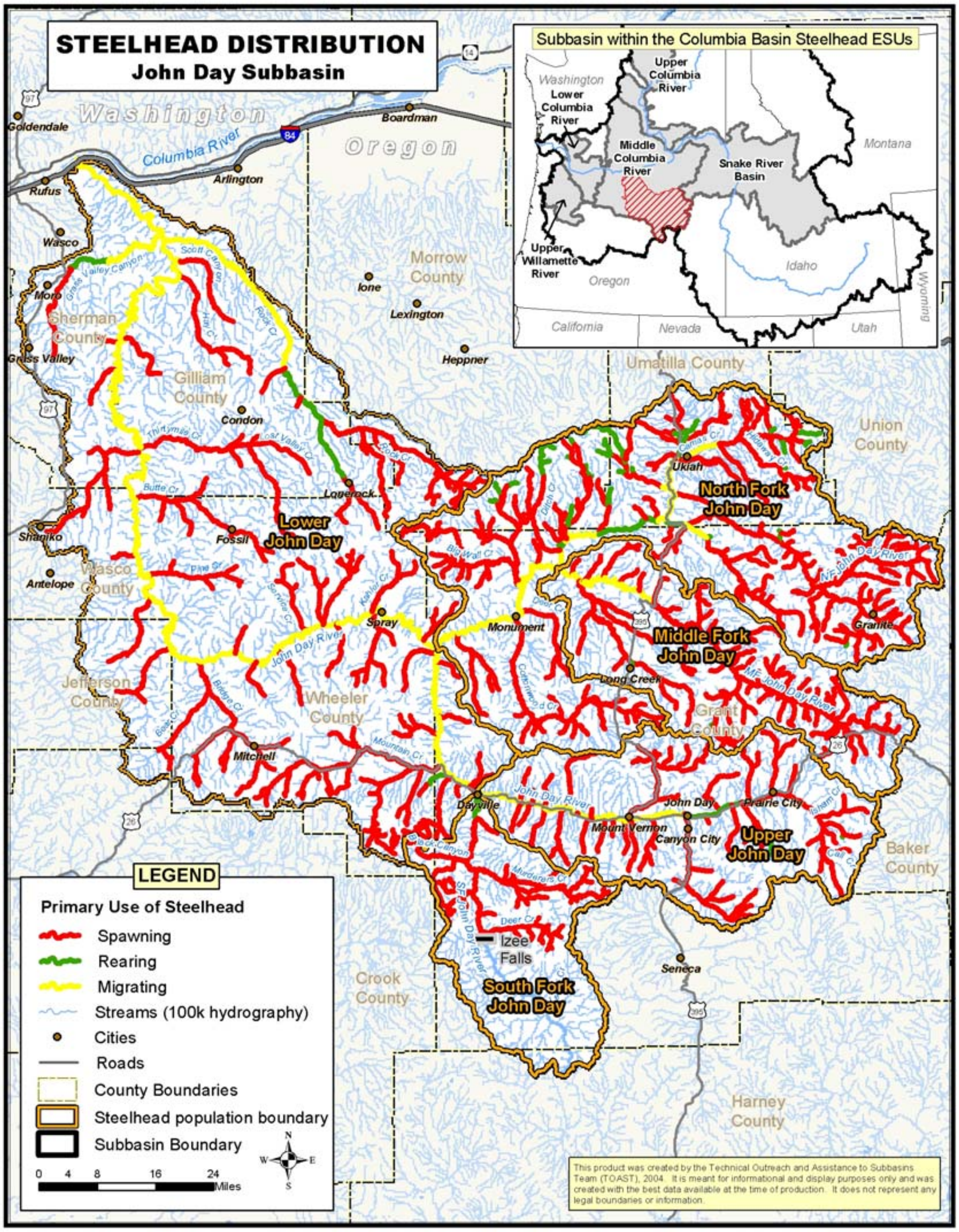

Figure 9. Distribution of summer steelhead in the John Day Subbasin.

Independent Populations of Mid-Columbia Steelhead within the John Day Subbasin

The Interior Columbia Basin Technical Recovery Team (TRT) defined the John Day River as a major grouping based primarily on subbasin topography and distance from other spawning aggregates (NOAA Fisheries 2003b). This subbasin is one of the few remaining summer steelhead streams in the interior Columbia Basin that have had little influence from introduced hatchery fish and that have more recently been classified as strong or healthy (Lee *et al.* 1997, Huntington *et al.* 1994). Within this major grouping the TRT defined five populations on the basis of genetic information, demographic correlations, and habitat/ecoregion data. Spawning areas are widely distributed across tributary and mainstem habitats but are not well-documented. The five major groupings are:

- **Lower John Day:** This population includes steelhead-supporting tributaries to the John Day downstream of the South Fork John Day River, including Pine Creek, Bologna Creek and Grass Valley Canyon. This widespread population is the most differentiated ecologically from other populations, occupying the lower, drier, Columbia Plateau ecoregion. This habitat divergence was the primary factor in delineating this population.

- **North Fork John Day:** The TRT defined this population on the basis of habitat characteristics, subbasin topography and demographic patterns. The North Fork occupies the highest elevation, wettest area in the John Day Subbasin. In addition, it encompasses sufficient habitat to support an independent population. Finally, Chilcote (2001) investigated population trajectories in the John Day (and other Oregon rivers). He found that the upper North Fork index count was the most divergent of the John Day stocks. This combination of factors supports this population delineation. It includes the mainstem North Fork John Day River and its tributaries.

- **Middle Fork John Day:** Spawning areas in the Middle Fork John Day River are well-separated from all other spawning areas with the exception of the North Fork John Day. This distance, coupled with habitat differences between this population and the North Fork population, and general subbasin topography led to independent population designation for this area. The population includes the Middle Fork John Day and all its tributaries.

- **South Fork John Day:** Genetic data indicate that *O. mykiss* samples from the South Fork John Day River that may include the anadromous form are differentiated from those in other parts of the John Day (Currens *et al.* 1985). The TRT delineated this as an independent population on the basis of this genetic information as well as subbasin topography. The species assemblage in the South Fork is also unique.

- **Upper John Day:** The Upper Mainstem John Day River population includes the mainstem John Day River and tributaries upstream from the South Fork. It is separated from the lower mainstem on the basis of habitat differences and from the South Fork on the basis of topography.

Although the lower reaches of spawning areas in these populations are in close proximity, the TRT generally felt that separate population status was warranted due to the distribution of fish within each branch of the John Day (with relatively small proportions of available spawning habitat present at the lower reaches), the size of each subbasin (large enough to support independent populations) and the river branching patterns. The extent to which these populations inter-breed is unknown.

ODFW empirical survey data in Table 23 confirm that there are significant populations of steelhead in all five of the steelhead population areas in the John Day Subbasin. Resource managers will manage for and maintain all five John Day steelhead populations.

Abundance

Abundance is a measure of the number of individual organisms in a population. Abundance is commonly measured over an entire generation and is expressed as a calculated effective population size.

With some exceptions, the recent five-year average (geometric mean) abundance for natural steelhead within this ESU was higher than levels reported in the 1999 status review. Returns to the Yakima River, Deschutes River, and sections of the John Day River system are up substantially in comparison to 1992 to 1997. Recent five-year geometric mean annual returns to the John Day Subbasin are generally below the corresponding mean returns reported in previous status reviews. Despite episodic increases in abundance, the total population has been trending downward since 1958 (Figure 10).

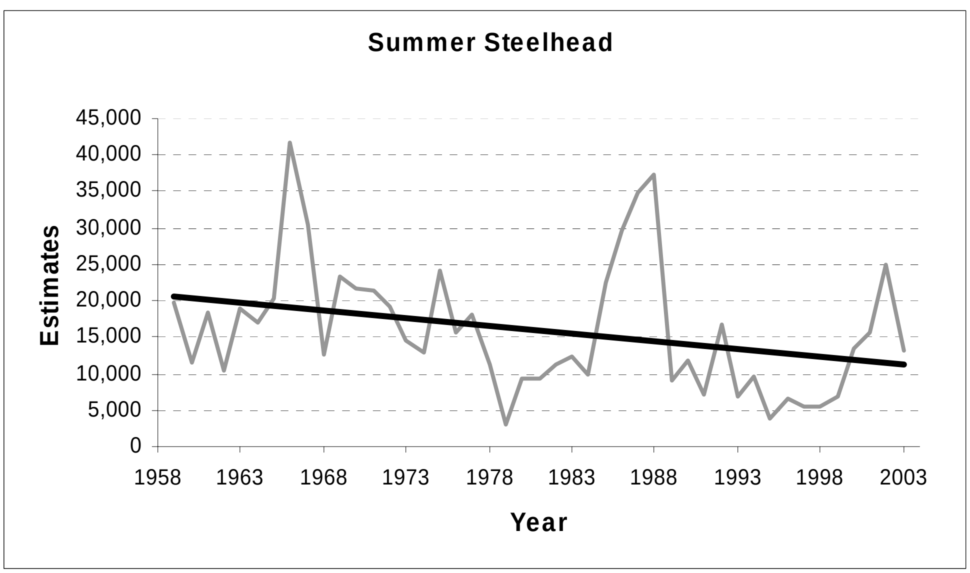

Figure 10. Estimates of total John Day adult summer steelhead numbers with trend line (ODFW estimates).

Table 23. Estimated catch of wild and hatchery steelhead in the John Day Subbasin as reported on steelhead punch cards (ODFW 2001).

Zone	Year	Wild	Hatchery	Total Catch	% Hatchery
1	1996	108	184	292	63.0%
	1997	171	682	853	80.0%
	1998	154	546	700	78.0%
2	1996	3	0	3	0.0%
	1997	80	70	150	46.7%
	1998	6	4	10	40.0%
3	1988	2996	1510	4506	33.5%
	1989	2596	2324	4920	47.2%
	1990	601	1390	1991	69.8%
	1991	1798	1352	3150	42.9%
	1992	399	487	886	55.0%
	1993	302	557	859	64.8%
	1994	176	761	937	81.2%
	1995	428	778	1206	64.5%
	1996	223	529	752	70.3%
	1997	234	610	844	72.3%
	1998	11	40	51	78.4%
North	1988	16	12	28	42.9%
Fork	1989	55	0	55	0.0%
	1990	23	23	46	50.0%
	1991	242	163	405	40.2%
	1992	0	0	0	n/a
	1993	52	20	72	27.8%
	1994	33	7	40	17.5%
	1995	22	38	60	63.3%
	1996	79	54	133	40.6%
	1997	161	84	245	34.3%
	1998	0	0	0	n/a
Middle	1988	37	12	49	24.5%
Fork	1989	20	24	44	54.5%
	1990	26	36	62	58.1%
	1991	115	16	131	12.2%
	1992	0	4	4	100.0%
	1993	42	0	42	0.0%
	1994	30	3	33	9.1%
	1995	6	3	9	33.3%
	1996	48	6	54	11.1%
	1997	110	n/a	110	n/a
	1998	0	0	0	n/a

NOAA Fisheries (2003a) reports the median annual rate of change in abundance since 1990 to be +2.5%, with individual trend estimates ranging from -7.9% to +11%. The same basic pattern is also reflected in population growth rate estimates for the production areas. The median short-term (1990 to 2001) annual population growth rate estimate was 1.045, assuming that hatchery fish on the spawning grounds did not contribute to natural production. The median short-term growth rate under the assumption of equal hatchery/natural origin spawner effectiveness was 0.967. The John Day is the only subbasin of substantial size in which production is clearly driven by natural spawners.

Steelhead Harvest in the Subbasin

Direct commercial harvest of steelhead in non-Indian fisheries was eliminated by legislation in the early 1970s. A fishery on wild steelhead has been limited to catch and release since 1996.

Stray hatchery steelhead have been observed during incidental and statistical creel programs since 1986. All hatchery-produced steelhead in the Columbia Basin have the adipose fin removed prior to release. Stray hatchery steelhead are removed during open fishing periods (Table 24) to minimize the potential for negative interactions between out-of-subbasin strays and wild fish. Most hatchery strays are removed by sport fishermen in the mainstem John Day (Table 23, Zones 1-3). However, significant numbers of hatchery fish migrate into some tributaries (Table 23, North Fork and Middle Fork catches) and may interbreed with wild populations. The impact of this potential inter-breeding is unknown and constitutes a critical uncertainty in management of John Day steelhead populations.

Prior to 1996, harvest of wild fish was allowed, with a two fish per day bag limit. Since then retention of non-clipped fish has been prohibited. The Umatilla Tribes conduct a small subsistence fishery in the North Fork. (USBR 2003)

Table 24. Description of Time Periods in which Fisheries Occur within the John Day Subbasin (USBR 2003).

Fishery Location	Time Period	Comments
Zone 1 - Mouth of John Day to Cottonwood Bridge (RM 38)	Year Round	Catch and release of all unmarked steelhead
Zone 2 - Cottonwood Bridge (RM 38) to Kimberly (RM 185)	Year Round	Catch and release of all unmarked steelhead
Zone 3 - Kimberly (RM 185) to Mouth of Indian Creek (RM 257)	Sept. 1 – April 15	Catch and release of all unmarked steelhead
North Fork - Mouth of North Fork to RM 60 at Hwy 395 Bridge	Sept. 1 – April 15	Catch and release of all unmarked steelhead
Middle Fork - Mouth of Middle Fork to RM 24.2 at Hwy 395 Bridge	Sept. 1 – April 15	Catch and release of all unmarked steelhead
South Fork John Day River		Closed to adult steelhead fishing
All Other Tributaries		Closed to adult steelhead fishing

Assessment Results

Population Status

EDT baseline reports indicate that 45% of steelhead escapement in the John Day Subbasin is to the North Fork (Table 25, Figure 11). This is greater than the 29% estimated by fishery managers for the 1992 to 1997 baseline period (Table 25, Figure 12), although the estimated subbasin-wide escapement for EDT is similar to that estimated by fishery managers (10,568 vs. 10,293). The North Fork and South Fork populations are estimated to have the highest productivity, while the Lower John Day has the lowest productivity (Table 25). All populations are below the EDT estimate of present capacity.

Comparing these baseline abundances to the 1992 to 1997 averages, the total abundance is very similar, while the distribution differs. EDT estimates a higher population in the North Fork, South Fork, and Upper John Day, but a much lower population in the lower John Day. The total baseline abundance exceeds the NOAA Fisheries interim target, though the Lower John Day and Upper John Day are both at lower abundances than the target abundances. The EDT estimate of historic abundance potential is much lower than that estimated by fishery managers (Table 25).

Table 25. Summer steelhead population averages historic abundance potential, baseline abundance and baseline capacity based on EDT results, observed averages, and interim targets.

Population Area	EDT Historic Abundance Potential	EDT Baseline Abundance (no harvest)	EDT Baseline Productivity (no harvest)	EDT Baseline Capacity (no harvest)	Empirical 1992-1997 Average	Empirical 1999-2003 Average	NOAA Fisheries Interim Targets	Professional Judgment Estimated Historic
Lower JD	10,108	1,292	2.8	2,028	3,355	6139	3200	17,738
North Fk JD	14,698	4,870	4.7	6,202	3,345	6120	2700	25,578
Middle Fk JD	5,930	1,448	3.6	2,010	1,534	2806	1300	10,934
South Fk JD	2,941	1,221	4.7	1,553	690	1262	600	5,586
Upper JD	5,912	1,737	4.2	2,283	1,369	2505	2000	10,164
Total	39,589	10,568		14,076	10,293	18,832	9800	70,000

Empirical data per ODFW, NOAA interim targets per NMFS 2002.

NOAA Fisheries cites interim abundance targets (eight-year, or approximately two generations, geometric mean of annual natural spawners) for each of the five population groupings in the John Day River (Table 25). Also shown in this table are the empirical averages for 1992 through 1997 and for 1999 through 2003 for each of the steelhead population areas based on ODFW survey information. A review of this data illustrates that steelhead abundance was 83% greater in 1999 to 2003 than in the earlier years of 1992 to 1997. For the most recent period the recovery targets were met in all five independent population areas. In 1992 to 1997 the interim targets were met in all of the population areas except the Upper John Day.

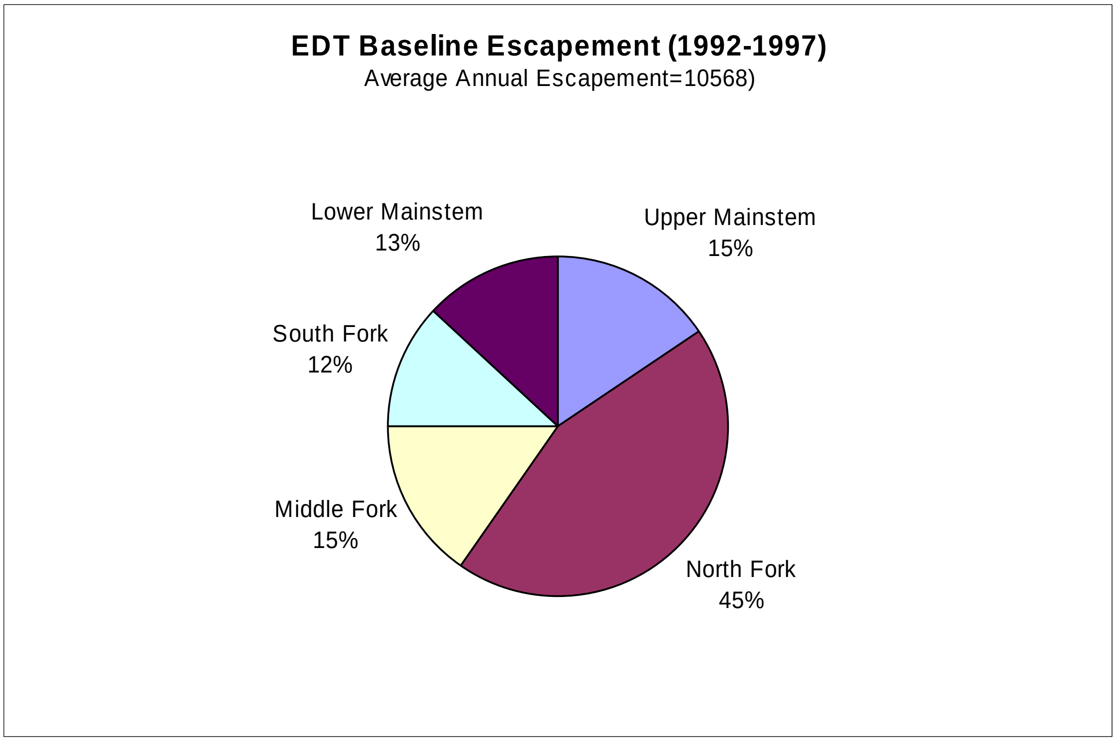

Figure 11. Distribution of John Day steelhead populations as estimated by EDT for the years 1992-1997.

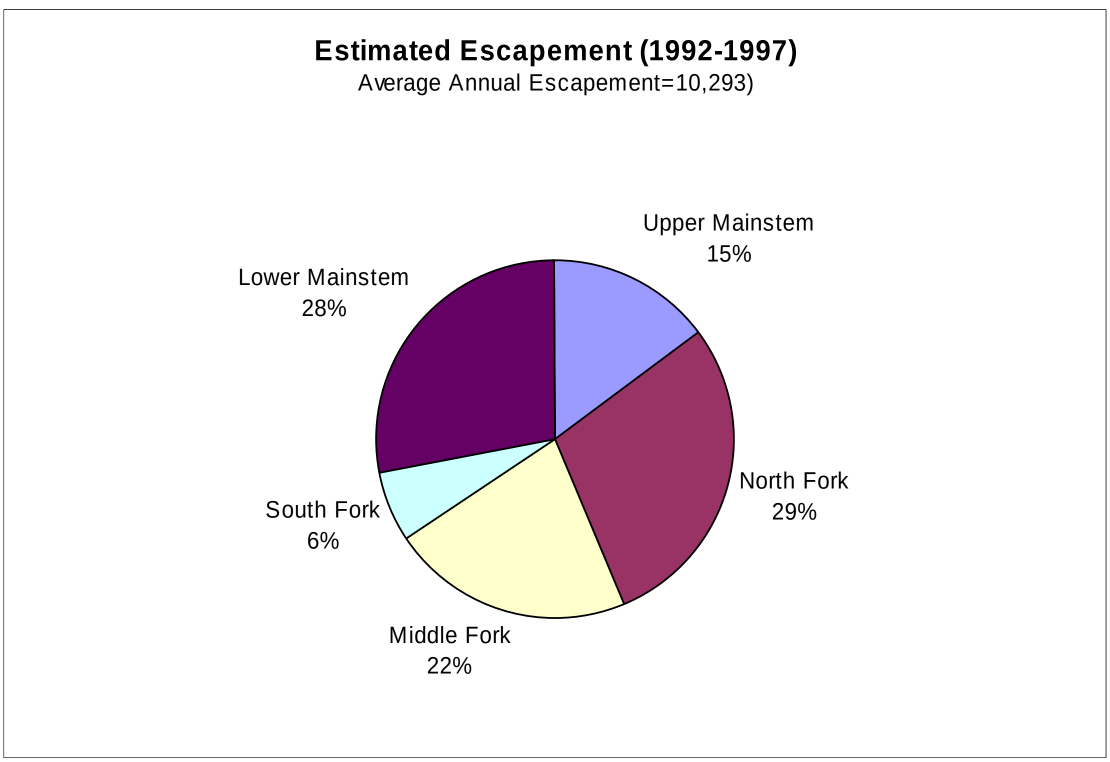

Figure 12. Distribution of John Day steelhead populations as estimated by fish managers for the years 1992-1997.

It is important to note that the ODFW empirical data used here were collected for the purpose of identifying trends. They were not collected for the purpose of determining statistically sound abundance figures. The true abundance of steelhead may vary significantly. ODFW assimilated this information using boundaries for the population areas that vary slightly from the steelhead population areas used by NOAA Fisheries. NOAA Fisheries makes the break between the Lower John Day and Upper John Day at the confluence of the South Fork John Day. ODFW assumes the break is at the confluence of the North Fork John Day River.

Juvenile Productivity

The productivity of a population is a measure of its ability to sustain itself or its ability to rebound from low numbers. The EDT baseline productivity values are shown in Table 25. The EDT productivity parameter is one of the parameters in the Beverton Holt production function. It represents a rate of increase at extremely small population levels. It does not represent the rate of population growth of the present steelhead populations. To sustain a population it is essential that the productivity numbers exceed 1.0.

The EDT values for the John Day suggest that no population is in immediate danger of decline. Compared to historic levels, however, current populations are substantially less productive than formerly. This can be summarized in the spawner/recruit curves generated by EDT (Figure 13). These curves indicate that the stocks currently are very close to, or just above, replacement level when compared to the historic conditions. The distance between the current curve and the replacement line at a given level of spawners is the surplus available for harvest. The only populations that could support minimal harvests at the NOAA Fisheries interim population targets are the South Fork and North Fork.

The EDT results suggest that productivity is highest in the South Fork John Day and the North Fork John Day and the lowest in the Lower John Day. Historically, according to EDT, the Lower John Day was also the least productive steelhead population. However, the John Day technical team disagreed with this conclusion, and felt that the Lower John Day summer steelhead had higher productivity than the other populations. The technical team also was skeptical that the South Fork summer steelhead population is currently the most productive population in the John Day Subbasin. The relative productivity of the five populations, both currently and historically, are gaps in knowledge that should be addressed in the future.

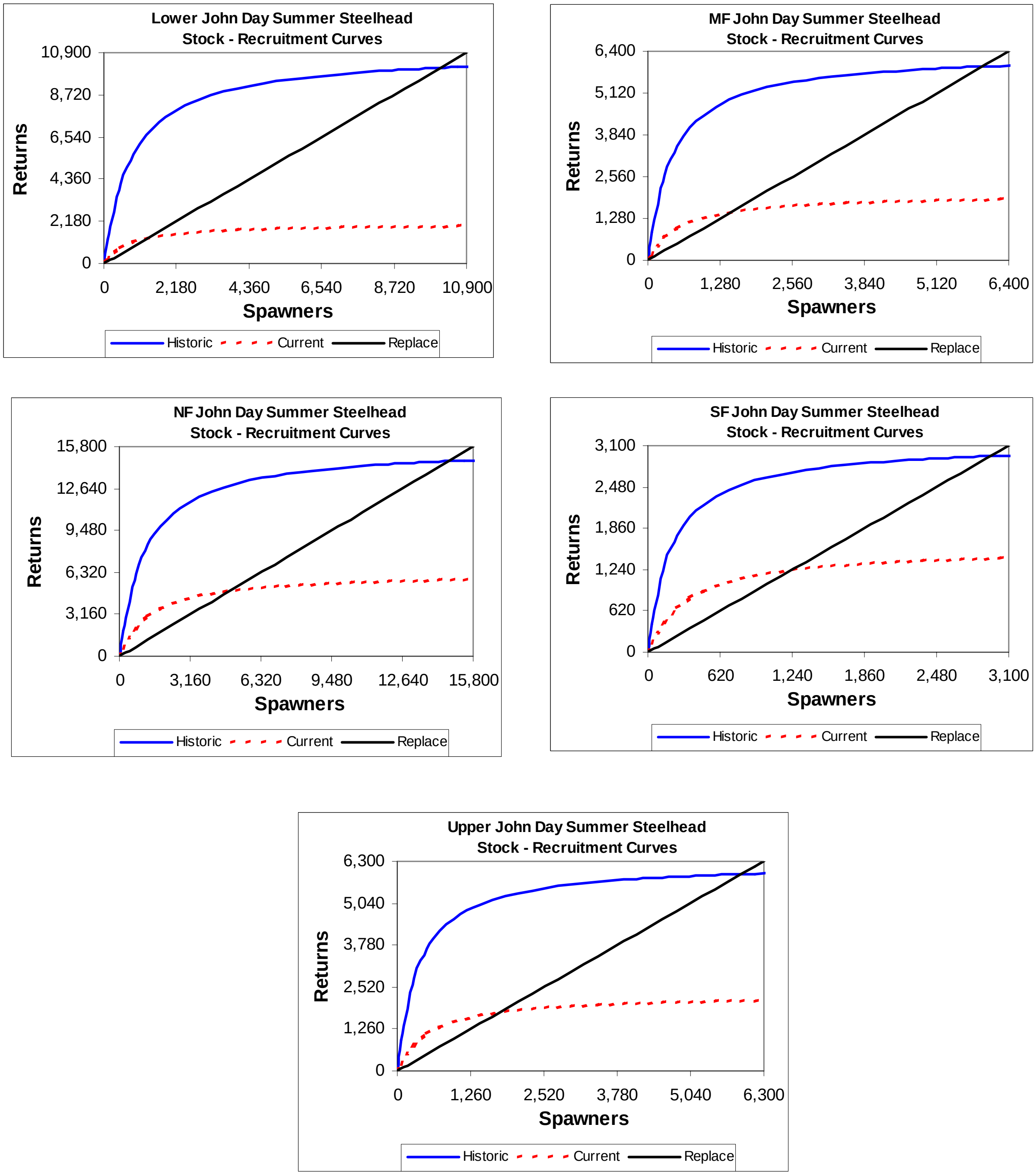

Figure 13. Stock recruitment curves produced by EDT baseline report for the five steelhead populations of the John Day Subbasin.

Diversity

Diversity is important for the long-term persistence of salmonid populations, whether it be genetic or phenotypic. This index expresses the diversity as a percent of the historic potential (Note: historic diversity is, by definition, 100%). The diversity indices for summer steelhead in the John Day Subbasin are as follows:

- Lower John Day – 18%
- North Fork John Day – 53%
- Middle Fork John Day – 57%
- South Fork John Day – 72%
- Upper John Day – 39%

The EDT model estimates that the South Fork population has retained 72% of its historic diversity of life history patterns. The remaining four populations have been seriously impacted, however, having lost from 43 percentage points (Middle Fork John Day) to 82 percentage points (Lower John Day) of their original life history patterns. The John Day Subbasin is one of the few areas where hatchery fish have not been directly introduced into the river system. For a complete set of EDT model baseline steelhead results for the five populations, see Appendix R.

Identification of Limiting Factors

Environmental Relationships by Population

One of the EDT model outputs is a list of potential protection and restoration areas and their ranks. For the John Day Subbasin, the planners chose HUC5s, of which there are 43, as the geographic areas for summarizing EDT diagnostic results. Those highest ranked HUC5s may produce the greatest increase in productivity and abundance with restoration. Those designated with a high protection value are most important to preserve current habitat and environmental conditions. The protection and restoration ranking for each HUC5, as well as the restoration value of each attribute (high, medium, or low) within that HUC5, are presented in Appendix S. Priority HUC5s were those ranked within the top quartile of all HUC5s used by each population. Priority attributes are those rated as having a "high" or "medium" impact on production. In this section, only the top quartile protection and restoration HUC5s will be listed along with those attributes within each top priority restoration HUC5 that are high or medium priority. See Appendix S for a complete set of EDT Diagnostic Reports for summer steelhead.

Lower John Day

Steelhead spawning in the Lower John Day population area is in tributary streams connected by the John Day River. Table 26 presents the top quartile of the 18 HUC5s denoted by EDT as important to this population for restoration and protection. One HUC5 (JDR Johnson Creek) is in the top quartile for both protection and restoration. Common to all four top priority HUC5s for restoration is key habitat quantity, temperature, sediment load, and habitat diversity. Upon reviewing the restoration attributes by geographic area, the technical team thought that flow restoration was also important for Bridge Creek, though probably not as important for Johnson Creek.

A set of maps displaying the EDT quartile for each HUC5 for protection and restoration for summer steelhead and spring chinook in the John Day Subbasin can be found in Appendix V.

Table 26. Top quartile protection and restoration geographic areas with important restoration attributes as estimated by EDT (black), with additional attributes listed by the subbasin planners (gray) for Lower John Day summer steelhead.

Lower John Day Summer Steelhead										
Geographic area priority			Attribute for Restoration							
Geographic area	Protection benefit	Restoration benefit	*Channel stability/landsc.1/*	*Flow*	*Habitat diversity*	*Obstructions*	*Sediment load*	*Temperature*	*Key habitat quantity*
Bridge Creek		X		▒	■	■	■	■	■
JDR Johnson Creek	X	X		■	■		■	■	■
Lower JDR Kahler Creek		X		■	■	■	■	■	■
Lower JDR Muddy Creek	X								
Mountain Creek		X	■		■		■	■	■
Rock Creek	X								
Upper Middle JDR	X								

The Lower JDR MacDonald Ferry HUC5 was designated by EDT as a top HUC5 for protection. This HUC5 contains portions of the John Day Reservoir and was also selected as an important HUC5 for other John Day steelhead populations. In all cases, key habitat quantity was a relatively high ranking attribute for protection. This suggests that the increase in volume resulting from the John Day Reservoir was treated as favorable habitat by the EDT model. This unexpected result shows the importance of conditioning EDT model results with professional expertise. This reach was excluded from the list of top quartile HUC5s for both Lower John Day and Upper John Day steelhead populations.

North Fork

Among the 17 HUC5s denoted by EDT as important to the North Fork population, all six HUC5s in the top restoration and protection quartiles are within the North Fork watershed (Table 27). Three of the geographic areas (NF JDR Big Creek, and the upper North Fork) are listed as high priority for both protection and restoration, signifying that all three should be protected from further degradation and that restoration on any of the limiting factors listed would have the potential to increase productivity and abundance for the population. Common to all four top priority HUC5s for restoration is key habitat quantity while sediment load is a top priority for three HUC5s.

Table 27. Top quartile protection and restoration geographic areas with important restoration attributes as estimated by EDT for North Fork John Day summer steelhead.

NF John Day Summer Steelhead								
Geographic area priority			Attribute for Restoration					
Geographic area	Protection benefit	Restoration benefit	*Flow*	*Habitat diversity*	*Obstructions*	*Sediment load*	*Temperature*	*Key habitat quantity*
Cottonwood Creek		X	■	■		■	■	■
Desolation Creek	X							
NF JDR Big Creek	X	X			■			■
NF JDR Potamus Creek		X		■		■	■	■
Upper Camas Creek	X							
Upper NF JDR	X	X				■		■

Middle Fork

Among the 14 HUC5s denoted by EDT as important to the Middle Fork John Day steelhead population, all five HUC5s in the top restoration and protection quartiles are within the Middle Fork watershed (Table 28). Three of the geographic areas (Big Creek, Camp Creek, and Long Creek) are listed as high priority for both protection and restoration, signifying that all three should be protected from further degradation and that restoration on any of the limiting factors listed would have the potential to increase productivity and abundance for the population. Common attributes to all five top priority HUC5s for restoration is key habitat quantity and sediment load. Upon review, the John Day technical team thought that habitat diversity and temperature were important attributes for restoration for Camp Creek. The John Day technical team was dubious of the protection value for Long Creek.

Table 28. Top quartile protection and restoration geographic areas with important restoration attributes as estimated by EDT (black), with additional attributes listed by the subbasin planners (gray) for Middle Fork John Day summer steelhead.

MF John Day Summer Steelhead							
Geographic area priority			Attribute for Restoration				
Geographic area	Protection benefit	Restoration benefit	*Flow*	*Habitat diversity*	*Sediment load*	*Temperature*	*Key habitat quantity*
Big Creek	X	X			■		■
Camp Creek	X	X		▒	■	▒	■
Long Creek	X	X	■	■	■		■
Lower MF JDR		X		■	■	■	■
Upper MF JDR	X				■		■

South Fork John Day

Steelhead habitat in the South Fork John Day River is limited to that area downstream of Izee Falls (Figure 1). Among the 13 HUC5s denoted by EDT as important to this population, one priority HUC5 is in the Lower John Day watershed (Table 29) with JDR Johnson Creek being ranked as having a high priority for restoration.

Table 29. Top quartile protection and restoration geographic areas with important restoration attributes as estimated by EDT (black), with additional attributes listed by the subbasin planners (gray) for South Fork John Day summer steelhead.

SF John Day Summer Steelhead					
Geographic area priority			Attribute for Restoration		
Geographic area	Protection benefit	Restoration benefit	*Sediment load*	*Temperature*	*Key habitat quantity*
JDR Johnson Creek		X			black
Lower SF JDR	X	X	black	black	black
Middle SF JDR	X		black	gray	black
Murderers Creek	X	X	black	gray	black

Among the high priority HUC5s, two (Lower South Fork and Murderers Creek) are listed for both protection and restoration, signifying that both should be protected from further degradation and that restoration on any of the limiting factors listed would have the potential to increase productivity and abundance for the population. Common to all four top priority HUC5s is key habitat quantity, with three of the HUC5s also having sediment load as a priority. Upon review, the John Day technical team thought that temperature should be added as an attribute for restoration for Middle SF JDR and Murderers Creek.

Upper John Day

Among the 15 HUC5s denoted by EDT as important to the Upper John Day River steelhead population, all of the top restoration and protection quartiles are in the Upper John Day portion of the subbasin (Table 30).

Table 30. Top quartile protection and restoration geographic areas with important restoration attributes as estimated by EDT for Upper John Day summer steelhead.

Upper John Day Summer Steelhead								
Geographic area priority			Attribute for Restoration					
Geographic area	Protection benefit	Restoration benefit	Flow	Habitat diversity	Obstructions	Sediment load	Temperature	Key habitat quantity
Beech Creek		X	■	■	■	■	■	■
Canyon Creek	X							
Fields Creek		X		■		■		■
Laycock Creek		X		■	■	■		■
Strawberry Creek	X	X		■		■	■	■
Upper JDR	X							

Among the high priority HUC5s in the Middle Fork drainage, one (Strawberry Creek) is listed for both protection and restoration, signifying the importance of this HUC5 to steelhead. Common to all five top priority HUC5s for restoration is key habitat quantity, sediment load, and habitat diversity.

Identification of Restoration Priorities

Table 31 summarizes the EDT outputs from each steelhead population area as presented above. Complete EDT outputs, including all HUC5s relevant to each population, are presented in Appendix S.

EDT model results were used along with consideration of other factors such as landowner cooperation, potential for successful restoration, and synergies with existing restoration efforts. The methods used to establish restoration priorities are presented in Section 5.2.2.4, Restoration Strategies and Priorities.

Table 31. First quartile geographic areas with the high and moderate ranked restoration attributes as estimated by EDT.

John Day Summer Steelhead Restoration Priorities											
Geographic area priority					Attribute for Restoration						
Geographic area	Lower and Middle Mainstem	North Fork	Middle Fork	Upper Mainstem and South Fork	*Channel stability*	*Flow*	*Habitat diversity*	*Obstructions*	*Sediment load*	*Temperature*	*Key habitat quantity*
Bridge Creek	X						■	■	■	■	■
JDR Johnson Creek	X					■	■		■	■	■
Lower JDR Kahler Creek	X					■	■	■	■	■	■
Mountain Creek	X				■		■		■	■	■
Cottonwood Creek		X				■	■		■	■	■
NF JDR Big Creek		X						■			■
NF JDR Potamus Creek		X					■		■	■	■
Upper NF JDR		X							■		■
Big Creek			X						■		■
Camp Creek			X						■		■
Long Creek			X			■	■		■		■
Lower MF JDR			X				■		■	■	■
JDR Johnson Creek				X							■
Lower SF JDR				X					■	■	■
Murderers Creek				X					■		■
Beech Creek				X		■	■	■	■	■	■
Fields Creek				X			■		■		■
Laycock Creek				X			■	■	■		■
Strawberry Creek				X			■		■	■	■

Analysis of Limiting Factors

Several limiting factors have already been presented for the top quartile HUC5s of each steelhead population. Another perspective on limiting factors was completed for all the HUC5s used by steelhead. The percentage of geographic areas (HUC5s) with attribute classes of high or medium priority for restoration was compared (Figure 14). Geographic areas utilized exclusively by out-of-area populations for migration were excluded from this analysis to avoid these areas being over weighted in the analysis. (For example, Lower JDR McDonald Ferry is used by all five populations. To prevent this reach by being weighted by a factor of five, it only entered into the analysis for Lower John Day summer steelhead.) Key habitat quantity is a limiting factor for 100% of the geographic areas, while sediment load is a limiting factor in over 80% of geographic areas. Habitat diversity, temperature, and flow are the other significant limiting factors.

The John Day technical team questioned the ranking of some of the limiting factors. They thought that, subbasin-wide, temperature was as much, if not more, of a limiting factor than sediment load. They also thought that flow should be as much of a limiting factor as temperature. (Note that in earlier EDT runs, flow was felt to be too much of a limiting factor and thus the ratings for current flow were upgraded to reduce the impact of flow as a limiting factor.)

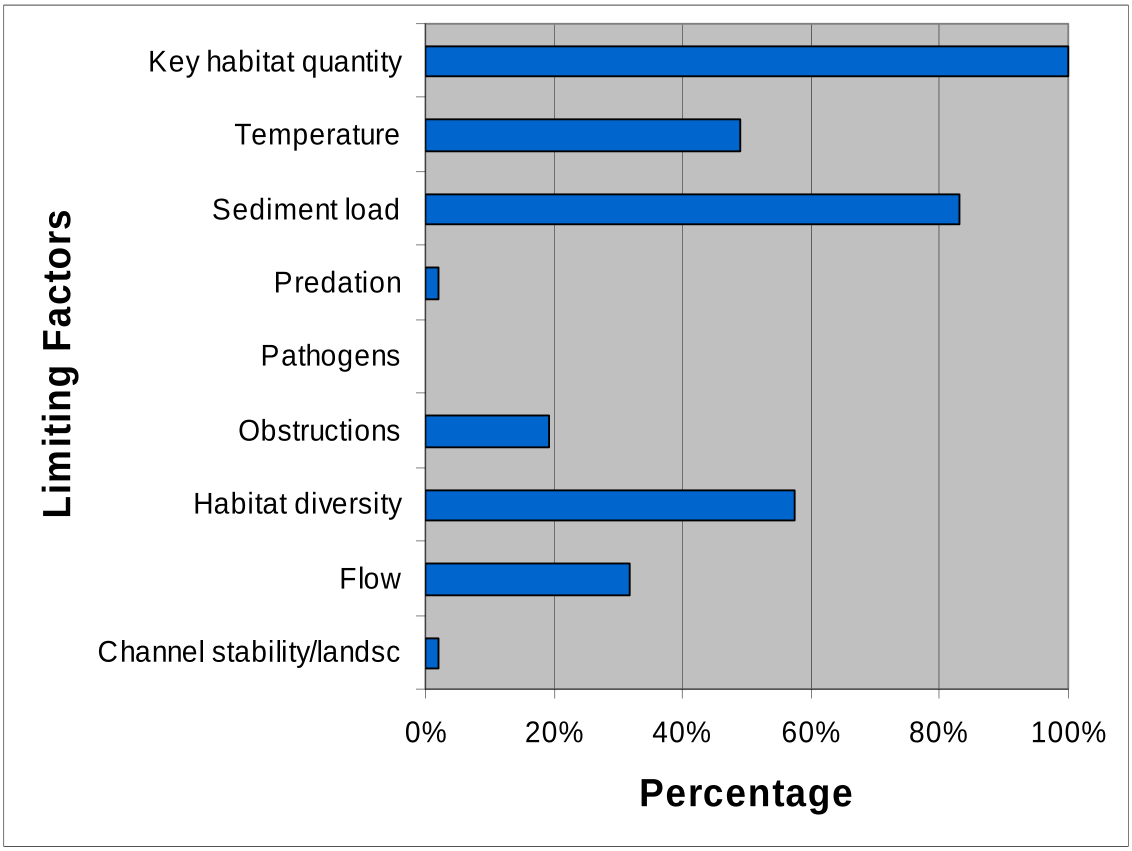

Figure 14. Limiting factors for summer steelhead by percentage of geographic areas (John Day Subbasin HUC5s).

3.2.4 Aquatic Focal Species Population Delineation and Characterization

Spring Chinook Salmon *(Oncorhynchus tshawytscha)*

Some chinook salmon populations were among the first salmon populations to become extinct in Oregon, due to their preferred status in the harvest (Hume 1893) and to extensive, early habitat degradation in eastern Oregon (Thompson and Haas 1960). The range of chinook salmon in Oregon historically included all Columbia and Snake River subbasins and all coastal streams below natural barriers. Where adequate habitat was available historically, adult chinook entered rivers most of the year with peaks that formed separate breeding populations (ODFW 1995).

The species is extinct in the Snake River above the Hells Canyon dam complex, in the Deschutes River above the Pelton/Round Butte dam complex, in the Oregon portion of the upper Klamath Basin, above dams in the Sandy, Willamette, Umpqua and Rogue rivers, and in the Umatilla and Walla Walla rivers. Populations have been lost from other basins including an early fall-run population in the lower Grande Ronde River, the fall-run population in the John Day River and the spring-run population in the upper Hood River. Winter-run populations may have been lost in the Sandy River and in Tillamook Bay. Irrigation diversions, hydroelectric dams, and other habitat problems that decreased flows, caused blockages, and increased summer and fall water temperatures caused many of the early extinctions (Thompson and Haas 1960, Fulton 1968). (ODFW 1995)

The chinook salmon is an anadromous species that rears in the Pacific Ocean for most of its life and spawns in freshwater streams in North America from Kotzebue Sound, Alaska, through central California. The majority of mature chinook salmon enter Oregon coastal rivers from about April through December, although a few fish are probably entering some rivers during every month of the year. Spring chinook begin entering the Columbia River in February. Entry into most Oregon rivers reaches a low point in summer. Different populations of chinook salmon in a basin can be distinguished by the season of the year during which they return to fresh water since fish with different run timings tend to spawn in different parts of the basin and thus maintain some reproductive isolation. Such populations in Oregon rivers are usually called either spring or fall chinook, although several populations could legitimately be described as summer or winter chinook. Spawning generally occurs from August to early November for spring chinook and from October to early march for fall chinook. All adults die within two weeks after spawning. (ODFW 1995)

The populations in the Mid-Columbia subbasins cluster loosely with each other, but are clearly a distinct group compared to all other chinook populations in Oregon (Schreck *et al*. 1986, Utter *et al*. 1989, and Marshall 1993).

The spring run of chinook salmon in the John Day is grouped into the Mid-Columbia River ESU. This ESU includes all naturally-spawned populations of spring-run chinook salmon in Columbia River tributaries from the Klickitat River upstream to and including the Yakima River (excluding the Snake River Basin).

In February, the adult spring chinook from the John Day Subbasin enter the Columbia River from the Pacific Ocean and migrate 217 miles up river, passing three dams to reach the confluence of the John Day and Columbia rivers. Spring chinook distribution within the John Day Subbasin is presented in Figure 15. Adult spring chinook salmon migrate upstream into and within the subbasin during April, May, and June. Most spring chinook return as 4-year-olds (75%), with 3-year-old (2.5%) and 5-year-old (22.5%) returns comprising the remainder (Lindsay *et al*. 1985). (USBR 2003)

Spring chinook salmon are regularly found in 38 streams in the subbasin (Table 32, Figure 15). Spring chinook salmon spawn in the Mainstem above Prairie City, in the Middle Fork above Armstrong Creek, and in the North Fork above Camas Creek including Granite Creek and its tributaries Clear and Bull Run creeks (Lindsay *et al*. 1986). Spawning habitat is primarily limited to the mainstem and major tributaries of the North Fork, such as Granite, Clear, and Bull Run creeks. (USBR 2003) In some years, small numbers of adults return to the South Fork John Day River, Camas Creek, Desolation Creek, and Canyon Creek.

They arrive at holding and spawning areas in the Upper John Day, Middle Fork John Day, North Fork John Day, and Granite Creek (a tributary to the North Fork) by early July (USBR 2003). Adults are consistently found in pools with a depth greater than 4.9 feet and with escape cover such as undercut banks, fallen trees or other debris, boulders, or vegetation (Lindsay *et al.* 1985). The adult holding locations are cold-water refugia and are well known to the biologist of the John Day watershed. While the daytime temperatures of the John Day are warm, night time temperature cool sufficiently to allow the adults to move within the system to the next cool water holding area. The adults are found in these locations until they spawn in late August through late September (USBR 2003).

Emergence of fry commences in March and April following high water (USBR 2003). Distribution extends downstream after emergence, then as water temperatures increase and flows decrease juveniles move into cooler tributaries and mainstem areas. By late September and early October, a shift back downstream usually takes place concurrent with decreasing water temperatures and increasing flows (Lindsay *et al*. 1985). Juveniles reside in rearing areas for approximately 12 months before migrating downstream the following spring, with migration peaking past Spray (RM 170) on the mainstem during the second week in April (Lindsay *et al*. 1985).

Rearing habitats are both on the mainstem reaches and the lower reaches of significant tributaries. (USBR 2003) The majority of rearing is in the lower portions of the cooler water tributaries, and not in the mainstem rivers where spawning occurs. Recapture data in the Columbia River indicate that smolts from the John Day River enter the Columbia from April through May and enter the Columbia River estuary in May and June (Lindsay *et al*. 1985).

Spring chinook spawning surveys have been conducted in index areas of Granite Creek, Clear Creek, Bull Run Creek, North Fork John Day River, Middle Fork John Day River and Upper John Day River since 1978. A few of these index areas have been surveyed since 1959.

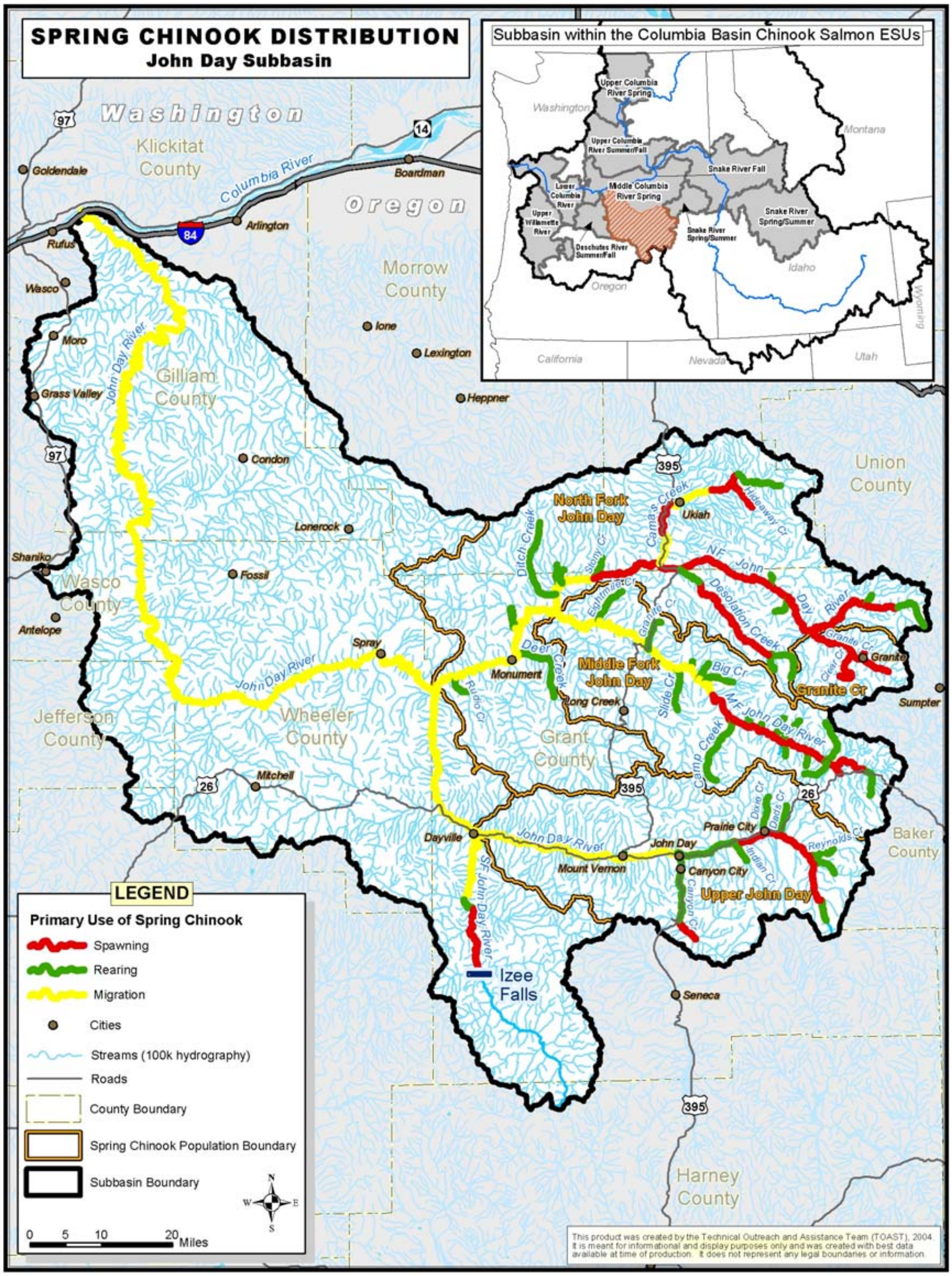

Figure 15. Spring chinook distribution in the John Day Subbasin.

The trend in estimated numbers returning to the subbasin for spring chinook salmon in the John Day River appears be slightly increasing for the period of record (Figure 16). However, the pattern of returning adult salmon is very different between the first 20 years and the second 20 years of the period. The reasons for strong variability in returns and the extreme differences between the peaks and valleys of this curve since about 1984 are unknown and deserve further attention. Recent increases have been attributed to improvements in fish habitat in the mainstem John Day River above the town of John Day and in the Middle Fork John Day River above the town of Galena (approximately mid-way between State Highways 7 and 395) and to improve ocean conditions.

Table 32. Distribution of spring chinook salmon (including juveniles) in John Day Subbasin streams. (Source: StreamNet)

Tributary Stream	Main Stream	Miles of Tributary	Miles Used	% Used
John Day River	Columbia River	277.6	181.8	65%
Bull Run Creek	Granite Creek	9.3	3.1	33%
Clear Creek	Granite Creek	8.0	2.3	29%
Indian Creek	John Day River	11.8	3.4	29%
North Fork	John Day River	111.0	59.6	54%
Beaver Creek	John Day River	4.10	0.8	20%
Beech Creek	John Day River	18.7	1.7	9%
Canyon Creek	John Day River	27.5	10.4	38%
Dads Creek	John Day River	8.6	4.2	49%
Deardorff Creek	John Day River	9.6	1.0	10%
Dixie Creek	John Day River	11.4	1.3	11%
Reynolds Creek	John Day River	9.3	1.4	15%
South Fork	John Day River	57.3	27.6	48%
Big Boulder Creek	Middle Fork	6.5	2.1	32%
Big Creek	Middle Fork	11.6	1.0	9%
Butte Creek	Middle Fork	4.9	2.2	45%
Camp Creek	Middle Fork	15.6	11.3	72%
Clear Creek	Middle Fork	12.7	3.9	31%
Coyote Creek	Middle Fork	2.5	0.6	24%
Deerhorn Creek	Middle Fork	3.4	1.5	44%
Eightmile Creek	Middle Fork	8.9	0.7	8%
Granite Boulder	Middle Fork	8.1	4.0	49%
Granite Creek	Middle Fork	5.9	1.3	22%
Huckleberry Creek	Middle Fork	6.4	0.5	8%
Indian Creek	Middle Fork	13.6	1.7	13%
Slide Creek	Middle Fork	10.2	0.3	3%
Squaw Creek	Middle Fork	9.4	2.8	30%
Big Wall Creek	North Fork	21.3	2.3	11%
Camas Creek	North Fork	36.7	15.5	42%
Deer Creek	North Fork	11.1	2.5	23%
Desolation Creek	North Fork	21.1	5.0	24%
Ditch Creek	North Fork	19.5	1.9	10%
Granite Creek	North Fork	16.2	10.0	62%
Mallory Creek	North Fork	14.3	4.0	28%
Middle Fork	North Fork	71.0	40.3	57%
Potamus Creek	North Fork	18.4	0.6	3%
Rudio Creek	North Fork	16.8	3.4	20%
Stony Creek	North Fork	6.8	3.0	44%

The estimates for the population in the Granite Creek system show a decreasing trend, while the other three spring chinook populations in the John Day Subbasin appear to be on the increase (Figure 17). Granite Creek is a tributary of the upper North Fork. The reasons for the Granite Creek population's declining trend, in light of the increase in North Fork populations, are not clear. However, the decline appears to correlate with recent intensive forest management activities and degradation from historic mining (USBR 2003). Like the North Fork population, the Middle Fork and Upper John Day spring chinook populations also show a positive trend.

In 2000, record numbers of spring chinook salmon spawned in the index areas of the John Day River. According to unpublished data from the ODFW, a total of 477 redds were counted in the North Fork John Day that year, when in 1995 only 27 redds were tallied. In the declining Granite Creek system, 241 redds were counted, more than double the 20-year average. Spawning populations in both the mainstem and Middle Fork John Day rivers were the highest

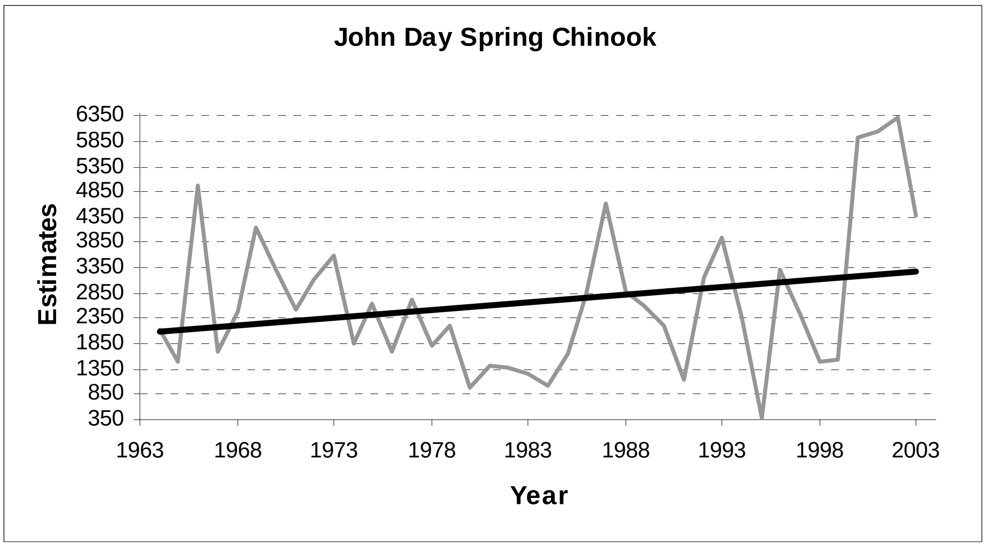

Figure 16. Estimates of total spring chinook escapement in the John Day Subbasin, 1964 to 2000 (estimate data per ODFW).

recorded since 1959. Contributing factors probably include improved ocean conditions, success in habitat restoration (screened diversions, improved adult and juvenile fish passage, efficient irrigation, riparian cover) and improved management practices. (USBR 2003)

Description of Chinook’s Aquatic Introductions, Artificial Production and Captive Breeding Programs

Although no releases of hatchery chinook salmon have been made into the rivers of the John Day Subbasin, a small number of stray hatchery adults have been recovered during spawning surveys in the fall (Wilson *et al*. 2000). This small number (less than 1% of the total adult return) is thought to present little risk to the genetic integrity of the population. (USBR 2003)

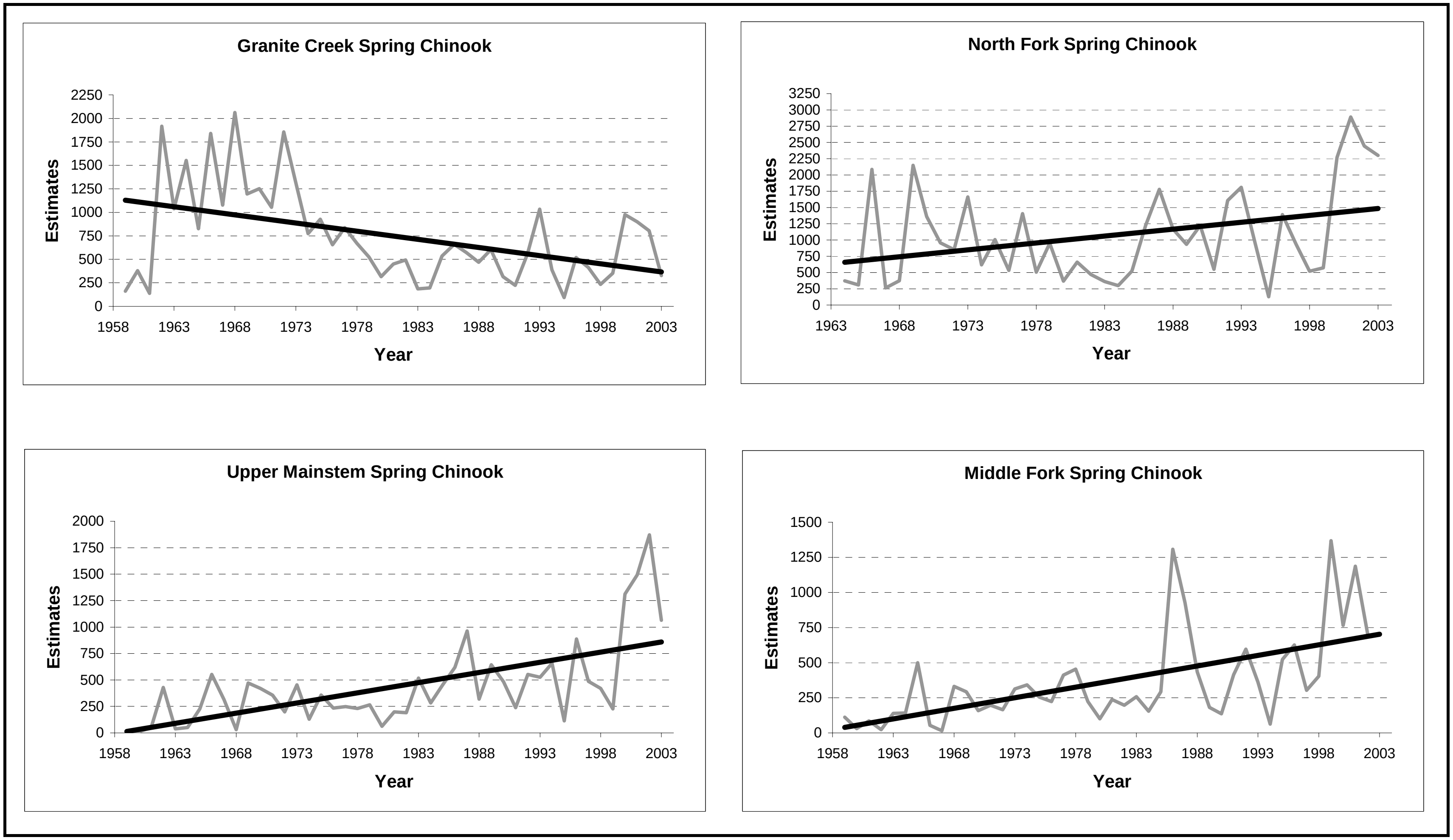

Figure 17. Estimates of adult spring chinook escapement for each John Day population, with trend lines. (estimate data per ODFW)

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Chinook Harvest in the Subbasin

All angling for salmon in the John Day Subbasin has been prohibited since 1976. The CTUIR have a limited subsistence fishery on Granite Creek and on the North Fork between Highway 395 and Big Creek (excluding tributaries). This tribal fishery has been conducted in the last decade with a variable annual quota of 100 fish or less (ODFW 1995). Oregon State Police (OSP) provide priority enforcement presence in chinook holding and spawning areas. Harassment and poaching problems seem to be decreasing as a result (ODFW 1995). The escapement target that would allow a sport fishery to resume is 7000 fish to the mouth of the John Day River for three to four consecutive years, but this target has not yet been met. Escapement to the spawning areas during 2000 and 2001 was about 6000 spawners. The Tribes, OSP and ODFW closely monitor the quota for this tribal fishery and the fishery itself. (USBR 2003)

Environmental Conditions for Chinook

Reduced streamflows, especially during summer, have contributed to higher water temperatures. Further, reduced streamflows have created physical and thermal obstacles to fish movement. Reduced riparian vegetation and shade have contributed to higher water temperatures and reducing habitat diversity. Yet, the aquatic habitat is healthier than in many other Columbia Basin tributaries due to the absence of large dams and the presence of quality habitat in some federally-owned headwater areas. (USBR 2003)

Downstream-migrating juvenile fish are susceptible to entrapment in water diversions that are either inadequately screened or not screened at all. Fish become impinged on inadequate screens, or are drawn into the diversion system without an escape route back to the main stream. Trapped fish eventually die as they run out of water, or are exposed to other lethal conditions (such as high water temperatures, lack of dissolved oxygen, or physical contact with pumps and sprinklers) in the irrigation channel or agricultural field. (USBR 2003)

During critical low water years, some fish may encounter passage and spawning difficulties in some upper subbasin streams. Flows necessary for migration are available most years. However, juveniles moving out of unfavorably high stream temperatures in some mainstem reaches to cooler water in tributaries are blocked from some streams because of low flows, passage barriers, irrigation demands or a combination of the three. Research studies in the John Day Subbasin revealed that when mean daily stream temperatures exceed 68° F, young chinook disappear from the mainstem habitat either by escaping to cooler tributaries where available or are lost to mortality. (ODFW 1990)

Overal, the quality of the habitat used by spring chinook in the Upper John Day drainage has been stable to improving, except in the area used by the Granite Creek population. Part of the spring chinook habitat in the North Fork is protected by scenic waterway and wilderness designations. Habitat outside of these protected areas has been impacted by certain logging, road construction, mining and grazing activities. Logging activity, including road construction and clearcuts, have been more extensive in the Granite Creek watershed than elsewhere in the John Day Subbasin**.** Habitat impacts affecting the Granite Creek population include heavy mining activity since the mid-1970s. Several blowouts of acid mine waste ponds in the subbasin have affected water quality. (ODFW 1995) Habitat in the upper mainstem has been improving due to riparian fencing, improved water management and other habitat improvement projects on private lands.

EDT Assessment Results

Abundance. Abundance is a measure of the number of individuals in a population. For the John Day spring chinook, adult fish numbers have been estimated over the last five decades. Figure 17 shows the estimates of adult numbers for each of the four populations of the system. Except for the Granite Creek population, most of the populations appear to have a positive trend. The early years of 2000s have been tremendous years for return of several salmonids species within the Columbia Basin, including the spring chinook of the John Day River. Recent ocean conditions have been very positive for salmonid survival during these years.

The EDT model runs are based on population trends and environmental conditions of the period from 1992 to 1997. During this period, ocean conditions were not positive for survival and the populations show fluctuations during this time, but appear to remain at a stable state. Several measures of abundance are shown below in Table 33. See Appendix T for a complete set of EDT baseline reports for spring chinook. These are compared to the observed averages for each period. The empirical data shown in Table 33 illustrates that there has been significant increases in all John Day Subbasin populations in recent years.

The EDT baseline abundance total is similar to the 1992 to 1997 average. However, most of the fish are produced in the North Fork. Granite Creek, Middle Fork, and Upper John Day EDT numbers are approximately half of the observed numbers. Attempts were made in the EDT model of the John Day to adequately reflect how spring chinook utilize rearing habitat; in particular, habitat in the significant tributaries in the vicinity of the mainstem river spawning beds. While the numbers for each population were elevated from the spring 2004 results and the total number of spring chinook is closer to reality, the model appears to need further work if it is to be used for subbasin scenario work. The model is still not reflecting the observed proportions of fish from each population, as it is overestimating the North Fork population and underestimating the other three populations. This is the case for both the current abundance and the historic potential. The work to correct for this issue is discussed under "EDT Methods" in Section 3.2.3.

Table 33. Spring chinook adult population averages.

Population Area	EDT Historic Abundance Potential	EDT Baseline Abundance (no harvest)	EDT Baseline Productivity[1] (no harvest)	EDT Baseline Capacity (no harvest)	Empirical 1992-1997 Average	Empirical 2000-2004 Average	Professional Judgement Estimated Historic
North Fk JD	6,252	1,731	5.2	2,145	1,139	2,554	22,280
Granite Cr	1,059	85	2.2	157	501	667	3,760
Middle Fk JD	2,152	177	2.2	328	431	942	7,680
Upper JD	1,767	217	2.7	345	538	1,353	6,280
Total	11,230	2,210		2,975	2,609	5,516	40,000

Observed data per ODFW.
[1] smolts per spawner

Further EDT data provided in Table 33 shows that severe losses occurred in productivity and abundance for all populations when a comparison is made between present status and the historic (template) condition. The North Fork population has lost 66% of productivity and 72% of its abundance, compared to historic conditions. The remaining three populations have been more severely impacted, losing between 92% and 88% of each of these indices. The actual losses in productivity and abundance are probably somewhat greater for the North Fork spring chinook and somewhat less for the other populations, given the inaccuracies in EDT estimates of present abundance. The relative impacts to each population are probably similar to that shown, however.

The risk of further decline, based upon observed abundance and productivity, is greatest for the Granite Creek, Middle Fork and Upper John Day spring chinook salmon populations. This is also reflected in the EDT stock recruitment results (Figure 18). These three populations are at low abundance ($\leq$ 500) and are near replacement level of productivity. During any future periods of adverse environmental conditions, these populations of spring chinook salmon may not be able to maintain themselves.

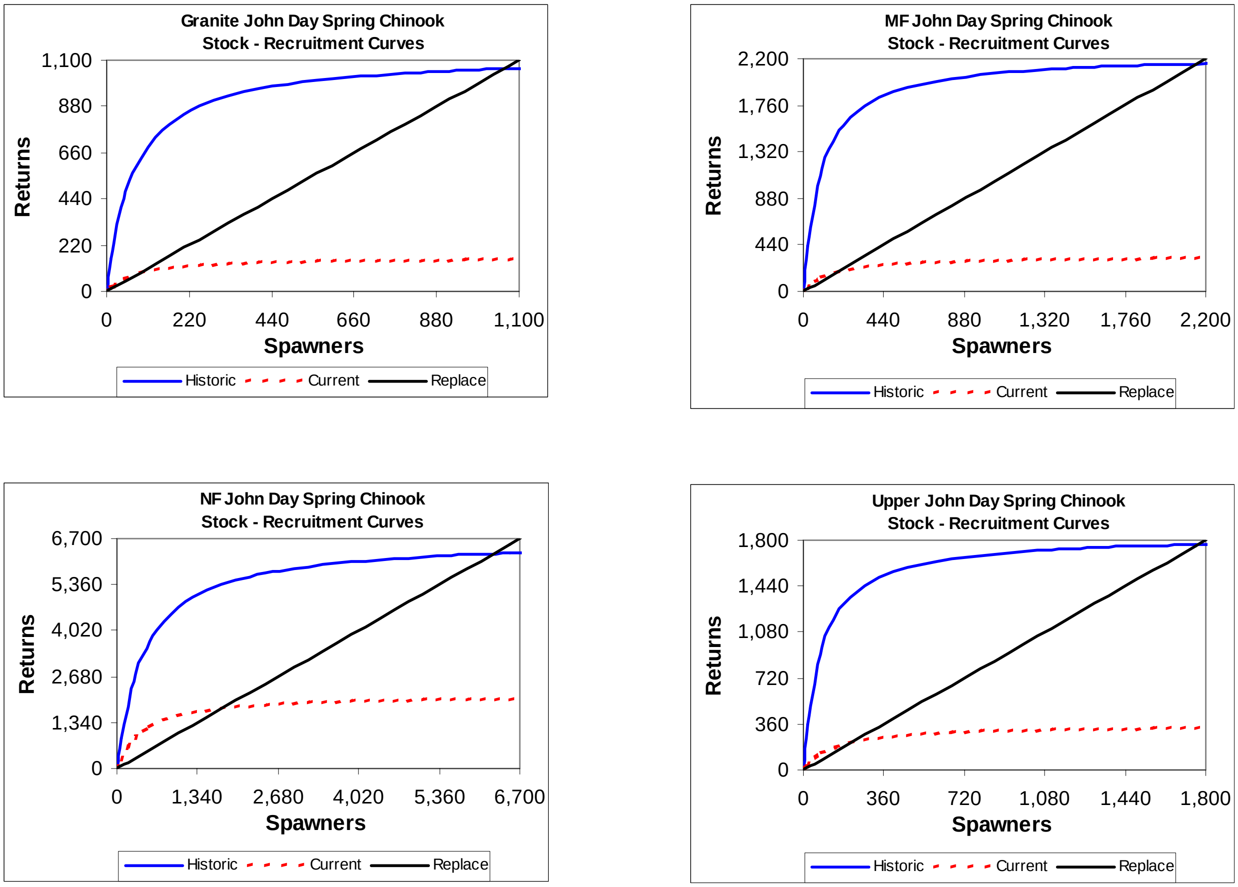

Figure 18. Stock recruitment curves produced by EDT baseline report for the four populations of the John Day Subbasin.

Juvenile Productivity. Changes made to the model and the rating of additional reaches have increased the productivity levels for all spring chinook populations from those first reported in the spring 2004 subbasin plan. All populations now exceed 2.0, while past numbers exceeded 2.0 only for the North Fork population.

There have been several efforts to determine the smolt production in the John Day Subbasin.

1. ODFW 1988 smolt production estimates were 306,400 smolts. This was determined utilizing the 1987 estimated escapement of 4,596 adults (ODFW 1990).
2. Five-year average estimated production from spawning ground surveys = 240,000 smolts (ODFW 1990).
3. United States vs. Oregon subbasin reports estimate 279,000 current smolts and project the future number of smolts to be 356,250 (ODFW 1998).

The U.S. vs. Oregon data shown in #3 above is believed to be the best estimate available.

The data shown in Table 34 illustrates that the smolt production estimated by EDT (61,953) is far smaller compared to estimates determined from a variety of sources listed above. Smolt productivity (smolts/spawner) does not vary as much as other indicators between populations in the adult baseline report. Values range from 76 smolts/spawner (Granite Creek) to 110 smolts/spawner (North Fork). EDT current (based on 1992-97enviromental conditions) smolt production is greatest for the North Fork population (42,130) and ranges between 3,800 and 8,600 for the remaining populations. Smolt production in the Middle Fork and the upper mainstem should be similar to the numbers coming out of the North Fork and the recent ODFW research has placed smolt estimates for the entire John Day at:

- 2001 – 92,900
- 2002 – 103,100
- 2003 – 83,950
- 2004 – 91,400

Table 34. Spring chinook juvenile population averages from EDT.

Population Area	EDT Historic Abundance Potential	EDT Baseline Abundance (no harvest)	EDT Baseline Productivity[1] (no harvest)	EDT Baseline Capacity (no harvest)
North Fk JD	127427	42130	110	54078
Granite Cr	22682	3806	76	9252
Middle Fk JD	43025	7416	81	15376
Upper JD	38570	8601	98	14426
Total	231704	61953		93132

[1] smolts per spawner

The two most likely reasons that EDT is underestimating present smolt production are the problems with the reach ratings and/or the rearing “patch” which may not adequately account for all tributary production. In either case this discrepancy and subsequent estimates of survival rates are felt to be too unreliable for use at this time. However EDT results are useful for analyzing the causes for decline from template conditions, but should be used cautiously when estimating the amount of decline or present productivity.

See Appendix T for more detailed results of adult and juvenile spring chinook populations modeling in EDT.

Diversity. The EDT model produces an index that expresses the diversity as a percent of the historic potential (Note: historic diversity is, by definition, 100%). Corrections to the spring 2004 model runs have increased diversity for all the populations and benefited the Middle Fork and the Upper John Day the most. Work in the spring of 2004 indicated that the North Fork had the greatest diversity and the Upper John Day had the lowest diversity at 5%. The most recent runs of the EDT model for the four population of spring chinook salmon in the John Day Subbasin results without harvest are as follows:

- North Fork John Day – 81%
- Granite Creek – 41%
- Middle Fork John Day – 71%
- Upper John Day – 89%

The diversity index changed the least from historic to present conditions compared to productivity and abundance. Losses ranged from 59 percentage points for the Granite Creek population to 11 percentage points for the Upper John Day population.

Identification of Limiting Factors

Environmental Relationships by Population. One of the EDT model outputs is a list of potential protection and restoration areas and their ranks. For the John Day Subbasin the planners chose HUC5 watersheds, of which the John Day Subbasin has 43, as the Geographic Areas for summarizing EDT diagnostic results. High restoration potential ranking HUC5s may produce the greatest increase in productivity and abundance with restoration. Those designated with a “high” protection value are most important to preserve current habitat and environmental conditions. The limiting factors are also presented with each HUC5 and are ranked as having “high” (or large), “medium,” “low,” or “no” impact on focal species survival. Only “high” and “medium” priority attributes are listed with the top quartile of HUC5s for restoration. Priority HUC5s were those ranked within the top quartile of all HUC5s used by a single population. Priority attributes are those rated as having “high” or “medium” impact on production. Only the top quartile results for each population of spring chinook salmon that was analyzed are presented here. See Appendix U for complete results on the ranking of restoration and protection HUC5s for spring chinook salmon.

Granite Creek. The Granite Creek spring chinook population spawns only in the Granite Creek HUC5. All other HUC5s that are important to this population are similar habitat that is occupied by the North Fork population and the common migration corridor of the Lower John Day River. Table 35 lists only the top quartile HUC5s from 11 HUC5s assigned by EDT as important for this population.

Table 35. Top quartile protection and restoration geographic areas with important restoration attributes as estimated by EDT (black), with additional attributes listed by the subbasin planners (gray) for Granite Creek spring chinook.

Granite John Day Spring Chinook					
Geographic area priority			**Attribute for Restoration**		
Geographic area	**Protection benefit**	**Restoration benefit**	***Habitat diversity***	***Sediment load***	***Key habitat quantity***
Granite Creek	X	X	■	■	■
NF JDR Big Creek	X	X	▒		■
NF JDR Potamus Creek	X	X	■		■

All three HUC5s in the top quartile are listed for both protection and restoration, which signifies that all three should be protected from any further degradation and that restoration on any of the limiting factors listed would have the potential to increase productivity and abundance for the population. The NF JDR Big Creek and NF JDR Potamus Creek HUC5s are located immediately downstream of Granite Creek. Common to all three HUC5s is key habitat diversity, which was given priority by EDT for focal species survival. Habitat diversity is a priority for Granite Creek and is understood by the technical team to be very important for NF JDR Big Creek even though EDT did not identify it as a priority.

Middle Fork. The Middle Fork spring chinook population spawns in the HUC5s of Big and Camp creeks and Upper MF JDR. Other HUC5s that are important to this population (defined by EDT) are the remaining areas of the Middle Fork John Day River and habitat that is occupied by the North Fork population below the confluence of the Middle Fork and the common migration corridor of the Lower John Day River. Table 36 lists only the top quartile HUC5s from 13 HUC5s assigned by EDT as important to this population.

Table 36. Top quartile protection and restoration geographic areas with important restoration attributes as estimated by EDT (black), with additional attributes listed by the subbasin planners (gray) for Middle Fork John Day spring chinook.

MF John Day Spring Chinook							
Geographic area priority			**Attribute for Restoration**				
Geographic area	**Protection benefit**	**Restoration benefit**	***Flow***	***Habitat diversity***	***Sediment load***	***Temperature***	***Key habitat quantity***
Big Creek	X	X		black		black	black
Camp Creek	X	X	gray	black	black	black	black
Upper MF JDR	X	X	gray	black	black	gray	black

All three of the HUC5s in the top quartile are listed for both protection and restoration; these three are the spawning habitat of the Middle Fork population. EDT is indicating that these HUC5s should be protected from further degradation and that restoration on the listed limiting factors should increase productivity and abundance for the population. Among the top areas listed, EDT indicates that Camp Creek is in need of restoration on the most habitat attributes. The attributes of temperature and key habitat quantity for Camp Creek were ranked as the greatest priority for species survival. Spawning for this population covers the entire length of the Middle Fork John Day River in the Camp Creek HUC5. Spawning in Big Creek and Upper MF JDR HUC5s are approximately a third of the length in Camp Creek HUC5. In addition, the technical team believes that flow should be a greater priority for increasing chinook productivity and abundance in Camp Creek and Upper MF JDR HUC5s than suggested by the EDT results. Temperature is also of concern in the Upper MF JDR area. The technical team would elevate its priority, whereas EDT places it in a low priority.

North Fork. The North Fork spring chinook population spawns in several HUC5s in the watersheds of Camas and Desolation creeks, and Middle and Upper NF John Day rivers. Other HUC5s that are defined by EDT as important to this population are common areas of the migration corridor in the Lower John Day River. Table 37 lists only the top quartile HUC5s from 14 HUC5s EDT assigned to this population.

Table 37. Top quartile protection and restoration geographic areas with important restoration attributes as estimated by EDT for North Fork John Day spring chinook.

NF John Day Spring Chinook					
Geographic area priority			**Attribute for Restoration**		
Geographic area	**Protection benefit**	**Restoration benefit**	***Habitat diversity***	***Temperature***	***Key habitat quantity***
Desolation Creek	X				
Lower Camas Creek		X	■	■	■
NF JDR Big Creek	X	X	■	■	■
NF JDR Potamus Creek	X	X	■	■	■
Upper NF JDR	X				

For this population, EDT lists only two of the spawning areas as needing both protection from additional habitat degradation and restoration of habitat attributes with limiting factors. These two HUC5s are also shared as priority areas with the Granite Creek population. The technical team did not have any further addition to these EDT results.

Upper John Day. The upper mainstem spring chinook population spawns in several HUC5s. Most of the spawning occurs in the Upper JDR and Strawberry Creek HUC5s. A small area is used for spawning in the Canyon Creek watershed and, on rare occasions, spawning occurs in the Lower South Fork of the John Day River (since spawning in the SF is rare for this population, it was not included in the EDT analyses). Other HUC5s that are defined by EDT as important to this population are middle areas of the mainstem above the NF and the common areas of the migration corridor in the Lower John Day River. Table 38 lists only the top quartile HUC5s from 13 HUC5s assigned by EDT to this population.

For this population, EDT lists only two of the spawning areas as needing both protection from additional habitat degradation and restoration of habitat attributes with limiting factors. Canyon Creek, a spawning area, was not listed. However, Laycock Creek, a HUC5 immediately downriver of all three spawning areas, is listed for both protection and restoration. EDT rated key habitat quantity as high priority for all of the HUC5s listed.

The technical team questions several of the EDT ratings for spring chinook in this geographic area. While temperature rated as a high priority for the Upper JDR, the team feels that the Laycock Creek HUC5 was not rated high enough for this attribute. Also, while EDT rated flow as of little importance for Strawberry and Laycock creeks, the team would place greater importance on this attribute for these three HUC5s.

Table 38**.** Top quartile protection and restoration geographic areas with important restoration attributes as estimated by EDT (black), with additional attributes listed by the subbasin planners (gray) for Upper John Day spring chinook.

Upper John Day Spring Chinook							
Geographic area priority			**Attribute for Restoration**				
Geographic area	**Protection benefit**	**Restoration benefit**	***Flow***	***Habitat diversity***	***Temperature***	***Key habitat quantity***	
Laycock Creek	X	X	▒	■	▒	■	
Strawberry Creek	X	X	▒	■	■	■	
Upper JDR	X	X	▒	■	■	■	

Further, while the HUC5s listed above for the four populations of spring chinook are of great importance, the technical team feels that restoration work in steelhead-based tributary streams will be the most cost-effective strategy to achieve improvements for all species. Therefore, the team tended to rank HUC5s with large tributaries as higher priorities for restoration based on the steelhead outputs from EDT with the assumption that what is good for steelhead will also benefit tributary rearing spring chinook salmon.

<u>Analysis of Limiting Factors</u>

Several limiting factors have already been presented for the top quartile HUC5s of each spring chinook salmon population. Another limiting factors breakdown of EDT output was completed on all the HUC5s used by spring chinook. Here the percentage of geographic areas (HUC5s) with attribute classes of “high” or “medium” priority for restoration was compared (Figure 19). Since the main use of the Lower John Day Subbasin by the populations of spring chinook salmon is as a migration corridor, the mean scores (from four populations) of each HUC5 were used in this common area.

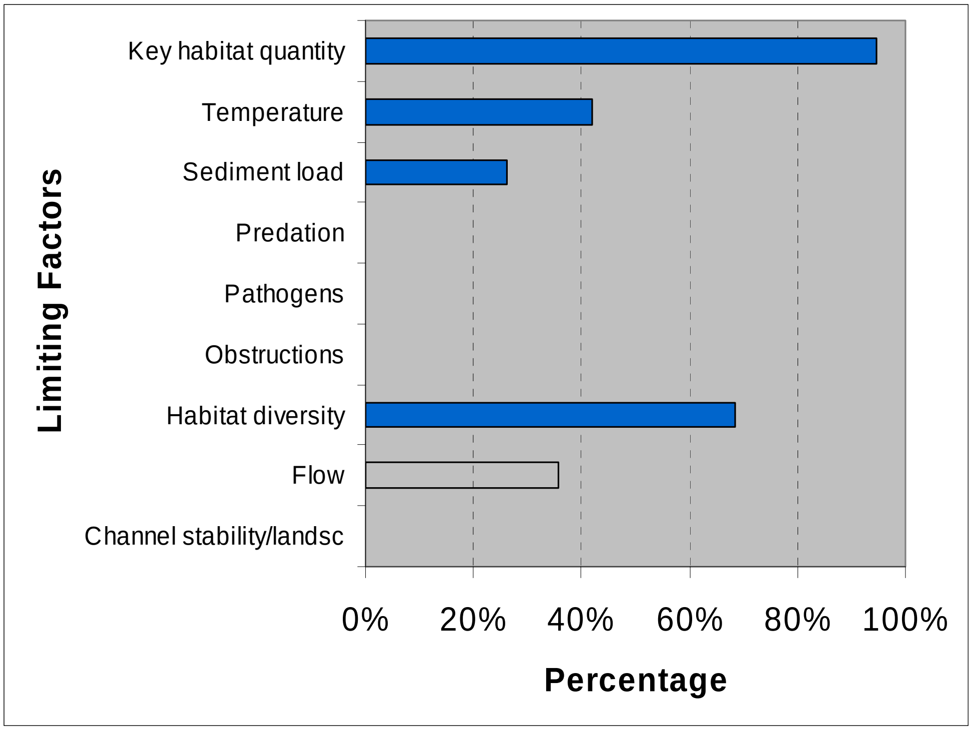

Figure 19. Limiting factors for spring chinook by percentage of geographic areas (HUC5s of the John Day Subbasin).

Key habitat quantity is a limiting factor for approximately 95% of the geographic areas. This is a very similar result to that found for summer steelhead. Key habitat quantity refers to the key habitat type required of each life stage for each species; the physical area of each of these habitats is accumulated across all life stages. Channelization of streams and rivers can affect almost all the key habitats over the range of life stages. Further, a major loss of a few habitat types for some of the life stages (for example, the loss of 60% of pool habitat between current and historic conditions) would produce a limiting factor from key habitat. Habitat diversity showed up in almost 70% of the geographic areas of spring chinook, very similar to the finding for steelhead. Temperature as a limiting factor was again similar between spring chinook and summer steelhead as a limiting factor in 40 to 50% of the geographical areas for each species. For spring chinook, sediment load was a limiting factor for approximately 30% of the areas, while steelhead had more than twice as many areas with this limiting factor. Although flow was a limiting factor for summer steelhead it did not show up in the spring chinook EDT results. However, the technical team believes that flow should also be included as a limiting factor for spring chinook for several of the HUC5s representing almost 40% of the top priority areas.

<u>Relationship to Delisting Criteria</u>

Spring chinook salmon in the Mid Columbia ESU are not proposed for listing at this time. Hence, no interim or final delisting criteria have been proposed. However, three chinook populations are presently in what could be termed a borderline status and could be candidates for listing if they were to decline significantly during periods of poor environmental conditions.

The abundance of Granite Creek, Middle Fork and Upper John Day populations are all near 500 fish. Populations below this level may increase the risk of negative demographic impacts from environmental variation and of unwanted genetic change in small populations. Though the Middle Fork and Upper John Day populations have been increasing recently, their productivity is relatively low, indicating they would be more vulnerable to decline during periods of adverse environmental conditions. The Granite Creek population has been relatively stable during the last several years, but should receive particular attention for restoration actions because it exhibits a long-term declining trend.

3.2.4 Aquatic Focal Species Population Delineation and Characterization

Bull Trout *(Salvelinus confluentus)*

Much of this bull trout section was taken from the U.S. Fish and Wildlife Service's 2003 draft recovery plan for the John Day River Recovery unit (USFWS 2003).

Bull Trout Population Data and Status

The U.S. Fish and Wildlife Service issued a final rule listing the Columbia River and Klamath River populations of bull trout (*Salvelinus confluentus*) as a threatened species under the Endangered Species Act on June 10, 1998 (63 FR 31647). An emergency rule listing the Jarbidge River population as endangered due to road construction activities was published on August 11, 1998 (63 FR 42757), and the population was subsequently listed as threatened on April 8, 1999 (64 FR 17110), when the emergency rule expired. The Coastal-Puget Sound and St. Mary-Belly River populations were listed as threatened on November 1, 1999, (64 FR 58910), which resulted in all bull trout in the coterminous United States being listed as threatened. The five populations discussed above are listed as distinct population segments, *i.e.*, the U.S. Fish and Wildlife Service has concluded that they meet the requirements of the joint policy with the National Marine Fisheries Service regarding the recognition of distinct vertebrate populations (61 FR 4722).

Bull trout present in the John Day Subbasin are part of the Columbia River Distinct Population Segment (DPS) encompassing parts of Oregon, Washington, Idaho and Montana. Historically, bull trout are estimated to have occupied about 60% of the Columbia River Basin. Presently bull trout occur in 45% of their estimated historical range (Quigley and Arbelbide 1997). The U.S. Fish and Wildlife Service identified the John Day Subbasin as one of 22 recovery units within the Columbia River Distinct Population Segment (USFWS 2003).

The John Day Recovery Unit includes bull trout from three watersheds: the North Fork John Day River, the Middle Fork John Day River, and a portion of the Upper Mainstem John Day River. Each of these areas corresponds to a core area for recovery purposes (Figure 20). Inclusions of other areas within the John Day River Recovery Unit (e.g., the mainstem John Day River below the town of Spray) have been identified as research needs. Research needs apply to areas where the recovery unit team feels more information is needed to accurately plan and implement recovery actions.

After considering information that is currently available, including that in Ratliff and Howell (1992), and Buchanan *et al.* (1997), eleven existing, local populations (or stocks) of bull trout within the John Day Subbasin were identified. A local population is considered to be fish of a given species which spawn in a particular lake or stream(s) at a particular season, and which to a substantial degree do not interbreed with any group spawning in a different place, or in the same place at a different season.

Although bull trout historically occurred throughout the John Day Subbasin, they were probably never as abundant as other salmonids in the subbasin. It is certain that they were more abundant and more widely distributed than they are today. The local populations of the North Fork John Day River Core Area were described as a special concern in the early 1990s, indicating the possibility that extinction could occur (Ratliff and Howell 1992). Because of further reduced numbers since that time, these populations have been downgraded to having a moderate risk of extinction (Buchanan *et al.* 1997). Relative to extinction, the Middle Fork John Day River Core Area holds local populations at high risk of extinction since they are only found in tributaries, and are thought to be extinct in the Middle Fork John Day River itself (Ratliff and Howell 1992). Populations in the Upper Mainstem John Day Core Area are thought to be at moderate risk of extinction (Ratliff and Howell 1992).

North Fork John Day. According to the U.S. Fish and Wildlife Service, there are no **r**eliable estimates of populations for North Fork John Day streams (Paul Bridges, USFWS, personal communication, March 25, 2004).

Middle Fork John Day. Bull trout in the Middle Fork John Day River persist at low abundance levels. In 1999, population surveys were conducted in Clear Creek, Big Creek, Deadwood Creek and Granite Boulder Creek to estimate abundance. Total numbers of bull trout, consisting primarily of juvenile and subadult fish, were estimated to be 1950 individuals in Big Creek, 640 individuals in Clear Creek and 368 individuals in Granite Boulder Creek (Hemmingsen 1999). Additional surveys were conducted during the summer of 2000 in Vinegar Creek and part of Davis Creek. A single bull trout was found in Vinegar Creek and none were found in Davis Creek.

Upper Mainstem John Day River. The Oregon Department of Fish and Wildlife estimated from 1990 surveys that the Upper Mainstem John Day River, Call Creek, and Rail Creek may have more than 300 total spawning adults (ODFW 1995).

Bull trout typically have more specific habitat requirements than other salmonids.
As a result, bull trout are more sensitive to changes in habitat and less able to persist and thrive when habitat conditions are altered or degraded (Rothschild and DiNardo 1987). Channel and hydrologic stability, substrate, cover, temperature, and the presence of migration corridors consistently appear to influence bull trout distribution or abundance (Ziller 1992).

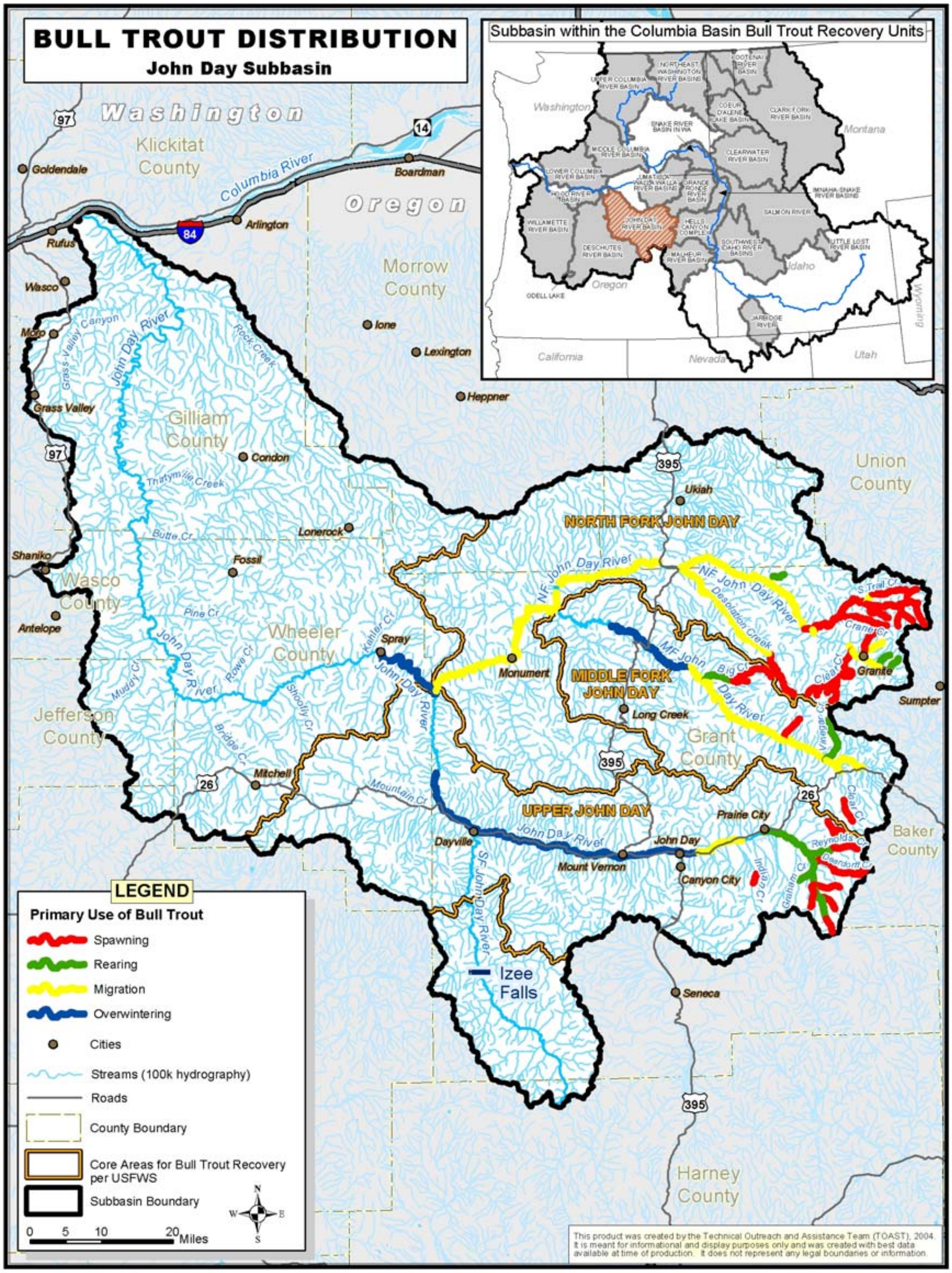

Figure 20. Bull trout distribution and Recovery Unit core areas in the John Day Subbasin.

Adults usually spawn from August through November in the coldest headwater tributaries of a river system, and require water temperatures less than 50° F for spawning, incubation and rearing (Weaver and White 1985). Although migratory bull trout (fluvial and adfluvial) may use much of a river basin through their life cycle, rearing and resident fish often live only in smaller watersheds or their tributaries (second to fourth order streams) (Ziller 1992).

Juvenile bull trout are closely associated with stream channel substrates, often using interstitial (space between substrate) spaces for cover (Fraley and Shepard 1989). A close association with channel substrates appears more important for bull trout than for other species. This specific rearing habitat requirement suggests that highly variable streamflows, bed movements, and channel instability will influence the survival of young bull trout, especially since embryos and alevins incubate in substrate during winter and spring (Rieman and McIntyre 1993).

A study to determine bull trout life history in the John Day River above Prairie City is currently underway (*Bull Trout Life History Project* by Oregon Department of Fish and Wildlife). Preliminary results from that study indicate that a remnant fluvial population persists and that movement is highly correlated to water temperatures and time of spawning. Adult bull trout migrate upstream in the John Day River toward spawning areas as early as July and commence spawning in early September. Spawning is usually complete by early November, at which time the adults immediately move downstream. It is assumed that bull trout in the Middle Fork and North Fork watersheds exhibit a similar migration pattern.

Information on carrying capacity is not currently available. However, the USFWS bull trout recovery team believes that, in a recovered condition, the subbasin will support about 5000 adult spawners, with perhaps 1500 each for the upper mainstem and Middle Fork core areas and 2000 for the North Fork core area. (Ron Rhew, USFWS, personal communication, April 20, 2004).

Bull trout have very low levels of genetic variation within populations (such as the John Day, Umatilla and Grande Ronde subbasin populations) but are highly differentiated between populations (Spruell and Allendorf 1997). The John Day and Grande Ronde bull trout populations tend to be similar genetically. However a unique allele frequency was found in seven of 10 John Day populations which was not present in any of the 11 Grande Ronde populations (Spruell and Allendorf 1997). The Oregon Department of Fish and Wildlife has collected enough data on bull trout in the John Day Subbasin to believe that there is genetic interchange between the population within the subbasin (Tim Unterwegner, ODFW, personal communication, April 13, 2004). Radio tagging and trapping efforts lead ODFW to believe that bull trout are migrating fairly extensively throughout the John Day River and its major tributaries above the town of Spray (Tim Unterwegner, ODFW, personal communication, April 13, 2004).

Bull Trout Distribution

Bull trout are indigenous to the John Day Subbasin and historically had a wider distribution within the subbasin than at present. The current distribution of bull trout is clearly fragmented (Howell and Buchanan 1992). The John Day watershed presently contains three bull trout subpopulations: one in the Upper John Day River, a second in the Middle Fork John Day River and a third in the North Fork John Day River. Bull trout distribution is limited primarily to headwaters of the Upper Mainstem, North Fork and Middle Fork John Day River tributaries, with seasonal use of the entire North Fork John Day River. In the winter of 2004, ODFW documented subadult bull trout movement in the mainstem John Day River down to the National Park Service Interpretive Center at RM 203 and in the Middle Fork down to the hot springs at Ritter (RM 15). Two individuals were caught in a downstream migrant screw trap on the mainstem and one individual was caught in another screw trap on the Middle Fork (Tim Unterwegner, ODFW, personal communication, April 8, 2004). See Figure 20 for distribution of bull trout within the John Day Subbasin.

Upper Mainstem John Day River. Based on distribution information contained in Buchanan *et al.* (1997), and professional judgment of the John Day River Recovery Unit Team, the USFWS identified two bull trout local populations in the Upper Mainstem John Day River. The first is the Upper John Day River local population (includes a portion of the mainstem John Day River, Deardorff Creek, Reynolds Creek, Rail Creek, Roberts Creek, and Call Creek) and the second is the Indian Creek local population above the flow barrier (Buchanan *et al.* 1997).

Historical records indicate the presence of bull trout in Dads Creek, Dixie Creek, Pine Creek, Canyon Creek, Laycock Creek, and Beech Creek (Buchanan *et al.* 1997). Resident (summer distribution) bull trout currently occupy approximately 48 miles of stream in the Upper Mainstem John Day River (MNF 1998a and 1999a). These areas that possess habitat that would be suitable for bull trout have been identified as potential local populations. The existing and potential local populations for the Upper Mainstem John Day River are displayed in Table 39 and Figure 21.

Table 39. List of current and potential local bull trout populations in the Upper John Day River subwatershed.

Population Number	Local Population	Existing Local Population	Potential Local Population	Life History Forms Present
1	Upper John Day River (includes mainstem John Day River, and Call, Reynolds, Deardorff, and Rail Creeks)	X		Resident and Fluvial
2	Indian Creek above flow barrier	X		Resident
3	Pine Creek		X	
4	Canyon Creek		X	
5	Strawberry Creek		X	

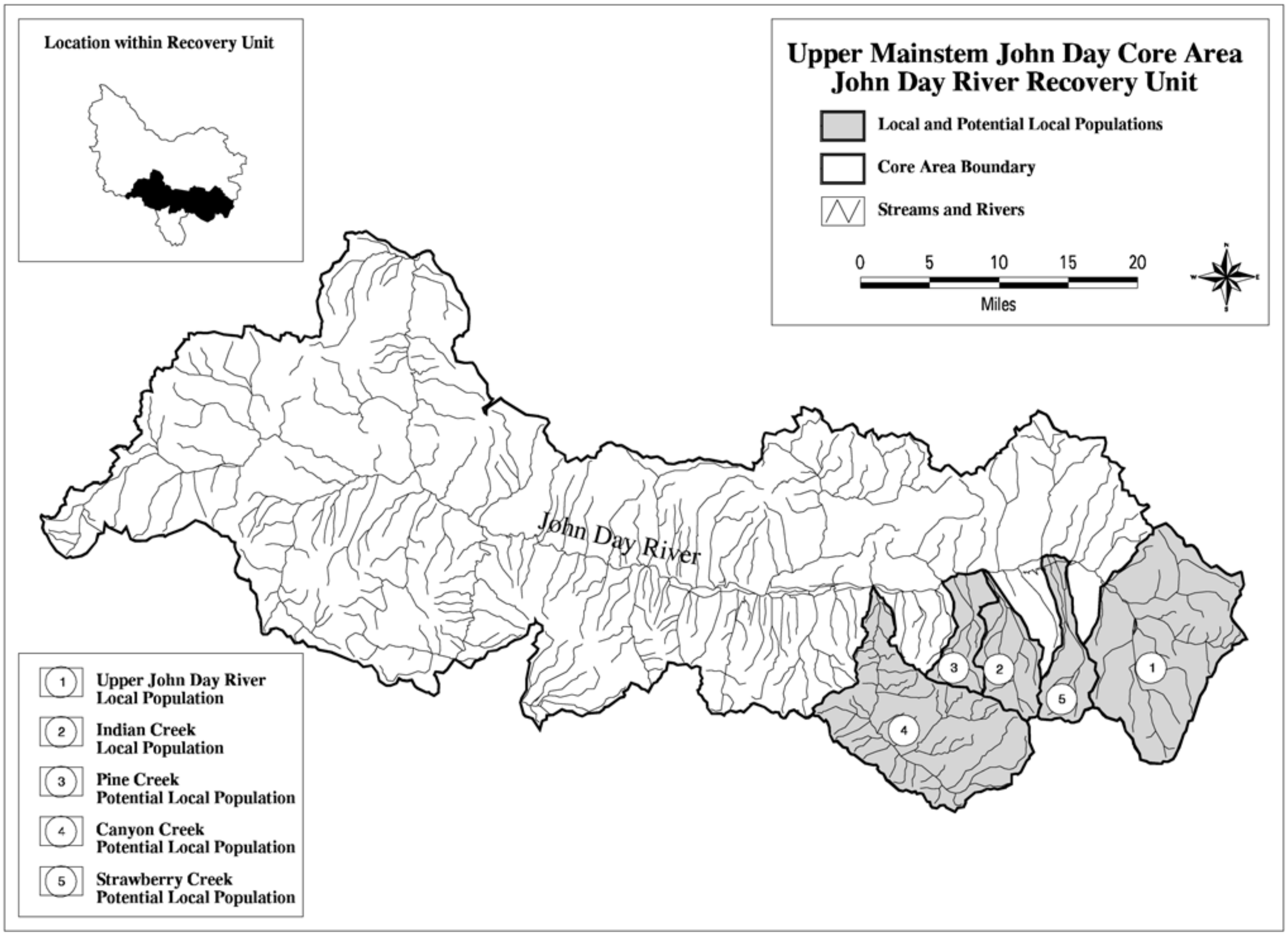

Figure 21. Bull trout local populations within the Upper Mainstem John Day Core Area.

Middle Fork John Day River. Distribution information for the Middle Fork John Day River indicates that three local populations currently exist within this drainage: Big Creek, Clear Creek and Granite Boulder Creek (Buchanan *et al.* 1997). The Malheur National Forest has identified an additional five areas as potential habitat for bull trout local populations (potential local populations) (1998a), including Big Boulder Creek, Butte Creek, Davis Creek, Upper Middle Fork John Day River, and Vinegar Creek. Isolated sightings of bull trout have been confirmed in Vinegar Creek. These existing and potential local bull trout populations for the Middle Fork John Day watershed are shown in Table 40 and Figure 22.

Current distribution in the Middle Fork John Day River is based on isolated sightings with the primary distribution restricted to tributaries and limited to 22% of stream miles previously known to support bull trout (Claire and Gray 1993, Buchanan *et al.* 1997). Data from the 1990 and 1992 Oregon Department of Fish and Wildlife Aquatic Inventory Project indicates that bull trout occupy approximately 16 miles of stream in the Middle Fork John Day River watershed, including 5.5 miles in Big Creek, 2.5 miles in Deadwood Creek (a tributary to Big Creek), 4 miles in Granite Boulder Creek; and 4 miles in Clear Creek.

Table 40. List of current and potential local bull trout populations in the Middle Fork John Day River subwatershed.

Population Number	Local Population	Existing Population	Potential Population	Life History Forms Present
1	Big Creek and tributaries	X		Resident and Fluvial
2	Clear Creek	X		Resident
3	Granite Boulder Creek	X		Resident and Fluvial
4	Big Boulder Creek		X	
5	Butte Creek		X	
6	Davis Creek		X	
7	Upper Middle Fork John Day River (mainstem and tributaries above Clear Creek)		X	
8	Vinegar Creek		X*	

*****Confirmed isolated sightings of bull trout.

Bull trout migration from these tributary streams during the summer is highly unlikely due to high water temperatures and habitat modifications in the mainstem. Aquatic inventory surveys conducted by the Oregon Department of Fish and Wildlife in 1990 and 1991 detected 60 bull trout in the Middle Fork John Day River watershed; two fish were measured at 10 inches and 14 inches, all others were less than eight inches in length (Buchanan *et al.* 1997). In the 1999 and 2000 surveys of Clear Creek, eight redds were observed each year (MNF 2001).

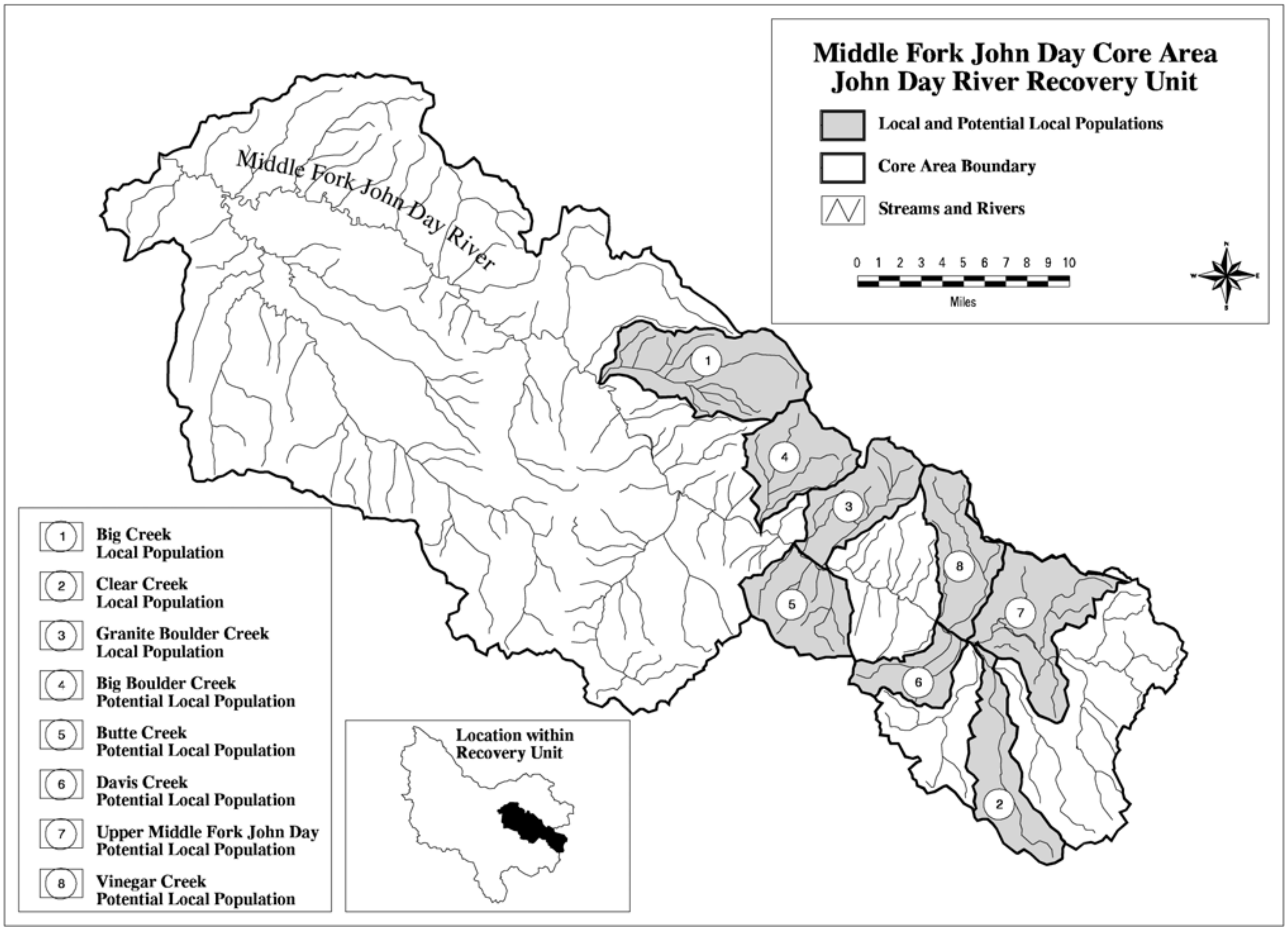

Figure 22. Bull trout local populations within the Middle Fork John Day Core Area.

North Fork John Day River. Based on distribution information contained in Buchanan *et al.* (1997), and professional judgment of the John Day River Recovery Unit Team, six local populations have been identified in the North Fork John Day River subbasin: Desolation Creek (includes South Fork Desolation Creek below the falls and North Fork Desolation Creek); Lower Clear Creek below the Pete Mann ditch (including Lightning Creek below the ditch); upper Clear/Lightning Creek including Salmon Creek, upper Granite Creek including Bull Run, Deep, Boulder, and Boundary creeks and the upper mainstem Granite Creek); upper North Fork John Day River (Crawfish, Baldy, Cunningham, Trail, Onion, and Crane creeks as well as the North Fork John Day River upstream of Granite Creek; and upper South Fork Desolation Creek above the falls. Based upon inventories conducted in 1992, bull trout distribution in the North Fork John Day River and tributaries is limited to 18% of the previously known range (Claire and Gray 1993).

The existing populations for the North Fork John Day Core Area are displayed in Table 41 and Figure 23 below. No potential populations were identified.

Table 41. List of current local bull trout populations in the North Fork John Day River subwatershed.

Population Number	Local Population	Existing Population	Life History Forms Present
1	Desolation Creek (includes South Fork Desolation Creek below waterfall, North Fork Desolation, and West Fork Meadowbrook creeks)	X	Fluvial and Resident
2	Lower Clear Creek below the ditch (includes Lightning Creek below ditch)	X	Resident
3	Upper Clear/Lightning creeks above the ditch (includes Salmon Creek)	X	Resident
4	Upper Granite (includes Bull Run, Deep and Boundary , Boulder Creeks and upper mainstem Granite Creek)	X	Fluvial and Resident
5	Upper North Fork John Day River (includes Crawfish, Baldy, Cunningham, Trail, Onion and Crane creeks, as well as mainstem North Fork John Day River upstream of Granite Creek)	X	Fluvial and Resident
6	Upper South Fork Desolation Creek above waterfall	X	Resident

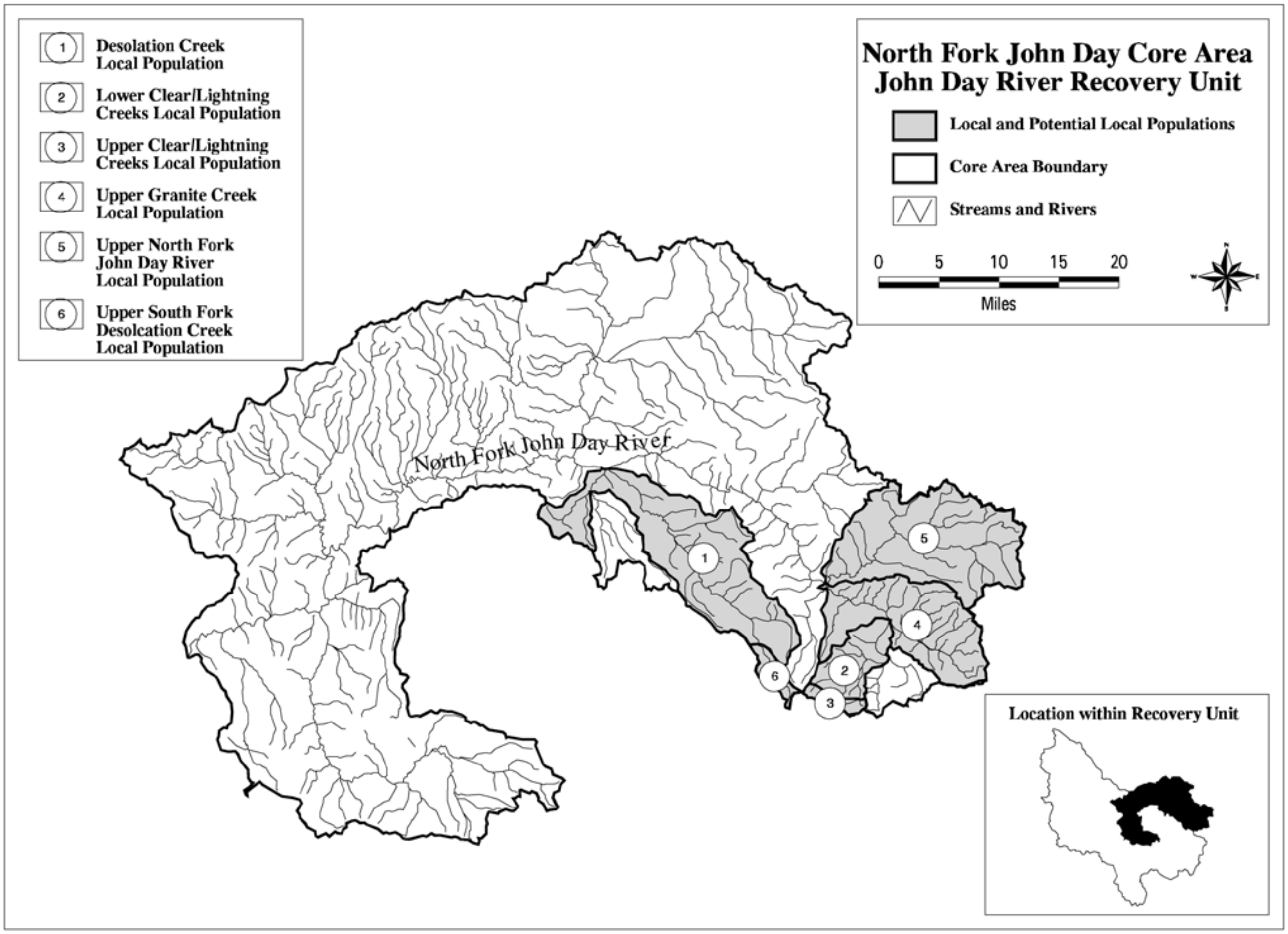

Figure 23. Bull trout local populations within the North Fork John Day Core Area.

Mainstem John Day River. Recent survey work by the Oregon Department of Fish and Wildlife (Hemmingsen *et al.* 2001) detected bull trout in the mainstem John Day River at river mile 170 near the town of Spray, downstream of the confluence with the North Fork John Day River (river mile 183). Two bull trout were radio tagged and tracked upstream during the summer. One bull trout was tracked to river mile 66 of the North Fork John Day River. It had traveled about 112 miles upstream during a period of 77 days. The second bull trout traveled about 137 miles upstream to river mile 3.8 in Granite Creek, a tributary to the North Fork John Day River (Hemmingsen *et al.* 2001). Presence of bull trout below the confluence of the two tributaries is an indication the local bull trout populations of the North Fork and Middle Fork John Day rivers may be connected via seasonal migration between these two subbasins and that the mainstem may serve as bull trout over-wintering and migration habitat.

In 2000, the Oregon Department of Fish and Wildlife captured eleven bull trout in the mainstem John Day River near the town of Spray, Oregon, while seining for juvenile chinook salmon. Two of the fish were implanted with radios and both were subsequently tracked into the North Fork John Day River. One was tracked upstream to Granite Creek, and the second was tracked as far as Texas Bar Creek, although it may not have gone that far on its own. The radio tag was found at the base of a tree containing an osprey nest. One of the fish tagged was 9.2 inches and the other was 9.7 inches long (Hemmingsen *et al.* 2001).

Although the role of the lower mainstem of the John Day River is not well understood at this time, it may be an important link between bull trout populations within the John Day Subbasin and the Columbia River. The recovery team has not identified this portion of the John Day River as essential for recovery at this time. But as further information becomes available, it may be appropriate to recognize the importance of the lower mainstem John Day River from its confluence with the North Fork John Day to its confluence with the Columbia River.

Within the John Day Subbasin, historic bull trout distribution likely included seasonal use of the entire mainstem and larger tributaries. Bull trout from the John Day Subbasin were known to migrate to and from the Columbia River (Buchanan *et al.* 1997). Historical records indicate presence of bull trout in Dads Creek, Dixie Creek, Pine Creek, Canyon Creek, Laycock Creek, and Beech Creek (Buchanan *et al.* 1997).

Elevated water temperature and reduced streamflow due to water diversions in the mainstem river and larger tributaries typically act as thermal barriers to migration during summer and early fall, isolating the local populations (Buchanan *et al.* 1997). Thermal barriers to migration exist in many reaches of stream where irrigation of agricultural lands take place. These barriers also exist in some forested reaches, particularly where channel alterations have occurred, or riparian vegetation has been altered or reduced by livestock grazing, logging, road building or mining.

<u>Description of Aquatic Introductions, Artificial Production and Captive Breeding Programs</u>

Bull trout recovery could be enhanced by the reintroduction of bull trout to areas in streams above many natural and man-made barriers (e.g., Cunningham Creek, Lightning Creek, both in the North Fork Core Area). For example, Bridge Creek is adjacent to Clear Creek (currently inhabited) and could provide about 11 miles of high quality habitat with good water quality that could be recolonized by bull trout (ODFW *in litt*. 2000). Access to Bridge Creek was blocked by a 15-foot dam (ODFW *in litt*. 2000), but passage was provided and steelhead have been entering the stream since 2001. Bull trout may now be entering Bridge Creek as well (USFWS 2003).

Although the USFWS draft recovery plan identifies opportunities for expansion above barriers (such as Cunningham Creek and Winom Creek), the recovery team did not feel that the likelihood of a separate potential population would be great, but that these would simply be expansions of current populations. The best example is Cunningham Creek, where the team proposed reintroduction of bull trout above the gradient barrier, using bull trout stock from below the barrier (Paul Bridges, USFWS, personal communication, March 25, 2004).

<u>Environmental Conditions for Bull Trout</u>

Historic land use activities that have impacted local bull trout populations include construction and operation of roads (including culverts that pose as fish passage barriers), forestry practices, agricultural development, livestock grazing, and mining. Some historic practices, such as pushup dam construction, that resulted in passage barriers may have significantly reduced important fluvial bull trout populations. Lasting effects from some of these early land use activities still limit bull trout distribution and abundance in the John Day River Recovery Unit.

Existing land use activities that contribute to compromised bull trout and other fish habitat include the formation of pushup dams for irrigation, riparian road construction and use, riparian grazing, agricultural development, residential developments, recreational use of riparian areas, mining and competition with non-native species.

Dams. There are no major hydropower dams located in the John Day Subbasin (ODA 2001). Anadromous fish access to the John Day Subbasin is constrained by passage through three mainstem Columbia River Dams: Bonneville, The Dalles, and John Day. Any limitation on the production of anadromous fish in the John Day Subbasin has a negative effect on stream productivity due to the loss of nutrients imported by the anadromous fish. This resource loss affects native fish, including bull trout in the John Day Subbasin, by the direct loss of potential prey as well as limiting the productive capacity of area streams for other fish and invertebrate prey species.

Forest Management Practices. Fire suppression policies and other forest management practices have affected both the composition and structure of forest stands in the subbasin (MNF 1998a and 1999b). Intensive fire suppression, a top priority for resource managers since the early 1900s, has reduced the frequency of "low intensity" fires. Without periodic low or moderate intensity fires or other disturbance, stand densities tend to increase and tree species composition shifts to favor shade-tolerant trees (UNF 1997).

In places, historic forest management practices have shifted forest composition from lodgepole pine to white fir as the dominant overstory in some areas of the forest and from ponderosa pine to Douglas fir in other areas (ODFW *in litt*. 2000). The removal of large diameter, fire-tolerant trees and the subsequent management of the faster-growing fir tree species have resulted in dense stands of trees that are more susceptible to larger fires and less conducive to more frequent low intensity fires (UNF 1997, MNF 1998a). The increase in large fires can be attributed to both weather conditions that followed the start of a fire and the type of fuels (MNF 1999b). Resulting fires impacted bull trout habitat, indirectly increasing sedimentation and water temperatures by loss of ground covering vegetation (Buchanan *et al.* 1997).

Upper Mainstem John Day River. Use of ground-based logging equipment on steep (greater than 30%) slopes and high road densities can contribute sediment to bull trout spawning and rearing areas (ODFW *in litt.* 2000). Increased stream temperatures, increased sediment delivery, and loss of large pools, in part from inappropriate forest management practices, are the main factors limiting bull trout productivity in this area.

Middle Fork John Day River. With the exception of Clear and Lunch creeks, the amount of large wood in streams and stream pool depths have been reduced in many reaches due to past harvest, railroad, and road building activities (MNF 1998a).

North Fork John Day River. Fish habitat has been affected through high water temperatures due to a lack of streamside shade, increased amounts of fine sediments, altered hydrologic patterns, lost pool habitat, and low amounts of in-stream woody structure (UNF and WWNF 1997a and 1997b).

Livestock Grazing. Livestock management practices that result in high intensity riparian grazing, and/or season-long use of riparian areas, have the potential to raise stream temperatures by reducing shade, increasing the width-to-depth ratio of the channel (resulting from trampled banks), and collapsing undercut banks. Degradation of aquatic habitat parameters may occur from grazing, causing significant disruption of normal behavioral patterns in bull trout. These disruptions may include avoidance of habitat adjacent to certain activities (all life stages) and failure or delay of normal spawning activities (adult stages). Mortality from redd failure and nest collapse (egg, alevin, and juvenile stages) is possible due to the presence of livestock in the streams.

Grazing pressure from domestic livestock has been reduced in recent years on federal lands within the John Day Subbasin. Full implementation of and compliance with PACFISH and INFISH standards for livestock grazing will be a key for bull trout recovery.

Upper Mainstem John Day River. The Deardorff, Hot Springs, Rail Creek and Reynolds Creek livestock grazing allotments contain streams inhabited by bull trout in the Upper John Day River (MNF 1999a). The negative impacts, if any, of these grazing allotments on bull trout habitat are unknown.

Middle Fork John Day River. Several areas of the Middle Fork John Day River lack adequate riparian vegetation and shrubs necessary to prevent bank erosion and heating of water (ODFW *in litt*. 2000). The absence of shrubs and deciduous trees in meadows along the upper reaches of the Middle Fork John Day River has been attributed to summer long grazing (ODFW *in litt*. 2000).

North Fork John Day River. Historically, more intense livestock (cattle, horses and sheep) grazing, as compared to the present, over much of the North Fork John Day River drainage contributed to aquatic habitat degradation (UNF *in litt.* 2000). Some damaged riparian areas have been attributed to livestock grazing on private land in the lower North Fork John Day River tributaries and along Camas Creek, a tributary to the upper North Fork John Day River (ODFW 1990) (BLM *in litt.* 2003). Current grazing on National Forest land is much lighter than in the past, but localized areas may experience concentrations of livestock and/or wild ungulates sufficient to damage stream banks and degrade habitat quality (UNF *in litt.* 2000). Grazing on private land varies widely, but lower Camas and Owens creeks show ongoing stream bank damage from livestock (UNF *in litt.* 2000).

Agriculture Practices. Some agricultural practices have changed hydrology, contributing to degraded stream and riparian conditions throughout the subbasin. Draining and conversion of wetlands to pastures, diking and channelization of streams, and removal of extensive beaver colonies and large trees in riparian corridors have all reduced the connectivity between rivers and their floodplains (ODFW *in litt*. 2000).

Cumulatively, warm irrigation return flow combined with decreased in-stream flow has significantly altered the temperature regime of area streams and rivers (ODFW *in litt*. 2000). Recent work to cool these waters through subsurface return looks promising. The recently-adopted Upper John Day and South Fork Agricultural Water Quality Management Plan discusses this in detail (USFWS 2003, OWRB *in litt*. 2003). Attempts to armor riverbanks to prevent erosion have also simplified the river channel and reduced habitat diversity (ODFW *in litt*. 2000).

A high number of pushup dams are used for irrigation within migratory bull trout habitat (NWPPC 2001). Some of these temporary dams result in intermittent passage and interrelated impacts such as sedimentation, reduced flows, channel alteration and associated water quality impacts (NWPPC 2001). Although participation in the fish screening program for irrigation works is extensive, there still remain many legal diversions which are unscreened and existing screens that do not meet current screen criteria (NWPPC 2001).

Upper Mainstem John Day River. Streams currently occupied, historically occupied, or that are potential habitat for bull trout are affected by irrigation activities in the upper mainstem. Indian Creek has virtually no flow during part of each summer, which seasonally isolates a local bull trout population (ODFW *in litt*. 2000). Irrigation withdrawals completely dry Pine Creek, a historic bull trout stream, for several miles each summer (ODFW *in litt*. 2000). Strawberry Creek, which contains core bull trout habitat, has passage problems attributable to multiple diversions with inadequate jump pools or the presence of concrete aprons (ODFW *in litt*. 2000). This stream is inadequately screened and has multiple channels once it leaves National Forest land. One of the diversions intercepts the main channel blocking all upstream passage (ODFW *in litt*. 2000). Two wooden plank dams have been recently reported on Reynolds Creek within a mile or so of the John Day River, that are likely barriers to migratory fish due to inadequate jump pools and minimal spill (USFWS 2003).

Middle Fork John Day River. The Oregon Department of Environmental Quality (1998) identified all streams inhabited by bull trout in the middle fork system (Middle Fork John Day River, Big Creek, Granite Boulder Creek and Clear Creek) as water quality limited, primarily for high summer temperatures, but also flow modification of the Middle Fork John Day River. High water temperatures in the Middle Fork John Day River are a factor contributing to isolating bull trout local populations in the Middle Fork John Day Core Area (ODFW *in litt*. 2000). Potential habitat is also limited by irrigation structures.

North Fork John Day River. The Pete Mann Ditch diverts most of the West Fork Clear Creek and virtually all of Salmon and Lightning creeks before continuing on to the North Fork Burnt River. The Pete Mann Ditch also partially dewaters East Fork Clear Creek, Dry Creek, Spring Creek, and Lightning Creek, all of which contain bull trout (ODFW *in litt*. 2000, UNF *in litt*. 2000). Although most of the water right is for mining use, the portion that is delivered to the Burnt River watershed is used to irrigate agricultural crops, primarily hay (ODFW *in litt*. 2000).

Transportation Network. As with many stream systems throughout the Pacific Northwest and the country, extensive road networks may parallel existing stream channels imposing a variety of impacts.

Roads have the potential to not only facilitate excessive inputs of fine sediment and possible habitat degradation in streams, but also increase human access which may induce angling mortality and introductions of nonnative fishes and increase the potential for water pollution through accidental spills.

Upper Mainstem John Day River. A paved county and Forest Service road follows the upper mainstem with several crossings and placement that constrains the flood plain (ODFW *in litt*. 2000). Improved roads also make bull trout spawning and rearing areas more accessible to the public and increase susceptibility to over harvest, poaching and harassment (ODFW *in litt*. 2000). Road densities and riparian road mileage are expected to be comparable to that reported for the north and middle forks.

Middle Fork John Day River. According to the Oregon Department of Fish and Wildlife (*in litt*. 2000), Highways 26 and 7 cross or follow parts of the Middle Fork John Day River, and culverts on Clear Creek and the middle fork could be either replaced with bridges, or with culverts that are more fish passage friendly. Road densities in roaded areas within the subwatersheds supporting bull trout range from 2.4 to 5.7 miles per square mile, with approximately 20% of roads occurring in the riparian habitat conservation areas, or RHCAs (MNF 1999a and 1999b).

North Fork John Day River. In the North Fork John Day River watershed, where roads were present in the non-wilderness portion of the subwatersheds (seven out of nine subwatersheds), road densities ranged from 3.0 to 6.7 miles per square mile. Miles of road within the riparian habitat conservation area range from zero to 13, and in some cases occur in 71% of the riparian habitat conservation areas adjacent to fish bearing streams, with up to 61 stream crossings (UNF and WWNF 1997a). Data from the Granite drainage indicate that road-related problems are likely more extensive than elsewhere in the North Fork watershed, with non-wilderness road densities ranging from 0.4 to 7.09 miles per square mile. In some watersheds the total length of road in riparian habitat conservation areas are over double the total length of fish bearing streams, (UNF and WWNF 1997b).

Mining. Dredge tailings can create deposits that are attractive to spawning fish because of the looseness and suitable particle size of gravels. However, dredge tailing areas tend to be less stable than natural spawning grounds. Since bull trout spawn after the suction dredging season, bull trout redds established in unstable gravels would be at high risk for loss when higher winter flows redistribute gravels. Therefore, embryo survival may be reduced in areas of dredge tailings, especially if high flows scour the tailings and destroy redds (Harvey *et al*. 1998).

Another threat exists to bull trout from lode operations, which may expose materials with a potential to leach metals or produce acid mine drainage (e.g., pH<6-6.5). Bull trout may be adversely affected where lode operations and/or settling ponds encounter or contain toxic or contaminated materials and occur within riparian habitat conservation areas or in uplands located upstream or adjacent to occupied bull trout spawning, rearing and resident areas (USFWS 2003).

Upper Mainstem John Day River. Mining activity in the Upper Mainstem John Day River was extensive in the past, and included large scale dredging of the Upper John Day River and lode mines in the Canyon Creek watershed and above Prairie City (OWRD 1986). Although active claims exist in a number of tributaries, the majority of current activity consists of small scale placer mining along area streams, such as Canyon Creek (OWRD 1986). According to the Malheur National Forest (1999a) there are no active mining operations in the upper mainstem, and recreational mining has not been observed for the last five years.

Middle Fork John Day River. Many parts of the mainstem Middle Fork were dredge mined (particularly near Galena at RM 45 and near the mouth of Granite Boulder Cr at RM 57) and several tributaries (such as Davis, Vincent, Vinegar, Ruby, Ragged and Butte creeks, among others) were placer mined (Tim Unterwegner, ODFW, personal communication, April 8, 2004). In the Granite Boulder subwatershed, hand-dredging streams involved lifting and washing stream rocks by hand and stacking them in the adjacent floodplain or terraces, removing the majority of the larger stream substrate from the channels in Elk, Deep, Big, Placer Gulch, Davis, Vinegar and Vincent creeks (MNF 1999b).

North Fork John Day River. Boulder Creek, a tributary inhabited by bull trout in the Granite Creek watershed, has a dewatered section resulting from past mining activities (John Day River Recovery Unit Team *in litt*. 2001). Lightning and Salmon creeks, in the Granite Creek watershed, are negatively affected by the Pete Mann mining ditch. The ditch diverts water from Granite Creek to the Burnt River watershed, and impedes bull trout movement upstream (UNF and WWNF 1997b, ODFW *in litt*. 2000).

Residential Development. Stream channel alteration has occurred within populated areas. Areas of the mainstem John Day River have been channelized and armored to keep flows within a designated course. However, residential development is, in a relative sense, not an appreciable factor in bull trout decline.

Recreation. Potential impacts to bull trout habitat from recreational activities include increased sediment delivery to streams from road and trail use, disturbed streambeds and banks from vegetation removal at camp sites and other localized recreation use, introduction of noxious weeds from tires from off-road and other vehicles and feed for stock animals, increased opportunity for poaching and potential introduction of non-native fishes.

Upper Mainstem John Day River. The main recreational impacts in this area are associated with the Strawberry Mountain Wilderness Area where there is a significant amount of camping and traveling near bull trout-inhabited streams. These streams are used by residential bull trout and as seasonal migratory corridors for spawning and dispersal. The primary impact outside of the Strawberry Mountain Wilderness Area is camping in designated campgrounds along the mainstem and tributaries (Larry Bright, Malheur National Forest, personal communication, March 30, 2004).

Middle Fork John Day River. The main recreational impacts in this area are camping and all-terrain vehicle use. There are fewer designated campgrounds in this area than in other areas of the subbasin, but there is a higher percentage of camping in undeveloped / undesignated campsites. Measures to mitigate these impacts – including signing, pole fencing and road closures – are showing some promise by reducing all-terrain vehicle use and camping in undeveloped camping areas (Larry Bright, Malheur National Forest, personal communication, March 30, 2004).

North Fork John Day River. Wilderness trails follow the North Fork John Day River and do not appear to adversely affect stream habitat. However, the potential for unlawful harvest of bull trout exists, especially during the fall spawning season, due to the proximity of these trails to the North Fork John Day River and Baldy Creek (UNF and WWNF 1997a). In September of 1999, the remains of a large female bull trout were found in Baldy Creek, immediately adjacent to the existing trail (John Day River Recovery Unit Team *in litt*. 2001). The U.S. Forest Service was unable to determine who had poached the fish (John Day River Recovery Unit Team *in litt*. 2001).

Fisheries Management. The use of rotenone pesticide to kill undesirable fish species in headwater lakes and streams was historically common. Treatments were typically conducted at times and locations such that it is very unlikely that bull trout were killed. However, rotenone projects may have locally reduced the forage base for migratory bull trout (ODFW *in litt*. 2000).

Major treatment projects were completed on the North Fork in 1966, 1969, 1971, 1973 and 1982; on the Middle Fork in 1966, 1974 and 1982; on the South Fork in 1965 and 1978; and on the mainstem in 1962, 1967, 1970 and 1979. Smaller projects were completed on Camas and Long creeks after 1957 and in several standing water bodies since that time (including Aldrich Ponds in 1983) (USFWS 2003).

Upper Mainstem John Day River. Brook trout inhabit the upper mainstem drainage including Slide and Little Slide lakes in the Strawberry Creek drainage (ODFW *in litt*. 2000). Historically, brook trout and hatchery rainbow trout stocking occurred on a limited basis in the upper subbasin (ODFW 1990). A few specialized put-and-take fisheries continue to be implemented in ponds and lakes (*e.g.* Trout Farm Pond and Magone Lake), but angling effort in areas inhabited by bull trout is described as low (ODFW *in litt*. 2000).

Middle Fork John Day River. At present, there are no brook trout known to inhabit the Middle Fork or its tributaries, and no bull trout/brook trout hybrids have been reported (Claire and Gray 1993). Angling effort in Middle Fork areas inhabited by bull trout is described as very low, attributable to the discontinued stocking of legal sized and fingerling trout (ODFW *in litt*. 2000).

North Fork John Day River. Brook trout inhabit the North Fork drainage, including Crawfish and Baldy lakes (ODFW *in litt*. 2000). Most of the lakes are in drainages where bull trout are currently or were historically found. Bull trout/brook trout hybrids have been found at several locations in the North Fork John Day Core Area (Claire and Gray 1993), including Winom Creek. Historic angling included targeting bull trout in the North Fork John Day Core Area, but has since markedly diminished (ODFW *in litt*. 2000). Some poaching may occur, especially during the hunting season (John Day River Recovery Unit Team *in litt*. 2001).

Isolation and Habitat Fragmentation. The major isolating mechanism affecting local bull trout populations in the John Day Subbasin is seasonally inadequate water quality and quantity in the mainstem river and tributaries, a result of degraded riparian and stream habitat conditions.

Other barriers include low head dams, diversions, and natural waterfalls (Claire and Gray 1993, ODFW *in litt*. 2000).

Upper Mainstem John Day River. Local populations in the upper mainstem are seasonally isolated due to high water temperatures and reduced flows in the connecting mainstems. Multiple agricultural diversions in the core habitat on Strawberry Creek prevent all upstream fish passage (ODFW *in litt*. 2000). A section of Indian Creek is virtually dewatered during the summer, isolating the small local bull trout population (ODFW *in litt*. 2000).

Middle Fork John Day River. Populations within the Middle Fork drainage are at greatest risk from isolation due to habitat fragmentation, seasonally high water temperatures and reduced flows in the connecting mainstems (ODFW *in litt*. 2000). Bull trout are found in only three Middle Fork tributaries that are geographically distant. Population estimates for two of the tributaries are below 800 total fish of all ages, and existing data show no evidence of interchange between the local populations (ODFW *in litt*. 2000). There is a 15-foot dam on Bridge Creek that prevents access to approximately 11 miles of good habitat, but the passage barrier has been removed by installation of a fish ladder. (ODFW *in litt*. 2000). There is also a natural waterfall on Granite Boulder Creek that is a fish barrier. No fish have been found above it (Claire and Gray 1993).

North Fork John Day River. Natural waterfalls on South Fork Desolation, East Meadowbrook, and Big creeks potentially isolate bull trout into separate local populations (Claire and Gray 1993). Seasonally high water temperatures and reduced streamflow in many connecting streams prevent migration and seasonally isolate local populations. The Pete Mann Ditch on Clear Creek impedes upstream movement of bull trout from Lightning and Salmon creeks (ODFW *in litt*. 2000).

A comparison of the significance of threats for each core area follows in Tables 42, 43, and 44.

Table 42. Significance of past (last 100 years) and present threats to bull trout within the Upper Mainstem John Day Core Area of the John Day River Recovery Unit.

Threat or Activity	Low		Moderate		High	
	Past	Present	Past	Present	Past	Present
Dams	X	X				
Forest Management Practices				X	X	
Livestock Grazing				X	X	
Agricultural Practices		X			X	
Transportation Network				X	X	
Mining				X	X	
Residential Development	X			X		
Recreation	X	X				
*Fisheries Management				X	X	
**Isolation & Habitat Fragmentation					X	X

*Includes influence of non-natives (e.g. brook trout).
**Includes influence of fish passage problems (culverts, unscreened diversions, etc.).

Table 43. Significance of past (last 100 years) and present threats to bull trout within the Middle Fork John Day Core Area of the John Day River Recovery Unit.

Threat or Activity	Low		Moderate		High	
	Past	Present	Past	Present	Past	Present
Dams	X	X				
Forest Management Practices				X	X	
Livestock Grazing				X	X	
Agricultural Practices		X			X	
Transportation Network				X	X	
Mining				X	X	
Residential Development	X			X		
Recreation	X	X				
*Fisheries Management		X			X	
**Isolation & Habitat Fragmentation					X	X

Table 44. Significance of past (last 100 years) and present threats to bull trout within the North Fork John Day Core Area of the John Day River Recovery Unit.

Threat or Activity	Low		Moderate		High	
	Past	Present	Past	Present	Past	Present
Dams	X	X				
Forest Management Practices				X	X	
Livestock Grazing		X			X	
Agricultural Practices		X			X	
Transportation Network				X	X	
Mining					X	X
Residential Development	X			X		
Recreation	X	X				
*Fisheries Management				X	X	
**Isolation & Habitat Fragmentation					X	X

Tables 43 and 44: *Includes influence of non-natives (e.g. brook trout).
**Includes influence of fish passage problems (culverts, unscreened diversions, etc.).

In the John Day River Recovery Unit, some local populations are relatively strong, but the majority are at relatively low numbers. Degradation and fragmentation of bull trout habitat have resulted in populations that are at high risk. Ultimately, these threats must be addressed in the near future for recovery to be achieved. PACFISH/INFISH has greatly helped the bull trout. The change in perspective of the action agencies and the public has made the difference. However, direct action to restore connectivity and habitat is key to the bull trout's survival, let alone its recovery. (Paul Bridges, USFWS, personal communication, March 25, 2004).

Harvest in the Subbasin. Bull trout are aggressive by nature and readily take lures or bait, making them very susceptible to angling. Historically, a few anglers selectively angled for and caught bull trout. Creel survey information for the John Day River drainage indicates a reduction in the percentage of bull trout taken versus other trout species from approximately 22% during the period from 1961 to 1970 to 4.5% from 1981 to 1992 (Claire and Gray 1993).

Harvest of bull trout has been prohibited in the John Day Subbasin since 1994. Prior to the prohibition, legal harvest was higher in the North Fork drainage than the Middle Fork or upper mainstem. Since the prohibition, efforts toward angler education and enforcement have been increased. Stocking of catchable rainbow trout was discontinued in the Middle Fork John Day and Desolation Creek to prevent incidental catch of bull trout.

Modeling Results

John Day Subbasin bull trout habitat has declined 35.4% - from 698.4 miles to 451.5 miles – from historic to current times (Table 45).

Table 45. Total historic and current John Day Subbasin bull trout habitat by land ownership category.

Land Ownership	Historic Habitat (miles)	Current Habitat (miles)	Miles Habitat Lost	% of Habitat Lost
Private	295.8	204.2	91.7	31.0%
U.S. Forest Service	349.6	204.1	145.6	41.6%
Bureau of Land Management	38.2	33.8	4.4	11.4%
Federal Energy Regulatory Commission	1.1	1.1	0.0	0.0%
National Park Service	4.8	4.8	0.0	0.0%
Oregon Division of State Lands	8.9	3.5	5.3	60.2%
Total	698.4	451.5	246.9	35.4%
% Publicly Owned	57.6%	54.8%	62.9%	

The Upper John Day has lost the most habitat (49%), while the North Fork has lost the least (23.2%) (Tables 46 to 48). Among ownership categories with more than 10 miles of habitat, the most habitat has been lost on land owned by the U.S. Forest Service in the Upper John Day and Middle Fork and on private land on the North Fork. Over the entire subbasin, 41.6% of habitat on Forest Service lands has been lost compared to 31% on privately owned lands and 11.4% on BLM land. The state and federal government own 72.5% of the historic habitat, and 77.4% of the current habitat in the North Fork John Day drainage (Table 46). In the Middle Fork drainage, the federal government owns the majority (58%) of historic habitat, but the majority (56.8%) of current habitat is in private ownership. In the Upper John Day drainage the federal government owns 42.2% of historic habitat and 28.1% of current habitat.

Table 46. Total historic and current North Fork John Day Drainage bull trout habitat by land ownership category.

Land Ownership	Historic Habitat (miles)	Current Habitat (miles)	Miles Habitat Lost	% of Habitat Lost
Private	75.3	48.1	27.2	36.1%
Bureau of Land Management	30.6	27.4	3.2	10.6%
U.S. Forest Service	158.9	133.4	25.5	16.0%
Oregon Division of State Lands	8.9	3.5	5.3	60.2%
Federal Energy Regulatory Commission	0.6	0.6	0.0	0.0%
Total	274.3	213.0	61.3	22.3%
% Publicly Owned	72.5%	77.4%	55.6%	

Table 47. Total historic and current Upper John Day Drainage bull trout habitat by land ownership category.

Land Ownership	Historic Habitat (miles)	Current Habitat (miles)	Miles Habitat Lost	% of Habitat Lost
Private	155.2	98.4	56.8	36.6%
U.S. Forest Service	104.0	30.3	73.7	70.8%
Bureau of Land Management	4.0	2.8	1.1	28.6%
Federal Energy Regulatory Commission	0.5	0.5	0.0	0.0%
National Park Service	4.8	4.8	0.0	0.0%
Total	268.5	136.9	131.6	49.0%
% Publicly Owned	42.2%	28.1%	56.8%	

Table 48. Total historic and current Middle Fork John Day Drainage bull trout habitat by land ownership category.

Land Ownership	Historic Habitat (miles)	Current Habitat (miles)	Miles Habitat Lost	% of Habitat Lost
Private	65.3	57.6	7.7	11.7%
U.S. Forest Service	86.7	40.3	46.4	53.5%
Bureau of Land Management	3.6	3.6	0.0	0.0%
Total	155.6	101.5	54.1	34.8%
% Publicly Owned	58.0%	43.2%	85.8%	

A current assessment of conditions in the John Day Subbasin, as specified using QHA, can be found in Appendix O and the associated maps in Appendix W. Comparing the mean current habitat attribute rating to the mean reference habitat attribute rating for each attribute provides a measure of which habitat attributes have changed the most from reference. By this measurement, riparian condition, habitat diversity, fine sediment, high temperature and channel stability are the habitat attributes with the greatest decline (Table 49). The QHA ratings suggest that there has been little change in the pollutants, obstructions, and oxygen attributes when comparing current to reference conditions.

Table 49. Mean QHA attribute values over all reaches under reference and current conditions and the percent reduction of that attribute for bull trout in the John Day Subbasin.

Attribute	Reference Mean	Current Mean	Percent Reduction
Riparian Condition	4.0	2.7	32%
Habitat Diversity	3.9	2.8	30%
Fine sediment	4.0	2.8	28%
High Temperature	3.9	2.9	27%
Channel stability	4.0	3.0	25%

High Flow	4.0	3.2	19%
Low Flow	4.0	3.3	18%
Low Temperature	4.0	3.5	13%
Oxygen	4.0	3.8	6%
Obstructions	4.0	3.8	4%
Pollutants	4.0	3.9	3%

Protection and restoration reach rankings produced by QHA (Tables 50 and 51) were evenly divided into quartiles with the first quartile being of greatest value to bull trout and the last (fourth) quartile having the least. Thus a reach in the first protection quartile would be among a set of reaches that are the most important for the protection of bull trout, while a reach in the first restoration quartile would be among a set of reaches that have the highest restoration potential for bull trout if fully restored to reference conditions All reaches where bull trout do not presently occur (but did occur in the reference condition) were placed in the fourth (bottom) protection quartile. This categorization was then reviewed by the John Day technical team and adjustments made to the four groups. One reach (Clear Cr (MF)) was upgraded from the second quartile into the top priority group for protection, while seven had their restoration ranking raised from a lower priority. Final groupings are listed under the priority groupings column of Tables 50 and 51.

The grouping of reaches into four categories based on their protection value and restoration potential is displayed in Figures 24 and 25. The top priority group of reaches for both protection and restoration is listed in Table 52. The reaches upgraded to this top priority group by the technical team are indicated by underlined reach names. Table 52 also gives the top three ranked attributes for each priority restoration reach for bull trout.

Table 50. Bull Trout QHA habitat protection rankings. Attributes are ranked within each reach and all reaches are ranked as to their protection value. Final groupings, as determined by the John Day technical team are listed under "Priority Grouping."

NPC= Not present currently

Protection Habitat Ranking

Reach Name	Reach Rank	Priority Grouping	Riparian Condition	Channel stability	Habitat Diversity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions
JD-1	40	3	9	6	8	10	7	5	2	4	11	1	3
JD-2	39	3	8	6	8	11	7	5	2	4	10	1	3
JD-3	33	3	8	7	10	11	9	4	3	5	6	1	2
MF-1	29	2	9	7	8	11	10	4	2	6	5	1	3
MF-2	27	2	10	7	9	11	8	4	2	6	5	1	3
MF-3	30	2	10	7	9	11	8	4	2	5	6	1	3
MF-4	34	3	10	8	9	11	4	5	2	3	7	1	6
INDIAN SYSTEM (MF)	NPC	4											
BIG CR (MF)-1	23	2	8	7	9	11	10	3	1	6	5	1	4
BIG CR (MF)-2	13	1	7	3	9	6	8	5	1	10	4	1	11
BIG BOULDER SYSTEM	NPC	4											
GRANITE BOULDER	3	1	7	4	8	3	9	6	1	10	5	1	11
BUTTE CR	NPC	4											
VINEGAR CR	35	3	6	5	8	7	9	3	1	11	4	1	10
DAVIS CR	NPC	4											
CLEAR CR (MF)	18	1	4	3	9	5	6	7	1	10	8	1	11
NF-1	38	3	11	7	8	10	6	4	2	5	9	1	3
NF-2	37	3	11	6	8	10	7	4	2	5	9	1	3
NF-3	31	3	11	4	8	10	7	5	2	6	9	1	3
CAMAS CR-1	NPC	4											
CAMAS CR-2	NPC	4											
CABLE CR	NPC	4											
CAMAS CR-3	NPC	4											
HIDAWAY CR	NPC	4											
NF-4	24	2	11	5	8	10	7	3	2	6	9	1	4
DESOLATION CR-1	36	3	11	5	9	10	8	3	2	7	6	1	4
DESOLATION CR-2	20	2	6	4	8	5	9	3	1	10	7	1	11
DESOLATION CR-3	5	1	6	5	7	3	4	9	1	8	10	1	11
BIG CR (NF)	60	4											
NF-5	12	1	4	3	8	9	6	5	1	10	7	1	11
GRANITE CR-1	28	2	10	9	8	11	7	4	1	6	5	2	3
GRANITE CR-2	17	2	8	10	9	7	6	3	1	5	4	2	11
CLEAR CR (GRANITE)-1	25	2	11	8	9	10	7	3	1	6	5	2	4
CLEAR CR (GRANITE)-2	9	1	9	8	10	7	6	3	1	5	4	2	11
SALMON CR	11	1	5	6	10	4	3	8	1	7	9	1	11
BULL RUN	22	2	7	6	9	8	11	3	1	10	4	2	5
CRANE CR-1	26	2	8	7	9	11	10	4	1	6	5	1	3
CRANE CR-2	16	1	7	3	9	5	5	4	1	10	8	1	11
NF-6	1	1	7	6	8	5	9	4	1	10	3	1	11
TRAIL CR	19	2	5	6	10	8	7	3	1	9	4	2	11
BALDY DRAINAGE	4	1	7	5	8	3	9	6	1	10	4	1	11
CRAWFISH-CUNNINGHAM	10	1	5	6	9	7	8	4	1	10	3	1	11
JD-4	32	3	8	10	11	9	7	4	2	5	6	1	3
CANYON CR (JD)-1	NPC	4											
VANCE-BERRY	NPC	4											
CANYON CR (JD)-2	NPC	4											
CANYON EF SYSTEM	NPC	4											
CANYON CR MF	NPC	4											
CRAZY CR	NPC	4											
CANYON CR-3	NPC	4											
JD-5	21	2	9	10	11	7	5	4	2	3	6	1	8
PINE CR-1	NPC	4											
PINE CR-2	NPC	4											
INDIAN CR (JD)-1	NPC	4											
INDIAN CR (JD)-2	2	1	6	5	7	3	4	9	1	8	10	1	11
STRAWBERRY SYSTEM	NPC	4											
REYNOLDS CR	15	1	7	6	10	5	3	4	1	8	9	1	11
DEARDORFF CR	8	1	5	4	9	3	6	7	1	10	8	1	11
JD-6	14	1	5	3	9	4	8	7	1	10	6	1	11
RAIL-CALL	6	1	4	5	9	3	6	8	1	10	6	1	11
ROBERTS CR	7	1	5	4	9	3	6	8	1	10	6	1	11

Table 51. Bull trout QHA habitat restoration rankings. Attributes are ranked within each reach and all reaches are ranked as to their protection value. Final groupings are listed under Priority Grouping. Reaches with names shaded had their priority grouping upgraded by the John Day technical team.

Restoration Habitat Ranking

Reach Name	Reach Rank	Priority Grouping	Riparian Condition	Channel stability	Habitat Diversity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions
JD-1	28	2	3	6	5	7	9	2	4	10	1	8	11
JD-2	33	3	4	8	5	6	10	2	3	9	1	7	11
JD-3	27	2	6	5	4	7	8	2	3	10	1	8	11
MF-1	42	3	2	7	8	9	6	3	4	5	1	10	11
MF-2	34	3	2	4	5	7	6	3	9	8	1	10	11
MF-3	15	1	1	3	5	2	4	9	7	7	6	10	11
MF-4	19	1	2	1	4	3	5	7	9	8	6	10	10
INDIAN SYSTEM (MF)	13	1	4	7	3	1	6	5	9	8	2	10	10
BIG CR (MF)-1	29	2	5	7	4	1	3	6	9	8	2	9	9
BIG CR (MF)-2	43	3	2	5	4	1	3	7	9	8	6	9	9
BIG BOULDER SYSTEM	41	3	3	2	4	1	6	7	10	8	5	10	9
GRANITE BOULDER	48	4	3	4	7	2	1	6	9	8	5	9	9
BUTTE CR	35	3	3	2	4	1	6	7	9	8	5	9	9
VINEGAR CR	22	2	4	3	2	1	7	6	9	8	5	9	9
DAVIS CR	40	3	3	5	4	1	6	7	9	8	2	9	9
CLEAR CR (MF)	39	2	3	2	4	1	6	7	10	8	5	10	9
NF-1	31	3	3	6	5	8	9	2	4	7	1	10	11
NF-2	32	3	2	9	5	7	8	3	4	6	1	10	10
NF-3	30	2	1	9	4	7	8	3	5	6	2	10	10
CAMAS CR-1	38	3	4	6	5	9	8	2	3	7	1	10	10
CAMAS CR-2	21	2	3	8	5	9	6	2	4	7	1	10	10
CABLE CR	18	1	3	5	8	2	4	7	9	6	1	9	9
CAMAS CR-3	24	2	2	9	6	8	7	3	4	5	1	10	10
HIDAWAY CR	14	1	2	6	8	3	4	5	9	7	1	9	9
NF-4	12	1	1	9	4	3	7	8	6	5	2	10	10
DESOLATION CR-1	17	1	1	7	3	4	6	8	9	5	2	10	10
DESOLATION CR-2	26	2	2	6	3	4	5	8	9	7	1	9	9
DESOLATION CR-3	52	4	1	2	3	4	4	4	4	4	4	4	4
BIG CR (NF)	45	3	4	3	5	1	2	7	8	8	6	8	8
NF-5	37	2	7	7	4	1	5	6	7	3	2	7	7
GRANITE CR-1	4	1	2	1	4	3	6	8	10	9	7	5	11
GRANITE CR-2	3	1	3	1	4	2	5	8	9	10	7	6	11
CLEAR CR (GRANITE)-1	1	1	1	2	4	3	7	10	9	8	6	5	11
CLEAR CR (GRANITE)-2	6	1	4	3	1	2	5	9	10	8	7	6	10
SALMON CR	23	2	4	2	3	1	5	8	9	7	6	9	9
BULL RUN	7	1	4	3	2	1	5	8	11	7	6	9	10
CRANE CR-1	44	3	7	8	3	2	4	6	9	5	1	9	9
CRANE CR-2	25	2	2	5	4	1	6	7	9	8	3	9	9
NF-6	57	4	3	3	3	2	1	3	3	3	3	3	3
TRAIL CR	36	2	6	3	2	1	7	5	10	8	4	9	10
BALDY DRAINAGE	60	4	2	2	2	1	2	2	2	2	2	2	2
CRAWFISH-CUNNINGHAM	55	4	4	3	2	1	4	4	4	4	4	4	4
JD-4	9	1	5	1	2	6	7	3	8	9	4	10	11
CANYON CR (JD)-1	10	1	6	1	2	5	7	4	9	8	3	9	11
VANCE-BERRY	47	4	4	3	2	1	6	7	9	8	5	9	9
CANYON CR (JD)-2	16	2	2	1	3	4	6	8	9	7	5	9	9
CANYON EF SYSTEM	46	3	1	2	4	5	7	6	9	8	3	9	9
CANYON CR MF	49	3	1	2	3	6	5	7	9	8	4	9	9
CRAZY CR	53	4	2	4	3	1	5	7	8	8	6	8	8
CANYON CR-3	58	4	1	5	4	2	5	5	5	5	3	5	5
JD-5	2	1	3	1	2	4	7	5	8	9	6	10	11
PINE CR-1	5	1	4	1	3	6	7	2	8	9	5	11	10
PINE CR-2	61	4	1	1	1	1	1	1	1	1	1	1	1
INDIAN CR (JD)-1	8	1	4	2	3	7	6	1	8	9	5	10	10
INDIAN CR (JD)-2	56	4	2	1	4	3	5	5	5	5	5	5	5
STRAWBERRY SYSTEM	11	1	4	6	2	7	8	1	8	8	3	8	5
REYNOLDS CR	20	2	3	2	4	1	8	7	9	9	5	9	6
DEARDORFF CR	50	4	3	2	5	1	7	6	7	7	4	7	7
JD-6	54	4	2	4	3	1	4	4	4	4	4	4	4
RAIL-CALL	59	4	3	2	3	1	3	3	3	3	3	3	3
ROBERTS CR	51	4	3	2	4	1	7	5	7	7	7	7	6

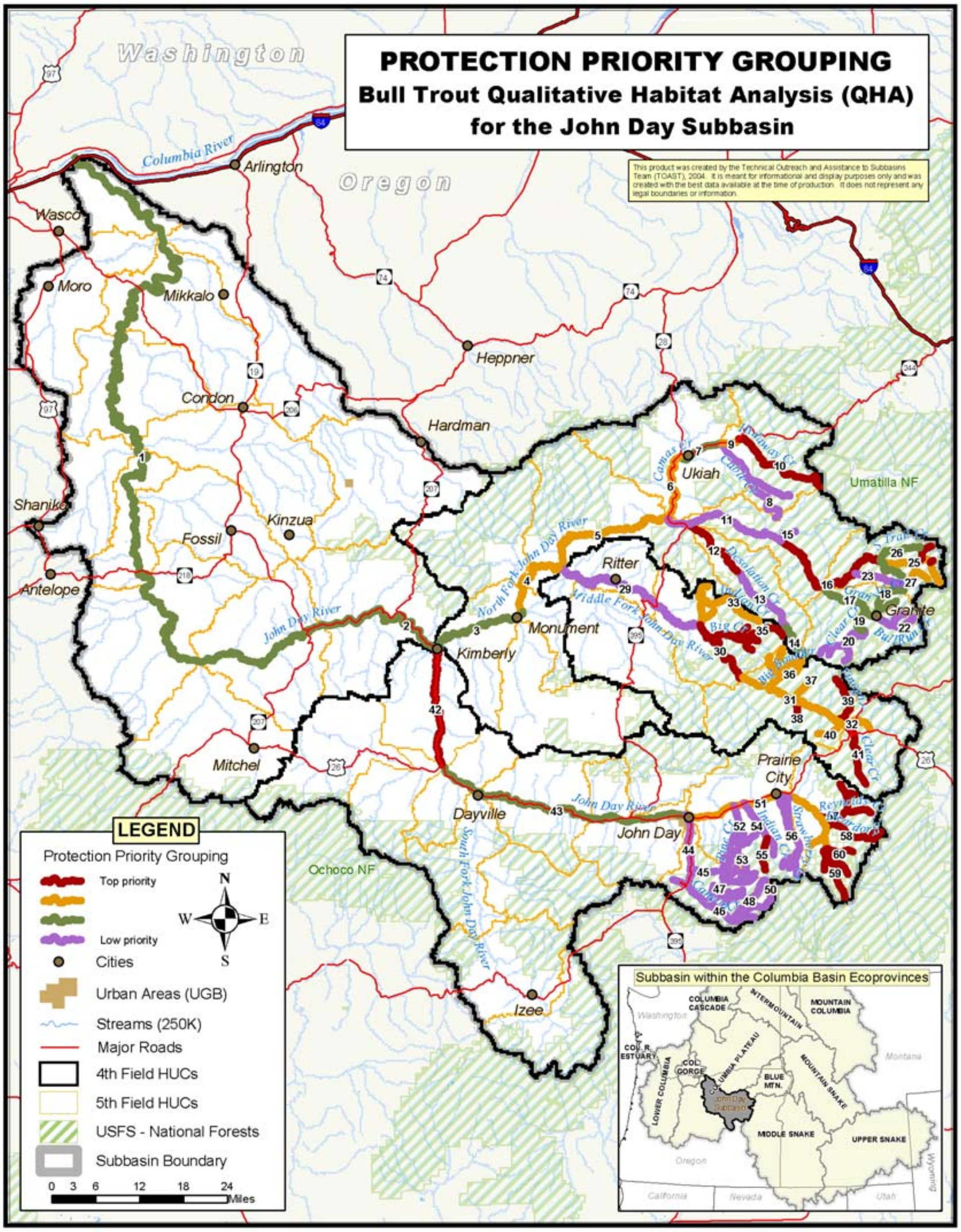

Figure 24. QHA results of protection quartiles by reach for bull trout.

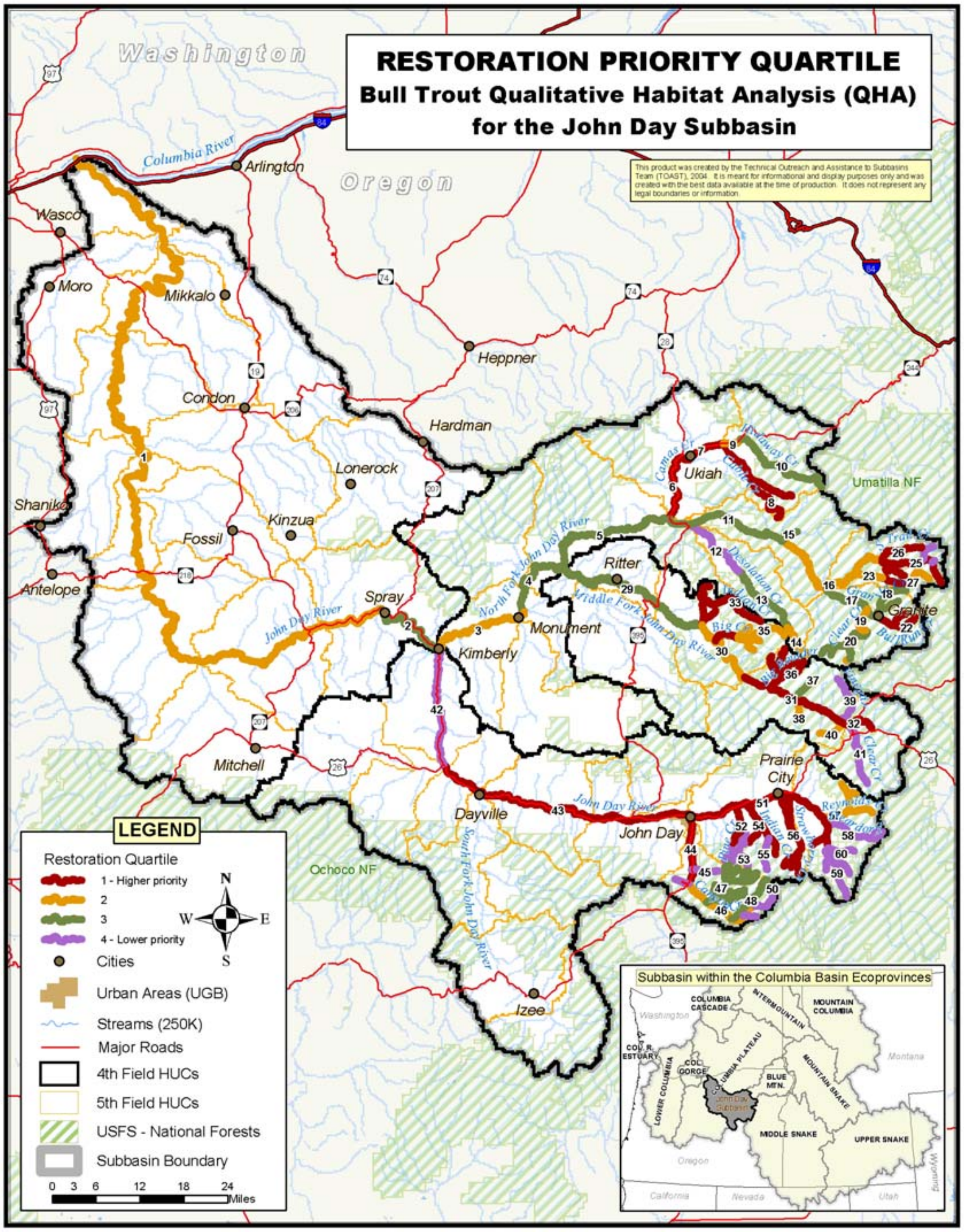

Figure 25. QHA results of restoration quartiles by reach for bull trout.

Table 52. Top priority protection reaches and top restoration reaches as determined from QHA rankings and technical team analysis. Reaches upgraded to this list by the technical team are underlined. The most important attributes for restoration reaches are also listed.

Protection Reaches	Restoration Reaches	Top Restoration Attributes
BALDY DRAINAGE	BULL RUN	Fine Sediment, Habitat Diversity, Channel Stability
BIG CR (MF)-2	<u>CABLE CR</u>	High Temperature, Fine Sediment, Riparian Condition
CLEAR CR (GRANITE)-2	CANYON CR (JD)-1	Channel Stability, Habitat Diversity, High Temperature
<u>CLEAR CR (MF)</u>	CLEAR CR (GRANITE)-1	Riparian Condition, Channel Stability, Fine Sediment
<u>CRANE CR-2</u>	CLEAR CR (GRANITE)-2	Habitat Diversity, Fine Sediment, Channel Stability
CRAWFISH-CUNNINGHAM	<u>DESOLATION CR-1</u>	Riparian Condition, High Temperature, Habitat Diversity
DEARDORFF CR	GRANITE CR-1	Channel Stability, Riparian Condition, Fine Sediment
DESOLATION CR-3	GRANITE CR-2	Channel Stability, Fine Sediment, Riparian Condition
GRANITE BOULDER	HIDAWAY CR	High Temp, Riparian Condition, Fine Sediment
INDIAN CR (JD)-2	INDIAN CR (JD)-1	Low Flow, Channel Stability, Habitat Diversity
JD-6	INDIAN SYSTEM (MF)	Fine Sediment, High Temperature, Habitat Diversity
NF-5	JD-4	Channel Stability, Habitat Diversity, Low Flow
NF-6	JD-5	Channel Stability, Habitat Diversity, Riparian Condition
RAIL-CALL	MF-3	Riparian Condition, Fine Sediment, Channel Stability
REYNOLDS CR	<u>MF-4</u>	Channel Stability, Riparian Condition, Fine Sediment
ROBERTS CR	NF-4	Riparian Condition, High Temperature, Fine Sediment
SALMON CR	PINE CR-1	Channel Stability, Low Flow, Habitat Diversity
	STRAWBERRY SYSTEM	Low Flow, Habitat Diversity, High Temperature

The attributes shown in Table 52, if improved, would provide the greatest restoration of bull trout productivity according to this model. The most common attributes on this list are channel stability, riparian condition, fine sediment, and habitat diversity, although high temperature and low flow are also on this list.

Note that when interpreting restoration rankings, a low ranking means that habitat improvements in that reach will result in little benefit to bull trout. This may mean that, although habitat is in poor condition, improving it would not result in much additional use (e.g. JD-2 in the lower mainstem). It can also mean that the habitat is in such good condition that little improvement is possible (e.g. NF-6 in the North Fork John Day).

The relative importance of the eleven attributes was ranked for each of four assessment areas in the John Day Subbasin (lower-middle, upper, North Fork, and Middle Fork). Values were normalized by dividing the minimum sum of ranks for all attributes in each watershed (lower, upper, North Fork, Middle Fork) by the sum of the ranks for each attribute. The result is a relative value (ranging from 0 to 1) of the importance of each attribute to the focal species of interest in a watershed.

These rankings are presented for each region in Figures 26 to 29. The highest ranked attribute in each assessment area (the attribute having the biggest overall impact on the species in each assessment area) has a value of 1.0. All other attribute impacts are scaled to this highest ranked attribute within each assessment area. Results indicate that high temperature is by far the most important limiting factor in the Lower Mainstem John Day (Figure 26) and also ranks high in the North Fork (Figure 27) and Middle Fork (Figure 28). Fine sediment, channel stability, habitat diversity, and riparian condition all rank high for the bull trout populations in the North Fork, Middle Fork, and Upper John Day (Figure 29) watersheds.

The HUC5s that contain top quartile protection reaches are listed in Table 53. The top four ranking attributes for restoration averaged over those top quartile protection reaches are also listed. Added to the list of priority HUC5s by subbasin planners (though not displayed in Table 53) was the Desolation Creek HUC5 in the North Fork.

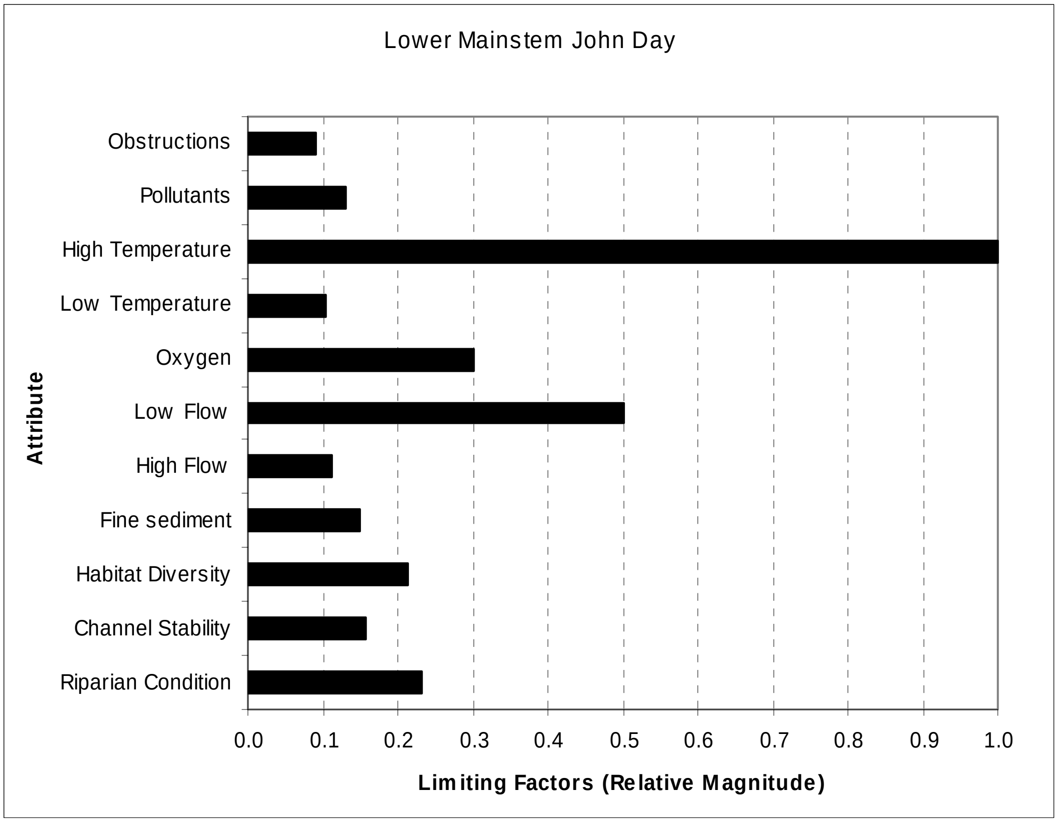

Figure 26. Limiting factors for habitat attributes for lower mainstem John Day.

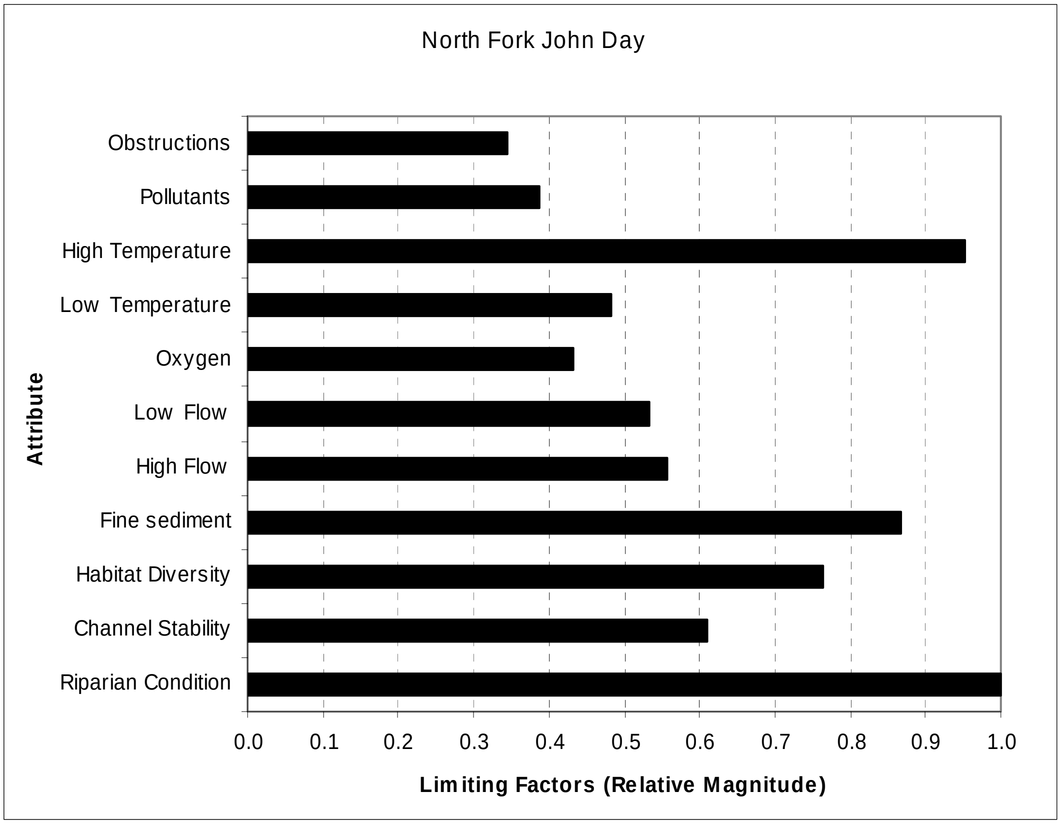

Figure 27. Limiting factors for habitat attributes for the North Fork John Day.

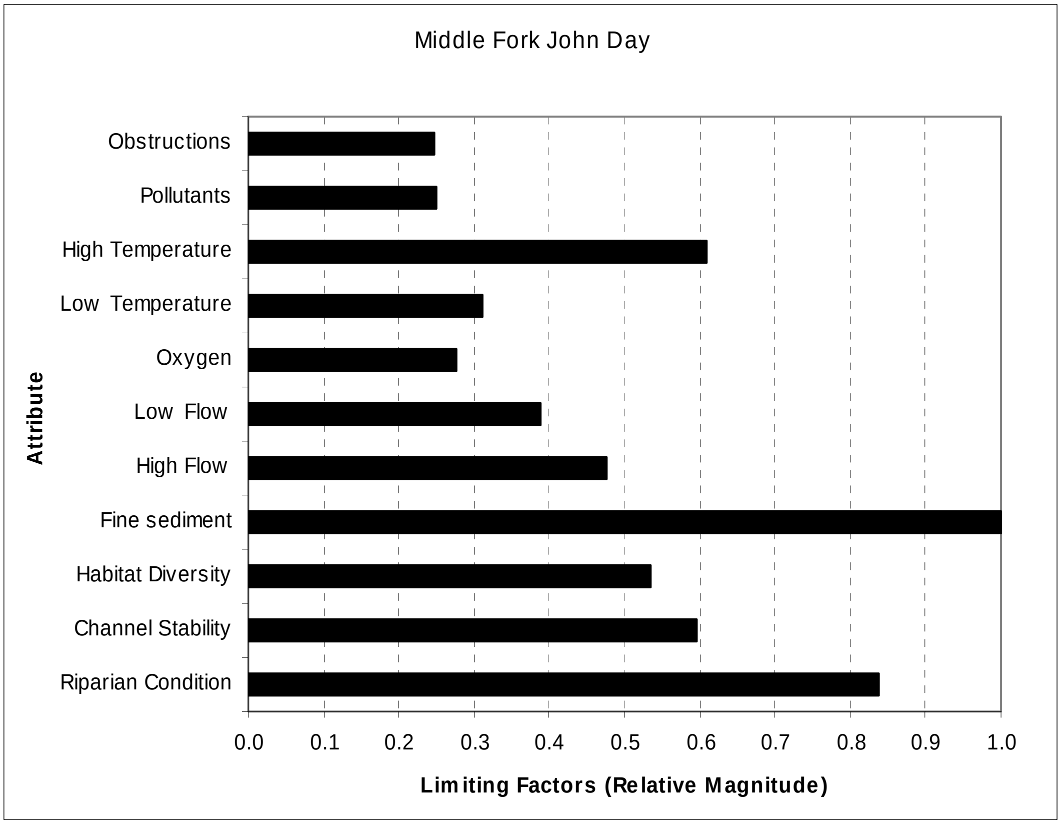

Figure 28. Limiting factors for habitat attributes for the Middle Fork John Day.

Figure 29. Limiting factors for habitat attributes for the Upper John Day.

Table 53. Priority QHA restoration geographic areas and the top four ranked QHA restoration attributes for priority reaches in those geographic areas.

John Day Bull Trout Restoration Priorities										
Geographic area priority				**Attribute for Restoration**						
Geographic area	**North Fork**	**Middle Fork**	**Upper Mainstem**	*Low Flow*	*High Flow*	*Fine Sediment*	*High Temperature*	*Riparian Condition*	*Channel Form*	*Channel Complexity*
Big Creek		X				■	■	■		■
Camp Creek		X			■	■		■	■	
Canyon Creek			X	■			■		■	■
FieldsCreek			X	■			■		■	■
Granite Creek	X					■		■	■	■
Laycock Creek			X	■			■		■	■
NF JDR Big Creek	X					■	■	■		■
Strawberry Creek			X	■				■	■	■
Upper Camas Creek	X				■	■	■	■		
Upper JDR			X			■		■	■	■
Upper Middle JDR			X	■			■		■	■

<u>Discussion</u>

The assessment areas with the greatest protection and restoration value are the North Fork and Upper John Day. The North Fork contained eight reaches in the top priority group for restoration and nine for protection, out of 26 total reaches. The Upper John Day contained six reaches in the top priority group for restoration and six reaches for the top priority group for protection out of 19 total reaches. The Middle Fork assessment areas had three reaches (out of 13) in the top priority group for protection and three for restoration.

The Lower Mainstem John Day assessment unit was rated low for bull trout protection and restoration value. However, it was the opinion of the John Day technical team that a healthy John Day bull trout population required connectivity with other Columbia River subbasins. Improving connectivity may require improving habitat in the Lower Mainstem John Day. The ranking of the high temperature attribute in the Lower Mainstem John Day (Figure 26) is due to this attribute's presumed impact on bull trout migration. If bull trout migration turns out to occur more often in the winter than during high temperature periods, then high temperature (and possibly low flow) likely does not adversely affect bull trout as much as is indicated in Figure 26. It was suggested by the technical team that the lack of connectivity between populations may be a function of low population sizes, rather than any particular habitat problem. One research need is a better understanding of the importance of connectivity between populations and, if it does turn out to be important, what factors (if any) are currently limiting the ability of bull trout to use the Lower Mainstem John Day River as a migration corridor.

Table 52 provides a list of the most important reaches for protection and restoration. One reach, Clear Cr-2 (Granite) appears on both the protection and restoration lists, indicating that this reach is of particular importance to bull trout. The adjacent reach, Clear Cr-1 (Granite) also ranks high for restoration potential. Other watersheds with reaches on both lists are Desolation Cr and Indian Cr (JD). In both cases, the upper portion of the system has high protection value while the lower portion has high restoration value. In both systems, the highest ranking attributes for restoration are habitat attributes (habitat diversity, riparian condition, habitat diversity) or flow/temperature attributes (high flow, high temperature), suggesting that habitat restoration projects combined with increasing flows where opportunities exist might be particularly effective at increasing bull trout habitat in these systems. The USFWS draft recovery plan for John Day bull trout specifically addresses restoring flow to Indian Creek and assessing connectivity issues in Salmon Creek.

The majority of bull trout habitat in the John Day Subbasin is publicly owned. However, in many cases and particularly in the Upper John Day, passage barrier obstructions, high water temperatures, or low flow in lower reaches where adjacent land ownership is private are preventing bull trout from accessing upstream reaches on public land. Although there is tremendous potential for restoration of bull trout on public land, in many of these cases it will require restoration projects on private land.

3.2.4 Aquatic Focal Species Population Delineation and Characterization

Redband Trout *(Oncorhynchus mykiss gairdneri)*

Redband Trout Population Data and Status

The species *Oncorhynchus mykiss* is one of the most taxonomically complicated groups in Oregon. The species probably consists of multiple subspecies, none of which have been formally recognized. Behnke (1992) proposes three subspecies with ranges extending into Oregon: *O.m. irideus*, or coastal rainbow and steelhead trout; *O.m. gairdneri*, or inland Columbia Basin redband and steelhead trout; and *O.m. newberrii*, or Oregon Basin redband trout. (ODFW 1995)

Currens (1997) suggests that separate groups of redband trout evolved in large river systems, such as the Columbia, Deschutes, Klamath and Sacramento rivers. The subspecies that occurs in the John Day Subbasin is *Oncorhynchus mykiss gairdneri*, which is present in inland drainages of the Pacific Northwest. Since redband trout and steelhead are considered the same subspecies, it is hard to distinguish between the two of them. So in this subbasin plan, redband trout have been broken into two categories: the redband trout that exhibit an anadromous life history (steelhead) are covered in the steelhead section of the plan and the redband trout that exhibit a residential life history will be covered in this section.

Ancestral redband trout probably reached the Sacramento-San Joaquin basin from the south during the second half of the Pleistocene Epoch and penetrated the Columbia, Fraser and

Athabasca river basins between 30,000 and 50,000 years ago (Behnke 1992). All redband trout of the Columbia and Fraser River basins are classified as *O. mykiss gairdneri*. This subspecies is genetically and morphologically differentiated from coastal rainbow trout. Morphological characteristics of distinction include the presence of vestigial basibranchial teeth, larger spots, more elliptical parr marks, fewer pyloric caeca, yellow and orange tints on the body, a trace of a cutthroat mark and light colored tips on dorsal, anal and pelvic fins (Behnke 1992). However, genetic techniques (e.g. protein electrophoresis) provide the only method to correctly identify this subspecies as unique from other salmonids. (Muhlfeld 2004)

Columbia River redband trout exhibit a wide variety of life history strategies. Anadromous stocks of redband (steelhead) trout migrate approximately 217 miles from the mouth of the John Day River down the Columbia River to the Pacific Ocean. Fluvial stocks occupy larger rivers and spawn in smaller tributaries. Resident forms inhabit smaller tributaries and headwater areas for their entire lives.

Redband trout commonly inhabit high elevation streams in arid regions characterized by extreme variation in seasonal water flow, temperature and dissolved oxygen levels (Behnke 1992, Vinson and Levesque 1994, Zoellick *et al*. 1999). However, despite their wide distribution and apparent adaptability to harsh environmental conditions, the redband trout is considered a "species at risk" (Marshall *et al*. 1996) due to the recent decline and disappearance of several populations (Nehlsen *et al*. 1991). At present, the management of redband populations is problematic because the physical and biological factors that limit the distribution and physiological tolerance of these trout are not well understood, and very little is known about the effects of environmental factors on the metabolic performance of wild native salmonids. (Rodnick 2002)

Abundance and distribution of redband trout are not routinely indexed in the John Day Subbasin. Juveniles with trout and steelhead life history types are difficult to differentiate where the two populations coexist, making independent monitoring difficult. At this time, abundance estimates of John Day trout populations are unknown. Summer distribution of redband trout is limited to headwater areas, similar to John Day cutthroat and bull trout, by a variety of land use impacts including stream dewatering from irrigation diversions and temperature barriers caused by stream alterations due to cattle grazing and timber harvest. (ODFW 1995).

Redband are more difficult to monitor than steelhead but appear to be abundant in most headwater areas. Redband populations are probably fragmented and isolated in some headwater areas due to habitat degradation in lower mainstems (ODFW 1995). Historic redband trout (*O.m. gairdneri*) populations probably included fluvial fish, which used the mainstem habitats for rearing (Kostow 2003). Recent length frequency measurements of redband trout demonstrated that over 98% of the fish sampled were less than six inches in length (ODFW 2001), suggesting that the current trout life history in the subbasin is residential. Few redband trout exceed 10 inches in length (ODFW 1996).

Densities of *O.m. gairdneri* greater than or equal to one inch in length have been measured at 43 locations in the three major drainages that produce steelhead in the John Day (the North Fork, Middle Fork and upper mainstem), summarized by subbasin in Table 54. These measurements were intended to target steelhead parr (young salmonids), but also include some unknown number of resident redband trout. According to abundance benchmarks developed by Dambacher and Jones (1995), most one inch and longer redband abundances ranged from moderate (0.06 to 0.19 fish per m^2) to high (>0.2) across the John Day Subbasin and from year-to-year within the same subbasin. These density measurements could be expanded to local abundance measurements if habitat areas were measured, but the necessary information is not currently available. (Kostow 2003)

Table 54. Density of 1+ *O. mykiss* in the John Day Subbasin, based on sampling in 43 locations. Abundance benchmarks for density data: low (< 0.05), moderate (0.06 – 0.19), high (>0.2), according to Dambacher and Jones (1995). (unpublished data, Tim Unterwegner, ODFW). (Kostow 2003)

Year	**North Fork Fish/m^2**	**Middle Fork Fish/m^2**	**Upper Mainstem Fish/m^2**
1990	0.05	0.15	0.19
1991	0.13	0.20	0.22
1992	0.28	NS	NS
1994	0.19	NS	NS
1996	0.23	NS	NS
2000	NS	0.23	NS

The John Day Subbasin contains over 2485 miles of *O. mykiss gairdneri* spawning and rearing habitat, now located primarily in tributaries and the upper portions of the subbasin (Kostow 2003). Redband trout tend to spawn in rivers and streams during the spring months of March, April and May. Cool, clean, well-oxygenated water is necessary for the eggs to survive. Redband trout fry emerge from the gravel in June and July. For the most part, they live near where they were spawned. Redband trout are three years old at maturity, with size varying depending on the productivity of individual waters. Few redband trout exceed 10 inches in length (ODFW 1996).

Redband trout require four basic habitat types to accommodate life history requirements: spawning, rearing, adult and overwintering (Behnke 1992). Redband trout fry emerge from the gravel in June and July. Redband trout eggs typically hatch in four to six weeks and alevins take about three to seven days to absorb the yolk sac before emergence. At a water temperature of 50° F, eggs hatch in approximately 31 days (Leitritz and Lewis 1980). Gravels free of sediments are optimum for spawning since sediment can smother eggs by impeding the free flow of oxygenated water and can trap alevins (Willers 1991). Bjornn and Reiser (1991) documented rainbow trout embryo survival as it related to the proportion of substrate composed of fines less than ¼ inch: 90% embryo survival with fines at 10%, 75% embryo survival with fines at 20%, and 50% embryo survival with fines at 30%. Spawning is adversely affected when substrate fines (< ¼ inch) exceed 25% (Bjornn and Reiser 1991). (Pyzik 2003)

After young trout emerge from the spawning gravel, they often rear in low velocity areas associated with stream margin habitats, high cover areas and interstitial spaces. Adults require habitat for resting and feeding and thus are generally found in areas of abundant cover associated with deep pools, large organic material, undercut stream banks and overhanging vegetation.

Over-winter sites, characterized by low velocity areas with cover, including large woody debris, are important to all age classes (Bjornn and Reiser 1991). (Pyzik 2003)

Redband trout possess a hereditary basis to persist at higher water temperatures than other species of trout (Behnke 1992). Sonski (1985) noted that redband trout raised in a hatchery continued to grow until temperature reached 75°F; his recommended temperatures included a range from 65 to 75°F to keep broodstock in good condition. Behnke (1992) has captured (fly-fishing) live redband in streams with temperatures of 82.9°F. Water temperatures exceeding 84.9°F can be fatal to rainbow trout (Bjornn and Reiser 1991). Recent studies in southeast Oregon streams (Little Blitzen River and Bridge Creek in the Blitzen River Basin and North Fork Twelvemile Creek in the Warner Basin) found that redband trout prefer water temperatures of 55°F. At this temperature, metabolic power and swimming ability were some of the highest reported for wild fish (Rodnick *et al*. in press). Stream shade and proper width-to-depth ratios are the key factors influencing water temperatures within streams of south central Oregon. (Pyzik 2003)

Steelhead and redband trout are sympatric (occupying the same range without loss of identity from interbreeding) in all basins that contain steelhead. Sympatric populations with different life histories form different populations due to assortative mating, but are not reproductively isolated from each other (Currens 1987). Each morphology appears to be able to produce offspring of the other type. Redband males have been observed to pair with steelhead females, particularly when steelhead populations are small. Redband trout populations also occur above barriers to anadromous fish. (ODFW 1995)

<u>Genetic Integrity</u>

Mid-Columbia from Fifteenmile Creek to Walla Walla, except South Fork John Day (described below). This group contains sympatric redband trout and summer steelhead populations in the lower Deschutes, John Day, Umatilla, and Walla Walla rivers, and redband trout and winter steelhead populations from Fifteenmile Creek and adjacent areas. Steelhead and trout in the Umatilla, John Day, and Deschutes have all been studied biochemically in some detail and population have been compared within basins. However, comparisons between the basins have not been analyzed. The populations as a group are clearly different from the populations in Oregon's Snake River, but differences within the group may also exist (Currens 1987, Currens and Stone 1989). (ODFW 1995)

South Fork John Day. This group includes steelhead and redband trout in the South Fork of the John Day River. The uniqueness of this group has been determined by allozyme and ecosystem comparisons within the John Day Subbasin. No comparisons have been made outside of the John Day Subbasin (Currens and Stone 1989). There is a barrier – Izee Falls – in the upper South Fork. However, the uniqueness of the South Fork group appears to extend below this barrier; thus, the boundary is drawn at the mouth of the South Fork. The uniqueness of the South Fork redband may result from two factors. First, the South Fork environment comprises a desert ecotype that is unique when compared to the rest of the John Day Subbasin. This feature may produce unique selection pressures on the South Fork populations compared to the rest of the John Day Subbasin. Second, Bisson and Bond (1971) detected unique related species assemblages in the South Fork John Day and in the mid-Silvies River in the Malheur Lakes Basin that suggest a recent (within the last 10,000 years) stream exchange between these basins. This exchange appears to have transferred fish in both directions. The uniqueness of the redband trout in this group may be partly explained by an historical event that naturally introduced novel genetic variation into the South Fork John Day from the redband population in the Silvies River. (ODFW 1995)

In response to population declines, resident forms of redband trout are considered a species of special concern by the U.S. Fish and Wildlife Service, American Fisheries Society, and all states throughout their historic range (Idaho, Oregon, Washington, Nevada, California and Montana). Additionally, they are classified as a sensitive species by the U.S. Forest Service and the Bureau of Land Management (BLM). In Oregon, the resident life form of the inland Columbia Basin subspecies, redband trout, is currently listed as a state "sensitive" species effective in 1990 and as a federal Category 2 candidate species (ODFW 1995). Despite their broad distribution, few strong populations exist. Known or predicted secure populations inhabit 17% of the historic range and 24% of the present range (Lee *et al*. 1997). Furthermore, Lee *et al*. (1997) reported that only 30% of the watersheds supporting spawning and rearing populations were classified as strong populations. Consequently, populations in Oregon and California have been petitioned for listing under the ESA. The California petition is currently under review and the 1999 petition to list the Great Basin redband trout in Oregon was deemed unwarranted at this time (Muhlfeld, 2004). USFWS determined they were not warranted for listing because they could not demonstrate the petitioned population was distinct from other redband populations, including those in the John Day River Subbasin. NOAA Fisheries is currently conducting a status review of inland steelhead under the federal Endangered Species Act (ODFW 1995).

Redband Trout Distribution

Currently in the John Day Subbasin, the redband trout inhabit the North Fork, Middle Fork, Mainstem, and South Fork John Day rivers and upper headwater areas. See Figure 30 for a map of redband trout distribution in the John Day Subbasin. Trout distribution has decreased within most basins, including in areas where they are currently sympatric with steelhead, primarily due to losses in mainstem reaches and the withdrawal of trout populations into headwater areas. Trout populations are no longer present in the lower mainstems of major inland basins such as the Yakima, John Day or Umatilla, which were likely highly productive reaches for trout historically. (ODFW 1995)

Description of aquatic introductions, artificial production and captive breeding programs

Most trout hatchery programs use a domesticated coastal rainbow trout that originated from wild rainbow (redband) trout in northern California about 100 years ago. Most trout releases are in high mountain lakes that do not have wild populations, although some have outlets and hatchery fish may stray out of them downstream into wild trout and steelhead populations. Stream releases of legal-sized hatchery rainbow also occur in the upper Deschutes, John Day, Grande Ronde, Pine, Burnt, and Powder subbasins. Non-native trout, including brook and brown trout, have also been released into the inland redband trout range. (ODFW 1995)

Trout hatchery programs, using domestic coastal rainbow stock, are present in tributaries of the John Day River and the mainstem Umatilla River. Stocking of rainbow trout in the mainstem and North Fork John Day River watersheds was first recorded in 1925 and continued until 1997 in rivers and streams and is ongoing in some lakes and ponds (Table 55). The streams where rainbow trout were consistently stocked include Canyon Creek and the John Day River in the upper mainstem watershed; and Camas Creek, Desolation Creek and North Fork John Day River in the North Fork watershed. Other streams with cutthroat trout were stocked once or twice with rainbow trout, most often in the 1920s or 1940s. (Gunckel 2002)

Of the ponds and lakes with stream outlets, Canyon Meadows Reservoir and Magone Lake were consistently stocked from 1964 to 1996 and 1940 to the present, respectively. In the North Fork John Day watershed, Olive lake and Pendland lake were stocked most frequently, from 1925 to 1985 and 1972 to present, respectively. (Gunckel 2002)

Hatchery stocks of rainbow trout planted in the John Day Subbasin were primarily Roaring River, Cape Cod, Willamette and Oak Springs stocks. The Oak Springs stock originally came from Utah in 1923. In 1971, milt (the sperm-containing fluid of a male fish) from a hatchery in Tacoma, Washington was mixed with this stock and the resulting stock was typically used for Eastern Oregon plantings (Kinunen & Moring 1976). Willamette Rainbow stock originated from McKenzie River rainbow. The Cape Cod stock came to Oregon from a commercial hatchery in

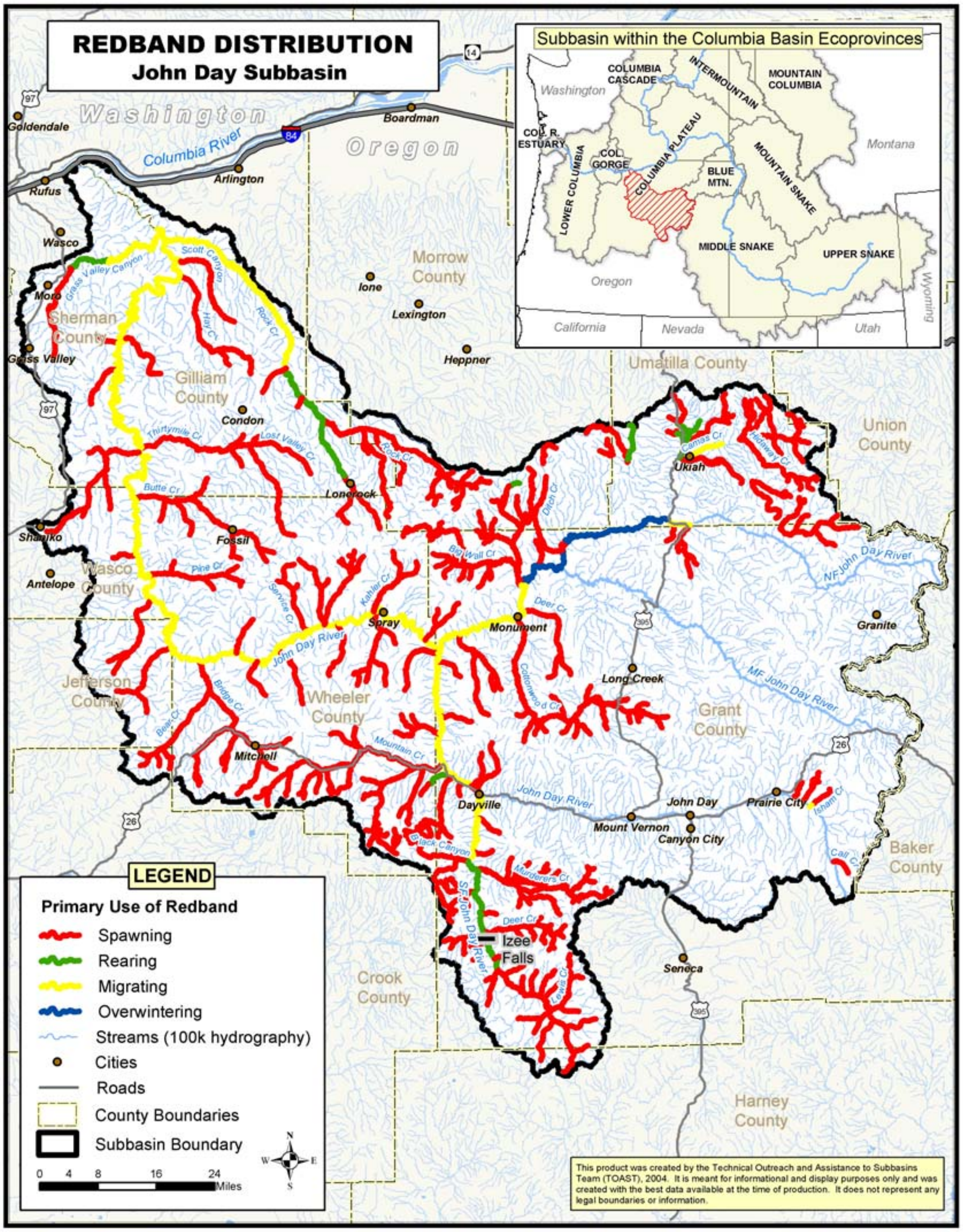

Figure 30. Distribution of redband trout in the John Day Subbasin.

Cape Cod, Massachusetts (Kinunen & Moring 1976). It is believed the Cape Cod hatchery originally obtained their rainbow trout from the McCloud Basin, California (Phil McKee, Fall River Hatchery, personal communication). The Roaring River stock was obtained from the W.S. Meadow trout farm in Idaho in 1937, which originally acquired the parent brood from Utah (Kinunen & Moring 1976). (Gunckel 2002)

Table 55. Total number and pounds of rainbow trout stocked in Upper John Day waterbodies, 1925-2001. n/a = not available; * = ponds and reservoir with a stream outlet. (Gunckel 2002)

Sub-Basin	Water body	Number	Pounds	# of Plantings	Year
North Fork	Big Meadow Creek		40	1	‘41
	Cable Creek	1,840	35	1	‘41
	Camas Creek	247,741	26,929	51	‘25- ‘97
	Crane Creek	20,000	25	2	‘29, ‘54
	Desolation Creek	117,341	29,972	49	‘41- ‘95
	Desolation Creek South Fork,	5,324	450	2	‘41, ‘57
	Fox Creek	6,550	1,600	2	‘41, ‘48
	Frazier Creek	2,831	51	1	‘41
	Hidaway Creek	2,001	36	1	‘41
	John Day River, North Fork	1,116,269	118,297	147	‘25- ‘97
	Lake Creek	21,120	69	1	‘46
	Winom Creek	1,051	20	1	‘41
	Baldy Lake	1,360	40	1	‘48
	Bridge Creek Mgt Area	2,842	40	3	‘81- ‘84
	Bull Prairie Reservoir*	433,677	13,628	44	‘62- ‘01
	Carvendar Reservoir*	9,038	3,209	4	‘98- ‘01
	Jump Off Joe Lake	11,320	17	2	’59, ’62
	Lost Lake	5,971	2,001	6	‘96- ‘01
	Olive Lake	715,421	11,292	31	‘25- ‘85
	Penland Lake	663,514	24,040	39	‘72- ‘01
	Twin Ponds	502	186	1	‘99
	Umatilla Forest Ponds	50,435	6,470	23	‘76- ‘01
Mainstem	Beech Creek	1,001	167	1	‘53
	Canyon Creek	826,448	70,676	113	‘25- ‘97
	Canyon Creek, East Fork	30,000	n/a	1	‘29
	Fields Creek	2,126	400	1	‘41
	John Day River	486,573	63,972	85	‘48- ‘88
	Rail Creek	1,849	360	1	‘41
	Canyon Meadows Reservoir*	211,982	60,114	72	‘64- ‘96
	Carpenter Pond	51,827	14,328	51	‘72- ‘91
	Dale Ponds	2,811	426	3	‘57- ‘58
	Dayville Pond	4,034	1,063	8	‘59- ‘64
	Dove Ponds	9,308	542	8	‘56- ‘59
	Holmberg Pond	9,610	1,526	10	‘58- ‘64
	Lemons Pond	1,952	472	5	‘58- ‘61
	Magone Lake	317,118	8,170	37	‘40- ‘01

	Morris Ponds	40,328	3,516	18	‘56- ‘62
	Mt. Vernon Pond	500	125	1	‘58
	Oliver Ponds	32,417	2,345	14	‘56- ‘62
	Patterson Pond	48,071	9,182	23	‘58- ‘73
	Retherford Pond	6,194	1,433	9	‘58- ‘63
	Seventh Street Pond	22,206	7,274	22	‘92-‘01
	Strawberry Lake	183,825	561	8	‘28-‘48
	Trout Farm Pond*	23,038	7,312	23	‘90- ‘01
	Trowbridge Ponds	17,899	1,129	15	‘56- ‘64
	Velvin Pond	910	156	2	‘57, ‘58

Harvest in the Subbasin

Redband trout have little commercial value, and historically have supported only a small sport fishery. Hence they have attracted little attention from managers, have not been well researched and their status has not been sufficiently documented compared to other salmonids in the Pacific Northwest. (Kostow 2003)

Most trout programs are restricted to lakes or reservoirs where impacts to wild trout are minimized. Angling regulations in these populations target hatchery fish and require the release of all wild steelhead. Since 1998, there have been no releases of hatchery rainbow trout into any streams within the subbasin. Current fishing regulations for the John Day Subbasin are five fish a day, 10 in possession, minimal length eight inches. Lakes are open year round, all streams (exceptions listed below) within the John Day River Subbasin are open for trout angling from the fourth Saturday in May to the end of October. The following streams are closed to all angling: Granite Creek system, Middle Fork John Day River from Highway 7 to Summit Creek.

Environmental Conditions for Redband Trout

Resident redband trout rely on many of the same habitat characteristics as steelhead. Consequently, many of the environmental conditions that arose as limiting factors for steelhead during the EDT analysis would also be limiting for resident redband; including lack of key habitat quality and habitat diversity, and increased sedimentation and seasonal water temperatures. In response to these conditions, and decreased summer flow, many resident redband populations have retreated to headwater areas where they have become fragmented and isolated. (ODFW 1995)

3.2.4 Population Delineation and Characterization

Westslope Cutthroat Trout *(Oncorhynchus clarki lewisi)*

The following information is from "Status of Westslope Cutthroat Trout (*Oncorhynchus clarki lewisi*) in the United States: 2002" (Shepard *et al*. 2003), volume 1 of the Interior Columbia Basin Ecosystem Management Project Draft EIS (ICBEMP 2000), and various other local sources referenced within this section.

<u>Westslope Cutthroat Trout Population Data and Status</u>

The WCT is one of 14 subspecies of cutthroat trout *O. clarki* native to interior regions of western North America (Trotter 1987, Behnke 1992). Cutthroat trout owe their common name to the distinctive red slash that occurs just below both sides of the lower jaw. Adult WCT typically exhibit bright yellow, orange and red colors, especially among males during the spawning season. Characteristics of WCT that distinguish this fish from the other cutthroat subspecies include a pattern of irregularly-shaped spots on a body that has few spots below the lateral line, except near the tail; a unique chromosome complement (2n = 66, versus 64 for other inland subspecies); and other genetic and morphological traits that appear to reflect a distinct, evolutionary lineage (Trotter 1987, Behnke 1992).

Westslope cutthroat trout (WCT) probably never were widely distributed within the Blue Mountains or Columbia Plateau. Productivity has been adequate to sustain localized migratory and isolated populations, resulting in current populations thought to be fairly secure. However, this conclusion must be tempered by uncertainty regarding the genetic integrity of remaining populations. Most current <u>wild</u> populations are depressed. Hybridization, fragmentation and loss of migratory populations have limited healthy populations to a much smaller proportion of their historical range. Further, competition with introduced rainbow and brook trout has impacted the ability of the species to fully occupy its natural niche in the ecosystem.

In the John Day Subbasin, hybridization is not believed to be a major reason for WCT decline. Habitat and water quality alterations are much more ubiquitous problems and have contributed to a decrease in distribution, aggravating any problems caused by hybridization. In other words, changes to habitat and water quality have pushed cutthroat into a smaller and smaller area where they are more likely to hybridize with native redband trout and steelhead (Tim Unterwegner, ODFW, personal communication, April 19, 2004).

Populations of WCT in these mostly isolated stream systems have remained stable in recent years. WCT distribution within the John Day Subbasin is limited primarily to public lands. Because of more restrictive land use regulations on public lands, the risk to WCT habitat is not as great as if it were primarily private lands.

While there hasn't been a planned effort to establish population trends, occasional and sporadic surveys have served to establish presence and productivity data in the John Day Subbasin. However, based on 1990 and 1992 stream survey data, Kostow (1995) reported that almost all John Day drainage WCT stocks have more than 300 spawning adults.

The spatial arrangement of range-wide populations of WCT with abundance deemed at or near capacity were obviously clumped and appeared related to the presence of areas designated as wilderness, roadless, or national parks. In the western states, about 3800 miles classified as "at or near capacity" (39% of all miles in this class) were in wilderness and about 930 miles (10% of all miles in this class) had field data to support this classification. Because assessments of abundance, regardless of data quality, were linked to quality of habitat, it is not surprising that most populations located in wilderness and roadless areas would be designated as being at or near capacity. Except where empirical observations indicated otherwise, nearly all habitats in wilderness areas were presumed to be in pristine condition. While assignment of 54% (2055 miles) of the miles of habitat rated "at or near capacity" within wilderness was based on professional judgment (low data quality), approximately 25% of the miles classified in this category in wilderness was supported by field data.

Appendix E of the 2003 Assessment Report (Shepard *et. al*. 2003) shows a comparison of WCT habitat in the John Day Subbasin that is currently and was historically occupied. Approximately 1229 miles of habitat are currently occupied, while 1393 miles are currently unoccupied (but historically occupied). Cutthroat were introduced into North Fork John Day tributaries in the early 1960s, so that watershed is not listed as historically occupied.

Westslope cutthroat trout usually mature at four or five years of age and spawn entirely in streams, primarily small tributaries. Spawning occurs between March and July, when water temperatures warm to about 50° F (Trotter 1987, Behnke 1992, McIntyre and Rieman 1995). Natal homing, i.e. the return of adult fish to spawning areas where they themselves were produced, is believed to occur in WCT. Individual fish may spawn only in alternate years (Shepard *et al.* 1984, Liknes and Graham 1988). Fertilized eggs are deposited in stream gravels where the developing embryos incubate for several weeks, with the actual time period inversely related to water temperature. Several days after hatching from the egg, WCT fry about one inch long emerge from the gravel and disperse into the stream.

Westslope cutthroat trout fry may grow to maturity in the spawning stream or they may migrate downstream and mature in larger rivers or lakes. Consequently, three WCT life-history types are recognized (Trotter 1987, Liknes and Graham 1988, Behnke 1992, McIntyre and Rieman 1995): *Resident* fish spend their lives entirely in the natal tributaries; *fluvial* fish spawn in small tributaries but their resulting young migrate downstream to larger rivers where they grow and mature; and *adfluvial* fish spawn in streams but their young migrate downstream to mature in lakes. After spawning in tributaries, adult fluvial and adfluvial WCT return to the rivers or lakes (Rieman and Apperson 1989, Behnke 1992). All three life-history types may occur in a single drainage (Bjornn and Liknes 1986, Rieman and Apperson 1989). Whether these life-history types represent opportunistic behaviors or genetically distinct forms of WCT is unknown. However, evidence from Washington State suggests that life-history types represent opportunistic behaviors. Here, numerous self-sustaining stocks of WCT in streams and lakes have established themselves outside the historic range of the subspecies as the result of widespread introductions of hatchery WCT.

Westslope cutthroat trout feed primarily on macroinvertebrates, particularly immature and mature forms of aquatic insects, terrestrial insects and, in lakes, zooplankton (Liknes and Graham 1988). These preferences for macroinvertebrates occur at all ages in both streams and lakes. Westslope cutthroat trout rarely feed on other fishes (Liknes and Graham 1988, Behnke 1992).

Growth of individual WCT, like that of other species of fish, depends largely upon the interaction of food availability and water temperature. Resident WCT usually do not grow longer than twelve inches, presumably because they spend their entire lives in small, coldwater tributaries. In contrast, fluvial and adfluvial WCT often grow longer than twelve inches and attain weights of two to three pounds. Such rapid growth results from the warmer, more-productive environments afforded by large rivers, lakes and reservoirs (Trotter 1987, Behnke 1992).

Spawning habitat for WCT occurs in low-gradient stream reaches that have gravel substrate ranging from 0.8 to three inches in diameter, water depths near 0.7 ft and mean water velocities from 1 to 1.3 feet per second (Liknes 1984, Shepard *et al.* 1984). Proximity to cover (e.g., overhanging stream banks) is an important component of spawning habitat for adult WCT. On the basis of information for other salmonid species, survival of developing WCT embryos is probably inversely related to the amount of fine sediment in the substrate in which the fertilized WCT eggs were deposited (Alabaster and Lloyd 1982). After they emerge from the spawning gravel, WCT fry generally occupy shallow waters near streambanks and other low-velocity areas (e.g., backwaters, side channels) (McIntyre and Rieman 1995). Fry move into main-channel pools as they grow to fingerling size (3 to 5 inches long). Juvenile WCT are most often found in stream pools and runs that have summer water temperatures of 45 to 61° F and a diversity of cover (Fraley and Graham 1981, McIntyre and Rieman 1995). Adult WCT in streams are strongly associated with pools and cover (Shepard *et al.* 1984, Pratt 1984a, Peters 1988, Ireland 1993, McIntyre and Rieman 1995). During winter, adult WCT congregate in pools (Lewynsky 1986, Brown and Mackay 1995, McIntyre and Rieman 1995), while juvenile fish often use cover provided by boulders and other large in-stream structures (Peters 1988, McIntyre and Rieman 1995). During summer in lakes and reservoirs, the primary habitat for rearing and maturation of adfluvial fish, WCT are often found at depths where temperatures are less than 61° F (McIntyre and Rieman 1995).

Genetic integrity. The historic range of WCT occurs both east and west of the Continental Divide in the Missouri, Saskatchewan and Columbia River basins. It is believed that the ancestral WCT moved upstream into the upper Columbia River Basin before geologic events formed impassable waterfalls on the Pend Oreille River near the present-day border between Washington and Idaho (Roscoe 1974, Behnke 1992). In turn, periodic connections between headwater streams allowed WCT from the Columbia River Basin to enter the Missouri and Saskatchewan River basins until soon after the last glacial period (i.e., the Pleistocene Epoch) approximately 7000 to 10,000 years ago (Behnke 1979, 1992, Trotter 1987). As the post-glacial waters receded, however, stocks of WCT east of the Continental Divide became isolated from those in the Columbia River Basin.

The present-day, disjunct WCT stocks in Washington and Oregon may have been deposited there by late-Pleistocene floods (Behnke 1992). Massive floods accompanied periodic bursting of the ice dams that formed glacial Lake Missoula, a large prehistoric lake that was inhabited by WCT and occupied major valleys in present-day western Montana.

Because WCT east of the Continental Divide became reproductively isolated from WCT west of the divide 7000 to 10,000 years ago, it is possible that subsequent evolution has led to genetic differences in WCT between the Missouri and Columbia River basins or among these and other reproductively isolated WCT stocks elsewhere in the historic range of the subspecies. Fish stocks that are reproductively isolated can evolve unique characteristics (i.e., adaptations) that can be important to survival of the stocks (Scudder 1989).

Cutthroat trout of the subspecies that we today recognize as WCT were first described in 1805 by the Lewis and Clark expedition on the basis of specimens caught near the Great Falls of the Missouri River, near the present-day city of Great Falls, Montana (Behnke 1992). However, as recently as the 1970s there was confusion regarding the appropriate taxonomic classification of the WCT (Roscoe 1974). Today, WCT are considered a distinct taxonomic form, distinguishable from the Yellowstone and other subspecies of cutthroat trout on the basis of spotting pattern, karyotype (66 chromosomes), and biochemical characteristics (Behnke 1992). These features separate WCT from the other subspecies of inland cutthroat trout to a substantial degree atypical of fishes representing different taxons within a single species (Allendorf and Leary 1988). The subspecies *Oncorhynchus c. alpestris,* known as the "mountain cutthroat trout," is considered a synonym of WCT. It occurs as disjunct stocks ranging from the John Day River drainage in eastern Oregon into British Columbia (Trotter 1987, Behnke 1992).

Paul Spreull at the University of Montana looked at samples from two populations (Dixie and Roberts creeks) from the Upper John Day and found pure WCT in upstream samples and WCT X rainbow trout hybrids in downstream samples. WCT X rainbow hybrids have also been identified via DNA analysis in Little Indian Creek. Most of the work to-date has been focused on determining species and subspecies purity. While this is a legitimate and important question relevant to genetic and biological conservation, like most biological questions, it is not that simple and a simple answer could be misleading. For example, if we assume WCT are native to the John Day and eastern Washington, they evolved in the presence of native rainbow/steelhead, and some expected background levels of hybridization could occur while still maintaining a more general level of reproductive isolation (e.g., a possibility in Dixie and Roberts creeks). Thus, detection of WCT X rainbow hybrids could be a product of sampling methods, location and size rather than a definitive answer concerning population purity.

Other important considerations regarding WCT in the John Day Subbasin and along the east slope of the Washington Cascades: 1. Rainbow trout and steelhead are native in most drainages where WCT occur, and 2. There is considerable uncertainty about the degree of genetic purity in "native" WCT, particularly in Washington where releases of hatchery WCT have been widespread since the turn of the century. Consequently, WCT X rainbow hybridization may be more of a threat to native rainbow trout populations in areas where WCT have been introduced.

Genetic Risks. Throughout their range, many of the historic habitats of WCT have been extensively colonized by introduced (stocked), nonnative fishes. Among these nonnative species are brook trout, rainbow trout, brown trout and lake trout (*Salvelinus namaycush*). Range-wide, genetic introgression (interbreeding) is considered to be the primary threat to the continued existence of WCT, particularly where they coexist with rainbow trout or Yellowstone cutthroat trout (Liknes and Graham 1988).

However, in the John Day Subbasin, the only introduced species are rainbow trout (from historic stocking, discontinued in 1995 where WCT are present) and brook trout (introduced in the 1930s and now self sustaining). The John Day population has a low threat of genetic introgression. Further, the WCT population is a very small part of the entire WCT distribution (Tim Unterwegner, ODFW, personal communication, April 19, 2004).

Spatial Diversity. In addition to the seasonal movements related to spawning and growth, WCT often move in response to seasonal changes in habitat conditions and habitat requirements. Fluvial and adfluvial WCT have been shown to migrate more than 62 miles in response to habitat needs (Bjornn and Mallet 1964, Liknes 1984). For example, there can be considerable movement to suitable pools used as overwintering habitat (Brown and Mackay 1995). Among resident WCT in tributaries, less extensive, seasonal movements may be made in response to changing habitat requirements and conditions, particularly water temperature. Westslope cutthroat trout may move relatively little in stream reaches that have numerous pools (Peters 1988), whereas movement can be more extensive in stream reaches with few pools (Lewynsky 1986, Peters 1988, McIntyre and Rieman 1995).

During their evolutionary history in the Columbia River Basin, WCT shared habitats with several piscivorous (i.e., fish-eating) fish species, namely northern pikeminnow (*Ptychocheilus oregonensis)*, bull trout, chinook salmon, and rainbow trout and their sea-run form, steelhead. In the Missouri River Basin, where WCT have probably occurred for 7000 to 10,000 years (Behnke 1992), the subspecies formerly coexisted with fewer species of fish, all of them essentially nonpiscivorous (e.g., Arctic grayling {*Thymallus arcticus*} and mountain whitefish {*Prosopium williamsoni*}). In both river basins, WCT also coexisted with sculpins (*Cottus* spp.), suckers (*Catostomus* spp.), and dace (*Rhinichthys* spp.) and other minnows.

Westslope Cutthroat Trout Distribution

Current Distribution. The John Day Subbasin consists of two major watersheds with WCT occupation: the Upper Mainstem John Day and the upper North Fork John Day. Resident WCT are the dominant life history form present; however, recent research has indicated larger, possibly fluvial life forms are present in the mainstem John Day River. Westslope cutthroat trout distribution overlaps with resident redband trout, with WCT generally being found in reaches with higher gradient, cooler temperatures and greater amounts of large woody debris. Westslope cutthroat trout distribution in the John Day Subbasin also overlaps with bull trout, steelhead trout and chinook salmon. Hybridization and introgression between WCT and redband trout has been noted in areas where overlapping distribution occurs. Figure 31 illustrates the regional distribution across the western states. Figure 32 illustrates WCT distribution in the John Day Subbasin.

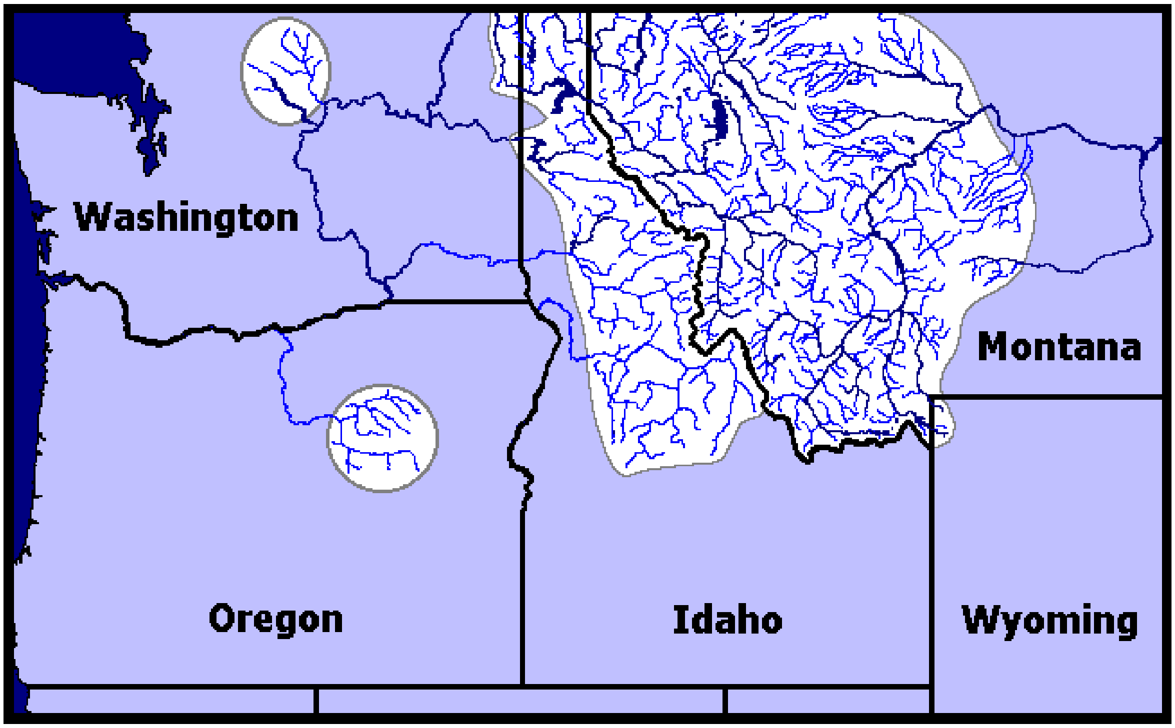

Figure 31. Westslope cutthroat trout distribution across the west.

Upper Mainstem John Day River Watershed. Hemmingsen and Gray (1999 draft) reported WCT distribution in the Upper Mainstem John Day River. The Malheur National Forest provided an updated WCT distribution map that contains additional WCT records, including presumed seasonal habitat distribution. Based on the Malheur distribution map, resident WCT currently occupy: 1) Fields Creek and tributaries, 2) Moon Creek, 3) McClellan Creek, 4) Ingle Creek, 5) Laycock Creek, 6) Canyon Creek and tributaries, 7) Little Pine Creek, 8) Dog Creek, 9) Pine Creek, 10) Indian Creek and tributaries, 11) Strawberry Creek and tributaries, 12) Upper John Day River and tributaries (including major tributaries: Graham, Call, Roberts, Reynolds, Deardorff, and Rail creeks), 13) Dixie Creek and tributary 14) Bear Creek, 15) Beech Creek and tributaries, 16) Birch Creek, and 17) Belshaw Creek. Portions of a total of 64 rivers, streams and tributaries are occupied either year-round (approximately 197 miles) or seasonally (an additional 94 miles) by WCT. Seasonal WCT habitat includes the lower portions of most of these occupied tributaries, an additional tributary without resident WCT (Widows Creek) and the mainstem John Day River downstream to Widows Creek (between the towns of Dayville and Mount Vernon). These "seasonal" zones appear to be habitat for wandering or migratory WCT. Hemmingsen and Gray (1999) conservatively estimate WCT occupying at least 221 miles across 41 streams.

Data generated by the ICBEMP (1996) predicts that 33 HUC5 watersheds occur in the mainstem John Day River within the current range of WCT. Westslope cutthroat trout presence is known within 17 HUC5 watersheds; while 13 HUC5 watersheds are known to not contain WCT. Further, the ICBEMP model predicts an additional two HUC5 watersheds contain WCT and one additional HUC5 watershed does not contain WCT (ICBEMP 1996). All WCT-occupied HUC5 watersheds in the mainstem John Day are predicted or known to have “depressed” WCT populations.

Resident WCT distribution overlaps with resident bull trout habitat in Indian Creek, the Upper Mainstem John Day River and the tributaries to the Upper Mainstem John Day River (Roberts, Call, Rail, Reynolds, and Deardorff creeks) for a total of 47.5 miles. Seasonal WCT distribution overlaps with migratory bull trout habitat throughout the Upper Mainstem John Day River downstream to the town of John Day (approximately 42 additional miles). Cursory analysis indicates bull trout and WCT occur sympatrically in the mainstem John Day River and its tributaries wherever bull trout are found (overlap between these two species, for resident and migratory forms, is approximately 90 miles). Westslope cutthroat trout are substantially more widely distributed than bull trout in the Upper Mainstem John Day River. Table 56 contains occupancy by fish use by land ownership in the Upper John Day River.

Table 56. Mileages of WCT Occupancy, Land Ownership - Upper John Day River.

Fish Use – Ownership	WCT Occupancy
Resident - Private Lands	71 miles
Resident - Public Lands	126 miles
Resident - Total	197 miles
Seasonal - Private Lands	94 miles
Seasonal - Public Lands	0 miles
Seasonal - Total	94 miles
Combined Mileage	291 miles

Resident WCT are the one known life-history form found in the Upper John Day River watershed. Resident fish occur in upper, forested reaches of the above streams. Larger, possibly migratory forms have only been found in the well-connected, upper headwaters area (at the confluence of Call, Rail, Reynolds, Roberts, Deardorff and Graham creeks with the mainstem John Day River), and in mainstem riverine habitats downstream in the broad river valley. Resident forms are often isolated in single streams, separated from other stocks by distance and habitat conditions. However, numerous stocks in the Upper John Day River exhibit occupation of multiple, connected tributary streams that are, as a group, isolated from other, single stream stocks by geographic distance and habitat conditions. This connectivity is important to avoid isolation and protect the interconnected stocks from cumulative watershed effects (Hemmingsen and Gray 1999 draft). No information is available regarding WCT spawning locations in the Upper Mainstem John Day River or its tributaries.

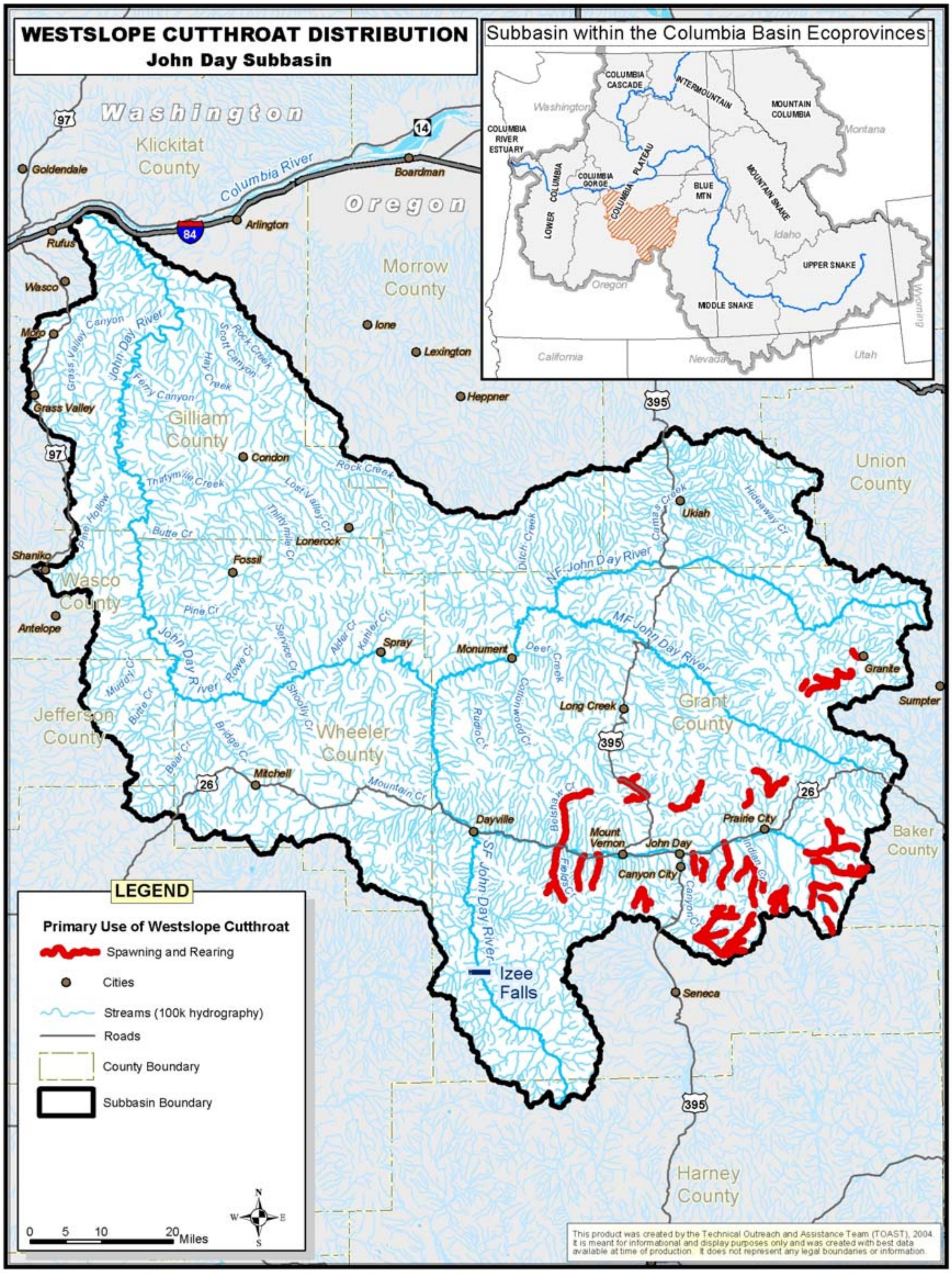

Figure 32. Distribution of westslope cutthroat in the John Day Subbasin.

Malheur National Forest file information indicates that WCT numbers in the Upper John Day, Prairie City and Canyon Creek HUC5 watersheds (Upper Mainstem John Day River; Graham, Roberts, Call, Rail, Reynolds, Deardorff, Strawberry, Indian, Pine, Dog, Little Pine, Canyon, Dixie and Bear creeks) were “relatively strong” (based on subjective field observations), while WCT numbers in the Beech Creek, Mount Vernon and Fields HUC5 watersheds (Fields, Moon, McClellan, Ingle, Laycock, Beech, Birch and Belshaw creeks) were “generally lower.” Kostow (1995) reported, based on juvenile fish trap data at irrigation diversions, a recent downward trend in WCT abundance. However, these data may not be an accurate measure of population trends.

Upper North Fork John Day River Watershed. Confusion exists as to the origin of WCT found in the North Fork John Day River watershed. No genetic data are available for these fish. ICBEMP (1996) analysis indicates all North Fork John Day WCT stocks were introduced. Hemmingsen and Gray (1999 draft) indicate at least some of the North Fork John Day WCT stocks may be either introduced WCT or another cutthroat subspecies (Lahontan and Yellowstone cutthroat have been stocked in certain North Fork John Day reservoirs in the past). Jim Hewkin (retired ODFW District Biologist) transplanted 100 WCT from Deardorff Creek (upper mainstem tributary) to Clear Creek (a tributary to Granite Creek) and 100 to South Fork Desolation Creek in 1960. Both Clear Creek and Desolation Creek are in the North Fork John Day watershed. This transplant was documented in the 1960 annual report for the John Day District. Even though these are “introduced” populations, it is believed they are important for reducing risks to the overall population and for WCT recovery efforts overall (Tim Unterwegner, ODFW, personal communication, April 19, 2004). For purposes of this analysis, it is assumed that these fish are WCT.

The Malheur NF also provides a WCT distribution map for the upper North Fork John Day River, based on previous U.S. Forest Service and ODFW stream surveys, indicating WCT occupy South Fork Desolation Creek, Lake Creek and tributary, and Clear Creek and tributaries (portions of eight streams). Hemmingsen and Gray (1999 draft) indicate WCT occupy portions of seven streams. ODFW records indicate that cutthroat trout found in the Olive Lake area (Lake Creek watershed) may have been brought there from outside the state (Kostow 1995 indicated Lahontan cutthroat trout have been stocked in Olive Lake. Hemmingsen and Grey (1999) indicate both Lahontan and Yellowstone cutthroat have previously been stocked in Olive Lake). Within the upper North Fork John Day River, WCT are found almost exclusively on Umatilla National Forest lands. Bull trout overlap with WCT in 13 miles of stream in the North Fork John Day River watershed.

Little summarized information is available for North Fork John Day WCT. Historic distribution data is not available and ICBEMP (1996) analysis indicates all stocks are introduced. Resident fish occur in the above drainages; however, no information was available regarding presence of migratory forms or seasonal distributions of WCT. No information is available regarding WCT spawning locations.

Data generated by ICBEMP (1996) predicts that 10 subwatersheds occur in the North Fork John Day River within the current range of WCT. Westslope cutthroat trout presence is known within 4 subwatersheds, and 6 subwatersheds have no information (ICBEMP 1996). All occupied subwatersheds in the North Fork John Day River watershed are predicted or known to have "depressed" WCT populations.

In summary, WCT occur in about 51 tributaries or stream reaches that collectively encompass 315 linear miles of stream habitat, distributed between 2 watersheds in the John Day River drainage.

Historic Distribution. The historic distribution of WCT (Behnke 1992) in streams and lakes is not known precisely but can be summarized as follows: west of the Continental Divide, the subspecies is native to several major drainages of the Columbia River Basin, including the upper Kootenai River drainage from its headwaters in British Columbia, through northwest Montana, and into northern Idaho; the Clark Fork River drainage of Montana and Idaho downstream to the falls on the Pend Oreille River near the Washington-British Columbia border; the Spokane River above Spokane Falls and into Idaho's Coeur d'Alene and St. Joe River drainages; and the Salmon and Clearwater River drainages of Idaho's Snake River Basin. The historic distribution of WCT also includes disjunct areas draining the east slope of the Cascade Mountains in Washington (Methow River and Lake Chelan drainages), the John Day River drainage in northeastern Oregon, and the headwaters of the Kootenai River and several other disjunct regions in British Columbia. East of the Continental Divide, the historic distribution of WCT includes the headwaters of the South Saskatchewan River drainage (U.S. and Canada); the entire Missouri River drainage upstream from Fort Benton, Montana, and extending into northwest Wyoming; and the headwaters of the Judith, Milk, and Marias rivers, which join the Missouri River downstream from Fort Benton. The historic range of WCT is considered the most geographically widespread among the 14 subspecies of inland cutthroat trout.

Historic WCT distribution is anecdotal at best. No tributaries currently absent of WCT are known to have supported these fish in the past (ICBEMP 1996). However, Kostow (1995) reported "suspected" historical WCT habitat has been reduced 59%, based on assumptions (no substantive evidence) that WCT had a wider historical distribution in the North Fork and Middle Fork John Day watersheds. The distribution of WCT in various branches of the John Day River system may have been much further downstream than at present. Descriptions of the mainstem river valley by explorers and trappers such as Peter Skene Ogden indicate conditions suitable to these fish prior to European settlement of the West. Likewise, distribution of year-round resident fish in the valley and foothill reaches of tributaries may have been reduced from the historic distribution due to habitat alteration.

Identification of differences in distribution due to human disturbance.

Upper John Day River Watershed. Kostow (1995) reported mainstem John Day River drainage habitat modifications due to changes in stream channel structure, loss of riparian vegetation, dewatering and changes in the hydrographs of the mainstem and major tributaries. These habitat modifications were caused by agricultural development, irrigation diversions, livestock grazing and timber harvest. In the majority of occupied tributary streams, habitat modifications, especially on private lands, have probably shifted WCT distribution to upstream reaches, further exacerbating geographic isolation. However, in tributaries where WCT co-exist with bull trout, WCT have a greater downstream distribution, possibly indicating greater WCT tolerance than bull trout to modified habitat conditions.

Aforementioned habitat modifications have effectively isolated WCT in certain tributary systems for at least the warmer months due to warm water and low streamflows (Kostow 1995). While seasonally impassable physical barriers to WCT passage (i.e., irrigation diversion dams) often occur in the mainstem John Day River, occupied tributary streams do not exhibit WCT physical passage barriers, except for Strawberry Creek. A total of 62 water diversions with associated fish screens and passage features are present within occupied resident or migratory WCT habitat in the Upper Mainstem John Day River key watershed. It is unknown how many additional diversions without fish screening facilities exist in this key watershed, or the efficacy of existing fish screening and passage features at allowing unhindered fish movement during periods of operation.

WCT in the upper mainstem headwaters area (Graham, Roberts, Call, Rail, Reynolds, Deardorff creeks) exist within a "checkerboard" of public (Malheur National Forest) and private (mostly commercial timberlands, with some stream bottom pasture lands) land ownership. Due to this land ownership pattern, harvest on private timberlands is considered a potential threat to WCT in this area of the watershed. However, the highly-connected streams of this portion of the watershed would allow for rapid WCT recolonization.

Upper North Fork John Day River Watershed. A dirt road parallels the lower portion of WCT occupation along Clear Creek, and a road system accesses Olive Lake on Lake Creek near the lower portion of WCT occupation. Mines and access roads are located at the headwaters of tributaries to South Fork Desolation and West Fork Clear creeks. No other occupied WCT reach in this drainage is readily accessible to motorized travel. Forest Service file maps also indicate at least one diversion, for placer mining purposes, on East Fork Clear Creek. Two reservoirs (Olive Lake and Upper Reservoir) are located on Lake Creek; WCT distribution occurs above, between, and below these two reservoirs. No upstream passage is provided at these reservoirs. Extensive mining sites (placer and hard rock) historically and currently occur on or near several occupied tributaries. A majority of occupied WCT habitat in this drainage (85 %, or approximately 20 miles) is completely surrounded by, or has one stream bank directly adjacent to, either the Vinegar Hill-Indian Rock Scenic Area or North Fork John Day Wilderness Area.

<u>Description of Aquatic Introductions, Artificial Production and Captive Breeding Programs.</u>

Current Introductions and Production. Westslope cutthroat trout is not currently being introduced into the subbasin. There are no artificial production activities in the subbasin.

Historic Introductions and Production. Historically, WCT have been introduced into the John Day Subbasin. Approximately 100 WCT taken from Deardorff Creek, a mainstem John Day River tributary, were stocked into South Fork Desolation Creek and another 100 were stocked into Clear Creek by ODFW in 1960. These were stocked in an attempt to re-establish populations of fish after spruce budworm spraying occurred in 1958. ODFW records indicated Olive Lake was planted with WCT from Twin Lakes in the 1970s. The WCT in Twin Lakes originated from WCT taken from Washington. This stocking likely explains why WCT are now found in Lake Creek, which drains Olive Lake. Further details of past introductions of WCT are included in the "Current Distribution" section above.

Streams in the John Day were also stocked with what were presumed to have been Yellowstone cutthroat, although WCT were also cultured at the Yellowstone Hatchery. Consequently, populations identified as "pure" may still be the product of hatchery introductions.

The historical record on the presence of native WCT in the subbasin is not clear. Though it is certain that WCT have been stocked in the subbasin, there is no hard evidence indicating WCT were not indigenous to the subbasin. Stephanie Gunckel (2002) did an extensive literature review and interviewed many long time residents of the John Day Valley, who have no recollection of bringing westslope cutthroat into the subbasin. WCT's widespread distribution in the upper mainstem (16 tributaries) is an indication they have been here for a very long time. Brook trout were introduced about the same time as the alleged stocking of Yellowstone cutthroat by the Deardorff family, and they are restricted to relatively small reaches in two streams. (Tim Unterwegner, ODFW, personal communication, April 19, 2004).

Ecological Consequences of Artificial Production and Introduction. Today, many of the historic habitats of WCT have been extensively colonized by introduced (stocked) nonnative fishes. Among these nonnative species are brook trout, rainbow trout, brown trout and lake trout (*Salvelinus namaycush)*. Griffith (1988) considered brook trout to be the most significant competitor with all subspecies of cutthroat trout in streams, leading to the elimination of WCT in some areas. There are introduced brook trout in the John Day Subbasin, but they are limited to two streams: the upper reaches of Canyon Creek and the Upper Mainstem John Day River. The significance of impacts of brook trout introductions on WCT has not been evaluated. However, it is the professional opinion of Tim Unterwegner (Unterwegner, ODFW, personal communication, April 19, 2004) that the impacts are isolated to only those areas where brook trout are found. The problem is much more severe in upper Canyon Creek than in the Upper Mainstem John Day watershed, as upper Canyon Creek has a reservoir that is conducive to brook trout growth.

Nonnative fish species and subspecies can also pose threats to the genetic integrity of WCT. Liknes and Graham (1988) considered genetic introgression (interbreeding), particularly with rainbow trout or Yellowstone cutthroat trout, to be the primary threat to the continued existence of WCT where these species coexist. In the John Day Subbasin, where redband and steelhead overlap with WCT and are native, the threat of introgression is not significant. The reduction in WCT distribution associated with loss of habitat, reduced streamflows, warmer water temperatures in the summer, loss of off channel habitat and channelization; and further restriction of redband/steelhead distribution into the best habitat quality areas occupied by cutthroat has probably contributed to the threat of introgression.

Relationship between Naturally and Artificially-Produced Populations. During their evolutionary history in the Columbia River Basin, WCT shared habitats with several piscivorous (i.e., fish-eating) fish species, namely northern pikeminnow *Ptychocheilus oregonensis*, bull trout, chinook salmon, rainbow trout and their sea-run form, steelhead. In the Missouri River Basin, where WCT have occurred for probably 7000 to 10,000 years (Behnke 1992), the subspecies formerly coexisted with fewer species of fish, all of them essentially nonpiscivorous (e.g., Arctic grayling *Thymallus arcticus* and mountain whitefish *Prosopium williamsoni)*. In both river basins, WCT also coexisted with sculpins *Cottus* spp., suckers *Catostomus* spp., and dace *Rhinichthys* spp. and other minnows. Today, many of the historic habitats of WCT have been extensively colonized by introduced (stocked), nonnative fishes. Among these nonnative species are brook trout, rainbow trout, brown trout and lake trout *Salvelinus namaycush*. Griffith (1988) considered brook trout to be the most significant competitor with all subspecies of cutthroat trout in streams, leading to the elimination of WCT in some areas.

<u>Harvest in the Subbasin.</u>

In the Upper John Day River Watershed, ODFW biologists indicate a lack of a "targeted" WCT fishery due to a combination of small size of resident WCT and land ownership patterns/topographic features restricting or precluding angler access. In addition, ODFW stocking programs and angling regulations are currently designed to emphasize lake and pond fisheries, further minimizing possible over-harvest of exclusively stream-resident WCT.

In the Upper North Fork John Day River Watershed, Granite Creek and most of its tributaries are currently closed to angling to protect chinook salmon. However, Lake Creek and South Fork Desolation Creek are open to angling and are managed under a five-fish daily bag with an eight-inch minimum-size limit. However, there is no hatchery stocking program and no targeted fishery on either Desolation or South Fork Desolation Creek, due to a combination of small size of resident WCT and land ownership patterns/topographic features restricting or precluding angler access.

No information is available on historic harvest.

<u>Environmental Conditions for Aquatic Focal Species.</u>

Characterization of Historic. WCT currently occupy about 33,500 miles (59%) of the nearly 56,500 miles of historically-occupied habitats. However, the genetic status of WCT across all this area has not been determined by genetic testing. WCT currently occupy over 18,000 miles in Idaho (95% of historical), almost 13,000 miles in Montana (39% of historical), about 250 miles in Oregon (21% of historical), and almost 2000 miles in Washington (66% of historical).

Characterization of Current.

Upper John Day River Watershed. Habitat modifications have effectively isolated WCT in certain tributary systems for at least the warmer months due to warm water and low streamflows (Kostow 1995). While seasonally-impassable physical barriers to WCT passage (i.e., irrigation diversion dams) often occur in the mainstem John Day River, occupied tributary streams do not exhibit WCT physical passage barriers, except for Strawberry Creek. A total of 62 water diversions with associated fish screens and passage features are present within occupied resident or migratory WCT habitat in the Upper Mainstem John Day River key watershed. It is unknown how many additional diversions without fish screening facilities exist in this key watershed, or the efficacy of existing fish screening and passage features at allowing unhindered fish movement during periods of screen operation.

WCT in the upper mainstem headwaters area (Graham, Roberts, Call, Rail, Reynolds and Deardorff creeks) exist within a "checkerboard" of public (Malheur National Forest) and private (mostly commercial timberlands, with some stream bottom pasture lands) land ownership. Due to this land-ownership pattern, harvest on private timberlands is considered a potential threat to WCT in this area of the watershed. However, the highly-connected streams of this portion of the watershed would allow for rapid WCT recolonization.

Upper North Fork John Day River Watershed. A dirt road parallels the lower portion of WCT occupation along Clear Creek, and a road system accesses Olive Lake on Lake Creek near the lower portion of WCT occupation. Mines and access roads are located at the headwaters of tributaries to South Fork Desolation and West Fork Clear creeks. No other occupied WCT reach in this drainage is readily accessible to motorized travel. Malheur National Forest records also indicate at least one diversion, for placer mining purposes, on East Fork Clear Creek. Two reservoirs (Olive Lake and Upper Reservoir) are located on Lake Creek; WCT distribution occurs above, between, and below these two reservoirs. No upstream passage is provided at these reservoirs. Extensive mining sites (placer and hard rock) historically and currently occur on or near several occupied tributaries. A majority of occupied WCT habitat in this drainage (85 %, approximately 20 miles) is completely surrounded by, or has one stream bank directly adjacent to, either the Vinegar Hill-Indian Rock Scenic Area or North Fork John Day Wilderness Area.

Characterization of Potential and Estimated Reference Condition for Long-Term Sustainability. Federal regulations that protect WCT and their habitat in Oregon include CWA; NEPA; FLPMA; INFISH and PACFISH; and National Forest Management Plans. In addition, Endangered Species Act Section 7 actions directed toward the protection of listed bull trout and Mid-Columbia River steelhead and their habitats will also afford benefits to WCT.

In the John Day River drainage, ODFW surveys have been conducted since 1990 for WCT (Gray, *in litt.* 1998). These data are beneficial in ODFW, USFS, USFWS and others' analyses of project impacts to WCT. Bonneville Power Authority funding has been provided for ongoing fish-screen maintenance activities and has assisted in riparian and in-water habitat restoration activities along the mainstem John Day River, above the town of John Day.

Bull trout, listed as a threatened species in 1998, provide additional Endangered Species Act protection to aquatic habitats co-occupied by bull trout and WCT. Within the mainstem John Day River drainage, a total of 24% (47.5 miles) of resident WCT distribution and 45% (42 miles) of seasonal WCT distribution is sympatrically occupied by either resident or migratory bull trout (Pence, *in litt.* 1998). A total of 56% (13 miles) of WCT distribution in the North Fork John Day River watershed overlaps with bull trout. The listing of bull trout has resulted in additional awareness and diligence on the part of numerous agencies, including USFS, BLM, ODFW, Oregon Department of Forestry and Oregon Division of State Lands.

Westslope cutthroat trout occupy several protected areas, including the Strawberry and North Fork John Day Wilderness areas, and the Vinegar Hill-Indian Rock Scenic Areas. A total of approximately 44 miles of stream is within these protected areas, representing approximately 20% of current resident habitat in these two watersheds (approximately 20 miles [85%] in protected areas for North Fork John Day watershed and approximately 24 miles [12 %] in protected areas for mainstem John Day River drainage).

Characterization of Future with No New Actions. Many of the remaining WCT stocks are restricted to small, headwater streams in mountainous areas where the adverse effects of human activities on WCT and its habitat have often been negligible. This is especially true for many of the remaining, genetically-pure WCT stocks (e.g., Shepard *et al.* 1997). Such spatial separation precludes natural movement and interbreeding among stocks, however, thereby increasing the likelihood that some stocks will become extinct due to limited genetic variability. In addition, the probable small sizes of these individual WCT stocks and the short stream reaches that they might inhabit make individual stocks more vulnerable to extirpation due to natural catastrophes such as floods, landslides, wild fires and other stochastic environmental effects.

Despite the probable small sizes of the WCT stocks that inhabit these confined stream reaches, however, evidence of inbreeding depression in extant WCT stocks has not been found. Inbreeding depression would be anticipated if the effective population size (i.e., the number of breeding-age adults) of a WCT stock was too small and repeated inbreeding occurred, leading to accumulation and dominance of certain alleles (i.e. phenotypic expressions of a gene) and loss of genetic diversity. Thus, there is no evidence that the probable small effective population size of some WCT stocks is resulting in genetic changes that could have adverse effects on stock viability.

Similarly, although the probable small sizes of these individual WCT stocks and the short stream reaches that they might inhabit make individual stocks more vulnerable to extirpation due to floods, landslides, wild fires and other stochastic environmental effects, this review found no evidence that contemporary WCT stocks have been lost as the result of such natural catastrophes.

3.2.5 Terrestrial Focal Species Population Delineation and Characterization

Present Distribution and Population Data

Species accounts for the 11 terrestrial focal species are included in Appendix D (See Section 3.2.2 for a description of how the focal species – both terrestrial and aquatic – were selected.). These accounts discuss and illustrate range-wide the characterization and distribution for each focal species.

This section includes maps showing habitat potential within the John Day Subbasin for all focal species (Figures 33 through 39) except: American beaver, Columbia spotted frog, great blue heron and yellow warbler. Habitat potential maps are not available for these riparian-related species because data of sufficient resolution is not available for these “linear” habitats. In addition, the aquatic assessment in this plan deals entirely with the riparian habitat type that covers these four riparian terrestrial species. These terrestrial species receive numerous indirect benefits from riparian recovery projects.

These habitat potential maps (they are not distribution maps) for the terrestrial focal species were produced through three steps by the Oregon Natural Heritage Information Center. First, a species distribution map was produced using sixth field watershed refinements. Second, an updated vegetation layer was created from numerous sources. This vegetation layer identified habitat needs for each of the terrestrial species. Third, a simple habitat suitability index was created for the habitat types in the vegetative layer. The result of this modeling process was a data set that allowed mapping of habitat quality for each terrestrial focal species on a "ramped" scale from poor to excellent. Again, these are the habitat potential maps displayed in Figures 33 through 39.

Locally Extirpated and Introduced Species

A number of terrestrial wildlife species have been extirpated from the John Day Subbasin, including the Columbia sharp-tailed grouse, the gray wolf, the grizzly bear and the California bighorn sheep. Columbia sharp-tailed grouse were extirpated from Oregon in the 1960s due to a combination of factors, including over-hunting in the mid- to late- 19th century, the conversion of native habitats to crop production and habitat degradation from livestock grazing (Hays *et al.* 1998, Crawford and Coggins 2000). Sage grouse, a species dependent on shrub-steppe habitat, were extirpated from the John Day Subbasin by 1955 because of habitat conversion, overgrazing and over-hunting (Stinson *et al.* 2003). The gray wolf and grizzly bear were both extirpated from the subbasin by the 1940s, primarily due to predator control efforts. California bighorn sheep were extirpated from Oregon by 1915 due to over-hunting, unregulated domestic livestock grazing, and parasites and diseases carried by domestic livestock. However, these sheep have been successfully reintroduced in many areas of the John Day Subbasin (ODFW 2003b).

A large number of terrestrial wildlife species have been introduced to the John Day Subbasin, both intentionally and accidentally. Non-native gamebirds introduced into the subbasin to provide recreational activities include the ring-necked pheasant, wild turkey, California quail, chukar, and Hungarian partridge. Because these species are popular game species in the John Day Subbasin, wildlife managers in the subbasin work to maintain their populations. However, populations of many of these species have been declining in the last 20 to 30 years for a variety of reasons, including changes in agricultural practices, non-native weed invasions and weather variability (ODFW 1999).

Other species intentionally introduced as game animals in the John Day Subbasin or in adjacent subbasins include the bullfrog, the Virginia opossum, the eastern fox squirrel, and the European red fox. Bullfrogs are particularly problematic in the area due to their negative effects on native amphibian species. In fact, their introduction is considered a major factor in the decline of many of these species (Csuti *et al.* 1997). As a result of their aggressive behavior and rapid growth rate, bullfrogs out-compete native amphibians (Corkran and Thoms 1996). In addition, they are voracious predators, often eating the eggs, tadpoles and adults of native frog species. In the John Day Subbasin, the bullfrog's preferred habitat is similar to that of many other amphibians native to the John Day Subbasin, especially to that of the Columbia spotted frog. The Virginia opossum can also negatively impact native wildlife. As opportunistic feeders, they often consume a variety of small birds, mammals, and reptiles (Csuti *et al*. 1997).

Two non-native bird species common in the John Day Subbasin and virtually everywhere else in the United States are the European starling and the house sparrow. Intentionally introduced in the 1800s from Europe, these birds are aggressive competitors for nesting cavities. They commonly out-compete native cavity-nesting birds, and are known to destroy nests and eggs and kill nestlings and adults while taking over nest sites.

Two non-native mammalian species closely associated with humans globally also occur in the John Day Subbasin. The Norway rat and house mouse are found in cities and towns of the subbasin, but their prevalence and their effect on native wildlife in the subbasin are not known.

Other non-native animals common in the John Day Subbasin are pet animals that escape or are intentionally released. Common feral animals in the subbasin include cats, dogs, and red eared slider turtles. Cats, in particular, are known to have negative impacts on terrestrial wildlife, such as birds, rodents and reptiles, an effect that can be magnified in fragmented landscapes (Crooks and Soulé 1999). Introduced or escaped exotic mammals such as Mouflon and barbary sheep also pose significant health and potential genetic risks to native California bighorn sheep (Darren Brunings, ODFW, personal communication, May 24, 2004). Feral horses occur in significant numbers in the John Day Subbasin.

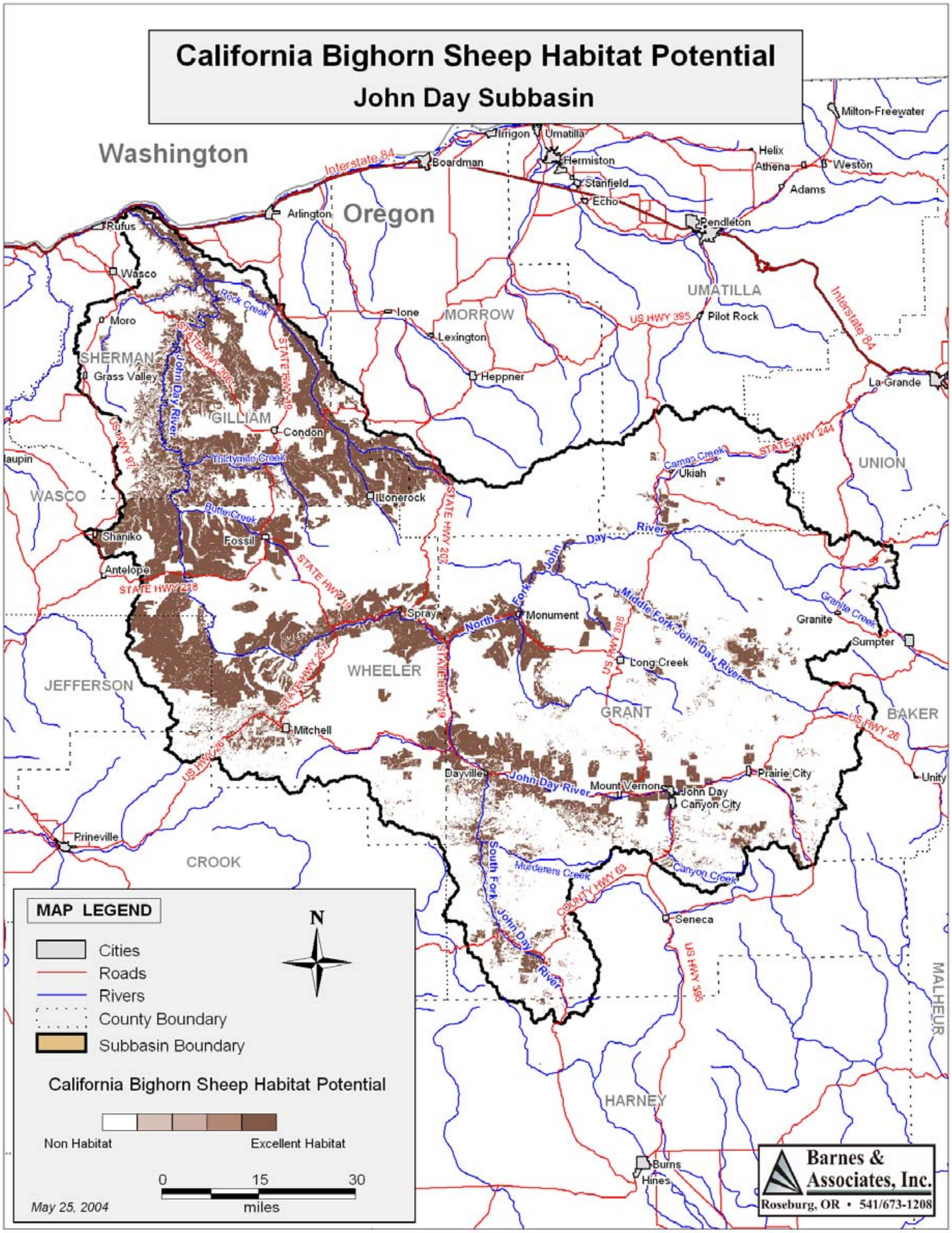

Figure 33. California bighorn sheep habitat potential in the John Day Subbasin.

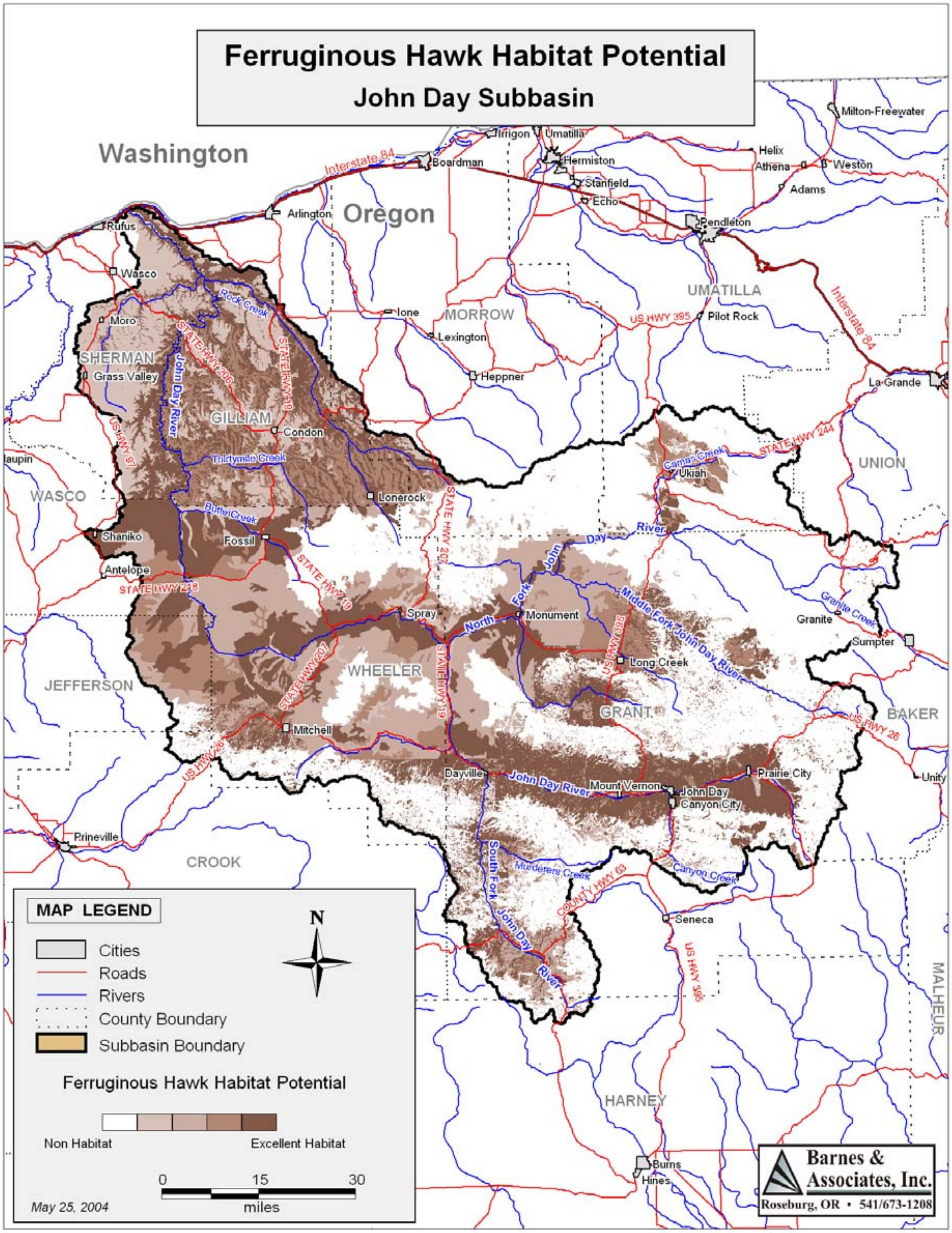

Figure 34. Ferruginous hawk habitat potential in the John Day Subbasin.

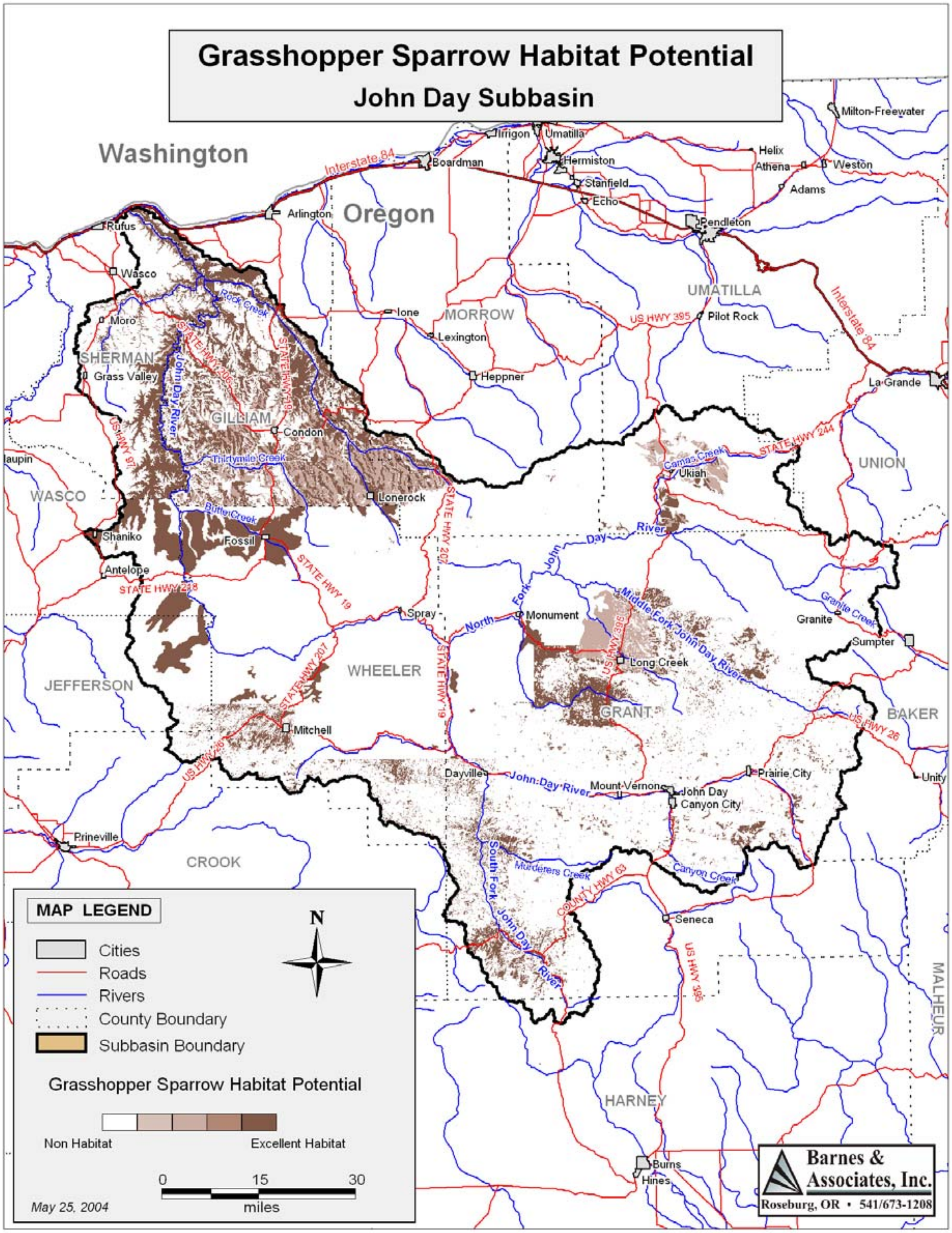

Figure 35. Grasshopper sparrow habitat potential in the John Day Subbasin.

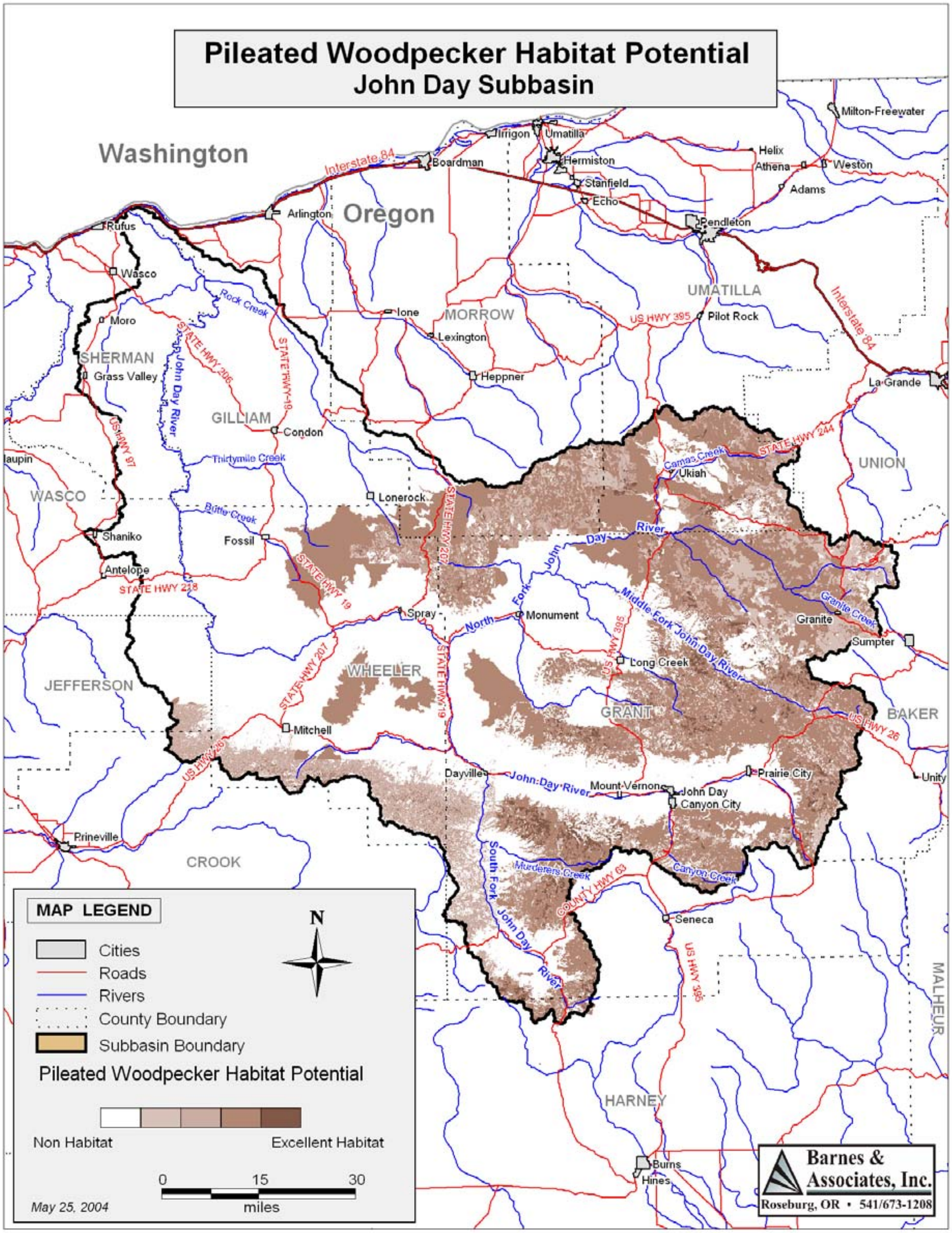

Figure 36. Pileated woodpecker habitat potential in the John Day Subbasin.

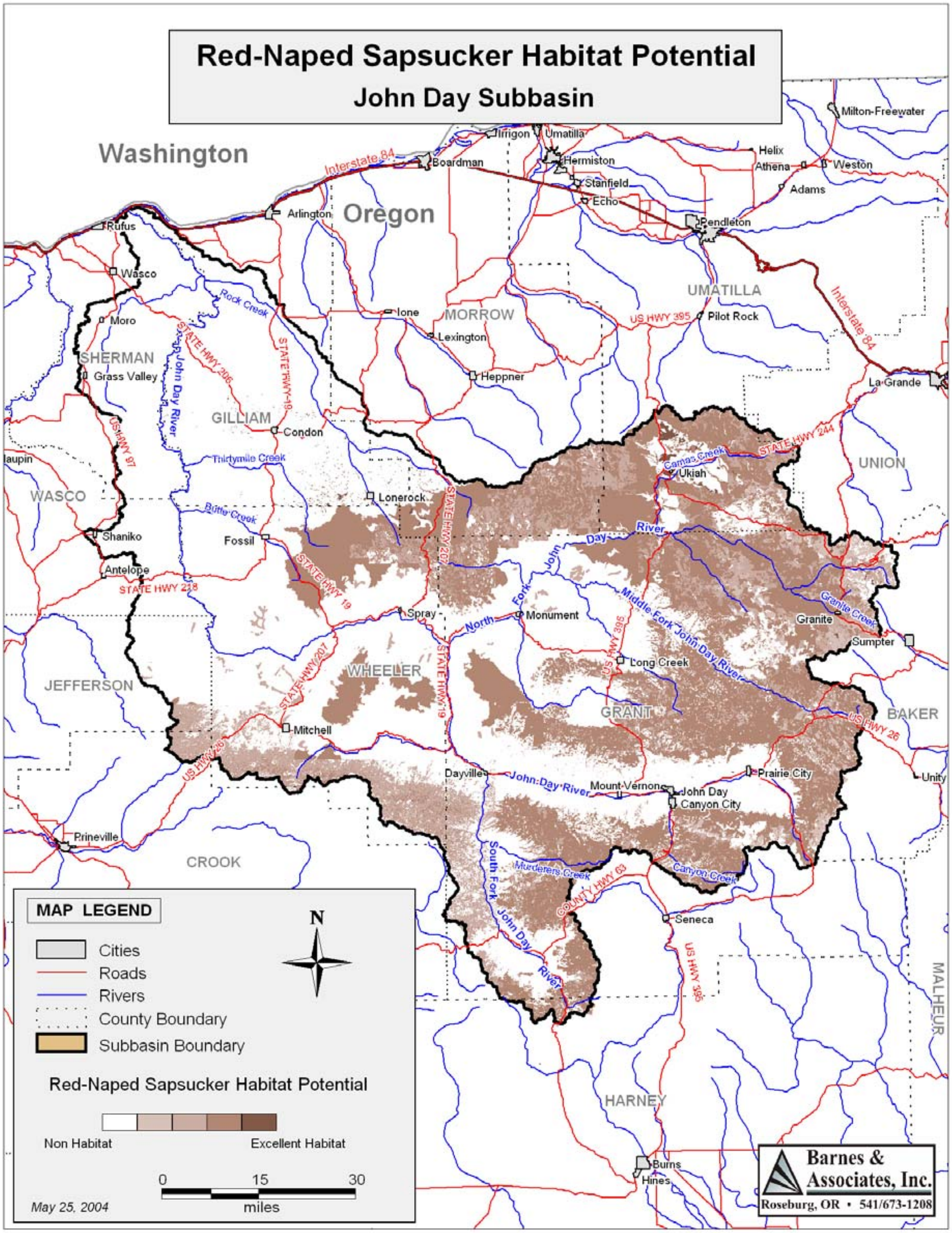

Figure 37. Red-naped sapsucker habitat potential in the John Day Subbasin.

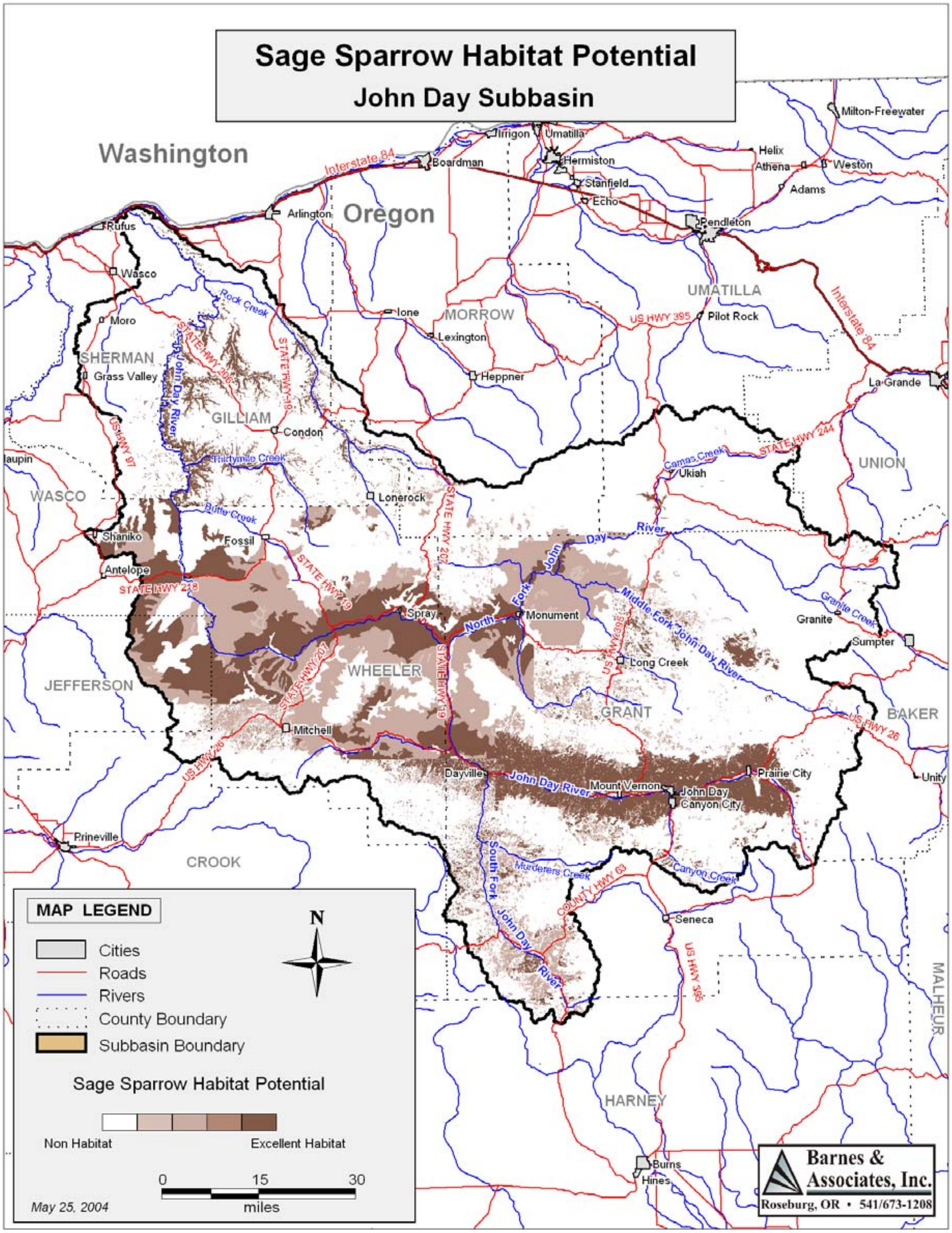

Figure 38. Sage sparrow habitat potential in the John Day Subbasin.

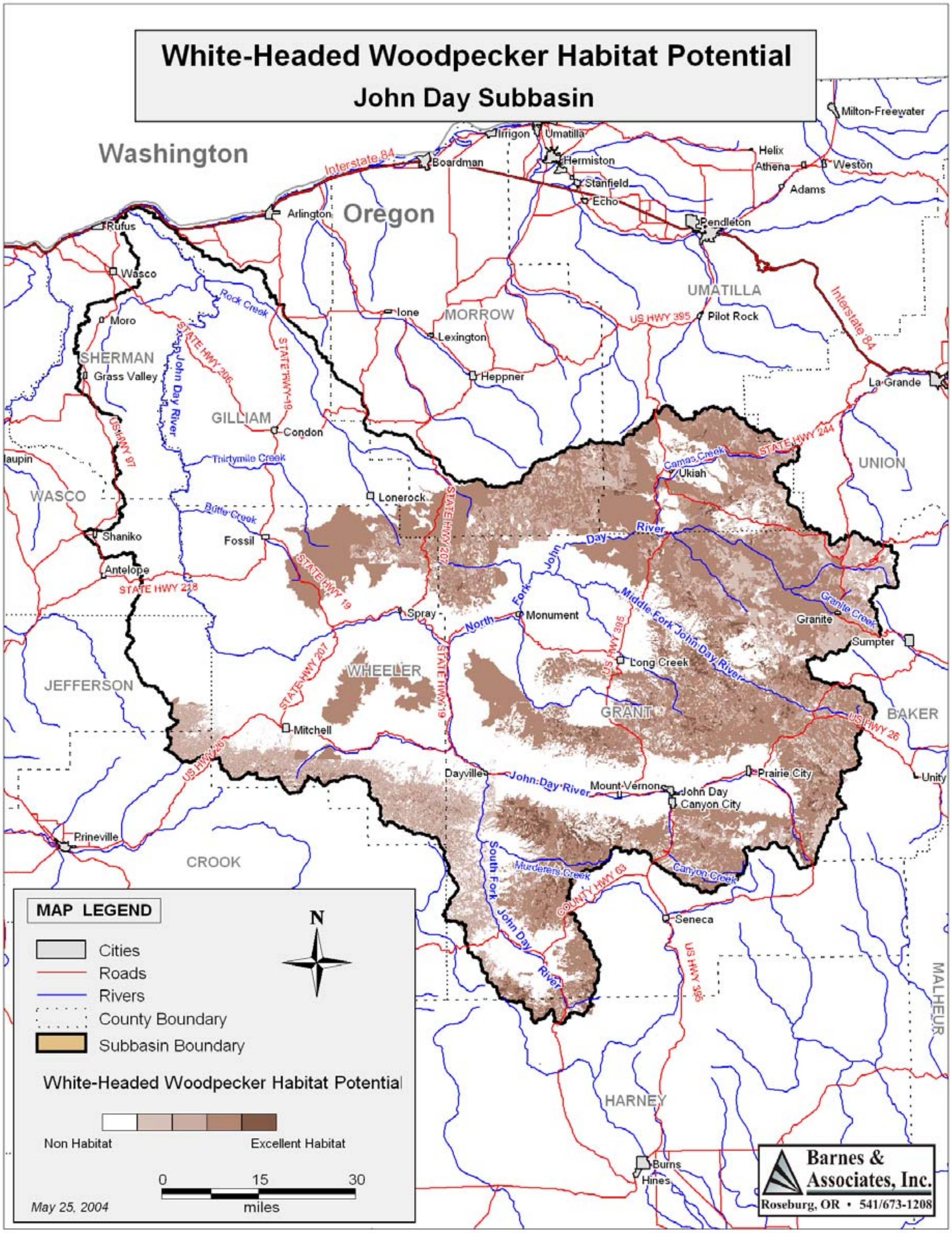

Figure 39. White-headed woodpecker habitat potential in the John Day Subbasin.

Assumptions about Productivity Environmental Conditions at HUC6 Level

Each of the terrestrial focal species is associated with a particular habitat. See Table 22 for a list of the terrestrial focal species and their associated habitats. Each of these focal habitats is discussed in detail in Appendix E.

Table 57 displays the acreages of both current (1999) and historic (circa 1850) habitat as well as absolute and percentage changes from historic to current. The spatial distributions of current and historic wildlife habitats across the entire John Day Subbasin are shown in Figures 40 and 41, respectively. These habitat types and acreages are from NWHI 2004.

Meaningful interpretation of these acreage changes should be looked at only for positive or negative trends, as habitat classification abilities differ significantly between the two time periods. The habitat type descriptions located in Appendix E describe the factors for the changes reflected in Table 57. The coarse resolution of the habitat distribution data needs to be considered when reviewing Figure 40. For instance, the "western juniper and mountain mahogany woodlands" habitat type displayed in Figure 40 also contains a significant component of grassland understory beneath the low canopy cover of western juniper in some areas.

Table 57. Habitat type changes from historic (c.1850) to current (1999) times.

	Acres		Change	
Habitat Type	Historic	Current	Acres	%
montane mixed conifer forest	11222	135281	124059	1105%
interior mixed conifer forest	196464	838318	641854	327%
lodgepole pine forest and woodlands	80938		-80938	-100%
ponderosa pine/white oak forest and woodlands	1862106	1278369	-583737	-31%
alpine grasslands and shrublands	2376	22192	19816	834%
western juniper and mountain mahogany woodlands	100420	1288505	1188085	1183%
interior grasslands	1623043	77857	-1545186	-95%
shrub-steppe	1182840	832387	-350453	-30%
desert playa and salt scrub shrublands	9143		-9143	-100%
open water (lakes, rivers, streams)	1013	5234	4221	417%
herbaceous wetlands	2718	35221	32503	1196%
interior canyon shrublands		163930	163930	
agriculture, pastures and mixed environs		385106	385106	
urban and mixed environs		8606	8606	
montane coniferous wetlands		851	851	
interior riparian wetlands		371	371	
Total	5072283	5072228	-55	

Two maps displaying the protection status of lands in the John Day Subbasin are in Figures 42 and 43.

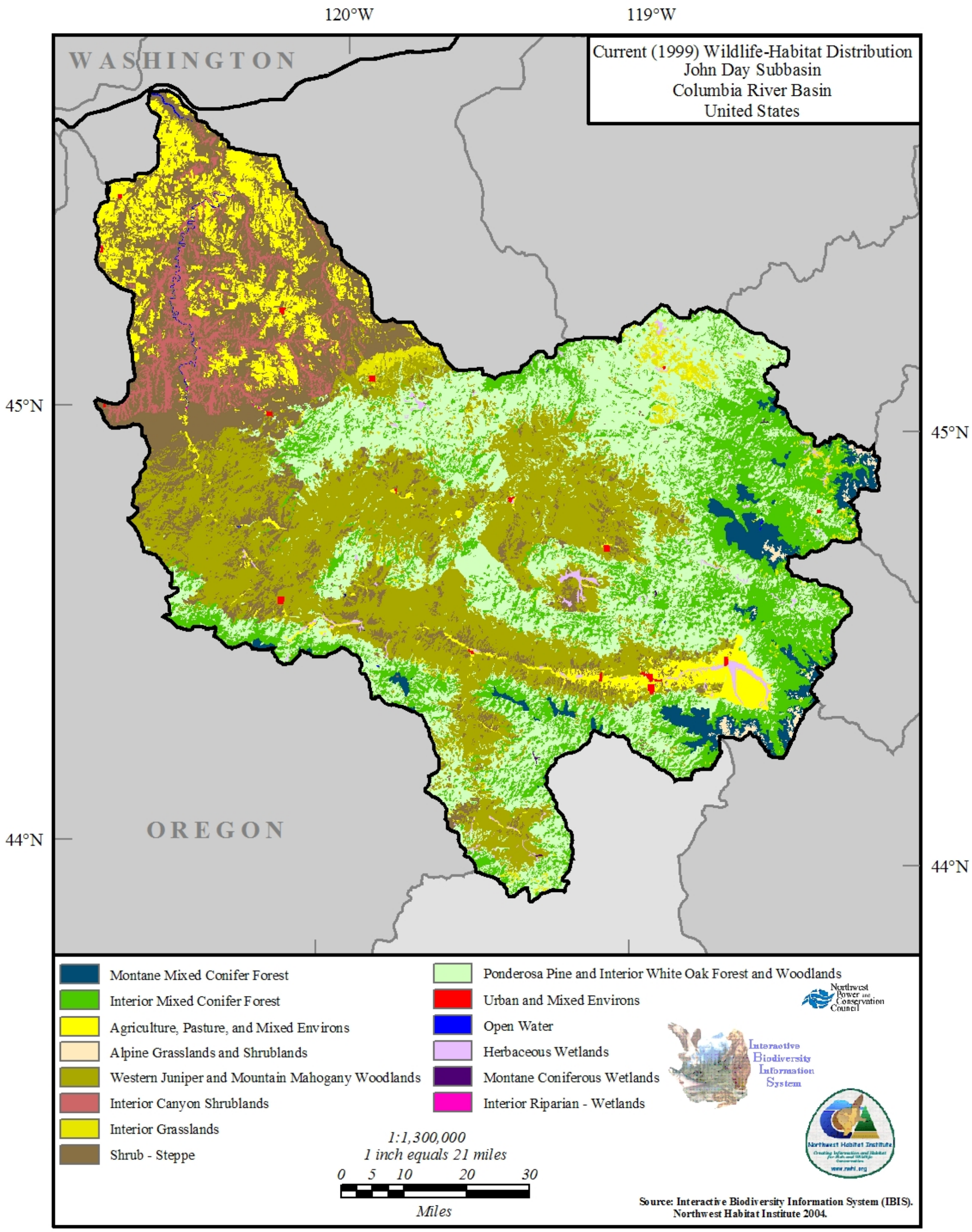

Figure 40. Current (1999) wildlife habitat distribution in the John Day Subbasin.

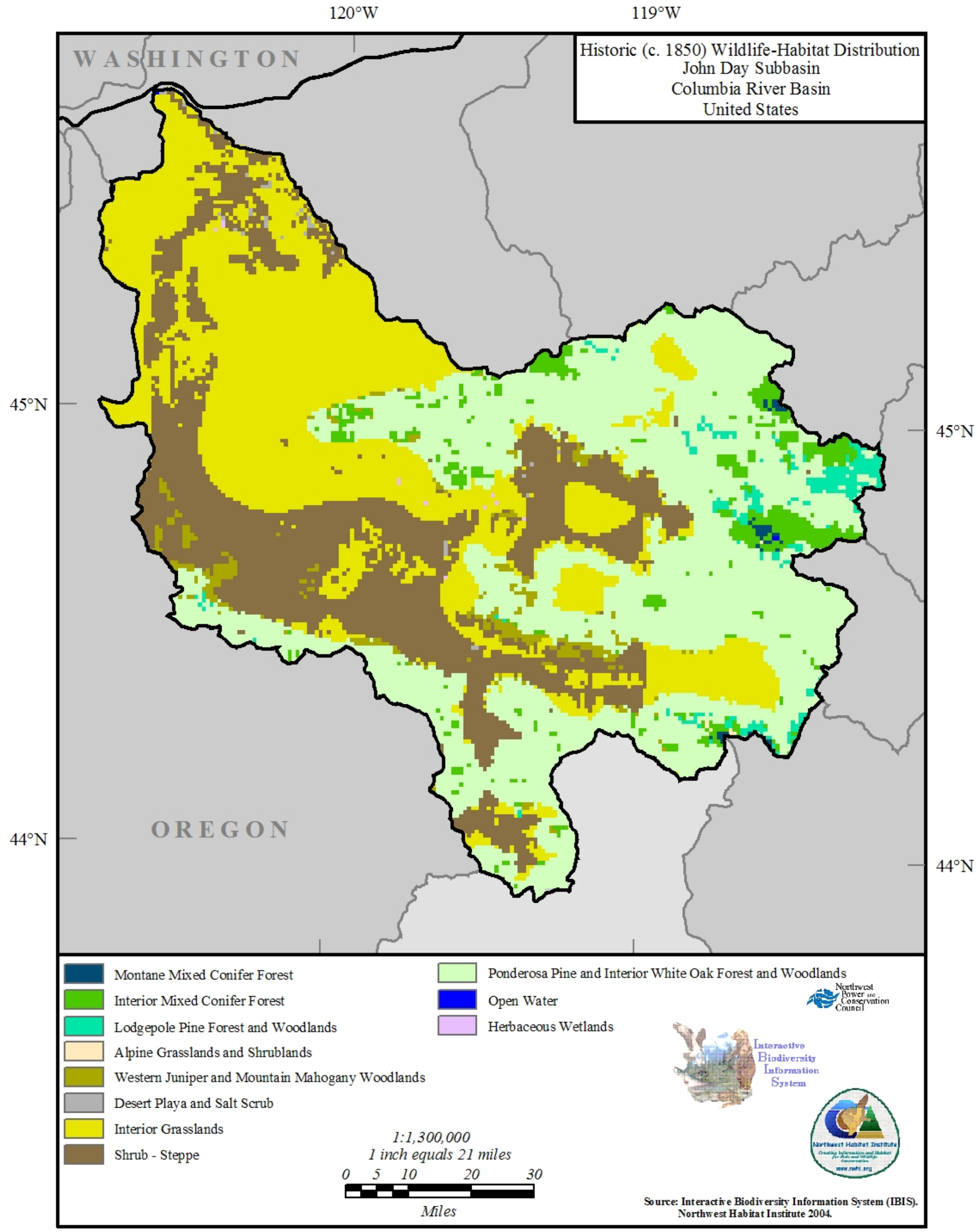

Figure 41. Historic (c. 1850) wildlife habitat distribution in the John Day Subbasin.

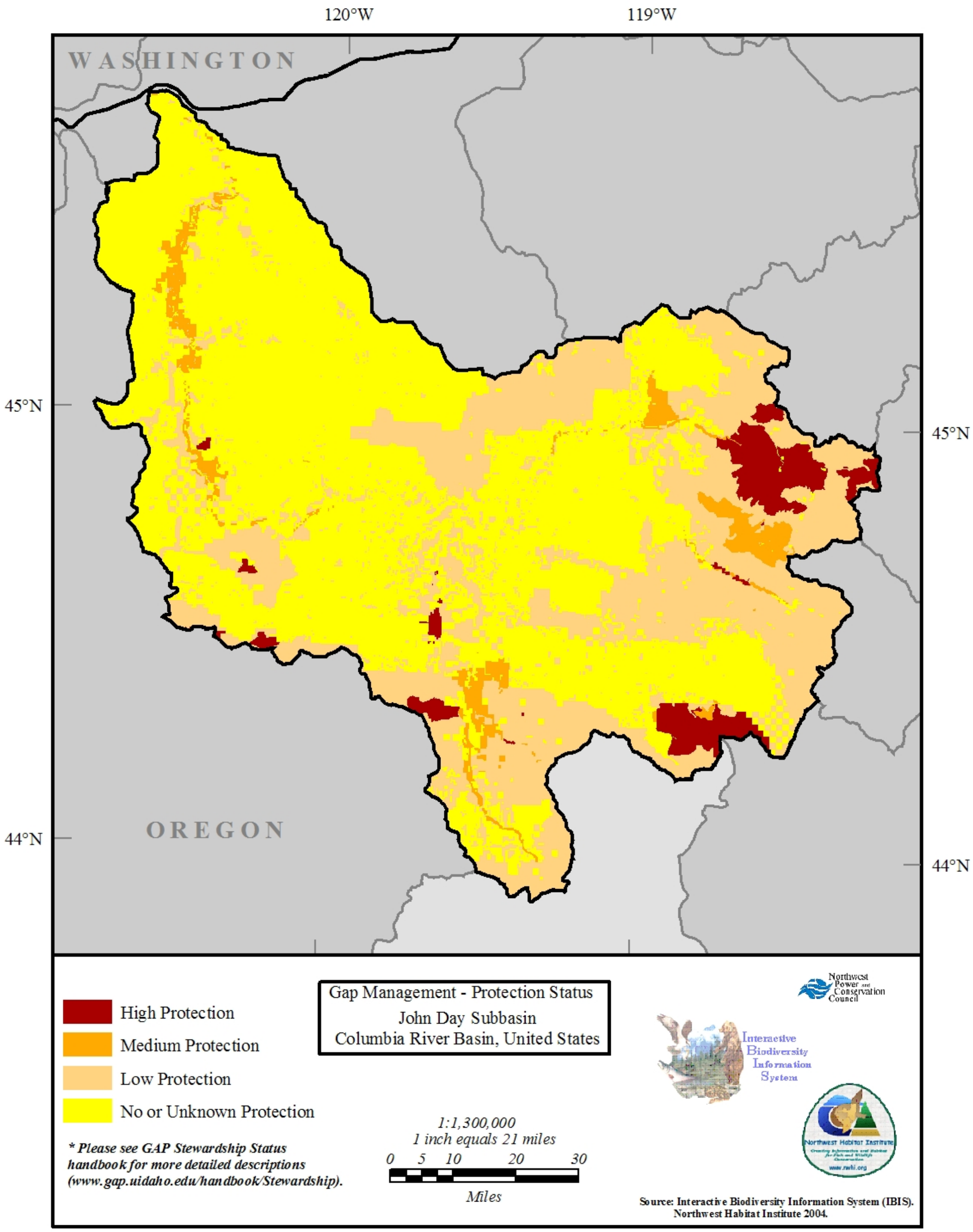

Figure 42. Protection status of lands in the John Day Subbasin.

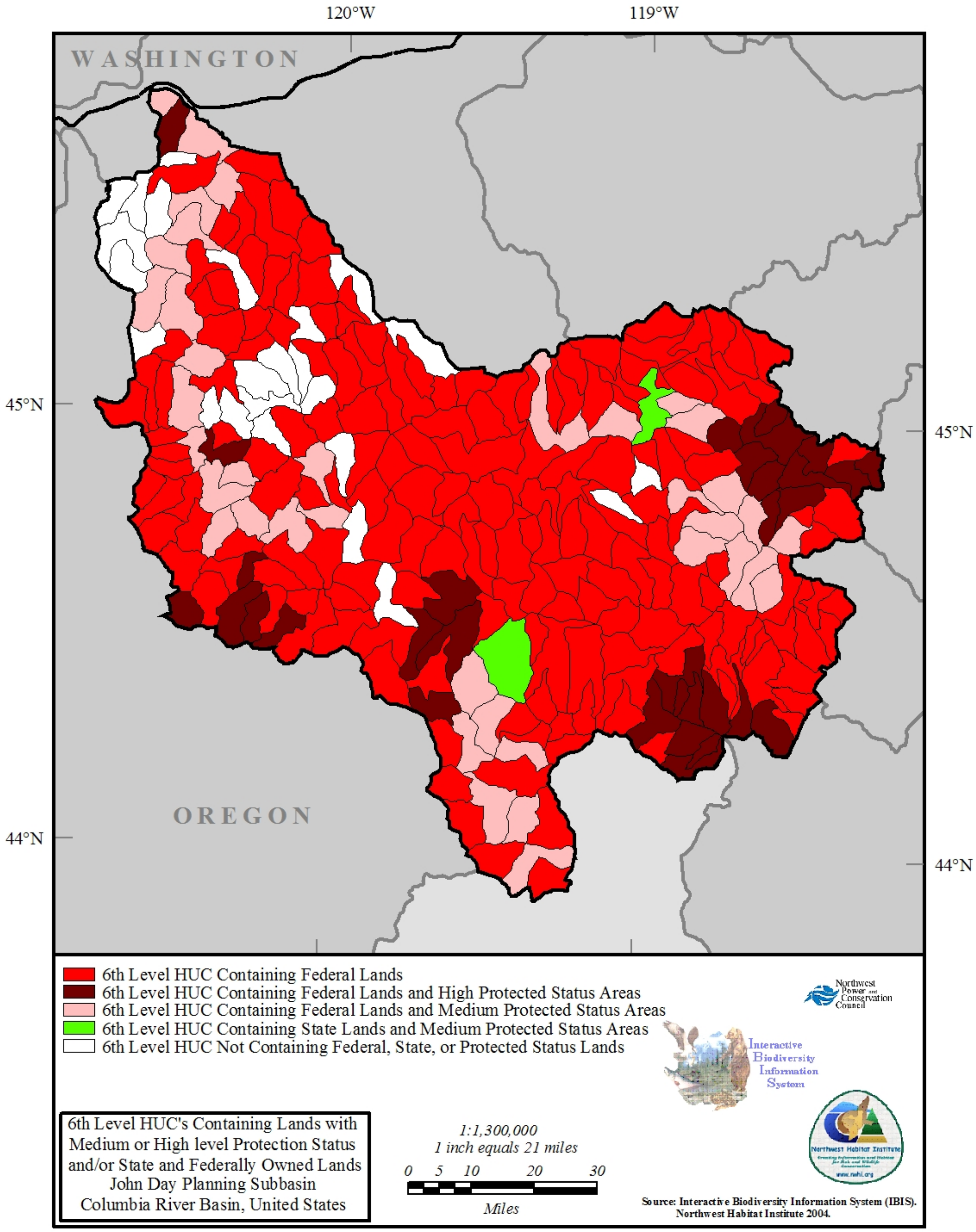

Figure 43. Protection status of HUC6 watersheds in the John Day Subbasin.

3.3 Out-of-Subbasin Effects

3.3.1 Aquatic

TOAST (2004) described out-of-subbasin effects (OOSE) in terms of all mortality factors that impact a migratory aquatic population from the time it leaves the subbasin to the time it returns to the subbasin. These effects can vary greatly from year to year, especially for wide ranging species such as salmon. Out-of-subbasin effects can be natural in origin, human-caused, or a combination of the two.

Within the John Day system, migratory aquatic focal species include summer steelhead and chinook salmon. These specific fish populations spawn within the John Day system, swim down the Columbia into the Pacific Ocean, and return to the John Day over the course of their life-cycle.

In the EDT model, survival rates are calculated for each life stage for a particular time and geographic area. The interaction of survival rates across areas and time determines the percentage of outmigrating juveniles from each subbasin that will return to that subbasin as adults. This survival rate is a measure of OOSE. Factors modeled in EDT include mainstem habitat quality and quantity, average monthly flows, juvenile travel time as a function of flow and habitat type, juvenile migration timing, survival at mainstem dams, in-river survival, fish transportation, interactions with hatchery fish, estuary survival, ocean survival, harvest impacts and upstream survival. A detailed description of these factors can be found in TOAST (2004). OOSE rates in EDT represent a 1992 to 1997 base period.

OOSE can vary greatly depending on ocean productivity. TOAST (2004) provided an overview discussing indicators of changing ocean conditions such as the Pacific Decadal Oscillation (PDO) and the El Nino/Southern Oscillation as well as the impact of climate change. The PDO is of particular interest to subbasin planners due to different PDO phases affecting ocean productivity and thus the juvenile survival rates. Periods of low ocean survival were from 1925 to 1947 and from 1977 to 1999, while the periods from 1947 to 1977 and the current period (2000 to present) are periods of higher ocean survival. The rates incorporated in the EDT model represent a period of relatively poor ocean conditions.

<u>Synthesis</u>

TOAST has provided the following synthesis of OOSE. To simplify application of OOSEs to subbasin assessments, the major sources of impact have been aggregated into a single smolt-to-adult-return rate (SAR) for survival from the time a year-class leaves the subbasin to the time it returns. If and when planners want to address the balancing of impacts across the four Hs (hydropower, habitat, harvest, hatcheries), SAR numbers will have to be disaggregated into their component fractions.

Aggregate Effects on Chinook

The smolt-to-adult ratios (SARs) that were used in the EDT Multi-Species Framework assessments were provided by Mobrand Biometrics (Chip McConnaha, Mobrand Biometrics, personal communication) and are shown in Table 58. These rates are the total survival rates of juvenile fish from the mouth of the subbasin to their return to the subbasin as adults. They were calculated from intermediate EDT results. The range limits in Table 58 were calculated from actual survival studies at Lower Granite Dam applied to the EDT estimates as described in TOAST (2004).

Table 58. Smolt-to-Adult (SAR) survival estimates (%) with range limits for John Day chinook outmigrants based upon in-river survival studies.

Point of Entry	EDT Point Estimate	Lower Range	Upper Range
Subyearling migrants	0.8	0.26	2.64
Yearling migrants	1.5	0.50	4.95

Late in the process of writing this plan, it was discovered that the SARs actually being computed for John Day spring chinook in the final EDT runs were almost four times those in Table 58. SAR survival estimates (%) produced by EDT analyses of John Day spring chinook salmon in December 2004 were:

- Granite Creek – 5.61%
- Middle Fork – 5.74%
- North Fork – 5.52%
- Upper John Day – 5.44%

These SAR estimates of over 5.4% appeared to be very high given the poor ocean conditions in 1992 to 1997 that EDT was supposed to be emulating. Mobrand staff could not provide an explanation for this discrepancy.

The latest EDT SAR estimates also appeared high compared to actual field estimates, which are available for the 1978 to 1980 and 1999 to 2001 outmigration years (Ruzycki (ODFW) e-mail to Phil Roger dated 1/6/2005 and Ruzycki (ODFW) e-mail to Jeff Fryer dated 2/2/05). Smolt-to-adult survival rates were 0.98%, 1.25%, and 1.32% for 1978 to 1980 with a geometric mean rate of 1.17%. This was a time of relatively poor ocean survival, similar to 1992 to 1997. The 1999 to 2001 SAR estimates, which coincide with a high productivity PDO regime, were 7.8%, 2.6%, and a projected rate of 2.7%[1] with a geometric mean rate of 3.8%.

Given the considerable uncertainty in the EDT SAR estimates, it is recommended that the current EDT results be used only to identify the major limiting habitat conditions on salmon production.

[1] The 2001 SAR estimate is currently 2.28%. The abundance of five-year-old returns from this cohort has not yet been estimated, but this age group typically contributes about 20% of the total returns. This would raise the 2001 SAR estimate by about 0.46%, resulting in a total SAR of 2.7% (Ruzycki e-mail to Jeff Fryer dated 2/2/05).

Aggregate Effects on Steelhead

EDT assessments for steelhead populations were not included in the Multi-Species Framework project. Instead, SAR rates were estimated from observed results obtained from other studies (TOAST 2004). The minimum SAR observed for Snake River populations above Lower Granite Dam since 1992 was 1.04% in the 1992 migration year, while the maximum SAR was 4.68% in the 2000 migration year (TOAST 2004). TOAST assumed the same per-dam mortality rate as that for spring chinook to develop the SAR estimates for John Day populations (Table 59).

Table 59. Smolt-to-Adult (SAR) survival point estimates (%) with range limits for John Day steelhead outmigrants.

Point of Entry	Point Estimate	Lower Range	Upper Range
John Day Pool	2.82	1.73	7.80

Late in the process of writing this plan, actual SAR rates computed from EDT output in December 2004 were made available:

- Lower John Day – 4.25%
- Middle Fork – 4.38%
- North Fork – 4.37%
- South Fork – 4.34%
- Upper John Day – 4.40%

As with spring chinook, the steelhead SARs appeared high given the poor ocean conditions prevalent during the 1992 to 1997 base period. No data are available on John Day steelhead SARs, although very preliminary estimates suggest a SAR of 1 to 2% for the 1999 to 2000 brood years (Ruzycki e-mail to Phil Roger). Data from the Umatilla Subbasin Plan indicate a mean SAR of 3.95% for the 1996 to 1997 brood years for natural spawning steelhead. This is greater than the estimate in Table 59, but slightly less than the EDT estimates for steelhead. However, the 1996 to 1997 brood years spent some of their ocean residency in a high productivity PDO regime, thus survival rates would be expected to be somewhat higher than those in Table 59.

Given the considerable uncertainty in the EDT SAR estimates, it is recommended that the current EDT results be used only to identify the major limiting habitat conditions on salmon production.

Discussion

Smolt-to-adult return rates obtained from the most recent EDT runs were unexpectedly higher than those from earlier runs and usually exceeded rates estimated from field observations. Steelhead SARs are about 50% greater than those estimated from earlier EDT model analyses and perhaps double very preliminary observations for John Day populations. They are, however, within the estimated range of SARs observed during the 1992 to 2000 period. SARs for yearling chinook smolts are more than 350% greater in recent EDT analyses than previously estimated. They are also higher than the upper end of the range of SARs estimated from studies during the 1992 to 2000 period.

These discrepancies can only be evaluated and resolved by detailed analysis of the EDT trajectory data – a slow and complex process because of the amount of detail involved. Several possible sources of the problem suggest themselves, however. Mobrand staff have been making changes to the EDT model regularly since the first analyses in the spring of 2004. Some of these changes may have affected mainstem Columbia River conditions and may also have affected the calculation of OOSE survival.

A second possible source of the problem is the usually unexamined interaction between within-subbasin and out-of-subbasin aggregate mortality factors. During the calibration and testing phase of EDT, users adjust habitat ratings and fish population parameters in an attempt to produce abundance numbers close to reality. The problem is that if out-of-subbasin survival is overestimated by EDT, then a lower within-subbasin survival is required to produce a given number of adults returns. This may be affect chinook populations, because the smolt numbers estimated by EDT are significantly less than those observed by smolt enumeration projects in the basin.

The net result of this SAR anomaly is that there is more confidence in the qualitative aspects and limiting habitat attributes of EDT than in its quantitative output, which depends so heavily on the interactions of a large number of sequential life stages and environmental impacts. That is, the EDT assessment of environmental effects on smolt production is more reliable than estimates of population responses over the entire life cycle. Consequently, EDT analyses have been used to identify limiting habitat conditions rather than to quantify benefits from alternative restoration scenarios.

Basin-wide Assumptions – Effects on Productivity and Sustainability

It is clear that to lay the onus for fish survival entirely on stakeholders within the John Day Subbasin would be misplaced. However, these outside influences to migratory fish populations should not dissuade stakeholders from implementing plans to enhance the waterways and riparian areas within their sphere of influence.

For example, information provided by TOAST (2004) indicates the potential for a long-term climate change. Computer models generally agree that the climate in the Pacific Northwest will become gradually warmer and wetter over the next half century, with an increase in winter precipitation and warmer, drier summers. Loss of medium-elevation snowpack in response to warmer winter temperatures would have enormous and mostly negative impacts on the region's water resources, forests and salmon. These impacts include a diminished ability to store water in reservoirs for summer use, increased frequency and magnitude of forest and grassland fire, earlier peak flows, lower summer flows, and higher summer water temperatures. This will increase the impacts of temperature and habitat quantity limiting factors.

Knowing the potential for such climate change impacts, restoration strategies should pay particular attention to actions that will improve summer conditions for salmon.

3.3.2 Terrestrial

As with aquatic species, out-of-subbasin effects for terrestrial species are influenced by migratory habits. Of the 11 terrestrial focal species in the John Day Subbasin, the following migrate out of the subbasin: great blue heron, yellow warbler, red-naped sapsucker, sage sparrow, grasshopper sparrow and ferruginous hawk.

Very little is known about specific OOSE for each species. However, some generalizations can be made. Habitat destruction along the migratory route, as well as in the wintering location, is assumed to be a limiting factor. Negative impacts to habitat, depending on the species and their typical range, may include: timber harvest, grazing, farming, invasive plants, lack of fire management and development.

<u>Species Specific Out-of-Subbasin Effects (Ashley and Stoval 2004)</u>

Great blue heron
One of the biggest impacts on the great blue heron is potential poor water quality within the winter range. Poor water quality reduces the amount of large fish and invertebrate species available in wetland areas. Toxic chemicals from runoff and industrial discharges pose yet another threat. These chemicals can move through the food chain, accumulate in the tissues of prey and may eventually cause reproductive failure in the herons.

Yellow warbler
The yellow warbler is impacted by poorly functioning riparian areas and increased pesticide use. Riparian management requires the protection of riparian shrubs and understory and the elimination of noxious weeds. Increased pesticide use in the metropolitan areas, especially with the outbreak of mosquito born viruses like West Nile Virus, may impact food availability.

Red-naped sapsucker
Red-naped sapsuckers interbreed with other sapsucker species. This may lead to potential hybridization with red-breasted sapsucker (*Sphyrapicus ruber*) and yellow-bellied sapsucker (*Sphyrapicus varius*) where distributions overlap.

Sage Sparrow and Grasshopper Sparrow
Both the sage sparrow and the grasshopper sparrow are especially vulnerable to loss and fragmentation of shrub steppe habitat throughout their respective travel corridors.

<u>Basin-wide Assumptions – Effects on Productivity and Sustainability</u>

As with the aquatic species, responsibility for survival of terrestrial species lies beyond the borders of the John Day subbasin. These outside influences should not be a deterrent to ecosystem management.

3.4 Environmental/Population Relationships

The environmental/population relationships for each of the five aquatic focal species are discussed at length earlier in this chapter in sections 3.2 and 3.3. Information on species significant to Native Americans, namely Pacific lamprey and freshwater mussels can be found in Appendix C. Detailed information on terrestrial focal species can be found in Appendix D.

3.5 Identification and Analysis of Limiting Factors/Conditions

3.5.1 Aquatic Limiting Factors

Details on aquatic limiting factors can be found in Section 3.2.4.

3.5.2 Terrestrial Limiting Factors

The limiting factors for the terrestrial focal species can be found in the individual species descriptions included in Appendix D. For each species, these limiting factors can be found in the section titled "Factors Affecting Population Status."