Grande Ronde Subbasin Plan

May 28, 2004

Prepared for the
Northwest Power and Conservation Council

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Grande Ronde Subbasin Plan

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1. Executive Summary

An executive summary is not provided at this time.

2. Introduction

2.1 Description of Planning Entity

The Grande Ronde Model Watershed Foundation (GRMWF) is the Lead Entity for the preparation of the Grande Ronde Subbasin Plan. The GRMWF is the fiscal entity for the Grande Ronde Model Watershed Program (GRMWP). The Northwest Power Planning Council selected the Grande Ronde Subbasin as the model watershed for Oregon in 1992, creating the GRMWP. The Governor's office certified the program. A fourteen member Board of Directors, representing the diversity of interests in the subbasin oversees program activities. The GRMWP goal for habitat recovery is to take a total ecosystem approach, from ridge-top to ridge-top using a combination of active and passive restoration strategies. The project focuses on ecosystem restoration, activity and program coordination, educational outreach and private landowner involvement to promote species recovery in the Grande Ronde subbasin.

The GRMWP Board of Directors is the Management and Policy Group overseeing the preparation of the subbasin Plan. The following entities are represented on the GRMWP Board of Directors:

Union County Commission
Wallowa County Commission
Nez Perce Tribe
Confederated Tribes of the Umatilla Indian Reservation
Oregon Department of Fish and Wildlife
U. S. Forest Service
Wallow County Stock Growers
Wallowa Soil and Water Conservation District
Union Soil and Water Conservation District
Economic Development
Environmental/Conservation
Private Landowners
Public Interest
Private Forest & Landowners

An aquatics technical group was formed to prepare the aquatics elements of the plan. Representation on the core aquatic group included:

Oregon Department of Fish and Wildlife
Washington Department of Fish and Game
U. S. Forest Service
NOAA Fisheries
U. S. Fish and Wildlife Service
Nez Perce Tribe
Confederated Tribes of the Umatilla Indian Reservation

A wildlife technical group was formed to prepare the wildlife elements of the plan. Representation on the core wildlife group included:

Oregon Department of Fish and Wildlife
U. S. Forest Service
U. S. Fish and Wildlife Service
Nez Perce Tribe
Confederated Tribes of the Umatilla Indian Reservation
Cat Tracks Wildlife Consulting

The GRMWF contracted with Watershed Professionals Network LLC (WPN) of Boise, Idaho to conduct the aquatics assessment and provide technical aquatics support. Cat Tracks Wildlife Consulting was contracted to conduct the terrestrial assessment and serve as the writer/editor for the plan. GRMWF staff provided project management, GIS support and public outreach.

2.2. List of Participants

Asotin County Building and Planning
Asotin County Conservation District
Asotin County Noxious Weed Board
Bureau of Land Management
Columbia Intertribal Fish Commission
Confederated Tribes of the Umatilla Indian Reservation
Grande Ronde Model Watershed
Lower Snake River Compensation Plan
National Marine Fisheries Service
Natural Resources Conservation Service
Nez Perce Tribe
Oregon Department of Agriculture
Oregon Department of Environmental Quality
Oregon Department of Fish and Wildlife
Oregon Natural Heritage Program
Oregon State University
Oregon Water Resources Department
U.S. Bureau of Reclamation
U.S. Fish and Wildlife Service
Umatilla National Forest, USFS
Union Soil and Water Conservation District
Wallowa County Weed Board
Wallowa Whitman National Forest, USFS
Wallowa Resources
Wallowa Soil and Water Conservation District
Washington Department of Fish and Wildlife

2.3. Stakeholder Involvement Process

The representation on the GRMWP Board of Directors facilitated coordination with all entities involved in watershed restoration activities in the Grande Ronde subbasin. Throughout the time the GRMWP has been in existence the Board of Directors has actively represented their constituents. The GRMWP Board addressed subbasin planning issues at regularly scheduled monthly Board meetings beginning in April 2002. In addition to scheduled monthly meetings, special agency and public meetings were convened (Table 1). The final two public meetings were publicized by radio, newspaper and letter invitations to over 250 individuals. Public comment was allowed up to May 14, 2004.

Table 1. Public outreach meetings for subbasin planning in the Grande Ronde subbasin, Oregon.

Public Participation		
Date	Purpose/Objective	Audience
May 27-28, 2003	Kick off subbasin planning process Technical Workshop	Board of Directors, agency representatives
Regular Board meetings	Develop Management Plan – vision, objectives, strategies	Management & Policy Group (Board)
April 27, 2004	Plan/Discuss public meetings	Management & Policy Group (Board)
April 28, 2004	Discuss planning process, present draft plan, solicit comment	Stakeholders – Grande Ronde watershed
April 29, 2004	Discuss planning process, present draft plan, solicit comment	Stakeholders – Wallowa watershed

2.4. Overall Approach to the Planning Activity

Grande Ronde Subbasin planners used the Oregon Specific Guidance and the Technical Guide for Subbasin Planners, as well as numerous other guidance documents distributed by the Oregon Coordinating Group (OCG) and the Technical Outreach and Assistance Team (TOAST) to guide the planning process.

Assessment

Aquatic – GRMWP staff organized the aquatics team composed of the WPN contractor, agency biologists from the Wallowa-Whitman National Forest, the Umatilla National Forest, Oregon Department of Fish and Wildlife and Washington Department of Fish and Wildlife. Nez Perce and Confederated Tribes of the Umatilla Indian Reservation biologists did not participate in the initial EDT reach definition and attributing process but did participate in troubleshooting EDT and development of the Management Plan. The aquatics team used the Ecosystem Diagnosis and Treatment (EDT) model as the primary aquatics assessment tool. Numerous data sources including previous assessments, stream surveys, agency databases and personal knowledge were used to assign stream reach ratings. The team met on numerous occasions to designate stream reaches, assign reach attributes, and discuss and troubleshoot model results.

Terrestrial - GRMWP staff organized the terrestrial team composed of contractor Cat Tracks Wildlife Consulting, agency wildlife biologists from the Wallowa-Whitman National Forest and Oregon Department of Fish and Wildlife, Nez Perce wildlife biologist, CTUIR wildlife biologist and U. S. Fish and Wildlife Service biologist. The team designated focal species, prepared focal species accounts and conducted the assessment using the Interactive

Biodiversity Information System (IBIS). The team spent considerable time validating and comparing IBIS and Oregon Natural Heritage Information Center (ONHIC) vegetation data. Some changes to the vegetation types were made by the team to better represent current conditions.

Inventory

GRMWP staff and the writer/editor researched and summarized known plans and programs from the Grande Ronde Subbasin Summary, agency sources and from various websites. GRMWP uses a watershed restoration activity database developed by the GRMWP staff to coordinate and track all watershed restoration work implemented in the Grande Ronde Subbasin. Work was summarized by geographic areas corresponding to chinook and steelhead population areas to tie the inventory to limiting factors identified by the assessment, and to help formulate objectives and strategies by fish population.

Management Plan

The beginning point for the goals, objectives and strategies was the Subbasin Summary which included a summary by entity of their goals and objectives for the Grande Ronde Subbasin. The aquatics and terrestrial teams revised and expanded on these, and presented revised versions to the Management and Policy Group.

2.5. Process and Schedule for Revising/Updating the Plan

The 2000 Columbian River Basin Fish and Wildlife Program suggests subbasin plans be revised and updated every three to five years. Due to the limited time during this planning cycle to fully develop, calibrate and use the EDT assessment tool we suggest further work on this component of the plan within the next two years. Additionally the Management Plan component of this plan will likely require revision as a result of assessment changes.

3. Subbasin Assessment

3.1. Subbasin Overview

3.1.1. General Description

3.1.1.1 Subbasin Location:

Located in the southwest portion of the Blue Mountains Ecological province (Figure 1, Figure 1), the Grande Ronde subbasin is characterized by rugged mountains and two major river valleys. It is defined by the Blue Mountains to the west and northwest, and the Wallowa Mountains to the southeast. It is in these mountain ranges, with peaks as high as 7,700 feet in the Blues and nearly 10,000 feet in the Wallowas, where the headwater streams of the Grande Ronde begin. Subbasin corners are approximated by the following Townships and Ranges; NW corner (T7N/R39E), NE corner (T7N/R46E), SW corner (T4S/R42E), SE corner (T6S/R35E).

The Grande Ronde River flows generally northeast 212 miles from its origin to join the Snake River at river mile (RM) 169, about 20 miles upstream of Asotin, Washington and 493 miles from the mouth of the Columbia River. The Grande Ronde River begins in the Blue Mountains near the Anthony Lakes recreation area, flows north, then northeast and through the cities of La Grande and Island City (RM 157). Here, in the valley, the river slows and meanders the valley floor before continuing north-northeast through the towns of Imbler, Elgin and Troy, Oregon (RM 46), then it crosses into Washington at RM 38.7 before joining the Snake River.

There are 8 dams on the Columbia and Snake rivers between the Grande Ronde River and the Pacific Ocean.

Major streams flowing into the Grande Ronde are Catherine and Joseph creeks and the Wallowa and Wenaha rivers. Catherine Creek originates in the Eagle Cap Wilderness Area of the Wallowa Mountains and flows northwest, passing through the town of Union, then turns northeast to join the Grande Ronde at RM 140. The Wallowa River originates in the Lakes Basin area of the Eagle Cap Wilderness Area at elevations over 8,000 feet. The Wallowa River flows north into Wallowa Lake, the only large lake in the subbasin, then through the towns of Joseph, Enterprise and Wallowa before joining the Grande Ronde at RM 82. The Wenaha River begins in the Wenaha-Tucannon Wilderness Area and flows east to its confluence with the Grande Ronde River at the town of Troy (RM 46).

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3.1.1.2 Subbasin Size

The Grande Ronde subbasin encompasses an area of about 4,000 mi^2 in northeastern Oregon and southeastern Washington. The Grande Ronde subbasin drains much of the extreme northeast corner of Oregon as well as 341 mi^2 of southeast Washington. The subbasin includes large portions of Union and Wallowa Counties and a small portion of Umatilla County in Oregon as well as about a third of Asotin County and small portions of Columbia, and Garfield counties in Washington

3.1.1.3 Geology and Topography

The Grande Ronde subbasin has a complex geologic history. Rocks of the Columbia River Basalt Group dominate the surface geology of the area. Rocks older than the Columbia River Basalts occur only in the headwaters areas of the Grande Ronde River, the Wallowa River and Catherine Creek. These rocks consist of granitic intrusives and older volcanics with associated sedimentary deposits. Some of these older rocks are visible in the Wallowa Mountains where the andesitic core was exposed during uplift of the Wallowas (Baldwin 1964). Some older rocks may be visible near the mouth of the Grande Ronde River where the channel cuts into basement rock below the basalt layers.

The structural geology of the area is also complex. Regional deformation has included easterly and southeasterly tilting and uplift and northwesterly compression. Because of these forces, many faults cut the bedrock formations. These faults follow a general northwest-southeast trend. Some structural deformation continues in the area as evidenced by offsets in modern alluvial and colluvial deposits. The southern portion of the subbasin is subsiding faster than the northern portion as demonstrated by the large bend in the Grande Ronde River to the south. The presence of hot springs and regional, deep ground water flow systems also indicate ongoing tectonic activity.

Soils in the Grande Ronde River subbasin are highly variable and may range from those on thin, rocky, low-productivity ridgetop scablands to those in deep ash accumulations on very productive sites (Johnson and Simon 1987). Soils in the area can be divided into 4 main groups (USDA SCS 1985).

Soils that formed in alluvial and lacustrine deposits are found on the floodplain, terraces and fans of the Grande Ronde and tributary valleys. These soils form on gentle slopes and are well suited for cultivated crops and pasture.

Soils that formed in a combination of alluvium, eolian and lacustrine deposits mixed with residuum and colluvium from basalt and volcanic tuff are found in higher terraces and alluvial fans of the Grande Ronde subbasin. Slopes vary considerably, ranging from less than 5 percent up to 45 percent. These soils are also used for irrigated crops and pasture, as well as rangeland.

Soils derived exclusively from colluvium and residuum from basalt and volcanic tuff are found on the dry foothills above the valleys and below the timbered areas. Slopes vary from less than 5 percent to as much as 70 percent. Areas with steeper slopes tend to have a high erosion hazard. These soils are mainly used for rangeland and wildlife habitat.

Soils that formed in colluvium and residuum from basalt and volcanic tuff and recent volcanic ash are found in the forested uplands of the subbasin. Slopes vary from less than 5 percent to greater than 70 percent, and have variable erosion hazard. Predominant land uses in this soil type are timber production, wildlife habitat and woodland grazing.

Rugged mountains in the headwater areas have an important influence on the character of the Grande Ronde subbasin. Peaks in the Wallowa Mountains approach 10,000 ft and serve as the source of many of the Grande Ronde's tributary streams. The Blue Mountains reach elevations of 7,700 ft and are the source of the Grande Ronde River and other, tributary streams. The relatively low elevation of the Blue Mountains can result in earlier melt off than in the Wallowa Mountains. This, in turn, can result in low flows in the Grande Ronde River in late summer (July, August, & September).

The Grande Ronde Valley, between the Blue and Wallowa Mountains, lies at a relatively high elevation (2,600-2,800 ft). The valley floor is virtually flat; over one stretch of 4.5 river miles, there is an elevation change of just 7 feet (USDA 1997).

The other major valley in the subbasin is the Wallowa Valley. Wallowa Valley lies between the Wallowa Mountains to the south and west and high plateau country to the north and east and is oriented generally southeast to northwest. The valley is approximately 32 miles long, as measured from two miles south of Wallowa Lake to one mile west of Water Canyon (approximately six miles northwest of the town of Wallowa) where the Wallowa River enters a narrow canyon. Elevations range from 4,680 feet at the south end of the valley (Wallowa Lake) to 2,760 feet at the north end.

3.1.1.4 Climate:

The relief of the Blue and Wallowa Mountains creates several localized climatic effects. The diversity of landscapes between mountain ranges, rolling topography and deep, dissected canyons influences local climatic patterns. However, the major influence to the regional climate comes from the Cascade Mountains lying nearly 200 miles to the west. These mountains form a barrier against the modifying effects of moist winds from the Pacific Ocean resulting in a modified Continental climate in the Grande Ronde River subbasin.

Winters are cold and moist. January is the coldest month, with an average daily minimum temperature of 24°F. Summers in the subbasin are warm and dry. July is the warmest month with an average daily maximum of 84°F. Temperature and precipitation vary considerably with elevation. In winter, valleys tend to be colder than lower slopes of adjacent mountains due to cold air drainage. Average annual precipitation increases from 14 inches on the valley floor to more than 60 inches in some mountain areas. On average, precipitation increases approximately 5 inches with each 1,000-foot rise in elevation (USDA 1979). Precipitation occurs in the mountains throughout the year but falls primarily as winter snow. The average annual frost-free period in the Grande Ronde Valley is 160 days. The cooler Wallowa Valley may experience frost at any time of the year but the average frost-free period is 130 days.

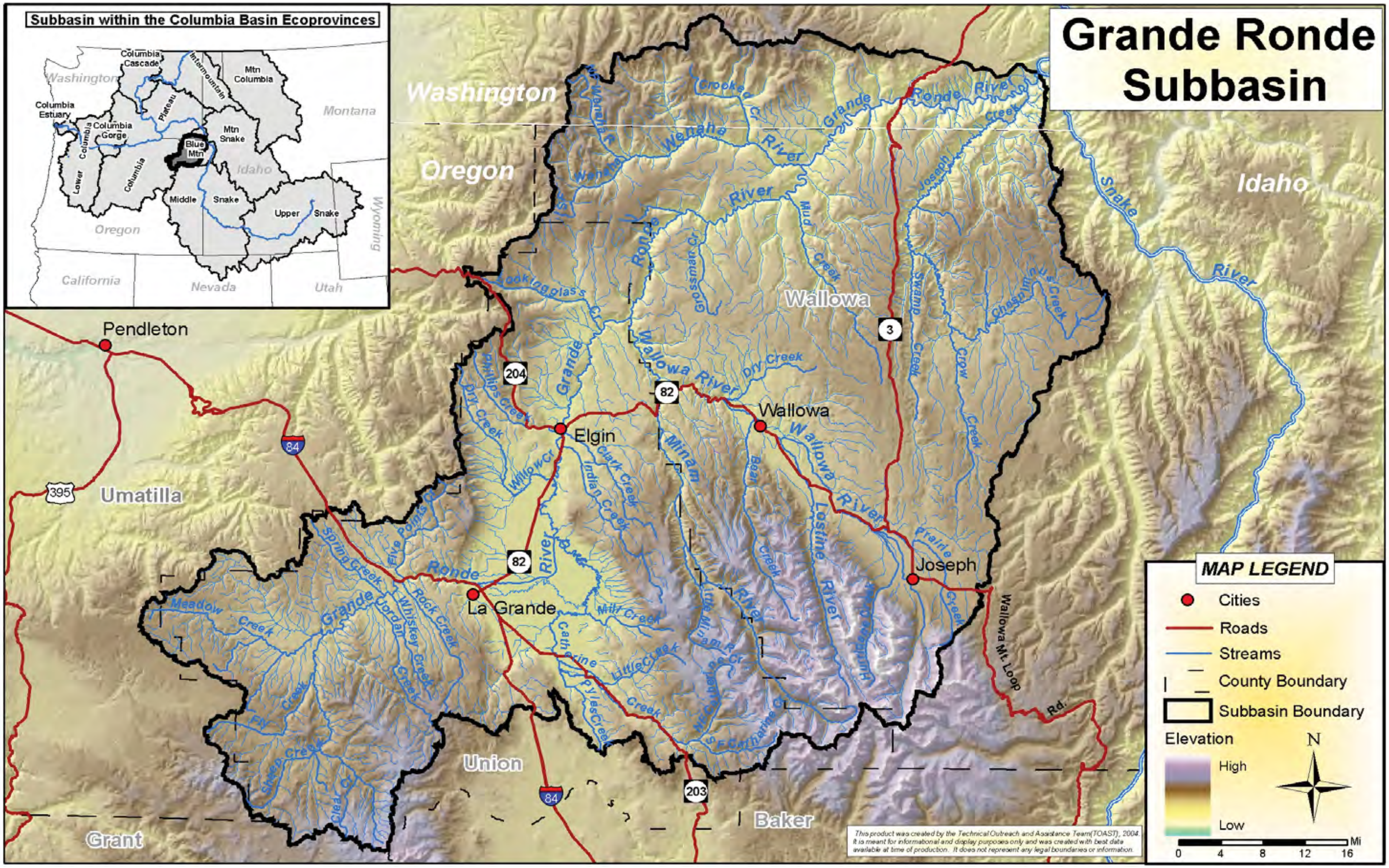


Figure 1. The Grande Ronde River Subbasin

3.1.1.5 Land Cover:

At one time grasslands occupied an extensive area in eastern Oregon. The major dominants included bunch grasses such as bluebunch wheatgrass, sheep fescue and giant wild rye (Shelford and Hanson 1947). The native grasses offered high quality grazing for livestock. During the droughts of the 1930's one cattleman remarked, "…when the first settlers came to the country there was an abundance of fine grass. The valleys were covered with tall meadow grass that was cut and stored for winter feed. The open hillsides all had a heavy stand of bunchgrass and scarcely any sagebrush" (Ewing, 1938). He later stated that it was now all cheatgrass and scablands. Remnant strips of the grassland steppe vegetation still exist throughout farmed areas, but are generally confined to areas inappropriate for farming. According to Houle (1995), roots of indigenous bunchgrasses in the Palouse Region of southeastern Washington and northeastern Oregon, can extend 25 feet or deeper into the earth, and some of the deep root stalks live over 100 years. Such characteristics make native grasses instrumental in developing soils, controlling soil erosion, conserving water and providing wildlife habitat. Native bunchgrasses produce from seed, not by runners or rootstalks. Many native grass communities in the Grande Ronde subbasin have been lost because the plants were unable to mature and spread seed (they were burned, over-grazed, mowed, plowed or irrigated). Grassland plant communities in the subbasin include Idaho fescue-bluebunch wheatgrass (*Festuca idahoensis-Agropyron spicatum*) and bluebunch wheatgrass-Sandberg's bluegrass (*Agropyron spicatum-Poa sandbergii*). The Grande Ronde subbasin includes a portion of Zumwalt Prairie, the largest palouse prairie remaining in North America. This 146,000-acre prairie is located northeast of Joseph and Enterprise, Oregon in the Grande Ronde and Imnaha subbasins.

As elevation increases in the subbasin, grasslands intermingle with shrub/scrub plants, eventually grading into coniferous forests in the Blue and Wallowa mountains. Forest associations also exhibit an elevational gradient with low elevation Ponderosa pine (*Pinus ponderosa*) associations grading into Douglas-fir (*Pseudotsuga menziesii*), grand fir (*Abies grandis*), subalpine fir (*Abies lasiocarpa*), and mountain hemlock (*Tsuga mertensiana*) associations where conditions are appropriate.

Diverse wetland communities are found in various locations throughout the subbasin. These communities range from low elevation emergent wetlands to high elevation grass and sedge meadows, and riverine deciduous riparian communities dominated by black cottonwood (*Populus trichocarpa*) and willow (*Salix* spp). Black hawthorn (*Crataegus douglasii*), mountain alder (*Alnus incana*), and mountain maple (*Acer glabrum*) are also common in riparian areas and seeps. The vegetation of the Grande Ronde River subbasin is described in detail in Johnson and Simon (1987) and Johnson and Clausnitzer (1992).

3.1.1.6 Land Use and Population:

Until the mid-1800's, the Grande Ronde subbasin was utilized solely by the Cayuse, Umatilla, Walla Walla and Nez Perce Tribes (James 1984). The Confederated Tribes of the Umatilla Indian Reservation ceded all of their lands in northeast Oregon and southeast Washington to the federal government under the Treaty of 1855 (CTUIR 1996). The Nez Perce Tribe retained claim to its lands in the subbasin until the Treaty of 1863, when all of the Oregon territory was removed from the Nez Perce Reservation. The Tribes maintain reserved rights for these lands that include harvesting salmon, wildlife and vegetative resources (USACE 1997). As European settlers moved into the area, significant timber harvest, livestock grazing and agricultural production began (McIntosh 1992).

Settlers arrived in Union and Wallowa Counties to stay in 1861, many returning from the Willamette Valley after passing through the Grande Ronde Valley on the Oregon Trail. From 1840 through the 1870's an estimated 300,000 emigrants passed through the Grande Ronde Valley. The railroad came to the Grande Ronde Valley in 1884.

The estimated 2002 subbasin population was: Union County - 24,484 and Wallowa County - 7,025 The subbasin is sparsely populated with 12 persons per square mile in Union County and 2.3 persons per square mile in Wallowa County (Wallowa County statistics include the Imnaha Subbasin).

Agriculture, including crop production, livestock and forestry play a significant land use role in the subbasin. Major crops in Union County include wheat, hay and forage, grass and legume seeds, peppermint, potatoes and specialty crops such as canola. Wheat, hay and forage are the primary crops in Wallowa County. Livestock production accounts for nearly 40 percent of the gross farm income.

3.1.1.7 Economy

The subbasin's economy has become more diversified in recent years but is still heavily dependent either directly or indirectly on agriculture and timber resources. Table 2 displays employment data for 2000.

Table 2. Employment categories and job numbers in Union and Wallowa counties, Oregon.

Union and Wallowa County Employment				
Category	Wallowa County		Union County	
	Number	%	Number	%
Agriculture, forestry, fishing and hunting, and mining	512	16.8	799	7.3
Construction	201	6.6	543	5.0
Manufacturing occupations	332	10.9	1,444	13.3
Wholesale trade	44	1.4	286	2.6
Retail trade	380	12.5	1,433	13.2
Transportation and warehousing, and utilities	100	3.3	573	5.3
Information	60	2.0	180	1.7
Finance, insurance, real estate, and rental and leasing	131	4.3	417	3.8
Professional, scientific, management, administrative, and waste mgmt.	182	6.0	494	4.5
Educational, health and social services	593	19.5	2,615	24.0
Arts, entertainment, recreation, accommodation and food services	203	6.7	970	8.9
Other services (except public administration)	154	5.1	464	4.3
Public administration	151	5.0	665	6.1
Total	3,043		10,883	

U. S. Census Bureau Data

These natural resource based activities have the potential to be most directly affected by watershed protection and restoration, or regulatory activities. Additionally, most economic sectors would be indirectly affected by negative impacts to the natural resource based sector.

Natural resource based activities directly account for about 10 percent of the jobs in the Grande Ronde Subbasin. Agriculture's contribution to the local economy is likely a larger segment of the total picture when indirect affects are taken into account. Gross farm sales for 2003 were $42,116,000 for Union County and $33,999,000 for Wallowa County.

Median household income for 2000 was $33,738 in Union County and $32,129 in Wallowa County. Unemployment rates for northeast Oregon often exceed the state average. For 2001 unemployment was 10.8 percent in Wallowa County and 5.8 percent in Union County.

3.1.1.8 Land Ownership

The US Forest Service and the BLM manage about 46 percent (1,901 mi2) of the land in the Grande Ronde subbasin (Figure 2), with a small amount of additional public land managed by the states of Oregon and Washington. The percentage of public land is higher in Wallowa County than in Union County with 65 percent of the county in public ownership (USFS, BLM, state). The Grande Ronde River, Catherine Creek, Wallowa River and its tributaries, and Joseph Creek originate in the Wallowa-Whitman National Forest. The Wenaha River originates in the Umatilla National Forest. With the exception of those areas that lie within the Eagle Cap and Wenaha-Tucannon Wilderness Areas, the National Forests are managed for multiple use including, primarily, timber production, livestock grazing, and recreation. Seasonal recreation use of the forest, including big game hunting and mushroom harvest is economically significant to communities in the subbasin.

Privately owned land is generally at lower elevations along streams and on the valley floors. Nearly all of the agricultural lands of the Grande Ronde and Wallowa valleys are privately owned, as are portions of the Joseph Creek headwaters and high elevation meadows of the upper Grande Ronde River. Primary uses of private land are forest, range and cropland.

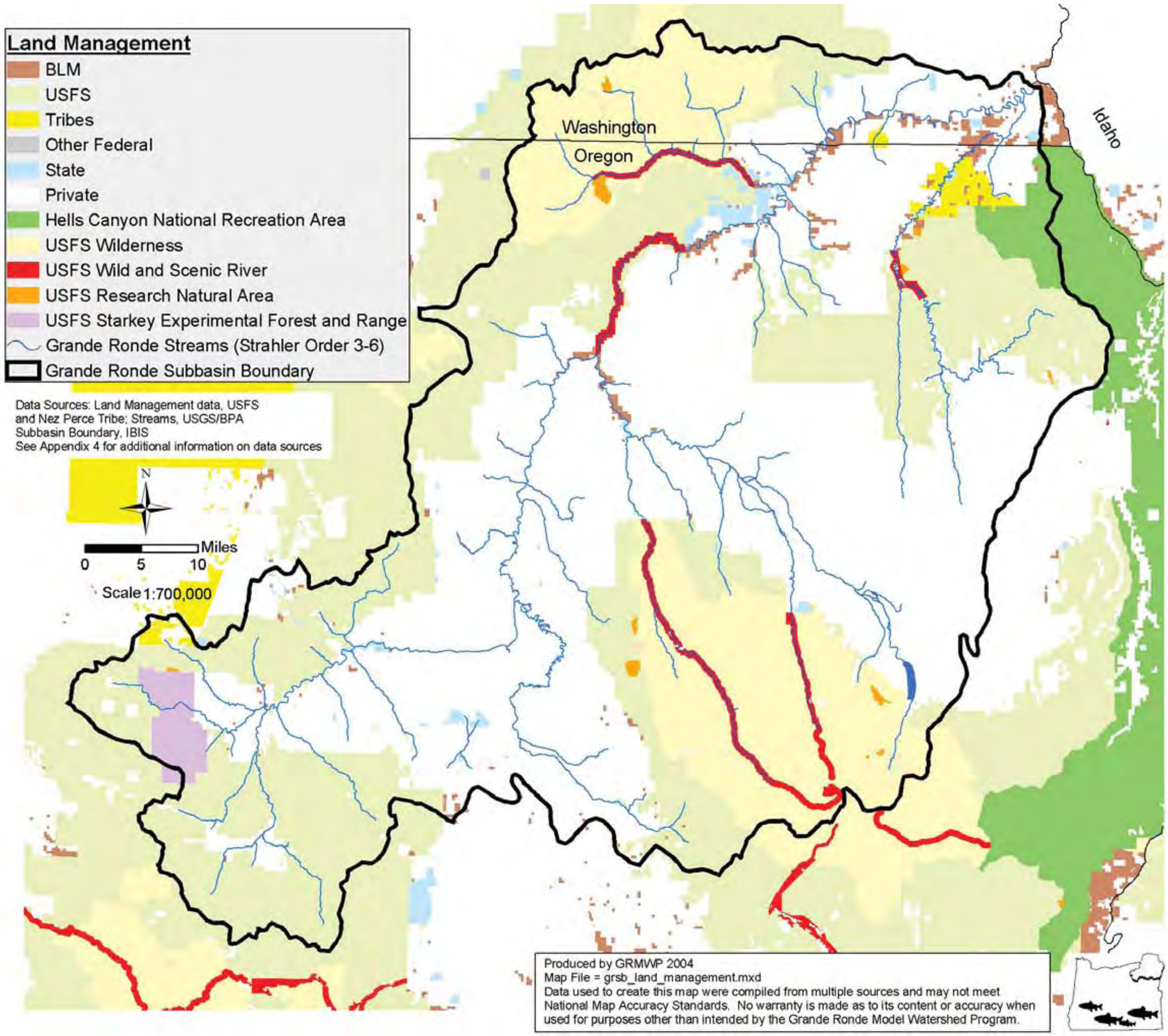


Figure 2. Land Ownership in the Grande Ronde River Subbasin.

3.1.2. Subbasin Water Resources

3.1.2.1 Watershed Hydrography

The Grande Ronde and its tributaries are snowmelt runoff streams. Peak runoff occurs in spring, generally from April through June, from melting snowpack and spring rains. Runoff recedes to low flows by late summer, usually August and September. Flow again increases in late fall in response to autumn rains.

The Grande Ronde subbasin drains much of the extreme northeast corner of Oregon as well as 341 mi^2 of southeast Washington. The subbasin is divided into three watershed areas – the Upper Grande Ronde, Lower Grande Ronde and Wallowa watersheds.

Upper Grande Ronde Watershed: The Upper Grande Ronde watershed drains approximately 1,650 mi^2, with a perimeter of 264 mi. and contains 917 mi of streams (221 miles of salmon habitat). The upper Grande Ronde watershed includes the Grande Ronde River and its tributaries from the headwaters to the confluence with the Wallowa River. Notable streams located in the Upper Grande Ronde watershed are listed in Table 3. Elevations in the watershed range from 2,312 ft. at the confluence of the Grande Ronde and Wallowa Rivers to over 7,000 ft. in the headwater areas.

Table 3. Notable Streams in the Upper Grande Ronde Watershed and their Points of Confluence with Larger Streams (RM). These streams are listed in order from downstream toward the headwaters.

Main Stream	Tributary (RM)	Tributary (RM)
Grande Ronde River		
	Lookingglass Creek – (85.1)	
		Jarboe Creek – (2.3)
		Little Lookingglass Creek – (4.0)
	Gordon Creek – (95.5)	
	Clark Creek – (98.7)	
	Phillips Creek – (99.7)	
	Indian Creek – (101.5)	
	Willow Creek – (105.7)	
	Catherine Creek – (143.9)	
		Mill Creek – (1.8)
		Ladd Creek – (10.3)
		Little Creek – (14.6)
		Little Catherine Creek – (28.4)
		N.F. Catherine Creek – (32.6)
	Fivepoint Creek – (169.3)	
	Rock Creek – (169.7)	
		Little Rock Creek
	Spring Creek – (169.9)	
	Whiskey Creek – (172.3)	
	Jordan Creek – (174.7)	
	Beaver Creek – (181.7)	
	Meadow Creek – (183.2)	
		McCoy Creek – (2.1)
		Waucup Creek – (18.4)
	Fly Creek – (184.5)	
	Sheep Creek – (194.0)	
		Chicken Creek – (2.3)
	Limber Jim Creek – (197.5)	

Source: EPA Watershed Profile and Hydrology Subcommittee 1965

Lower Grande Ronde Watershed: The Lower Grande Ronde watershed, exclusive of the Wallowa River drainage, drains approximately 1530 mi^2 and contains 773 miles of streams (140 miles of salmon habitat). This watershed includes The Grande Ronde River and tributaries, excluding the Wallowa River, from the Wallowa River to the confluence with the Snake River; 72 percent of this watershed is in the state of Washington. Notable streams located in the Lower Grande Ronde watershed are listed in Table 4. The Washington portion of the watershed contains 188 miles of perennial streams in the Wenaha drainage and 265 miles of streams in the Grande Ronde drainage (M. Kuttle, Washington Conservation Commission, personal communication, 2001). Elevations in the watershed range from about 1,000 ft. at the confluence of the Grande Ronde and Snake Rivers to over 5,800 ft. at the headwaters of the Wenaha River.

Table 4. Notable Streams in the Lower Grande Ronde Watershed (excluding the Wallowa River drainage) and their Points of Confluence with Larger Streams (RM). These streams are listed in order from downstream toward the headwaters.

Main Stream	Tributary (RM)	Tributary (RM)
Grande Ronde River		
	Joseph Creek – (4.3)	
		Cottonwood Creek – (4.4)
		Tamarack Creek – (12.6)
		Swamp Creek – (31.5)
		Elk Creek – (49.7)
		Chesnimnus Creek – (49.8)
	Rattlesnake Creek – (26.2)	
	Cottonwood Creek – (28.7)	
	Cougar Creek – (30.7)	
	Menatchee Creek – (35.9)	
	Grouse Creek – (40.0)	
	Wenaha River – (45.3)	
		Crooked Creek – (6.7)
		Butte Creek – (14.8)
		Beaver Creek – (21.7)
	Courtney Creek – (46.4)	
	Mud Creek – (52.0)	
		Buck Creek
		Tope Creek
	Wildcat Creek – (53.3)	
		Wallupa Creek
	Sickfoot Creek – (58.2)	
	Grossman Creek – (62.9)	
	Bear Creek – (66.2)	

Wallowa Watershed: The Wallowa watershed is the smallest of the three watersheds and drains about 950 mi^2, with a perimeter of 139 mi. and 494 mi. of streams (212 miles of salmon habitat). It includes the Wallowa River and its tributaries from the headwaters to the mouth. Notable streams in the watershed are listed in Table 5. Elevations in the watershed range from 2,288 ft. at the confluence of the Wallowa and Grande Ronde Rivers to over 8,000 ft. at the headwaters in the Lakes Basin of the Eagle Cap Wilderness Area.

Table 5. Notable Streams in the Wallowa Watershed and their Points of Confluence (RM) with Larger Streams. These streams are listed in order from downstream toward the headwaters

Main Stream	Tributary (RM)	Tributary (RM)
Wallowa River		
	Howard Creek – (3.4)	
	Minam River – (10.1)	
		Squaw Creek – (2.5)
		Murphy Creek – (12.8)
		Little Minam River – (17.5)
		North Minam River – (28.9)
	Deer Creek – (11.5)	
	Rock Creek – (18.4)	
		Dry Creek – (0.5)
	Bear Creek – (22.7)	
		Little Bear Creek – (7.5)
		Doc's Creek – (9.1)
		Goat Creek – (13.1)
	Whiskey Creek – (24.8)	
	Lostine River – (26.0)	
		Silver Creek – (14.0)
		Lake Creek – (19.4)
	Parsnip Creek – (29.0)	
	Trout Creek – (38.9)	
	Hurricane Creek – (39.8)	
	Prairie Creek – (40.1)	
	West Fork Wallowa River (54.8)	
	East Fork Wallowa River (54.8)	

3.1.2.2 Hydrologic Regime

Due to the varying physiography in the Grande Ronde River subbasin, the timing of spring runoff and peak discharge is also variable. The upper Grande Ronde River, flowing out of the relatively low elevation Blue Mountains, generally experiences seasonal peak flows in March or April (Figure 3) while peak flows in Catherine Creek, originating in the Wallowa Mountains, usually occur in May or June (Figure 4). Flows in the Wallowa River, which originates from mostly north-facing slopes of the higher elevation Wallowa Mountains, generally do not peak until late May or June (S. Hattan, Union/Wallowa County Water Master, personal communication, 2001).

Upper Grande Ronde River near Hilgard 1937-55 1966-81

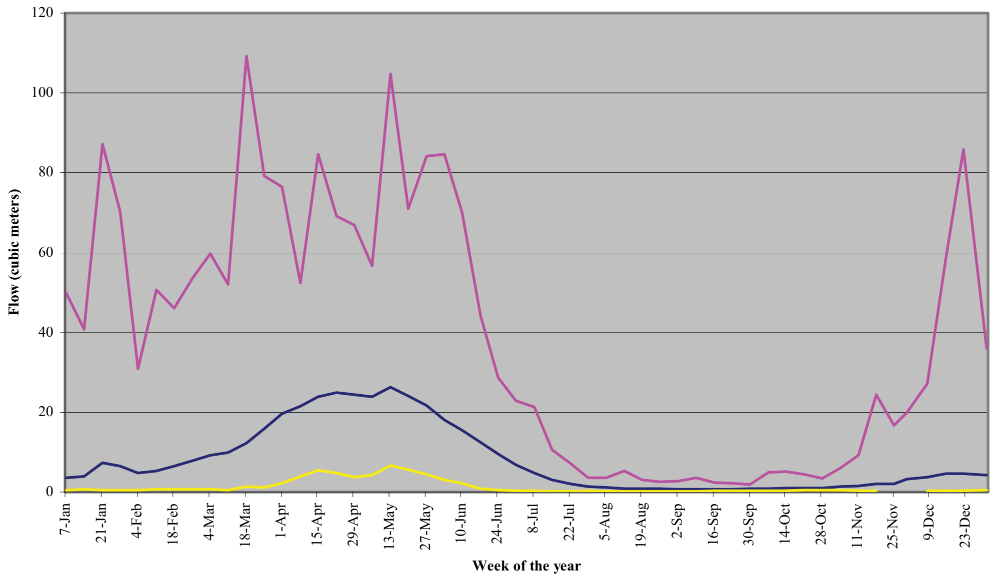


Figure 3. Hydrograph of Mean Flows in the Upper Grande Ronde River near Hilgard 1937-1955 and 1966-1981. The bottom line (yellow) represents minimum; the middle line (blue) mean; and the upper line (purple), maximum flows.

Catherine Creek near Union 1911-1996

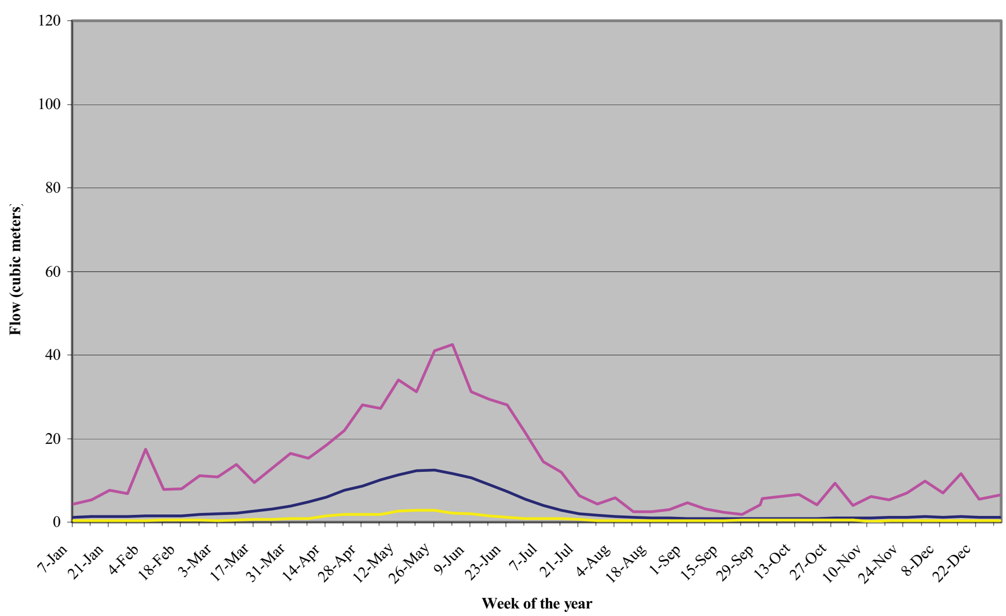


Figure 4. Hydrograph of Mean Flows in Catherine Creek near Union 1911-1996. The bottom line (yellow) represents minimum; the middle line (blue) mean; and the upper line (purple), maximum flows.

Gauging stations operated by the U.S. Geological Survey (USGS), the Oregon Water Resources Department (OWRD), Oregon Watershed Enhancement Board (OWEB) and the Wallowa Soil and Water Conservation District (WSWCD), measure and record stream flows throughout the subbasin. Average annual discharge of the Grande Ronde River at Troy, Oregon, the lowest gauging station presently in use, is approximately 2.25 million acre feet [3101 cubic feet per second (cfs)]. The only major tributary adding to the Grande Ronde River below this station is Joseph Creek, which is ungauged. Daily flows at gauging stations throughout the basin can vary 100-fold in as little as one month and differences between the annual minimum and maximum flows can be even greater. The gauging station on Catherine Creek near Union, Oregon recorded a minimum flow in 1998 of 1.4 cfs and a maximum the same year of 2,160 cfs. The average annual discharge of Catherine Creek at this gauging station is approximately 85,500-acre feet.

Three aquifers are found in the Grande Ronde subbasin (Table 6). The Columbia Plateau aquifer system is predominant in all three watersheds. Approximately 8 percent of the subbasin has no principal aquifer.

Table 6. Principle Aquifers in Grande Ronde Subbasin Watersheds.

Aquifer Type	Total Miles^2	Percent Subbasin	Rock Type	Percent by watershed		
				UGR	LGR	W
Columbia Plateau aquifer system	3079	75.1	Basalt, Volcanic	72.2	89.8	56.4
Pacific Northwest basin-fill aquifers	604	14.7	Unconsolidated sand & gravel	18.7	10.2	15.1
Volcanic and sedimentary rock aquifers	99	2.4	Basalt, Volcanic	6.1	0.0	0.0
No Principal Aquifer	320	7.8	N/A	3.0	0.0	28.5

3.1.2.3 Water Quality

The Oregon Department of Environmental Quality (ODEQ) has identified many stream segments within the Grande Ronde subbasin as water quality limited (Figure 5). Many of these streams are habitat areas for chinook salmon, summer steelhead and bull trout. Water quality limited means instream water quality fails to meet established standards for certain parameters for all for a portion of the year. Oregon's 1998 303(d) List of Water Quality Limited Waterbodies identifies nine parameters of concern in the upper Grande Ronde subbasin. These are algae, bacteria, dissolved oxygen, flow modification, habitat modification, nutrients, pH, sedimentation and temperature. All of these concerns exist within the Grande Ronde Valley portion of the subbasin. Three of these nine concerns – temperature, sediment and habitat modification – are widespread throughout the rest of the subbasin outside the Grande Ronde Valley.

While not the only issue, riparian habitat degradation is the most serious problem in the subbasin and improving these riparian areas will improve temperature, stability, sediment, other water quality factors and habitat (Clearwater BioStudies,1993, Bureau of Land Management 1993, Chen 1996, all cited in ODEQ 2000). Elevated water temperatures occur throughout the Upper Grande Ronde Subbasin (Bach 1995, cited in ODEQ 2000). Maximum water temperatures in the mainstem river are often observed upstream of the valley floor. It has been demonstrated that weather cycles alone cannot explain the persistent warm water temperatures in the subbasin (Chen 1996, cited in ODEQ 2000). Temperature studies specific to this subbasin have shown there are management strategies that will slow the rate of stream warming (Chen 1996, NRCS/USFS/ Union SWCD 1997, cited in ODEQ 2000). Slowing the rate of water warming will push the point at which maximum temperatures occur further downstream, adding many miles of fish habitat. These strategies would include the use of streamside vegetation to shield the water from solar radiation and provide thermal insulation particularly on smaller streams. Improved riparian vegetation along smaller order streams will dramatically reduce the daily maximum stream temperature. Significant, but not as dramatic, reductions could also be expected on the wider mainstem river (Chen 1996, NRCS/Union SWCD 1997, cited in ODEQ 2000).

Water quality parameters (and standards) of temperature (64°F/55°F, rearing/spawning), dissolved oxygen (98% sat), habitat modification (pool frequency), and flow modification (flows) relate to the beneficial use for fish life. Table 7 describes how temperature affects cold-water fish mortality. Standards for bacteria (fecal coliform) relate to the beneficial use for recreation. Most water quality problems in the Grande Ronde subbasin stem from legacy forestry, grazing and mining activities as well as current improperly managed livestock grazing, cumulative effects of timber harvest and road building, water withdrawals for irrigation, agricultural activities, industrial discharge and urban and rural development.

Table 7. Modes of Thermally Induced Cold Water Fish Mortality.

Modes of Thermally Induced Fish Mortality	**Temperature Range**	**Time to Death**
Instantaneous Lethal Limit – Denaturing of bodily enzyme systems	> 90°F > 32°C	Instantaneous
Incipient Lethal Limit – Breakdown of physiological regulation of vital bodily processes, namely: respiration and circulation	70°F to 77°F 21°C to 25°C	Hours to Days
Sub-Lethal Limit – Conditions that cause decreased or lack of metabolic energy for feeding, growth or reproductive behavior, encourage increased exposure to pathogens, decreased food supply and increased competition from warm water tolerant species	64°F to 74°F 20°C to 23°C	Weeks to Months

Reproduced from ODEQ 2000.

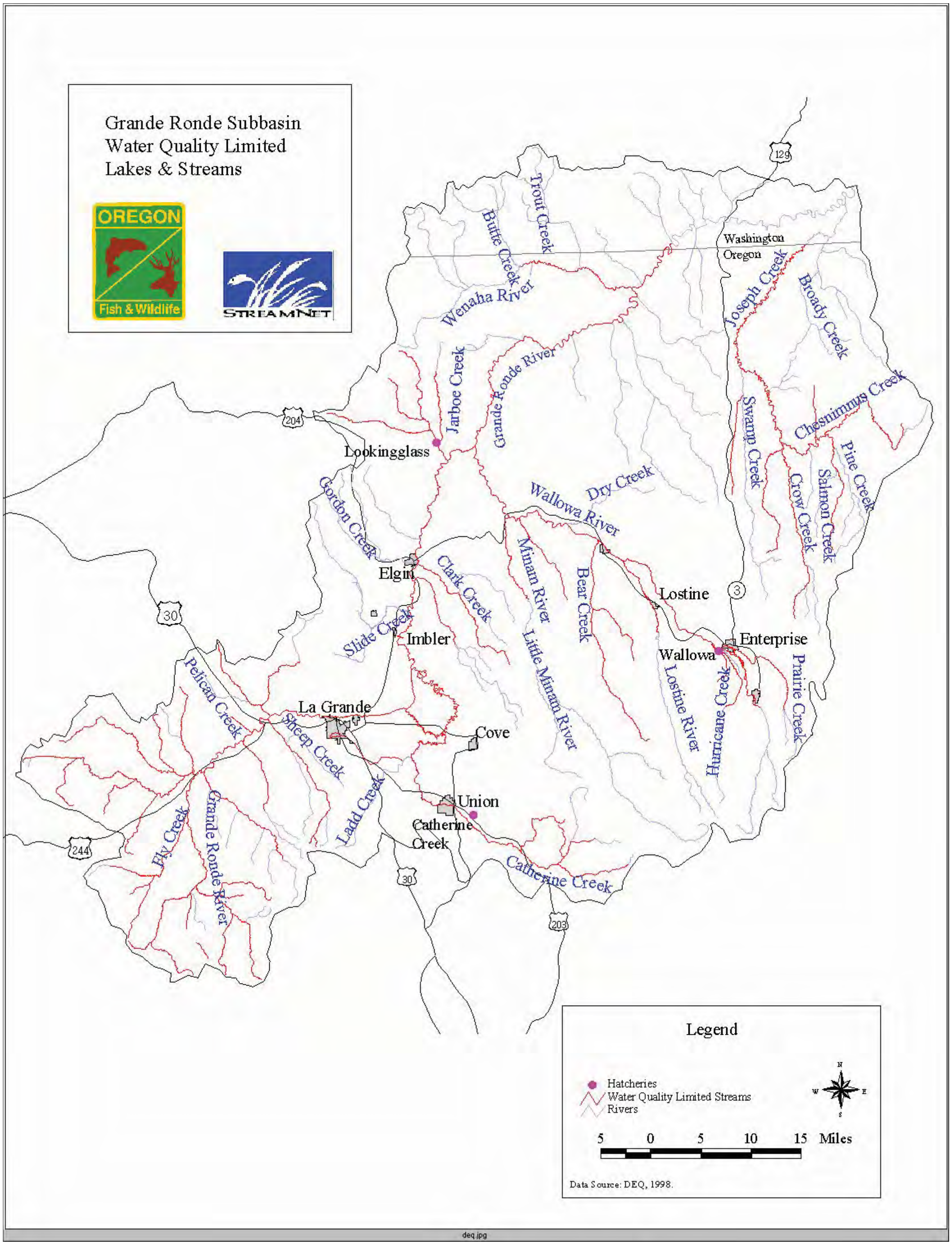


Figure 5. ODEQ Water Quality Limited, 303(d), Streams in the Grande Ronde River Subbasin.

There are 45 stream segments in the upper Grande Ronde watershed identified as water quality limited (Table 8), including most of the larger tributaries to the upper Grande Ronde River above La Grande.

Table 8. Upper Grande Ronde River Watershed 303(d) Listed Stream Segments and Parameters of Concern.

Stream	Parameters of Concern	Stream	Parameters of Concern
Grande Ronde River	Temperature, Sedimentation, Habitat Mod.	Indian Creek	Temperature
Grande Ronde River	Temperature, Sedimentation, pH, Nutrients, Habitat Mod., Dissolved Oxygen, Bacteria, Aquatic weeds/algae	Jarboe Creek	Temperature
Grande Ronde River	Temperature, Sedimentation, pH, Habitat Mod.	Jordan Creek	Sedimentation, Habitat Modification
Grande Ronde River	Sedimentation, Habitat Mod.	Lick Creek	Temperature
Grande Ronde R.	Temperature	Limber Jim Creek	Temperature, Sedimentation, Habitat Modification
Bear Creek	Temperature	Limber Jim Creek	Temperature
Beaver Creek	Temperature, Sedimentation	Limber Jim Cr., SF	Temperature
Burnt Corral Creek	Temperature	Lookout Creek	Temperature, Sedimentation
Catherine Cr., MF	Temperature	Little Lookingglass Creek	Temperature, Habitat Modification
Catherine Cr., NF	Temperature, Sedimentation	McCoy Creek	Temperature, Sedimentation, Habitat Modification
Catherine Cr., SF	Temperature, Sedimentation	McIntyre Creek	Sedimentation, Habitat Modification
Catherine Creek	Temperature, pH, Nutrients, Habitat Mod., Flow Mod., Dissolved Oxygen, Aquatic Weeds/Algae	Meadow Creek	Temperature, Sedimentation, pH, Habitat Modification
Catherine Creek	Temperature	Mill Creek	Temperature
Little Catherine Cr.	Sedimentation	Mottet Creek	Sedimentation
Chicken Creek	Temperature, Sedimentation, Habitat Mod.	Pelican Creek	Temperature
Chicken Cr., WF	Temperature	Rock Creek	Temperature, Habitat Modification
Clark Creek	Temperature	Sheep Creek	Temperature, Sedimentation, Habitat Modification
Clear Creek	Sedimentation	Sheep Creek	Sedimentation, Habitat Modification
Dark Canyon Cr.	Temperature, Sedimentation, Habitat Modification	Sheep Creek, EF	Temperature
Fivepoint Creek	Temperature	Spring Creek	Temperature
Little Fly Creek	Temperature, Sedimentation, Habitat Modification	State Ditch	Temp., pH, Nutrients, Habitat Mod., Flow Mod., Aquatic Weeds/Algae
Fly Creek	Temperature, Sedimentation, Habitat Modification	Waucup Creek	Temperature
Indiana Creek	Temperature	Wallowa River	Temperature, Sedimentation, pH, Habitat Mod., Flow Mod., Bacteria

There are 10 stream segments listed as water quality limited in the lower Grande Ronde River watershed, none of which are in Washington (Table 9).

Table 9. Lower Grande Ronde River Watershed 303(d) Listed Streams and Parameters of Concern.

Stream	Parameters of Concern	Stream	Parameters of Concern
Grande Ronde River	Temperature Sedimentation, Habitat Mod.	Elk Creek	Temperature, Sedimentation, Habitat Mod.
Chesnimnus Creek	Temperature, Sedimentation, Habitat Mod.	Davis Creek	Temperature
Crow Creek	Temperature	Peavine Creek	Temperature, Habitat Mod.
Joseph Creek	Temperature	Wenaha River	Temperature
Salmon Creek	Temperature		

Nine stream segments in the Wallowa watershed are listed as water quality limited (Table 10).

Table 10. Wallowa River Watershed 303(d) Listed Streams and Parameters of Concern.

Stream	Parameters of Concern	Stream	Parameters of Concern
Bear Creek	Sedimentation, Habitat Mod., Flow Modification	Hurricane Creek	Sedimentation, Habitat Mod., Flow Modification
Little Bear Creek	Temperature	Deer Creek	Temperature
Lostine River	Sedimentation, Habitat Mod., Flow Modification	Minam River	Temperature, Sedimentation
Prairie Creek	Sedimentation, Habitat Mod., Dissolved Oxygen, Bacteria	Spring Creek	Dissolved Oxygen, Bacteria
Wallowa River	Temperature, Sedimentation, pH, Habitat Mod., Flow Mod., Bacteria		

A Total Maximum Daily Load (TMDL) and Water Quality Management Plan (WQMP) and Agricultural Water Quality Management Area Plan (AWQMAP) have been developed for the Upper Grande Ronde River watershed (ODEQ 2000) and are in development for the lower Grande Ronde (in Oregon) and Wallowa watersheds. A TMDL is established to ensure that water quality standards are met and maintained. The total allowable pollutant load is allocated to point, non-point, and background sources of pollution.

Oregon Administrative Rules (OAR Chapter 340, Division 41) lists the designated beneficial uses for which water is to be protected in the Upper Grande Ronde subbasin (Table 11). Numeric and narrative water quality standards are designed to protect the most sensitive beneficial uses. In the Upper Grande Ronde sub-basin, resident fish and aquatic life, salmonid spawning, rearing and migration (i.e., anadromous fish passage) are designated the most sensitive beneficial uses.

Table 11. Designated Beneficial Water Uses in the Upper Grande Ronde Subbasin.

Designated Beneficial Uses Occurring in the Upper Grande Ronde Sub-Basin *(OAR 340-41-722)*			
Beneficial Use	***Occurring***	***Beneficial Use***	***Occurring***
Public Domestic Water Supply	✓	Anadromous Fish Passage	✓
Private Domestic Water Supply	✓	Salmonid Fish Spawning	✓
Industrial Water Supply	✓	Salmonid Fish Rearing	✓
Irrigation	✓	Resident Fish and Aquatic Life	✓
Livestock Watering	✓	Wildlife and Hunting	✓
Boating	✓	Fishing	✓
Aesthetic Quality	✓	Water Contact Recreation	✓
Commercial Navigation & Trans.		Hydro Power	

Reproduced from ODEQ 2000.

The Grande Ronde Water Quality Committee, a coalition of people from all affected interest groups, developed the Upper Grande Ronde Subbasin Water Quality Management plan (WQMP). The plan provides a framework for achieving the load allocations set out in the TMDL. The Committee prioritized areas within the subbasin for restoration and treatment (Table 12).

Table 12. Geographic Priority Areas for Water Quality Treatment in the Upper Grande Ronde Watershed. (H=high, M=medium, L=low)

Watershed	Temperature	Sediment	Flow
Lookingglass	L[1]	L	L
Lower Grande Ronde	L	L	L
Willow/Philips	H	H	H
Indian/Clark	M	M[2]	M
Catherine Creek	H	H	H
Beaver	M	M	L[3]
GRR Valley	H	H	H
Ladd Creek	H	H	H
Upper Grande Ronde	H	H	H[4]
Meadow Creek	H	H	H[4]
Spring/Five Pts.	H	M	M

[1]Lookingglass is listed for temperature because of Bull trout (50 degree criterion).
[2]Clark Crk. probably should be "high" for sediment but the watershed as a whole is medium.
[3]There is potential for flow being important because of the reservoir.
[4]Lost wet meadow/ground water storage & possible shift in spring runoff.

3.1.2.4 Riparian Resources

See Section 3.4.2 *Environment/Population Relationships, Combined Wetlands*and Wildlife Habitat #25 *Eastside (Interior) Riparian Wetlands.*

3.1.2.5 Wetland Resources

See Section 3.4.2 *Environment/Population Relationships, Combined Wetlands* and Wildlife Habitat Numbers 22 – *Herbaceous Wetlands,* 24 – *Montane Coniferous Wetlands* and 25 *Eastside (Interior) Riparian Wetlands.*

3.1.3. Hydrologic and Ecologic Trends in the Subbasin

3.1.3.1 Macro-climate and Influence on Hydrology in the Subbasin

See Section 3.1.2.2 *Hydrologic Regime.*

3.1.3.2 Macro-climate and Influence on Ecology in the Subbasin

The macroclimate of the subbasin, with its varying precipitation patterns, wind exposure and temperature extremes, is a major influence on the ecology of the subbasin. The lower elevation valley bottoms of the Grande Ronde and Wallowa Rivers are generally warmer and drier than higher elevation areas of the Blue and Wallowa Mountains. These differences can be seen in the progression of upland vegetation communities from shrub-steppe through ponderosa pine and grasslands to mixed conifer forests. The vegetation communities, in turn, influence use by a variety of wildlife species. Climatic differences also drive wildlife migration patterns as many species move down in elevation to escape winter's snow and cold and to higher elevation to escape summer's heat and find food.

3.1.3.3 Human Use Influence on Hydrology in the Subbasin

Most surface- and ground-water use is for irrigation. Information regarding the number of water diversions for irrigation is unavailable, as is the number of water rights holders in the subbasin. Sales and subdivision of water rights over the years has created a situation where there are too many small water rights holders for accurate records to be kept. Despite the lack of details regarding water rights and diversions, it is known that the water in the Grande Ronde River subbasin is fully appropriated (S. Hattan, personal communication, 2001); during the summer, there is no remaining unappropriated water. Efforts are underway to improve the available data regarding water rights in the subbasin, especially in streams used by anadromous fish, through stream surveys and diversion inventories (S. Hattan, personal communication, 2001).

Impoundments and Irrigation Projects:

Wallowa Lake is the only major water impoundment in the Grande Ronde River subbasin. Although it is a natural lake, a dam was constructed at the outlet in 1918 and enlarged between 1928 and 1929 to its present height. Located upstream of Joseph, Oregon, at RM 50.2 on the Wallowa River, Wallowa Lake has a storage capacity of 57,200 acre feet but is presently held at 44,000 acre feet and irrigates approximately 15,000 acres. The principal use for water stored in Wallowa Lake is irrigation, although a small proportion is diverted for municipal use in Joseph.

There are a number of minor impoundments in the subbasin (Table 13) as well as numerous small ponds that serve as water storage for irrigation and livestock. While power may have been generated in several locations historically, there remain only two working hydro-power generation facilities in the subbasin: The City of Cove, Oregon operates a generator powered by Mill Creek, a tributary of Catherine Creek, and PacificCorp operates a hydroelectric facility on the East Fork Wallowa River above Wallowa Lake. A third facility, on Indian Creek, has not been operational since 1985 but is being reviewed for relicensing by the Federal Energy Regulatory Commission (FERC).

Table 13. Minor Impoundments in the Grande Ronde Subbasin with Primary Use.

Impoundment Name	County	Primary Use
La Grande Reservoir	Union	municipal
Jubilee Lake	Union	recreation
Langdon Lake	Umatilla	recreation
Kinney Lake	Wallowa	irrigation
Minam Lake	Wallowa	irrigation
Lostine River Ranch Pond	Wallowa	recreation

Morgan Lake	Union	recreation

3.1.3.4 Human Use Influence on Ecology in the Subbasin

Human development and activities have changed the ecology of the subbasin in many ways including alterations to the vegetation communities, changes in vegetation structure, manipulation of surface and ground water resources, soil movement, relocation of streams and changes to the composition of fish and wildlife communities. The major activities that have resulting in those changes include: logging, fire suppression, grazing, cultivation and other agricultural development, draining of wetlands, ditching and diking of streams, water withdrawal and the introduction, both intentional and unintentional, of exotic plant and animal species.

3.1.4. Regional Context

3.1.4.1 Relation to the Columbia Basin

See Figure 1, page 18.

3.1.4.2 Relation to the Ecological Province

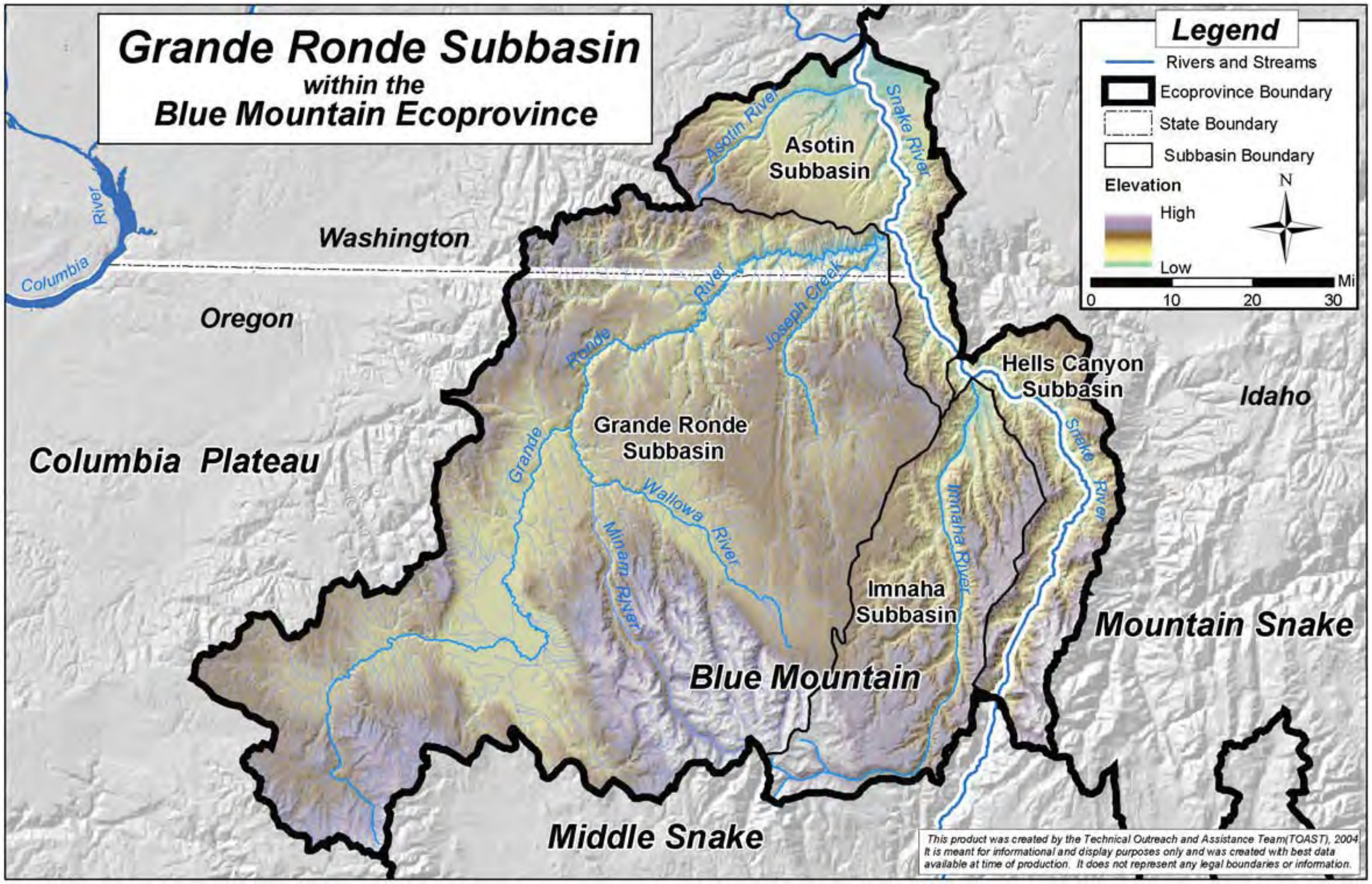


Figure 6. The Grande Ronde Subbasin within the Blue Mountains Ecological Province.

3.1.4.3 Relation to Other Subbasins in the Province

From the perspective of fish and wildlife management, the Imnaha subbasin and the Grande Ronde are often considered as a unit. This is due in part to their geographical location in the northeast corner of Oregon and regional management by the ODFW and the Tribes. It is also due to the inclusion of the Imnaha subbasin in the Grande Ronde Model Watershed Program. The Asotin and Snake Hell's Canyon subbasins, on the other hand, are considered completely separately from a management perspective due to their locations in Washington and Idaho and management by those states' fish and wildlife agencies with Tribal partnership.

3.1.4.4 Unique Qualities of the Subbasin within the Province

Of the four subbasins in the Blue Mountains Ecological Province, The Grande Ronde is the largest. Because of its size, the Grande Ronde subbasin encompasses a greater variety of habitats and likely supports greater diversity of fish and wildlife species than the others in the province.

3.1.4.5 NOAA Fisheries Evolutionary Significant Units (ESUs)

Anadromous fish in the Grande Ronde subbasin are considered part of the Snake River ESU by NOAA Fisheries.

3.1.4.6 USFWS Designated Bull Trout Planning Units

Bull trout in the Grande Ronde subbasin are considered part of the Grande Ronde Bull Trout Recovery Unit.

3.1.4.7 Priority Species and Habitats

Habitats and focal species selected for this planning effort are listed in Sections 3.2 and 3.4

3.1.4.8 Summary of External environmental Impacts on Fish and Wildlife

See Section 3.3 *Out of Subbasin Effects*

3.2. Focal Species Characterization and Status

3.2.1 Native/non-native Wildlife, Plant and Resident/anadromous Fish of Ecological Importance

Fish:

The Grande Ronde River subbasin once supported fisheries that were an important part of tribal cultures and economies (James 1984, Wallowa County and Nez Perce Tribe 1999, Ashe et al. 2000). These fisheries included both anadromous and resident populations and a variety of species. As European settlement came to the area, the fisheries were woven into the culture of these new inhabitants, as well. During the intervening years, some species have been lost from the subbasin and other, non-native species have been introduced.

An estimated 38 species of fish, including 15 introduced species and 6 species federally listed as Threatened or Species of Concern, are found in the Grande Ronde River subbasin (Table 16, Table 14, Appendix Table 1).

Once abundant (Thompson and Haas 1960), coho salmon (*Oncorhynchus kisutch*) were extirpated from the subbasin in the 1980's. Historic abundance of sockeye salmon (*O. nerka*) in the Wallowa River system is unknown, but it is assumed to have been high given the presence of sockeye canneries at Wallowa Lake in the 1890's (ODFW et al. 1990). Although anadromous sockeye salmon were extirpated from the area by 1905, their genetic component may still be present in wild kokanee in Wallowa Lake. Golden trout (*O. aguabonita*) are suspected to persist in a few high mountain lakes from introductions prior to 1958 but their present abundance and distribution are unknown.

Wildlife:

The Interactive Biodiversity Information System (IBIS) of the Northwest Habitat Institute (NHI) lists a total of 411 wildlife species for the Blue Mountain Ecological Province, most of which may be found in some portion of the Grande Ronde subbasin (Appendix Table 2). This list includes 13 amphibian species, 285 birds, 92 mammals and 21 reptiles.

Federal, state and tribal wildlife managers manage wildlife populations throughout the subbasin including big game, furbearers, upland birds and waterfowl as well as non-game wildlife. Many raptor species [e.g., golden eagle (*Aquila chrysaetos*), American kestrel (*Falco sparvarius*), northern goshawk (*Accipiter gentilis*)] inhabit the subbasin including several seasonal migrants [e.g., bald eagle (*Haliaeetus leucocephalus)*, Swainson's hawk (*Buteo swainsoni*)].

3.2.1.1 Species Designated as Threatened or Endangered

In addition to the Federal Endangered Species Act (ESA), Washington and Oregon both employ Endangered and Threatened Species listings at the state level. The Grande Ronde subbasin is, or may be, host to four fish species and fifteen wildlife species listed as Threatened or Endangered at the state or federal level, or both (Table 14, Table 15).

Table 14. State and Federally listed Threatened and Endangered Fish Species.

Common Name	*Scientific Name*	Federal Status	Washington Status[1]	Oregon Status[2]
Chinook Salmon – Snake River Spring Run ESU	(*Oncorhynchus tshawytscha*)	Threatened	C	Threatened
Chinook Salmon – Snake River Fall Run ESU	(*Oncorhynchus tshawytscha*)	Threatened	C	Threatened
Steelhead – Snake River Basin ESU	(*Oncorhynchus mykiss*)	Threatened	C	S-V
Bull Trout	(*Salvelinus confluentus*)	Threatened	C	S-C

[1] Washington Status Definitions: C = Candidate; SS = Sensitive;
[2] Oregon Status Definitions: S-US = Sensitive-Unclear Status; S-C = Sensitive-Critical; S-V = Sensitive-Vulnerable

Table 15. State and Federally listed Threatened and Endangered Wildlife Species

Common Name	*Scientific Name*	Federal Status	Washington Status[1]	Oregon Status[2]
Columbia spotted frog	*Rana luteiventris*	Candidate	SC	S-US
northern leopard frog	*Rana pipiens*	None	Endangered	S-C
western pond turtle	*Clemmys marmorata*	None	Endangered	S-C
upland sandpiper	*Bartramia longicauda*	None	Endangered	S-C
ferruginous hawk	*Buteo regalis*	None	Threatened	S-C
sage grouse	*Centrocercus urophasianus*	SOC	Threatened	S-V
streaked horned lark	*Eremophila strigata*	Candidate	SC	S-C
peregrine falcon	*Falco peregrinus*	None	SS	Endangered
sandhill crane	*Grus canadensis*	None	Endangered	S-V
bald eagle	*Haliaeetus*	Threatened	Threatened	Threatened

Common Name	Scientific Name	Federal Status	Washington Status[1]	Oregon Status[2]
	leucocephalus			
American white pelican	*Pelecanus erythrorhynchos*	None	Endangered	S-V
gray wolf	*Canis lupus*	Threatened	Endangered	Endangered
Canada lynx	*Lynx canadensis*	Threatened	Threatened	None
Pacific fisher	*Martes pennanti pacifica*	Candidate	Endangered	S-C
pygmy rabbit	*Brachylagus idahoensis*	Endangered[3]	Endangered	S-V

[1] Washington Status Definitions: SC = Candidate; SS = Sensitive;
[2] Oregon Status Definitions: S-US = Sensitive-Unclear Status; S-C = Sensitive-Critical; S-V = Sensitive-Vulnerable
[3]Only the Great Basin DPS in Douglas County Washington is Endangered; pygmy rabbit is a Species of Concern elsewhere.

3.2.1.2 Species Recognized as rare or significant to the Local Area

In the Grande Ronde subbasin, 2 species of fish and 23 wildlife species are designated Species of Concern by the USFWS and NOAA Fisheries.

Table 16. Federally desiganted Fish Species of Concern in the Grande Ronde River Subbasin.

Species	Federally Listed	Distribution
Redband trout (*Oncorhynchus mykiss gibbsi*)	Species of Concern	Basin wide
Pacific lamprey (*Lampetra tridentata*)	Species of Concern	unknown

Table 17. USFWS Wildlife Species of Concern in the Grande Ronde Subbasin.

* Denotes species extirpated from the area or whose population status is unknown**.**

Common Name	Scientific Name
tailed frog	*Ascaphus truei*
northern sagebrush lizard	*Sceloporus graciosus*
northern goshawk	*Accipiter gentilis*
western burrowing owl	*Athene cunicularia*
upland sandpiper	*Bartramia longicauda*
ferruginous hawk	*Buteo regalis*
black tern	*Childonia niger*
yellow-billed cuckoo	*Coccyzus americanus*
eastern Oregon willow flycatcher	*Empidonax trailii adastus*
harlequin duck	*Histrionicus histrionicus*
Lewis's woodpecker	*Melanerpes lewis*
mountain quail	*Oreortyx pictus*
white-headed woodpecker	*Picoides albolarvatus*
Columbian sharp-tailed grouse	*Tympanuchus phasianellus*
pale western big-eared bat	*Corynorhinus townsendii*
California wolverine*	*Gulo gulo*
silver-haired bat	*Lasionycteris noctivagans*
western small-footed myotis	*Myotis ciliolabrum*
long-eared myotis	*Myotis evotis*
fringed myotis	*Myotis thysanodes*

Common Name	*Scientific Name*
long-legged myotis	*Myotis volans*
Yuma myotis	*Myotis yumanensis*
Preble's shrew	*Sorex preblei*

In addition to the vertebrate species mentioned above, there are a number of invertebrates thought to be rare and/or imperiled, many of which are endemic to Oregon or Washington (Appendix Table 4). The status of many of those species is not well understood due largely to their rarity and the difficulty of studying them. Invertebrates serve many critical ecosystem functions including plant pollination, waste decomposition, soil aeration and as a food source for numerous other organisms. Invertebrates can have significant ecological and economic effects in the region through destruction of timber or agricultural crops, pollination failure due to the absence of a needed species, disease transmission, threats to native species from introduced invertebrates and other factors.

The Oregon Natural Heritage Program has identified 22 state or federally listed plant species and species of concern in the Oregon portion of the subbasin (Table 18).

Table 18. State and Federal Special Status Plant Species in the Grande Ronde Subbasin in Oregon including Designated State and Federal Status, Natural Heritage Rank, and Documented Locations in the Subbasin.

Common Name	Scientific Name	Federal Status[1]	State Status[2]	Natural Heritage Rank[3]	Documented Locations (drainages)
Wallowa ricegrass	*Achnatherum wallowaensis*	SOC		G2G3, S2S3	Imnaha, Lower Grande Ronde
Blue Mountain onion	*Allium dictuon*	SOC	WA – LT	G1, S1	Lower Grande Ronde
Hells Canyon rock cress	*Arabis hastatula*	SOC		G2, S2	Hells Canyon, Wallowa, Imnaha
upward-lobed moonwort	*Botrychium ascendens*	SOC	OR – C WA – S	G2G3, S2	Wallowa
crenulate moonwort	*Botrychium crenulatum*	SOC	OR – C WA – S	G3, S2	Upper Grande Ronde, Wallowa
skinny moonwort	*Botrychium lineare*	SOC	WA – S	G1, S1	
twin-spike moonwort	*Botrychium paradoxum*	SOC	OR – C WA - S	G2, S1	Upper Grande Ronde
stalked moonwort	*Botrychium pedunculosum*	SOC	OR – C WA – S	G2G3, S1	Upper Grande Ronde, NF John Day
broad-fruit mariposa-lily	*Claochortus nitidus*	SOC	WA – LT	G3, S1	Hell's Canyon
fraternal paintbrush	*Castilleja fraterna*	SOC		G2, S2	Wallowa, Imnaha
purple alpine paintbrush	*Castilleja rubida*	SOC		G2, S2	Wallowa (high elevations)
Hazel's prickly-phlox	*Leptodactylon pungens*	SOC	OR – C	G5, S?	Hell's Canyon
Greenman's lomatium	*Lomatium greenmanii*	SOC	OR – LT	G1, S1	Wallowa, Imnaha

membrane-leaved monkeyflower	*Mimulus hymenophyllus*	SOC	OR – C	G1, S1	Imnaha
stalk-leaved monkeyflower	*Mimulus patulus*	SOC	OR – LT	G3, S3	
Macfarlane's four-o'clock	*Mirabilis macfarlanei*	LT	OR – LE	G2, S1	Hell's Canyon, Imnaha
dwarf phacelia	*Phacelia minutissima*	SOC	OR – C WA – S	G3, S1	
Oregon semaphoregrass	*Pleuropogon oregonus*	SOC	OR – LT	G1, S1	Upper Grande Ronde
Bartonberry	*Rubus bartonianus*	SOC	OR – C	G2, S2	Hells Canyon
Spalding's campion (catchfly)	*Silene spaldingii*	LT	OR – LE WA - LT	G2, S1	Hell's Canyon, Zumwalt Prairie, Imnaha
Howell's spectacular thelypody	*Thelypodium howellii*	LT	OR – LE	G3?T1, S1	Hell's Canyon
Douglas clover	*Trifolium douglasii*	SOC	WA – S	G2, S1	Upper & Lower Grande Ronde

Source: ONHP 2001 and Nature Serve Explorer www.natureserve.org
[1] SOC = Species of Concern; LT = Listed Threatened
[2] LT = Listed Threatened; LE = Listed Endangered; C = Candidate; S = Sensitive
[3] Gx = Global Rank; Sx = State Rank (Oregon); For rank definitions, see www.natureserve.org

3.2.1.3 Species with Special Ecological Importance to the Subbasin

Many species in the subbasin, although they have no special legal status, are ecologically important due to functional specialization, critical functional links, habitat specialization or other characteristics that make them unique. Functional Specialists are those species that serve only one or very few key ecological functions. Critical functional link species (also called functional keystone species) are those whose removal would most alter the structure, composition or function of the community (IBIS 2003; Table 19). Functional specialists could be highly vulnerable to changes in their environment (IBIS 2003; Table 20). Several target species have been selected for use in Habitat Evaluation Procedures (HEP) through the loss assessment and mitigation crediting process [(Rasmussen and Wright 1990a, b, c, d) Table 21]. These target species and their habitats are considered for habitat mitigation throughout the Columbia Basin, including the Grande Ronde subbasin.

Table 19. Critically Functionally Linked Species in the Blue Mountain Ecological Province (NHI 2003)

Species Common Name	Species Scientific Name
Long-toed Salamander	*Ambystoma macrodactylum*
Black-chinned Hummingbird	*Archilochus alexandri*
Great Blue Heron	*Ardea herodias*
Redhead	*Aythya americana*
Greater Scaup	*Aythya marila*
Canada Goose	*Branta canadensis*
House Finch	*Carpodacus mexicanus*
American Beaver	*Castor canadensis*
Rocky Mountain Elk	*Cervus elaphus nelsoni*
Black Tern	*Chlidonias niger*
American Crow	*Corvus brachyrhynchos*
Big Brown Bat	*Eptesicus fuscus*

Mew Gull	*Larus canus*
Snowshoe Hare	*Lepus americanus*
Montane Vole	*Microtus montanus*
Brown-headed Cowbird	*Molothrus ater*
Mink	*Mustela vison*
Bushy-tailed Woodrat	*Neotoma cinerea*
American Pika	*Ochotona princeps*
White-tailed Deer	*Odocoileus virginianus ochrourus*
Deer Mouse	*Peromyscus maniculatus*
Raccoon	*Procyon lotor*
Rufous Hummingbird	*Selasphorus rufus*
Golden-mantled Ground Squirrel	*Spermophilus lateralis*
Red-breasted Sapsucker	*Sphyrapicus ruber*
Red Squirrel	*Tamiasciurus hudsonicus*
Northern Pocket Gopher	*Thomomys talpoides*
Black Bear	*Ursus americanus*

Table 20. Functional Specialist species in the Blue Mountain Ecological Province and the number of Key Environmental Functions (KEFs) performed by each (NHI-IBIS 2003).

Species Common Name	Species Scientific Name	# of KEFs
Turkey vulture	*Cathartes aura*	3
Peregrine falcon	*Falco peregrinus*	5
Common nighthawk	*Chordeiles minor*	5
Black swift	*Cypseloides niger*	5
Wolverine	*Gulo gulo*	5
Ringneck snake	*Diadophis punctatus*	6
Harlequin duck	*Histrionicus histrionicus*	6
Merlin	*Falco columbarius*	6
Northern pygmy owl	*Glaucidium gnoma*	6
Boreal owl	*Aegolius funereus*	6
Canada lynx	*Lynx canadensis*	6

Table 21. Target species selected for the John Day and McNary Projects and used in Habitat Evaluation Procedures in the Grande Ronde Subbasin (Rasmussen and Wright 1990a, b, c, d).

Species Common Name	Species Scientific Name	Habitat Association
Spotted sandpiper	*Actitis macularia*	Islands, mudflats, shorelines and sand and gravel bars
Lesser scaup	*Aytha affinis*	Open water
Canada goose	*Branta canadensis*	Islands and shorelines
Great blue heron	*Ardea herodias*	Sand/gravel/cobble/mud shorelines
Yellow warbler	*Dendroica petechia*	Riparian shrub and adjacent wetlands
Black-capped chickadee	*Parus atricopillus*	Mature forest canopy
Mink	*Mustela vison*	Shorelines and shallow water
Western meadowlark	*Sturnella neglecta*	Shrub-steppe and grassland
California quail	*Lophortyx californicus*	Shrub-steppe and grassland
Mallard	*Anas platyrhynchos*	Riparian and emergent wetland, islands
Downy woodpecker	*Picoides pubescens*	Riparian forest, upland forest

Table 22. Target species selected for the Lower Snake Compensation Plan and used in Habitat Evaluation Procedures in the Grande Ronde Subbasin (Saab and Lobdell 1988).

Species Common Name	Species Scientific Name	Habitat Association
Downey Woodpecker	Picoides pubescens	Riparian Forest
Song Sparrow	Melospiza melodia	Riparian Forest, Mesic Shrubland
Yellow Warbler	Dendroica petechia	Scrub-shrub Wetland
Marsh Wren	Cistothorus palustris	Emergent Wetland
Western Meadowlark	Sturnella neglecta	Shrubsteppe/Grassland/Forbland
Chukar	Alectoris chukar	Shrubsteppe/Grassland/Forbland
Ring-necked Pheasant	Phasianus colchicus	Agricultural Crops
California Quail	Lophortyx californicus	Mesic Shrubland
Mule Deer	Odocoileus hemionus	All Upland Types
River Otter	Lutra canadensis	Riverine/Limnetic
Mallard	Anas platyrhynchos	Emergent Wetland
Canada Goose	Branta canadensis	Riverine/Limnetic

3.2.1.4 Species Recognized by Tribes

Species Recognized by Columbia Plateau Tribes as Having Cultural or Religious Value

All living things are valued by the Tribes of the Columbia Plateau. In general, tribal religious beliefs are that the Creator created and gave foods and medicines in the form of plants and animals to the Natityat (i.e., Indian people) to survive. In return the Natityat made a promise to the Creator to always protect these gifts. As such, each species is believed to fulfill important roles in the ecosystem. Some examples of these roles in tribal tradition and culture are shown in Table 23. For more information on some of the species recognized by Tribes, see Appendix 7.

Table 23. Some examples of the importance of plants and animals in the cultural and spiritual lives of the Natityat.

Traditional or Cultural Role	**Examples of Animals Involved**
regalia	eagle feathers and otter, deer, and elk pelts
instruments/drums	eagle whistle, deer hide drum, dew claw rattles
housing	tule, lodgepole
subsistence	salmon, whitefish, mule deer, elk, grouse, chokecherry, lamprey, fresh water mussel, huckleberry, various root food plants, mushrooms
medicinal	various plants
burial/religious ceremonies	tule
stories/oral histories	coyote, owl
tools	elk/deer antler tools, fish bones, willow, mock orange, oceanspray, dogbane hemp

3.2.1.5 Locally Extirpated and Introduced Species

Several native fish and wildlife species are or were extirpated from Oregon and/or Washington including the Grande Ronde subbasin (Iten et al. 2001). A variety of factors contributed to the decline and disappearance of these species. Some were aggressively hunted and killed for bounty because of the threat they posed to humans and their livestock. Some species were hunted for meat and hides while others were persecuted as agricultural pests. Still other species existed in naturally small populations or in restricted habitats and were vulnerable to disturbances or habitat loss. Loss of habitat was a major factor in the decline of some of these species (Iten et al. 2001).

Several species once extirpated from the subbasin have been reintroduced with varying levels of success. There is disagreement on whether Rocky Mountain Goats are native to Washington and Oregon in general and to the Grande Ronde subbasin in particular. Witmer and Lewis (2001) list them as an introduced species with an introduction in northeast Oregon in 1950. Verts and Carraway consider mountain goats native to Washington but introduced to Oregon. On the other hand, ODFW (2003) considers mountain goats, based on archeological evidence, to be native to northeast Oregon and the Cascades. The subbasin technical team agrees that mountain goats were native to the area and were extirpated before the arrival of non-Native Americans. Mountain goats were selected as a focal species for subbasin planning and their historic and current distribution will be discussed in greater detail in section 3.2.4 of this document. Table 24 and Table 25 list fish and wildlife species extirpated from the subbasin as well as the approximate time period of extirpation and whether they have been reintroduced.

There is no record of plant species that have been extirpated from the subbasin. However, it is possible and may be likely that one or more small-area endemics or rare species now thought to be endemic to neighboring subbasins may have been extirpated and that their disappearance went unnoticed.

Table 24. Aquatic species extirpated from the Grande Ronde subbasin

Common Name	*Scientific Name*	Time of Extirpation	Reintroduced/ Status
Coho salmon	*Oncorhynchus kisutch*		
Sockeye salmon	*Oncorhynchus nerka*		

Table 25. Terrestrial wildlife species extirpated from the Grande Ronde subbasin, the approximate time of extirpation and whether the species has been reintroduced (O'Neil et al. 2001, ODFW 2003).

Common Name	*Scientific Name*	Time of Extirpation	Reintroduced/ Status
Bighorn sheep	*Ovis canadensis*	Mid-1940's	Yes / Successful
Bison	*Bos bison*	Early to mid-1800's	No
Yellow-billed cuckoo	*Coccyzus americanus*	By 1945	No
Gray wolf	*Canis lupus*	1940's	No
Grizzly bear	*Ursus arctos*	1931	No
Sharp-tailed grouse	*Tympanuchus phasianellus*	Early 1970's	Yes / small population
Rocky Mountain goat	*Oreamnos americana*	Late 19^{th} century	Yes / Successful

Just as human activities contributed, directly or indirectly, to the extirpation of these species, their reintroduction and recovery will require active management by humans.

In addition to the native species present in the Grande Ronde subbasin, many non-native species have been introduced, either intentionally or unintentionally (Witmer and Lewis 2001). Accidental introductions occur when animals escape captivity (e.g., red fox) when they arrive as stowaways on ships, trains, trucks or other vehicles (e.g., house mouse) and when habitat alteration allows a species to expand into regions not historically occupied (e.g., opossum).

Intentional introductions have occurred for a variety of reasons including a person's desire to have present species from the country or region of their heritage, in other words aesthetic reasons (e.g., European starling and eastern fox squirrel). Many game species have been introduced to provide recreational opportunities, often combined with aesthetic reasons (e.g., chukar and wild turkey). Some species, kept in captivity, were released because t he owners no longer wished or were able to care for the animals (e.g., bullfrog, goldfish). Many of the non-native fish species present in the subbasin were intentionally introduced to provide sport-fishing opportunities. Many plant species have also been introduced into the subbasin as forage plants, crops, and ornamental specimens. In general, these plants provide important benefits to humans but some have become pests that are detrimental to local ecosystems (see noxious weed section below). Table 26 and Table 27 list introduced fish and wildlife species.

Table 26. Introduced fish of the Grande Ronde subbasin.

Common Name	*Scientific Name*	Common Name	*Scientific Name*
Brook trout	*Salvelinus fontinalis*	Bluegill	*Lepomis macrochirus*
Lake trout	*Salvelinus namaycush*	Pumpkinseed	*Lepomis gibbosus*
Westslope cutthroat trout	*Oncorhynchus clarki lewisi*	Warmouth	*Lepomis gulosis*
Carp	*Cyprinus carpio*	Yellow perch	*Perca flavescens*
Black crappie	*Poxomis nigromaculatus*	Channel catfish	*Ictalurus punctatus*
White crappie	*Poxomis annularis*	Flathead catfish	*Pylodictis olivaris*
Largemouth bass	*Micropterus salmoides*	Brown bullhead	*A,eiurus nebulosus*
Smallmouth bass	*Micropterus dolomieui*	Golden trout	*Oncorhynchus aguabonita*

Table 27. Introduced wildlife of the Grande Ronde subbasin.

Common Name	*Scientific Name*	Common Name	*Scientific Name*
Chukar	*Alectoric chukar*	Red fox*	*Vulpes vulpes*
Gray partridge	*Perdix perdix*	House cat	*Felis catus*
Ring-necked pheasant	*Phasianus colchicus*	Domestic dog	*Canis familiaris*
Wild turkey	*Meleagris gallopavo*	Eastern gray squirrel	*Sciurus carolinesis*
White-tailed ptarmigan	*Lagopus leucurus*	Fox squirrel	*Sciurus niger*
California quail	*Calipepla californica*	House mouse	*Mus musculus*
Rock dove	*Columba livia*	Norway rat	*Rattus norvegicus*
European starling	*Sturnus vulgaris*	Black rat	*Rattus rattus*
House sparrow	*Passer domesticus*	Bullfrog	*Rana catesbiana*
Virginia opossum	*Didelphis virginiana*		

*Although the red fox is native to high elevations of the Grande Ronde subbasin, introductions of so-called "eastern red fox" have resulted in low elevation populations made up primarily of introduced animals (P. Matthews, ODFW, Personal communication 4/20/2004).

Introduced species have the potential for a variety of adverse ecological consequences including impacts to native species through competition for forage, nest sites and other resources; hybridization; disease transmission; predation; herbivory; damage to plants by trampling; prevention of plant regeneration and soil erosion (Witmer and Lewis 2001). Some introduced species may have positive consequences for certain native species even as they negatively affect others. For example, introduced upland game birds may compete with native upland birds for resources while providing an increased prey base for native avian and mammalian predators (Witmer and Lewis 2001).

Introduced species may also have adverse impacts on human health and activities through disease transmission to humans, pets and/or livestock; structural damage to buildings and roads;

reductions in water quality and quantity; contamination of food; competition for livestock forage and predation on livestock (Witmer and Lewis 2001).

Noxious Weeds:

The spread of noxious weeds has been described as a "biological emergency" (ODA 2001). Alien species in general are second only to habitat loss and degradation among threats to biodiverstiy (Wilcove et al. 2000). In Oregon, noxious weeds pose a serious economic and environmental threat. Oregon loses $83 million annually to 21 of the 99 state-listed noxious weeds (ODA 2001). These invasive, mostly non-native, plants choke out crops, destroy range and pasture lands, clog waterways, affect human and animal health and threaten native plant communities.

During the last 10 years, the number of state-listed noxious weeds in Oregon has increased by 40 percent. The recent detection of two aggressive invasive weeds, kudzu and smooth cordgrass, in Oregon has sounded a serious alarm about new invasions. The increasing spread of established weeds is equally alarming; infestations of some invasives have expanded up to 42 fold in Oregon since 1989 (ODA 2001).

A total of 57 noxious weeds have been listed by the weed boards of Union and Wallowa counties in Oregon and Asotin County in Washington (Table 28). Some of these species present an ever-increasing threat to crop and wildlands in northeast Oregon (Mark Porter, Wallowa Resources, personal communication, 2001). In the lower Grande Ronde River corridor, some noxious species are spreading quickly along the stream banks, utilizing recreational stream users and the stream itself as vectors (Mark Porter, personal communication, 2001).

Table 28. Union and Wallowa Counties, Oregon and Asotin County, Washington noxious weeds.

Common Name	Scientific Name	Common Name	Scientific Name
rush skeletonweed	*Chodrilla juncea*	hoary cress (white top)	*Cardaria draba*
common bugloss	*Anchusa officianalis*	Dalmatian toadflax	*Linaria dalmatica*
yellow toadflax	*Linaria vulgaris*	purple loosestrife	*Lythrum salicaria*
yellow hawkweed	*Hieraceum floribundum*	Scotch thistle	*Onopordum acanthium*
meadow knapweed	*Centaurea pratensis*	diffuse knapweed	*Centaurea diffusa*
spotted knapweed	*Centaurea maculosa*	sulfur cinquefoil	*Potetilla recta*
yellow starthistle	*Centaurea soltitalis*	tansy ragwort	*Senecio jacobaea*
medusahead rye	*Teaniatherum caput-medusa*	jointed goatgrass	*Aegilops cylindrica*
Mediterranean sage	*Salvia aethiopis*	musk thistle	*Carduus nutans*
perennial pepperweed	*Lepidium latifolium*	leafy spurge	*Euphorbia esula*
Canada thistle	*Cirsium arvense*	common teasle	*Dipsacus fullonum*
field dodder	*Custuca campestris*	hounds tongue	*Cynglossum officinale*
poison hemlock	*Conium maculatum*	puncture vine	*Tribulus terrestris*
St. Johnswort	*Hypericum perforatum*	common burdock	*Arctium minus*
western waterhemlock	*Cicuta douglasii*	velvetleaf	*Abutilon theophrasti*
Russian knapweed	*Cantaurea repens*	Scotch broom	*Cytisus scoparius*
Dyer's woad	*Isatis tinctoria*	buffalo burr	*Solanum rostratum*
catchweed bedstraw	*Galium aparline*	kochia	*Kochia scoparia*
quackgrass	*Agropyron repens*	wild oat	*Avena fatua*
morning glory	*Convolvulus sepium*	horsetail rush	*Equisetum arvense*
Russian thistle	*Salsola tenuifolia*	cereal rye	*Secale cereale*
common crupina	*Crupina vulgaris*	Japanese knotweed	*Polygonum cuspidatum*
meadow hawkweed	*Hieracium pratense*	bloodrop/pheasant eye	*Adonis aestivalis*
orange hawkweed	*Hieracium aurantiacum*	false hoary allysum	*Bertoroa incana*
chicory	*Cichorium intybus*	field bindweed	*Convovulvis arvensis*
mullen	*Verbascum thapsis*	myrtle spurge	*Euphorbia mysinites*

oxeye daisy	*Chrysanthemum leucanthemum*	reed canary grass*	*Phalaris arundinaceae*
ventenata	*Ventenata dubia*	tall buttercup	*Ranunculas acris*
bur buttercup	*Ranunculas testiculatum*		

* Reed Canarygrass is a native species but some varieties have been introduced; those introduced varieties may have contributed to the invasiveness of this species (Angela Sondenaa, Nez Perce Tribe, personal communication, 2/12/04).

In addition to those species listed as noxious weeds, numerous other introduced plants occur in the Grande Ronde subbasin. Given that most residential landscaping consists of introduced species, it would be impossible to list all of the introduced species present in the subbasin. However, many species have been introduced into previously natural habitats (e.g., Russian olive) or have escaped the urban/suburban environment and become established "in the wild (e.g., dalmatian toadflax). Further, some species have been introduced and become established through livestock feed (e.g., cheat grass). As with animals, introduced plants may be beneficial under certain circumstances. For example, some introduced, annual grasses may green up in late winter or spring before native, perennial grasses providing early forage for wildlife. Nevertheless, introduced plants are generally detrimental to the habitats in which they live. Introduced plants outcompete the native plant community, thus creating a monoculture that can increase erosion by wind and water; decrease the capture, storage and proper release of precipitation and alter nutrient cycling. Further, monocultures of introduced plants reduce biological diversity by displacing macro- and microfauna that depend on native plants for food and cover (Sheley and Petroff 1999).

The Pacific Northwest Exotic Pest Plant Council (PNW-EPPC) has compiled a list of "Exotic Pest Plants of Greatest Ecological Concern in Oregon and Washington" (PNW-EPPC 1997). The PNW-EPPC defines an exotic pest plant as "a non-native plant that disrupts, or has the potential to disrupt or alter the natural ecosystem function, composition and diversity of the site it occupies" (PNW-EPPC 1997). Different species of exotic plants have different potential for invasiveness and require different management responses in natural areas and wildlands.

Table 29. Introduced plants not listed as noxious weeds by county weed boards but which may be invasive and have an impact on habitat (PNW-EPPC 1997; This list is not exhaustive but includes the species most likely to be found in the Grande Ronde Subbasin).

Common Name	*Scientific Name*	Common Name	*Scientific Name*
Bull thistle	*Cirsium vulgare*	Curly dock	*Rumex crispus*
Yellow nut sedge	*Cyperus esculenta*	Venice mallow	*Hibiscus trionum*
Quack grass	*Agropyron repens*	Spiny cocklebur	*Xanthium spinosum*
Redstem filaree	*Erodium cicutarium*	Prickly lettuce	*Lactuca serriola*
Russian olive	*Elaegnus angustifolia*	Yellow sweetclover	*Melilotus officinalis*
Cheatgrass	*Bromus tectorum*	Pineapple weed	*Matricaria matricarioides*
Tamarisk	*Tamarix pentandra*	Black locust	*Robinia pseudoacacia*
Himalayan blackberry	*Rubus discolor*	Red sorrel	*Rumex acetosella*
Tumble mustard	*Sisymbrium altissimum*	Meadow salsify	*Tragopogan pratensis*
Tree of heaven	*Ailanthus altissima*	Longspine sandbur	*Cenchrus longispinus*
Blue mustard	*Chorispora tenella*	Yellowflag iris	*Iris pseudacorus*
Timothy	*Phleum pratense*	Western salsify	*Tragopogon dubius*
White sweetclover	*Melilotus alba*	Absinth wormwood	*Artemisia absinthium*
Flixweed	*Descurania sophia*	Birdsfoot trefoil	*Lotus corniculatus*

3.2.2 Focal Species Selection

3.2.2.1 List of Species Selected
Aquatic Wildlife:

- Snake River Spring Chinook Salmon (*Oncorhynchus tshawytscha*)
- Snake River Spring/Summer Steelhead (*Oncorhynchus mykiss*)
- Bull Trout (*Salvelinus confluentus*)

Terrestrial Wildlife:

- Mid- to High Elevation Conifer Forest
  - American marten (*Martes americana*)
  - Olive-sided flycatcher (*Contopus cooperi*)
- Ponderosa Pine Forest and Woodlands
  - White-headed woodpecker (*Picoides albolarvatus*)
- Alpine and Subalpine Habitats
  - Mountain goat (*Oreamnos americanus*)
- Eastside Canyon Shrublands
  - Rocky Mountain bighorn sheep (*Ovis canadensis*)
- Eastside Grasslands
  - Western meadowlark (*Sturnella neglecta*)
- Shrub-steppe and Salt-scrub Shrublands
  - Sage sparrow (*Amphispiza belli*)
- Agriculture, Pasture and Mixed Environs
  - Rocky Mountain elk (*cervus elaphus*)
- Open Water, Lakes, Rivers, Streams
  - Bald eagle (*Haliaeetus leucocephalus*)
- Wetlands
  - Columbia spotted frog (*Rana luteiventris*)
  - Great blue heron (*Ardea herodias*)
  - Yellow warbler (*Dendroica petechia*)
  - American beaver (*Castor canadensis*)

Plants:

- Rare or Unique Habitats
  - Quaking aspen (*Populus tremuloides)*
  - Curlleaf mountain mahogany (*Cercocarpus ledifolius*)

3.2.2.2 Methodology for Selection

Focal species are a limited set of aquatic species for which management objectives are established that describe a future desired condition for the species. These species were selected to be representative of basin communities and indicators of habitat conditions. Thus emphasis for selection was on species that spend the majority or critical stages of their lifecycles within the subbasin.

There were seven species of fish considered for use as aquatic focal species. These were; spring Chinook (Oncorhynchus tshawytscha), summer steelhead (Oncorhynchus mykiss), bull trout (Salvelinus confluentus), coho (Oncorhynchus kisutch), sockeye (Oncorhynchus nerka), fall Chinook (Oncorhynchus tshawytscha) and pacific lamprey (Lampetra tridentata).

Fall Chinook were eliminated from consideration because the fish utilizing the Grande Ronde Subbasin are a part of the broader Snake River fall Chinook population. The fall Chinook have a limited distribution in the Grande Ronde; they occur only in the mainstem river.

Sockeye and coho were eliminated as focal species because they are extinct in the Subbasin. The anadromous form of sockeye has been extinct since 1920 and only kokanee persist in Wallowa Lake. Coho salmon were extirpated from the subbasin in the 1980's.

Pacific lamprey occurred historically in the Grande Ronde River subbasin. Remnant populations may persist in the subbasin but their distribution and abundance are unknown making assessment of this species distribution and habitat conditions difficult.

The final focal species selected for consideration in this analysis are spring Chinook, summer steelhead and bull trout. This was based on their current presence and broad distribution in the basin, as well as, their biological, economic and cultural significance.

Wildlife species in the subbasin were evaluated for focal species selection by first selecting those species with state or federal legal status (ESA species), then selecting species critically functionally linked (CFL) to their communities and those which are functional specialists (FS) within the subbasin (Appendix Table 3). Among the species that fit one or more of those criteria (State listed, Federally listed, CFL, FS), it was noted whether they were also Partners in Flight (PIF) species, HEP species and/or managed (game) species as well as the number of subbasin habitats the species was closely associated with and whether any of those habitats were thought to be in decline or at risk. The resulting matrix (Appendix Table 3) was qualitatively evaluated by the subbasin terrestrial technical team to select Focal Species that: a) carried legal protection under a state or federal ESA, b) best represented habitats in decline or at risk, c) served a critical ecological function within their community or in the subbasin as a whole, d) were culturally, socially or economically important species within the subbasin, or e) any combination of the above. Finally, the subbasin Technical Team selected one or a few species they felt best represented each habitat while also filling the role of "ambassador" to the public to help members of the public connect and become involved with the process.

Focal plant species were selected because of their critical importance to the habitats they occupy. Aspen and mountain mahogany habitats in the subbasin are generally small inclusions within other habitats. These two plant species define those habitats.

3.2.3. Aquatic Focal Species Population Delineation and Characterization

3.2.3.1 Spring Chinook

Spring Chinook Population Data and Status

Spring Chinook salmon are indigenous to the Grande Ronde River subbasin and were historically distributed throughout the river system. Twenty-one tributaries supported spring Chinook runs, contributing to large documented runs in the subbasin. Spring Chinook spawning escapement in the subbasin was estimated at 12,200 fish in 1957 (USACE 1975). Recent escapement levels have numbered fewer than 1,000 fish (USDA Forest Service 1994). Snake River spring Chinook salmon were listed as threatened under the ESA in 1992.

Appendix H of NOAA Fisheries programmatic biological opinion (Opinion) concluding formal Endangered Species Act consultation on the Bonneville Power Administration (BPA) Habitat Improvement Program (HIP) in the Columbia River Basin summarizes the current status of the listed salmonid species in the Grande Ronde Subbasin (NOAA 2003a). According to this document the current condition of Snake River spring/summer Chinook population abundance, growth rate/productivity, spatial structure, and diversity is as follows:

- There has been a marked increase in 2001 returns for many populations. The 2001 returns for 2 populations are encouraging and approaching interim recovery target levels.

However the remaining Snake River spring populations remain far below their respective interim targets.

- The long term trends in productivity are very low (<< 1). However, the last two years productivity has been approaching 1.

- Chinook population spatial structure is widely distributed, with much of the historic habitat still available (~90%).

- Much habitat diversity remains and there is no evidence of wide-scale straying by hatchery populations.

- Recent events include the decision to stop utilizing non endemic Rapid River and Carson hatchery stock and to develop endemic spring Chinook broodstocks from the upper Grande Ronde River, Catherine Creek, and Lostine River.

Spring Chinook Unique Population Units

On the basis of potential dispersal distances, genetic information, and life-history traits the Interior Columbia Technical Review Team (TRT) identified and described the following six independent populations within the Grande Ronde Subbasin (TRT 2003):

Wenaha River (GRWEN). The Wenaha River fish are genetically and geographically distinct from all other Grande Ronde samples. The environmental characteristics of the Wenaha watershed also differ from other areas of the Grande Ronde subbasin where Chinook occur.

Wallowa–Lostine River (GRLOS). This population includes the Wallowa River, the Lostine River, Bear Creek and Hurricane Creek.

Minam River (GRMIN). This group is genetically closest to Catherine Creek, but the two areas are isolated by distance. In addition, juvenile migration timing differs significantly between the two areas. Interestingly, although spawning areas in the Minam are closest to the Wallowa–Lostine, the genetic distance between these two areas is rather high compared to other within-northeastern Oregon comparisons.

Catherine Creek (GRCAT). This population includes Catherine and Indian Creeks. Samples from Catherine Creek are well differentiated genetically from other within-basin populations, except for the Minam River, from which it is distinguished by distance (165 km) and timing of juveniles through the main stem.

Upper Grande Ronde (GRUMA). This population includes the upper Grande Ronde River and Sheep Creek. Genetic analysis indicates that fish spawning in this area were likely influenced by earlier outplantings of Rapid River stock (which have been discontinued). In addition, timing of juvenile migration appears to be different between this area and Catherine Creek, the nearest population.

Lookingglass Creek. The endemic Chinook in Lookingglass Creek are considered extinct as a result of adult collection of natural fish during the early years of Lookingglass Hatchery operations and extensive and continued natural spawning of Rapid River Hatchery stock in Lookingglass Creek. However, this creek is geographically separated from other spawning areas, and likely had the capacity to support an independent population historically. Currently Chinook occurring in Lookingglass are from fish allowed to spawn below the hatchery barrier.

An Ecosystem Diagnosis and Treatment (EDT) analysis was completed to evaluate the habitat potential and priorities within the Grande Ronde Subbasin. These six populations were considered individually in the Grande Ronde EDT analysis.

Spring Chinook Life History

Most Grande Ronde adult spring Chinook salmon pass Bonneville Dam and enter the Columbia Basin in April and May (ODFW et al. 1990). By June or July, the adults are holding in the Grande Ronde River subbasin near spawning tributaries. Spawning usually occurs in August and September. Eggs incubate in the gravel over the winter and fry emerge between March and May.

Spring Chinook salmon juveniles usually rear in the Grande Ronde River subbasin for one year before migrating to the ocean as smolts from March through May. Some juveniles begin their downstream migrations June through October of their first year. Chinook salmon continue to rear in fresh water prior to smolting the following spring. Adult spring Chinook salmon return to spawn at ages 3 to 6 (after 1-4 years in the ocean), although age 4 is the dominant age class among spawners.

As part of the EDT Analysis the specific timing and characteristics of each population was defined. This information is summarized in Appendix 8.

Spring Chinook Harvest & Supplementation

Sport harvest has been closed in the Subbasin since 1974 in Oregon and 1977 in Washington. There has been limited sport and tribal harvest of Lookingglass spring Chinook in 2001, 2002 to utilize the last remaining production of Lookingglass Hatchery Rapid River stock. Spring Chinook returns to Catherine Creek have been generally low however in 2004 returns were high enough to request a limited harvest. Prior to 2004 there had been limited tribal harvest in the late 1980's and no other harvest since the 1960's.

There has been no supplementation of Chinook in Lookingglass although in 2004 they will be placing some adults from Catherine Creek stock over the hatchery weir to allow spawning. Three hatchery initiatives are currently under way in the Grande Ronde: The Lower Snake River Compensation Plan (LSRCP), Northeast Oregon Hatchery Program (NEOH), and the Grande Ronde Endemic Supplementation Program (GRESP). These are described in detail in the Artificial Propagation Section.

Spring Chinook Current & Historic Distribution

Figure 7 illustrates the current and historic spring Chinook distributions in the Grande Ronde subbasin. Changes in Chinook distribution in the Grande Ronde Basin are somewhat subtle and difficult to map. Some areas historically used for Chinook spawning are now used primarily for seasonal rearing and migration due to human modification of the habitat which limits its use for spawning (J. Zakel, ODFW 2004 pers.comm).

Identification of Differences in Distribution Due to Human Disturbance

The decline in the Grande Ronde spring Chinook salmon population has been primarily attributed to passage problems at Columbia and Snake River dams (ODFW et al. 1990). Grande Ronde River anadromous fish must pass a total of 8 dams, 4 on the Columbia River and 4 on the Snake River, during up- and downstream migrations. Out-of-subbasin harvest and both in-and out-of-subbasin habitat degradation have also contributed to the population decline (Ashe et al. 2000).

Within the Grande Ronde River subbasin, riparian and instream habitat degradation has severely affected spring Chinook salmon production potential. Water withdrawals for irrigated agriculture, human residential development, livestock overgrazing, mining, mountain pine beetle damage, channelization, low stream flows, poor water quality, logging activity and road

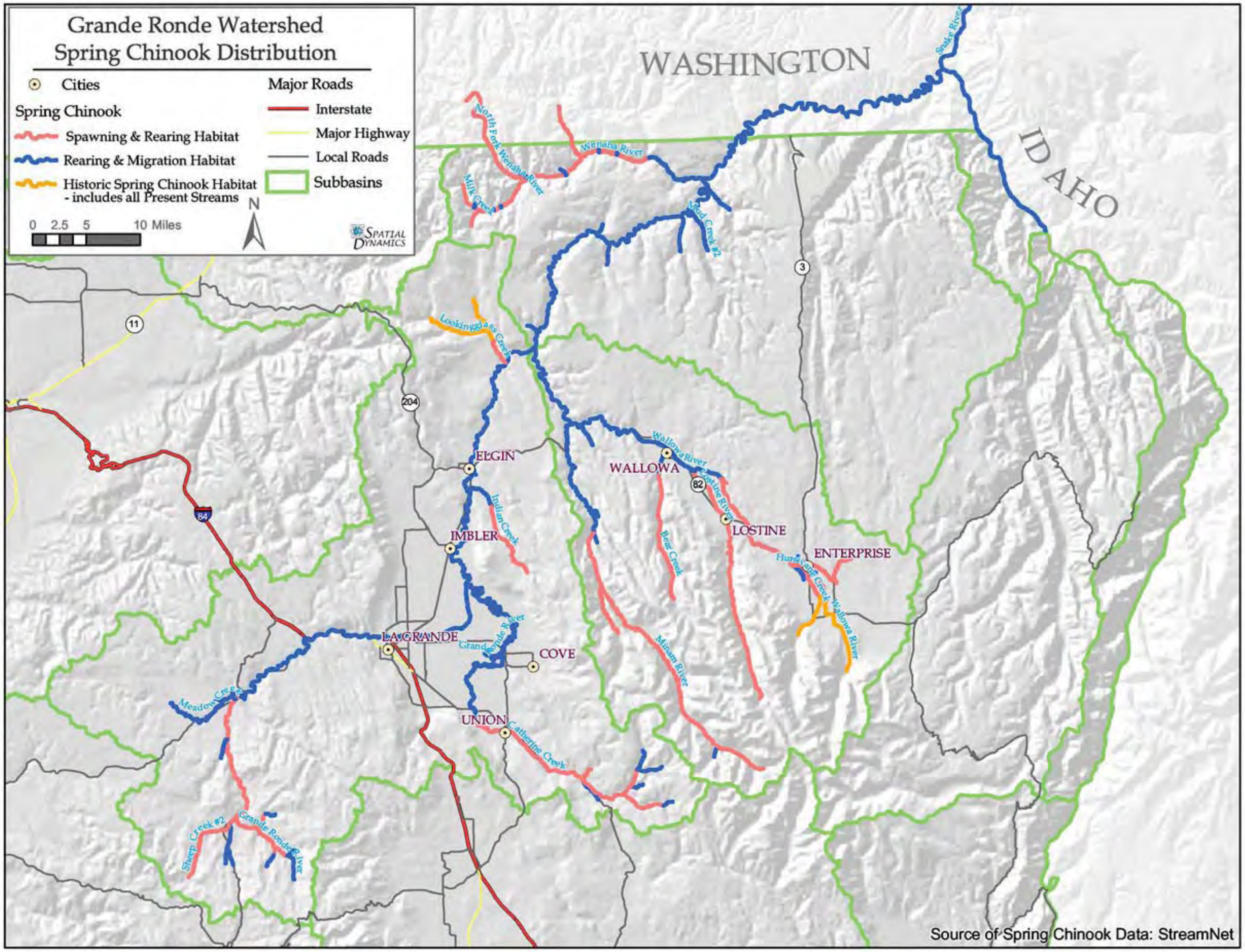


Figure 7. Historic and current distribution of spring Chinook salmon in the Grande Ronde subbasin, Oregon.

construction are major problems affecting salmon production. Many of these impacts have been reduced in recent years with management practices becoming more sensitive to fish and aquatic habitats. However, the effects of some past management activities remain.

Spring Chinook Population Risk Assessment

In order to support the planning decision process and address the whole array of potential habitat factors within the Subbasin, the Ecosystem Diagnosis and Treatment (EDT) Model was utilized for all six Chinook and four steelhead populations. EDT was developed to evaluate aquatic habitat with respect to the requirements of a particular fish species. EDT follows a medical diagnosis and treatment model where the "patient" is compared to an idealized "template." EDT does this by tracking habitat over the entire life cycle of a fish population and assessing the quantity and quality of the habitat in terms of survival at each of several life stages. This is done for both current (patient) and potential or historic (template) conditions. The inputs for the analysis include a set of environmental data covering the range of physical and biological factors that might describe the environment of the fish. These factors are assessed through a series of species-habitat "rules" based on the available scientific knowledge. The products of this analysis include an indication of the health of the environment in terms of the potential capacity and productivity of a fish population.

In order to run the EDT model the stream network in the Grande Ronde Subbasin was divided into 509 discrete reaches. Each of these 509 reaches was rated for 46 environmental attributes for current conditions and another 45 attributes for historical conditions. Over 45,000 ratings were assigned to reaches within the basin. Empirical observations within these reaches were not available for all of these ratings approximately 20% of these ratings are from empirical data. Much of the remaining data was based on the expert opinion of local biologists within the basin.

Due to time constraints, the large Subbasin size and large amount of available information it was difficult to fully analyze available data and calibrate the data to fit EDT definitions. In some cases the EDT attribute ratings were not properly assigned and as part of the model calibration ratings were reviewed and adjusted. However, additional calibration and validation is recommended.

In order to evaluate the results of the EDT model estimates of changes between current and historic spring Chinook returns were generated. These were provided by Brian Jonnasson and Bill Knox of ODFW and are summarized in Table 30. Overall there has been an estimated 87% decrease in adult spring Chinook salmon returning to the Grande Ronde Subbasin.

The EDT model also generates estimated of current and historic (template) abundance. In order to compare the changes in population numbers due only to habitat changes the EDT model uses current out-of-conditions for both the template and current population estimates, thus the estimated template returns from the EDT model should be lower than the actual historic returns. This is to standardize the EDT model and ensure the estimates are reflective of impacts solely due to changes in habitat conditions within the basin.

Table 30. Summary of Estimated Grande Ronde spring Chinook current and historic returns by population (data provided by B. Jonnasson ODFW pers. comm. 2004).

	Estimated Historic Returns		Estimated Current Returns		Miles of spawning habitat	Adults /Mile Template	Adults /Mile Current	% Decrease Historic to Current
	count	% of total	count	% of total				
Wenaha Spring Chinook	1,800	15%	453	30%	*45.60*	39.48	9.94	75%

Minam Spring Chinook	1,800	15%	347	23%	*42.54*	42.31	8.16	94%
Wallowa-Lostine Spring Chinook	3,600	30%	211	14%	*56.10*	64.17	3.76	95%
Lookingglass Spring Chinook	1,200	10%	190	12%	*29.82*	40.24	6.37	81%
Catherine Creek Spring Chinook	1,200	10%	188	12%	*29.82*	40.24	6.30	84%
Upper Grande Ronde Spring Chinook	2,400	20%	132	9%	*79.11*	30.34	1.67	84%
Total	**12,000**		**1,521**		***283.00***	**42.4**	**5.37**	**87%**

Table 31 summarizes the change estimated by the EDT model in Chinook spawner abundance from the template to the current habitat conditions. Comparing Table 30 and Table 31, the EDT modeled template returns are about half of the estimated historic adult returns. In addition, the EDT estimated and the current adult returns are about the same (1521 current, 1128 EDT estimate). Overall, EDT estimates a 78% decrease in adult returns from template to current conditions.

Figure 2 illustrates the modeled changes in Grande Ronde Spring Chinook abundance (number of spawners), productivity (returns/spawner) and Life History Diversity (% of potential) for each population.

Table 31. Summary of EDT estimated Grande Ronde spring Chinook current and historic returns by population.

	EDT Modeled Template Returns[1]		**EDT Modeled Current**		**Miles of spawning habitat**	**EDT Adults/Mile Template**	**EDT Adults/ Mile Current**	**% Decrease Historic to Current**
	count	% of total	count	% of total				
Wenaha Spring Chinook	555	11%	334	30%	45.60	12.17	7.33	40%
Minam Spring Chinook	950	19%	489	43%	42.54	22.33	11.50	49%
Wallowa-Lostine Spring Chinook	1,115	22%	112	10%	56.10	19.87	2.00	90%
Lookingglass Spring Chinook	368	7%	49	4%	29.82	12.34	1.64	87%
Catherine Creek Spring Chinook	701	14%	3	0%	29.82	23.50	0.10	100%
Upper Grande Ronde Spring Chinook	1,383	27%	141	13%	79.11	17.48	1.78	90%
Total	**5,072**		**1,128**		**283.00**	**17.92**	**3.99**	**78%**

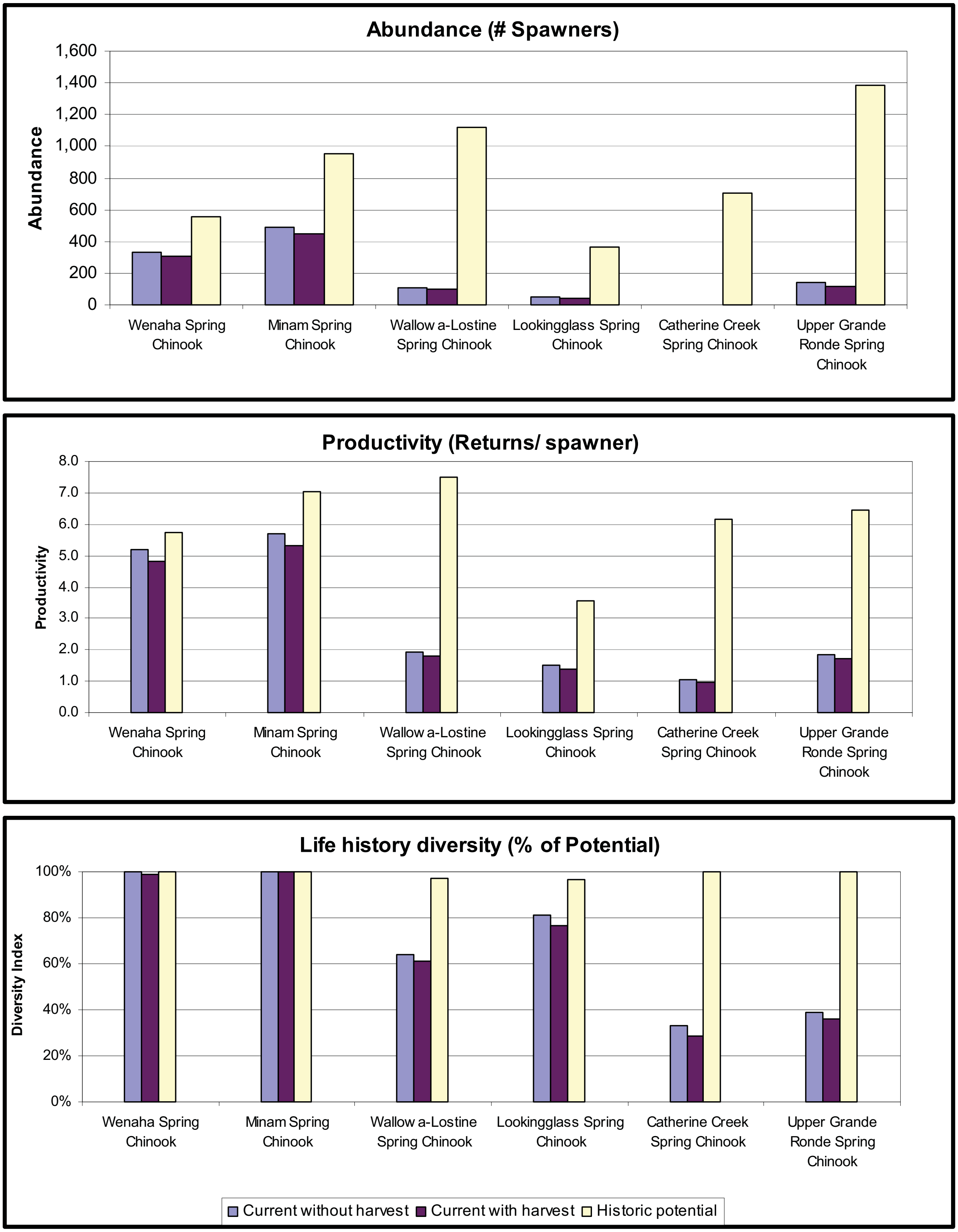


Figure 8. Plots of EDT estimates of habitat potential production of Grande Ronde spring Chinook.

Overall the Wenaha and Minam populations show the smallest decrease in abundance and have the highest % life history diversity. Both of these watersheds are in Wilderness areas with minimal land use and intact habitat conditions. The Wallowa-Lostine, Lookingglass and Upper Grande Ronde populations all show a 90% decrease in abundance due to a reduction in habitat capacity. Catherine Creek Chinook have an estimated 100% decrease in abundance. According to the EDT model results the population in Catherine Creek is just barely sustainable. This has been a difficult result to explain and there was not adequate time to properly calibrate the EDT model attributes. In general the Catherine Creek Chinook have shown reasonable resilience, rebounding when the ocean conditions turned (J. Zakel ODFW 2004, pers. comm.).

In addition to the baseline reports on abundance and productivity the EDT model generates 'diagnostic' reports which identify priority areas for protection and restoration and the potential percentage change in abundance and productivity with changes in habitat conditions. Finally the EDT model produces reports illustrating attributes with the largest impacts on production.

In order to facilitate analysis the 509 reaches identified in the Grande Ronde Subbasin were grouped into 87 geographic areas. The geographic areas were delineated based on valley forms, stream geomorphology and land ownership patterns. EDT results are presented and organized by geographic area. The geographic areas within each Chinook and steelhead population and reaches within each geographic area are listed in Appendix 8.

There are a few limitations of the EDT model which need to be considered in interpreting the EDT results. First, the EDT model does not route impacts from the source to the impact location. So for example in reaches identified as high in sediment the source of that sediment may activities in other upstream reaches. Second, the EDT model does address opportunity (just because something is broke there may not be a way to fix it, or a landowner may not want to fix it. Third the EDT model is species and area specific. This means we have results telling us which portions of the Subbasin if restored would result in the greatest increase of productivity for a specific population. But in order to develop an overall plan conditions and opportunities throughout the Subbasin need to be considered. We attempted to place the EDT results in this broader perspective in the 'Environmental Conditions for Focal Species' section. Following is a brief overview of the EDT results for each individual population which will be further discussed in 'Environmental Conditions for Focal Species'.

EDT Habitat Priorities for Grande Ronde Spring Chinook by Population

Wenaha Spring Chinook

This population utilizes habitat in 37 reaches of the Grande Ronde Subbasin. For purposes of this analysis these reaches were consolidated into 5 geographic areas (Appendix 8, Table 71). The lower Grande Ronde and Lower Wenaha are the only areas not within wilderness area boundaries. All reaches used by this population had a high protection value (Figure 9) indicating current conditions are relatively good. Restoration of the Lower Grande Ronde geographic area has the greatest potential to increase abundance and productivity.

Figure 10 shows the relative contribution of individual habitat attributes to restoration benefits. The highest priority attributes were habitat diversity and key habitat quantity. The life history stages most affected are the age 0 inactive, age 0 active and age 1 migrants. For all of these life history stages the factors influencing the habitat diversity attribute are hydromodifications, riparian function and wood. The factors influencing the key habitat quantity attribute are presence of primary pools.

Geographic Area	Protection benefit Category/rank		Restoration benefit Category/rank	
Lower Grnd Rnd R 1	A	3	A	1
Lower Wenaha R	A	1	A	4
Wenaha misc tribs	A	2	A	3
Upper Wenaha R	A	2	A	2
Wenaha Forks	A	2	A	5

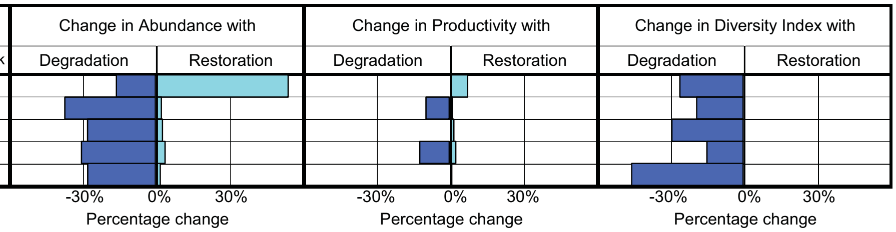


Figure 9. Habitat protection and restoration priorities for the Wenaha population of Grande Ronde spring Chinook salmon**.**

Geographic area	Protection benefit	Restoration benefit	Channel stability/landsc.1/	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Lower Grnd Rnd R 1	◯	◯					•		●					•				●
Lower Wenaha R	◯	◯																•
Wenaha misc tribs	◯	◯																
Upper Wenaha R	◯	◯																
Wenaha Forks	◯	◯																

Geographic area priority: Protection benefit, Restoration benefit. Attribute class priority for restoration.

1/ "Channel stability" applies to freshwater areas; "channel landscape" applies to estuarine areas.

Key to strategic priority (corresponding Benefit Category letter also shown)

A	B	C	D & E
◯ / ● High	○ / ● Medium	∘ / • Low	Indirect or General

Figure 10. Habitat attribute priorities for the Wenaha population of Grande Ronde spring Chinook salmon.

Minam Spring Chinook

This population utilizes habitat in 54 reaches of the Grande Ronde Subbasin For purposes of this analysis these reaches were consolidated into 7 geographic areas (Appendix 8, Table 72). The main Grande Ronde, Lower Wallowa and Lower Minam are the only areas not within wilderness area boundaries. Reaches used by this population in the Minam watershed had a high protection value (Figure 11) indicating current conditions are relatively good. Restoration of the Lower Minam, lower Wallowa and main Grande Ronde geographic areas have the greatest potential to increase abundance and productivity.

Figure 12 shows the relative contribution of individual habitat attributes to restoration benefits. The highest priority attributes were key habitat quantity and habitat diversity. Predation was a factor in the Grande Ronde and Wallowa rivers. The life history stages most affected are the age 0 inactive, age 0 active in the Wallowa and Lower Minam. In the Grande Ronde, the priority attribute was key habitat quantity and most affected life stages were age 0 inactive and age 1 migrants. For all of these life history stages the factors influencing the habitat diversity attribute are hydromodifications, riparian function and wood. The factors influencing the key habitat quantity attribute are presence of primary pools.

Geographic Area	Protection benefit Category/rank		Restoration benefit Category/rank	
Lower Grnd Rnd R 1	A	6	A	3
Lower Grnd Rnd R 2	A	5	A	2
Lower Wallowa R	A	4	A	1
Lower Minam R	A	3	A	2
Mid Minam R	A	2	A	5
Little Minam	A	4	A	6
Upper Minam	A	1	A	4

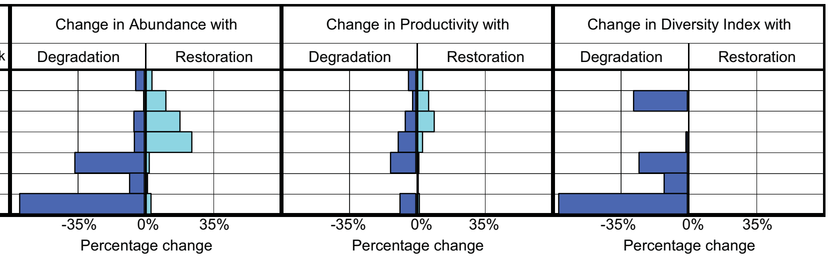


Figure 11: Habitat protection and restoration priorities for the Minam population of Grande Ronde spring Chinook salmon.

Geographic area priority			Attribute class priority for restoration															
Geographic area	Protection benefit	Restoration benefit	Channel stability/landsc.1/	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Lower Grnd Rnd R 1	◯	◯							•					•				
Lower Grnd Rnd R 2	◯	◯							•					•	•			●
Lower Wallowa R	◯	◯					•		●					•				●
Lower Minam R	◯	◯							•									⬤
Mid Minam R	◯	◯																●
Little Minam	◯	◯																●
Upper Minam	◯	◯																●

1/ "Channel stability" applies to freshwater areas; "channel landscape" applies to estuarine areas.

Key to strategic priority (corresponding Benefit Category letter also shown)

A		B		C		D & E	
◯ / ⬤	High	○ / ●	Medium	∘ / •	Low	(blank)	Indirect or General

Figure 12. Habitat attribute priorities for the Minam population of Grande Ronde spring Chinook salmon.

Wallowa-Lostine Spring Chinook

This population utilizes habitat in 108 reaches of the Grande Ronde Subbasin, for purposes of this analysis these reaches were consolidated into 12 geographic areas (Appendix 8, Table 73). Restoration of the Upper Wallowa, lower Lostine and mid-Wallowa geographic areas has the greatest potential to increase abundance and productivity (Figure 13).

Geographic Area	Protection benefit Category/rank		Restoration benefit Category/rank	
Lower Grnd Rnd R 1	A	7	C	11
Lower Grnd Rnd R 2	A	3	A	7
Lower Wallowa R	A	4	A	6
Mid Wallowa R	A	2	A	3
Lower Bear Cr (Wallowa)	A	5	A	9
Upper Bear Cr (Wallowa)	A	6	A	10
Lower Lostine R	A	1	A	2
Upper Lostine R	A	2	A	8
Spring Cr (Wallowa)	A	9	C	11
Upper Wallowa R	A	8	A	1
Hurricane Cr	A	10	A	4
Prairie Cr (Wallowa)	A	8	A	5

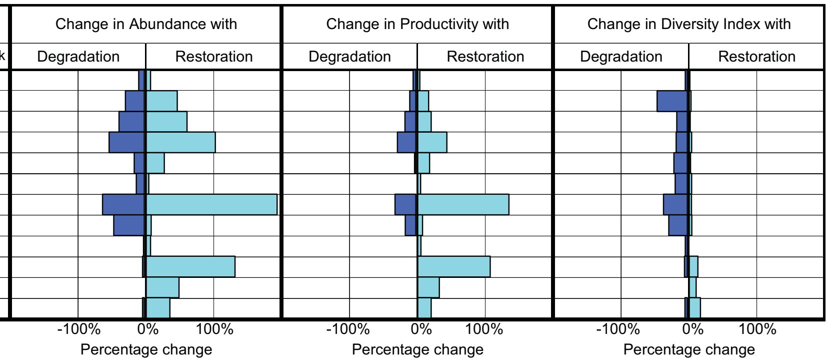


Figure 13. Habitat protection and restoration priorities for the Wallowa-Lostine population of Grande Ronde spring Chinook salmon.

Figure 14 shows the relative contribution of individual habitat attributes to restoration benefits. The highest priority attributes were key habitat quantity and habitat diversity. Sediment, temperature, predation, food and flow were factors in all of the priority geographic areas.

The life history stages most affected are the age 0 active which are primarily affected by changes in primary pool and backwater habitat. The egg incubation life history stage was affected by high sediment in the upper Wallowa. In the Lower Lostine key habitat quantity was impacting the prespawning holding life history stage which is affected by changes in the primary pools and glides.

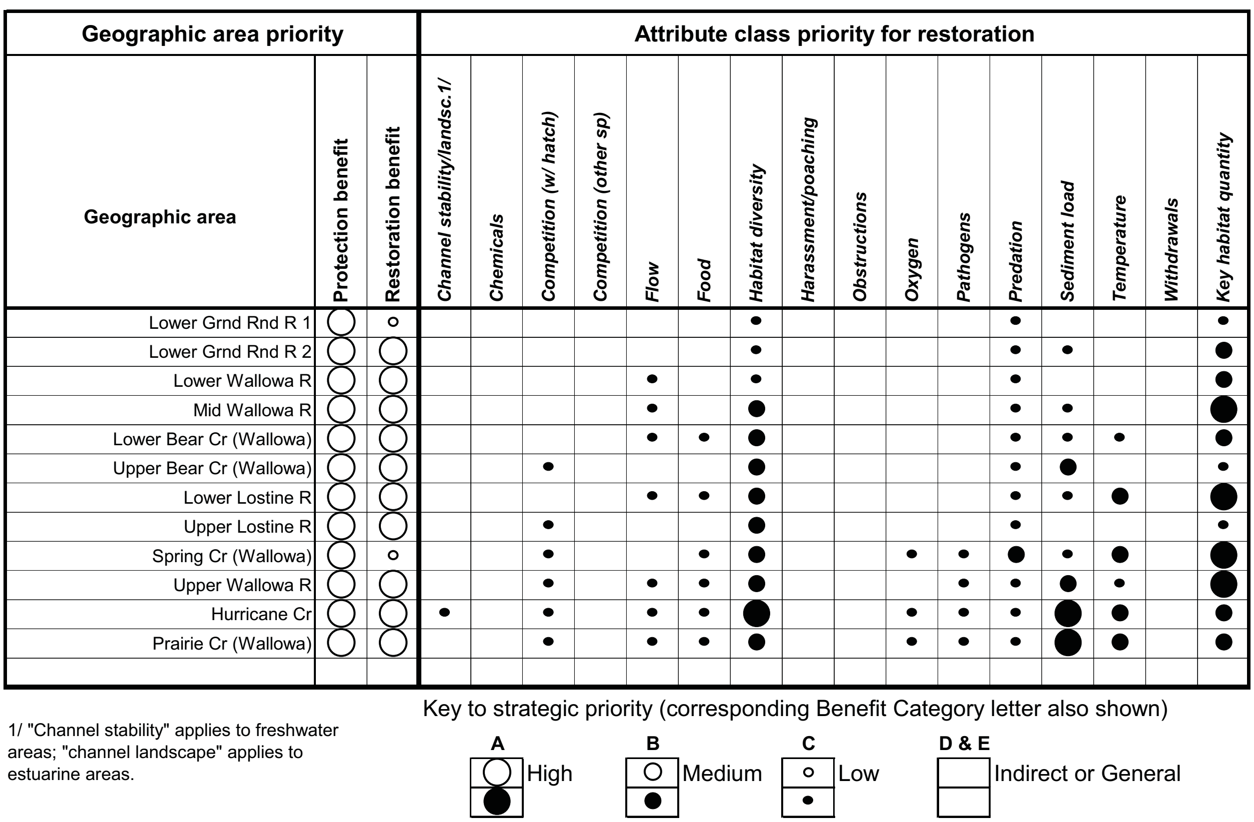


Figure 14. Habitat attribute priorities for the Wallowa-Lostine population of Grande Ronde spring Chinook salmon.

Lookingglass Creek Spring Chinook

This population utilizes habitat in 53 reaches of the Grande Ronde Subbasin. For purposes of this analysis these reaches were consolidated into 6 geographic areas (Appendix 8, Table 74). Restoration of the Lower Grande Ronde 2 (reaches 13 to 25, Wenaha to Wallowa) geographic areas has the greatest potential to increase abundance and productivity (Figure 15). The Lookingglass Creek Chinook population was extirpated as part of the hatchery broodstock process when the Lookingglass hatchery was constructed. This population was considered in the EDT analysis because an extensive effort has been initiated to establish an 'endemic' naturally spawning Chinook population using excess fish from Catherine Creek (see Artificial Propagation section).

Geographic Area	Protection benefit		Restoration benefit	
	Category	rank	Category	rank
Lower Grnd Rnd R 1	A	5	A	5
Lower Grnd Rnd R 2	A	1	A	1
Mid Grnd Rnd R 1	A	4	A	6
Lower Lookglass Cr	A	2	A	2
Little Lookglass Cr	A	4	A	4
Upper Lookglass Cr	A	3	A	3

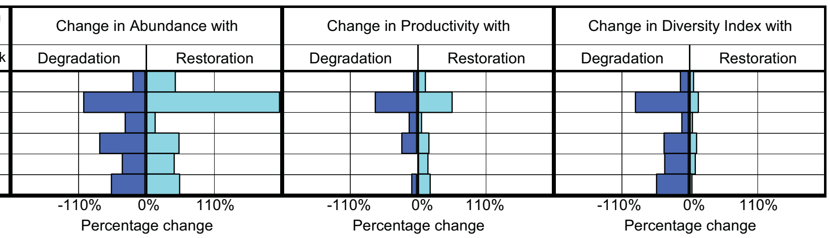


Figure 15: Habitat protection and restoration priorities for the Lookingglass population of Grande Ronde spring Chinook salmon.

Figure 16shows the relative contribution of individual habitat attributes to restoration benefits. The highest priority attributes were key habitat quantity and habitat diversity. Sediment, predation, and flow were low factors in some geographic areas. The life history stages most affected in Lower Grande Ronde 2 are the age 0 active and inactive and the key habitat attribute is primarily affected by changes in primary pool and backwater habitat. The Habitat diversity attribute is affected by decreases in riparian function and wood.

Geographic area priority			Attribute class priority for restoration															
Geographic area	Protection benefit	Restoration benefit	*Channel stability/landsc.1/*	*Chemicals*	*Competition (w/ hatch)*	*Competition (other sp)*	*Flow*	*Food*	*Habitat diversity*	*Harassment/poaching*	*Obstructions*	*Oxygen*	*Pathogens*	*Predation*	*Sediment load*	*Temperature*	*Withdrawals*	*Key habitat quantity*
Lower Grnd Rnd R 1	◯	◯							●					•				●
Lower Grnd Rnd R 2	◯	◯							•					•	•			●
Mid Grnd Rnd R 1	◯	◯					•		•						•			●
Lower Lookglass Cr	◯	◯					•		●					•		•		⬤
Little Lookglass Cr	◯	◯					•		●						•			●
Upper Lookglass Cr	◯	◯							•						•			⬤

1/ "Channel stability" applies to freshwater areas; "channel landscape" applies to estuarine areas.

Key to strategic priority (corresponding Benefit Category letter also shown)

A	B	C	D & E
◯ / ⬤ High	○ / ● Medium	∘ / • Low	Indirect or General

Figure 16: Habitat attribute priorities for the Lookingglass population of Grande Ronde spring Chinook salmon.

Catherine Creek Spring Chinook

This population utilizes habitat in 73 reaches of the Grande Ronde Subbasin. For purposes of this analysis these reaches were consolidated into 10 geographic areas (Appendix 8, Table 75). The middle Catherine Creek geographic area was identified as the priority area for restoration (Figure 17). Conditions in this reach have a very significant impact of the entire population, note the huge (5000+%) potential change in abundance with restoration of conditions in this reach.

Geographic Area	Protection benefit		Restoration benefit	
	Category/rank		Category/rank	
Lower Grnd Rnd R 1	A	4	A	7
Lower Grnd Rnd R 2	A	2	A	5
Mid Grnd Rnd R 1	A	6	A	8
Mid Grnd Rnd R 2	A	3	A	6
Lower Indian Cr	A	1	A	2
Mid Grnd Rnd R 3	A	7	A	9
Lower Catherine Cr	A	7	A	4
Mid Catherine Cr	A	4	A	1
Mid Catherine tribs	A	8	A	10
NF Caterine Cr.	A	1	A	4
SF Catherine Cr	A	5	A	3

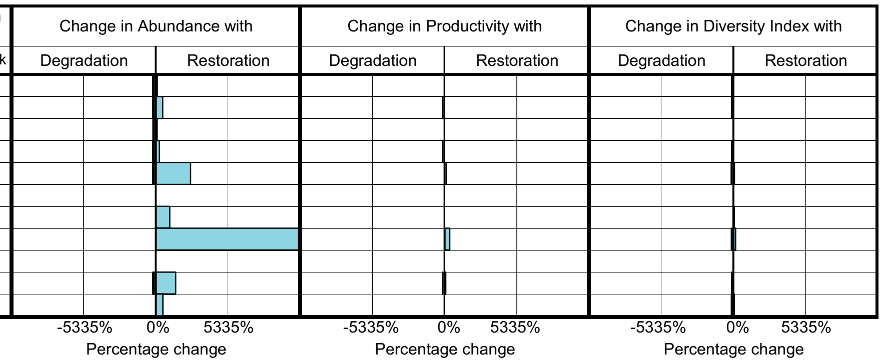


Figure 17: Habitat protection and restoration priorities for the Catherine Creek population of Grande Ronde spring Chinook salmon.

In general the priority impacts identified by EDT in Catherine Creek are a decrease in the Habitat Diversity and Key Habitat Quantity attributes (Figure 18), in addition sediment, flow and predation show up consistently as lower priorities. In Mid-Catherine Creek the priority reach for restoration EDT identifies a wide variety of attributes limiting current conditions. The highest priority impacts are, habitat diversity, key habitat quality temperature, with competition with hatchery fish, flow, food, pathogens, predation and sediment also limiting conditions.

Geographic area priority			Attribute class priority for restoration															
Geographic area	Protection benefit	Restoration benefit	Channel stability/landsc.1/	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Lower Grnd Rnd R 1	◯	◯							•					•				
Lower Grnd Rnd R 2	◯	◯							•					•	•			●
Mid Grnd Rnd R 1	◯	◯					•		•						•			●
Mid Grnd Rnd R 2	◯	◯					•		•					•	•			●
Lower Indian Cr	◯	◯					•		●			•			•	●		●
Mid Grnd Rnd R 3	◯	◯							●					•				⬤
Lower Catherine Cr	◯	◯					•		●				•	•	●	•		
Mid Catherine Cr	◯	◯			•		•	•	●				•	•	•	●		●
Mid Catherine tribs	◯	◯					•		⬤						⬤	•		•
NF Caterine Cr.	◯	◯					•		●						●	•		●
SF Catherine Cr	◯	◯							•						●			•

1/ "Channel stability" applies to freshwater areas; "channel landscape" applies to estuarine areas.

Key to strategic priority (corresponding Benefit Category letter also shown)

A		B		C		D & E	
◯ / ⬤	High	○ / ●	Medium	∘ / •	Low		Indirect or General

Figure 18: Habitat attribute priorities for the Catherine Creek population of Grande Ronde spring Chinook salmon.

Upper Grande Ronde Spring Chinook

This population utilizes habitat in 118 reaches of the Grande Ronde Subbasin. For purposes of this analysis these reaches were consolidated into 17 geographic areas (Appendix 8, Table 76). The highest priority area for restoration is the upper Grande Ronde from Meadow Creek to Limber Jim. In addition, restoration of the Middle Grande Ronde from the upper Grande Ronde Valley to Meadow Creek, Fly and Sheep Creeks would increase abundance (Figure 19).

Geographic Area	Protection benefit		Restoration benefit	
	Category/rank		Category/rank	
Lower Grnd Rnd R 1	A	6	C	12
Lower Grnd Rnd R 2	A	4	C	13
Mid Grnd Rnd R 1	C	12	C	14
Mid Grnd Rnd R 2	A	8	C	12
Mid Grnd Rnd R 3	A	9	A	7
Mid Grnd Rnd R 4	A	3	A	2
Mid Grnd Rnd tribs 4	C	11	A	5
Lower Meadow Cr	C	15	A	4
McCoy Cr	A	10	A	6
Upper Meadow Cr	C	14	A	9
Upper Grnd Rnd R 1	A	2	A	1
Fly Cr	A	7	A	3
Sheep Cr (GR)	A	1	A	4
Limber Jim Cr	C	13	A	8
Upper Grnd Rnd R 2	A	5	A	4
Clear Cr (GR)	C	11	A	10
Upper Grnd Rnd R 3	C	12	C	11

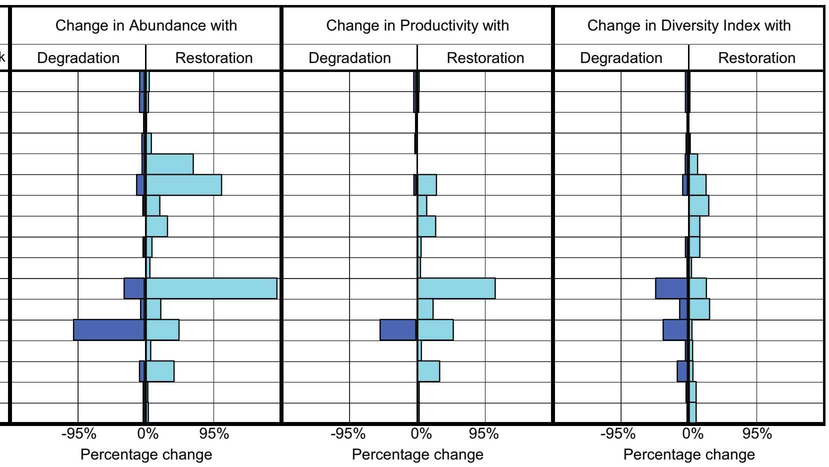


Figure 19: Habitat protection and restoration priorities for the Upper Grande Ronde population of Grande Ronde spring Chinook salmon.

Sediment, temperature, key habitat quantity and habitat diversity are the attributes that most often are limiting habitat for this population (Figure 20). In the priority reaches for restoration flow is also identified as an impact.

Geographic area priority			Attribute class priority for restoration															
Geographic area	Protection benefit	Restoration benefit	Channel stability/landsc.1/	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Lower Grnd Rnd R 1	High	Low							Low					Low				
Lower Grnd Rnd R 2	High	Low												Low				
Mid Grnd Rnd R 1	Low	Low							Low						Low			Medium
Mid Grnd Rnd R 2	High	Low							Low					Low	Low			High
Mid Grnd Rnd R 3	High	High					Low		Medium					Low	Low	Low		High
Mid Grnd Rnd R 4	High	High					Low		Medium					Low	Low	Medium		High
Mid Grnd Rnd tribs 4	Low	High							Low			Low			High			Medium
Lower Meadow Cr	Low	High					Low		Low			Low			High	Low		Low
McCoy Cr	High	High					Low		Medium			Low			High	Low		Medium
Upper Meadow Cr	Low	High					Low		Medium			Low			High	High		Low
Upper Grnd Rnd R 1	High	High					Low		Medium						Medium	Medium		Medium
Fly Cr	High	High					Low		Low						High	Low		Low
Sheep Cr (GR)	High	High							Low						Medium	Low		Medium
Limber Jim Cr	Low	High							Low						High			Medium
Upper Grnd Rnd R 2	High	High					Low		Low						Medium	Medium		Medium
Clear Cr (GR)	Low	High							Low						High			Medium
Upper Grnd Rnd R 3	Low	Low							Low						High			Medium

1/ "Channel stability" applies to freshwater areas; "channel landscape" applies to estuarine areas.

Key to strategic priority (corresponding Benefit Category letter also shown)

A High | B Medium | C Low | D & E Indirect or General

Figure 20: Habitat attribute priorities for the Upper Grande Ronde population of Grande Ronde spring Chinook salmon.

3.2.3.2 Summer Steelhead

Summer Steelhead Population Data and Status

Summer steelhead are native to the Grande Ronde River subbasin. The Grande Ronde subbasin historically produced large runs of summer steelhead. The size of those runs is unknown but an estimate of 15,900 to the mouth of the Grande Ronde River was given for 1957, prior to construction of lower Snake River dams (USACE 1975). Grande Ronde summer steelhead are part of the Snake River ESU and were federally listed as threatened in 1997.

Appendix H of NOAA Fisheries programmatic biological opinion (Opinion) concluding formal Endangered Species Act consultation on the Bonneville Power Administration (BPA) Habitat Improvement Program (HIP) in the Columbia River Basin summarizes the current status of the listed salmonid species in the Grande Ronde Subbasin (NOAA 2003a). According to the Opinion the current condition of Snake River summer steelhead population abundance, growth rate/productivity, spatial structure, and diversity is as follows:

- The abundance of returning adults is uncertain because there is a paucity of data for adult spawners. However, dam counts are currently 28% of the interim recovery target for the Snake River Basin (52,000 natural spawners). In addition, Joseph Creek exceeds the interim recovery target.
- There is mixed long- and short-term trends in abundance and productivity depending on the specific population.
- Diversity within the Snake River populations is of concern. The B-run steelhead particularly depressed (Clearwater & Salmon), in the Grande Ronde this is not an issue. Displacement of natural fish by hatchery fish (declining proportion of natural-origin spawners) is a concern and efforts are underway to reduce this. There is also evidence of homogenization of hatchery stocks within basins, and some stocks exhibiting high stray rates.
- To mitigate some of the concerns with hatchery fish, hatchery reform with increased use of local broodstock, and hatchery releases away from areas of natural production has been implemented (see Artificial Propagation section for details).

Summer Steelhead Unique Population Units

For the purposes of the Subbasin planning effort and EDT modeling we considered four summer steelhead populations. These groupings are consistent with the four populations identified by the Interior Columbia River basin TRT. Within the Grande Ronde, the four populations of summer steelhead are (TRT 2003):

Lower Grande Ronde (GRLMT-s). This population includes the mainstem Grande Ronde River and all tributaries (including the outlier Mudd Creek) upstream to the confluence of the Wallowa River, except the Joseph Creek drainage. Most genetic samples (except Mudd Creek, above) from this region formed a distinct cluster, and spawning areas in this population are well-separated from other populations.

Joseph Creek (GRJOS-s). Spawning areas in Joseph Creek are well separated (67 km) from other spawning aggregations. In addition, samples from the tributaries to Joseph Creek (Chesnimnus and Elk Creeks) form a distinct group in a cluster analysis.

Wallowa River (GRWAL-s). This population includes the Minam River, the Lostine River and several smaller tributaries as an independent population. Spawning within this population currently does not begin until the confluence of the Wallowa and Minam Rivers, and this population was separated from the lower mainstem on this topographical and distance factor. This population includes the outlier Prairie Creek.

Upper Grande Ronde (GRUMA-s). The remainder of the Grande Ronde drainage, including the mainstem upper Grande Ronde and Lookingglass Creek, Catherine Creek, and Indian Creek is designated as an independent population. Dry Creek, which was an outlier in the genetic analysis is included in this population. Like other outliers, this may reflect the contribution of resident fish to the sample.

Summer Steelhead Life History

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 so 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 1.5 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. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. 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.

Most summer steelhead rear for two years in the Grande Ronde River system before migrating to the ocean. Analysis of scales from 26 wild adult summer steelhead collected at Wallowa Hatchery during 1983-1984 showed all had smolted at age 2 (R. Carmichael, ODFW, unpublished data). Most smolt migration occurs from April through June (Smith 1975). There is a smaller pulse of fish in the fall, when juveniles are thought to migrate to lower stream reaches to avoid freezing conditions in the upper tributaries. Upstream areas may be repopulated the following spring. Juveniles may also move upstream to find cool water sanctuaries during the summer (ODFW 1993).

Adult summer steelhead spend one to three years in the ocean before returning to spawn. Returning Grande Ronde River adult summer steelhead pass Bonneville Dam during July and John Day Dam primarily during August-October. Like most Snake River populations, Grande Ronde River summer steelhead migrate through the lower Snake River during two periods: a fall movement that peaks in mid- to late-September and a spring movement that peaks during March and April. Some adult summer steelhead enter the lower Grande Ronde River as early as July but most adults enter from September through March (ODFW 1993).

Wild fish are generally 4 years old at maturity, having spent 2 years in fresh water, 1½ years in the ocean, and ½ year migrating to the subbasin and holding there until spawning. Spawning occurs from March through mid-June. Peak spawning takes place from late April through May. Fry emerge from May through July.

As part of the EDT Analysis the specific timing and characteristics of each population was defined. This information is summarized in Appendix 8.

Summer Steelhead Current & Historic Distributions

Summer steelhead are presently distributed throughout the Grande Ronde subbasin (Figure 21). It is important to note the map does not include all areas occupied by steelhead. Steelhead can occupy some of the smallest tributaries and will also use seasonal streams. The streamnet data used for mapping is at such a large scale mapping all small tributaries is impractical, in addition during the EDT analysis, notes were found in Forest Service data on steelhead observations above the mapped reaches. Changes in steelhead distribution from historic to current are also somewhat subtle and difficult to map. There appear to be changes in how habitat is utilized due to human modification of the habitat which limits its use for spawning (J. Zakel, ODFW 2004 pers.comm).

Harvest & Supplementation

The Wenaha and Minam rivers and Joseph Creek are wild fish management areas for summer steelhead in the subbasin and, thus, receive no hatchery supplementation. In the lower Grande Ronde there is no intentional supplementation. It is likely some there are strays but not in large numbers. There has been no harvest of wild steelhead in sport fisheries since late 1970's. Fishing is open for harvest of adipose fin-clipped hatchery adults since 1986. Joseph Creek has been closed to steelhead angling since the mid-1970's.

Some supplementation of Deer Cr., Catherine Cr., and upper Grande Ronde occurred in late 1980's and early 90's. Releases of hatchery steelhead into upper Grande Ronde and Catherine

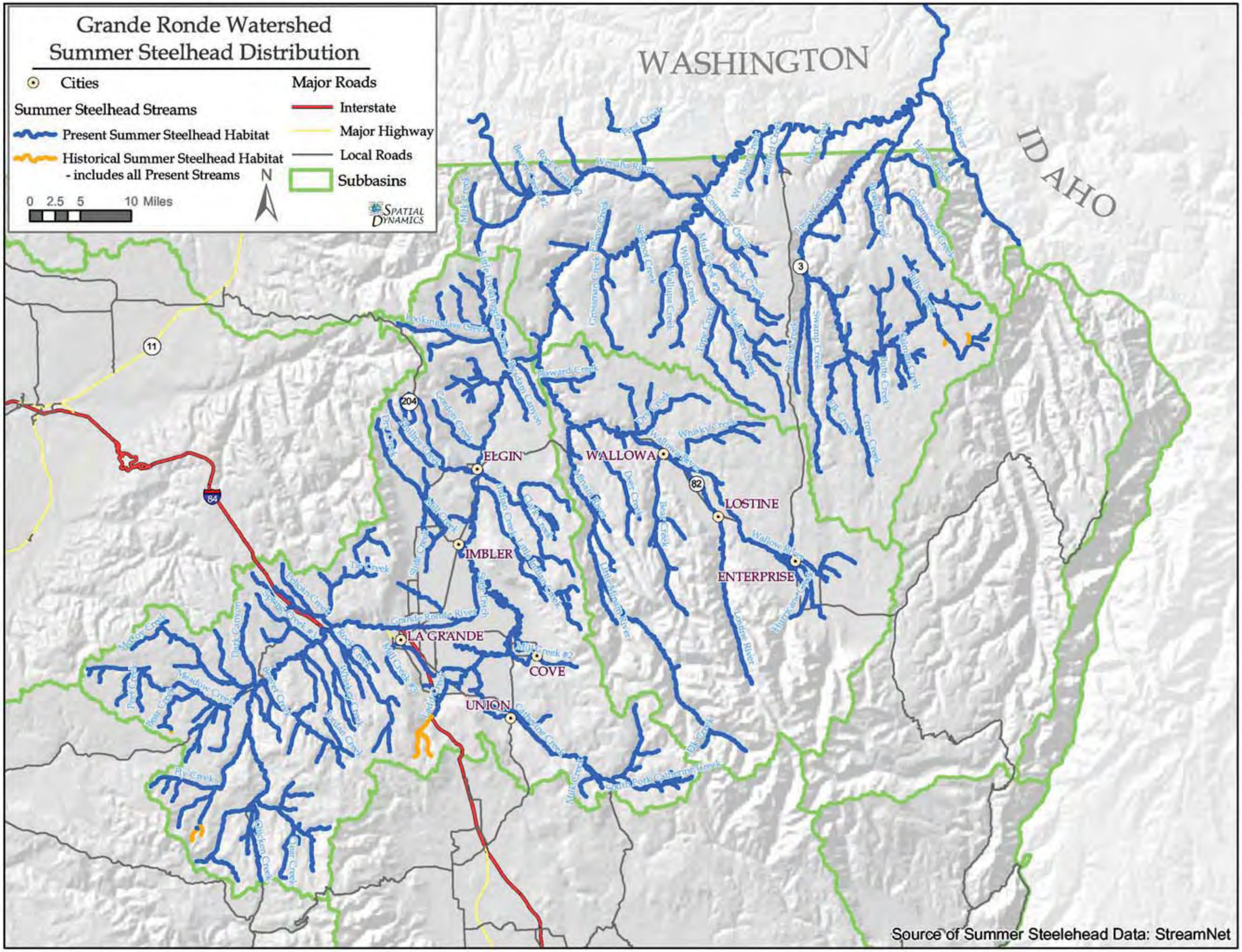


Figure 21. Historic and current distribution of steelhead in the Grande Ronde subbasin, Oregon.

Cr. were discontinued in the late 1990's. Releases are now confined to acclimation facilities in Spring Creek (Wallowa Hatchery) and Deer Creek. Only wild adults are released above Deer Creek weir for natural spawning. Sport harvest is restricted to only adipose fin-clipped hatchery adults.

Identification of Differences in Distribution Due to Human Disturbance

Anadromous fish production in the Grande Ronde River subbasin is limited by two factors. Adult escapement of salmon and steelhead is currently being determined by out-of-subbasin issues and is insufficient to fully seed the available habitat. The carrying capacity of the habitat and fish survival have been reduced within the subbasin by land management activities which impact hydrology, sedimentation, habitat distribution and complexity, and water quality (Columbia Basin Fish and Wildlife Authority 1999, Mobrand and Lestelle 1997, Wallowa County and Nez Perce Tribe 1993). The following EDT analysis identifies specific areas of the Subbasin and impacts that are limiting steelhead production.

Steelhead Population Risk Assessment

Population data for Oregon summer steelhead presented in Chilcote (2001; an ODFW document that has not been peer reviewed) suggest a "long term cyclic phenomena" in population abundance and productivity. Grande Ronde populations appear to follow this type of population cycle. Chilcote (2001) also addressed extinction risk in populations of Oregon summer steelhead. He concluded that none of the Grande Ronde populations are presently at risk of extinction. His model further predicted that at adult mortality rates (from harvest) of less than 45 percent, the risk of extinction remains essentially zero. There is disagreement among co-managers regarding the validity of these conclusions

In order to support the planning decision process and address the whole array of potential habitat factors within the Subbasin. The Ecosystem Diagnosis and Treatment (EDT) Model was utilized for all six Chinook and four steelhead populations.

In order to evaluate the results of the EDT model estimates of changes between current and historic summer steelhead returns were generated. These were provided by Brian Jonnasson and Bill Knox of ODFW and are summarized in Table 32. Overall there has been an estimated 70% decrease in adult summer steelhead returning to the Grande Ronde Subbasin.

Table 32. Summary of Estimated Grande Ronde summer steelhead current and historic returns by population (data provided by B. Jonnasson ODFW pers. comm. 2004).

	Estimated Historic Returns		Estimated Current Returns		Miles of spawning habitat	Adults /Mile Template	Adults /Mile Current	% Decrease Historic to Current
	count	% of total	count	% of total				
Lower Grande Ronde	2,400	16%	608	14%	253.84	9.45	2.39	75%
Joseph Creek	3,600	24%	945	21%	223.10	16.14	4.24	74%
Wallowa River	3,750	25%	1,193	27%	173.45	21.62	6.88	68%
Upper Grande Ronde	5,250	35%	1,755	39%	613.96	8.55	2.86	67%
Total	**15,000**		**4,500**		1,264.35			**70%**

The EDT model generates estimated of current and historic (template) abundance. In order to compare the changes in population numbers due only to habitat changes the EDT model uses current out-of-conditions for both the template and current population estimates thus the estimated returns from the EDT model should be lower than the actual historic returns. This is to make the EDT model estimates more reflective of impacts due to changes in habitat conditions within the basin.

Table 33 summarizes the change estimated by the EDT model in summer steelhead spawner abundance from the Template to the Current habitat conditions. Comparing Table 32 and Table 33, the EDT modeled Template returns are about the same as the estimated Historic and Current Adult returns. It is unclear why the EDT historic Estimates are the same as the ODFW estimates. There were numerous problems getting the EDT model calibrated and running. There was not adequate time to fully troubleshoot the input data and calibrate the output. The patterns between populations appear reasonable so it was decided to utilize the EDT analysis on priority restoration areas and limiting factors.

Table 33: Summary of EDT estimated Grande Ronde summer steelhead current and historic returns by population.

	EDT Modeled Template Returns[1]		EDT Modeled Current		Miles of spawning habitat	EDT Adults/Mile Template	EDT Adults/ Mile Current	% Decrease Historic to Current
	count	% of total	count	% of total				
Lower Grande Ronde	2,514	18%	1,536	31%	253.84	9.90	6.05	39%
Joseph Creek	3,045	22%	621	12%	223.10	13.65	2.78	80%
Wallowa River	2,501	18%	1,151	23%	173.45	14.42	6.64	54%
Upper Grande Ronde	5,812	42%	1,712	34%	613.96	9.47	2.79	71%
Total	**13,872**		**5,020**		1,264.35			64%

[1] – In order to compare the changes in population numbers due to habitat changes the EDT model uses current out-of-conditions for both the Template and Current population estimates.

Table 22 illustrates the modeled changes in Grande Ronde Summer Steelhead abundance (number of spawners), productivity (returns/spawner) and Life History Diversity (% of potential) for each population.

Overall the Lower Grande Ronde and Wallowa populations have the smallest decreases in abundance and productivity (39%, 54% respectively). These populations include the Wenaha and Minam watersheds which are in Wilderness areas with minimal land use and intact habitat conditions. There areas have had the least impact and are where we would expect the least decreases in productivity. Considering the EDT Historic and Current estimates are calculated with current out of basin conditions this pattern is consistent with what we would expect.

The Joseph Creek and Upper Grande Ronde populations showed an estimated 80 and 71% decrease in abundance. These estimated are not dramatically different than expected.

In addition to the baseline reports on abundance and productivity the EDT model generates 'diagnostic' reports which identify priority areas for protection and restoration and the potential percentage change in abundance and productivity with changes in habitat conditions. Finally the EDT model produces reports illustrating the priority attributes for restoration.

What the EDT model does not do is route impacts from the source to the impact location. So in reaches identified as high in sediment the sources of that sediment may be activities in other upstream reaches. In order to facilitate analysis, the 509 reaches identified in the Grande Ronde Subbasin were grouped into 87 geographic areas. The geographic areas were delineated based on valley forms, stream geomorphology and land ownership patterns. EDT results are presented and organized by geographic area. The geographic areas within each Chinook and steelhead population and reaches within each geographic area are listed in Appendix 8.

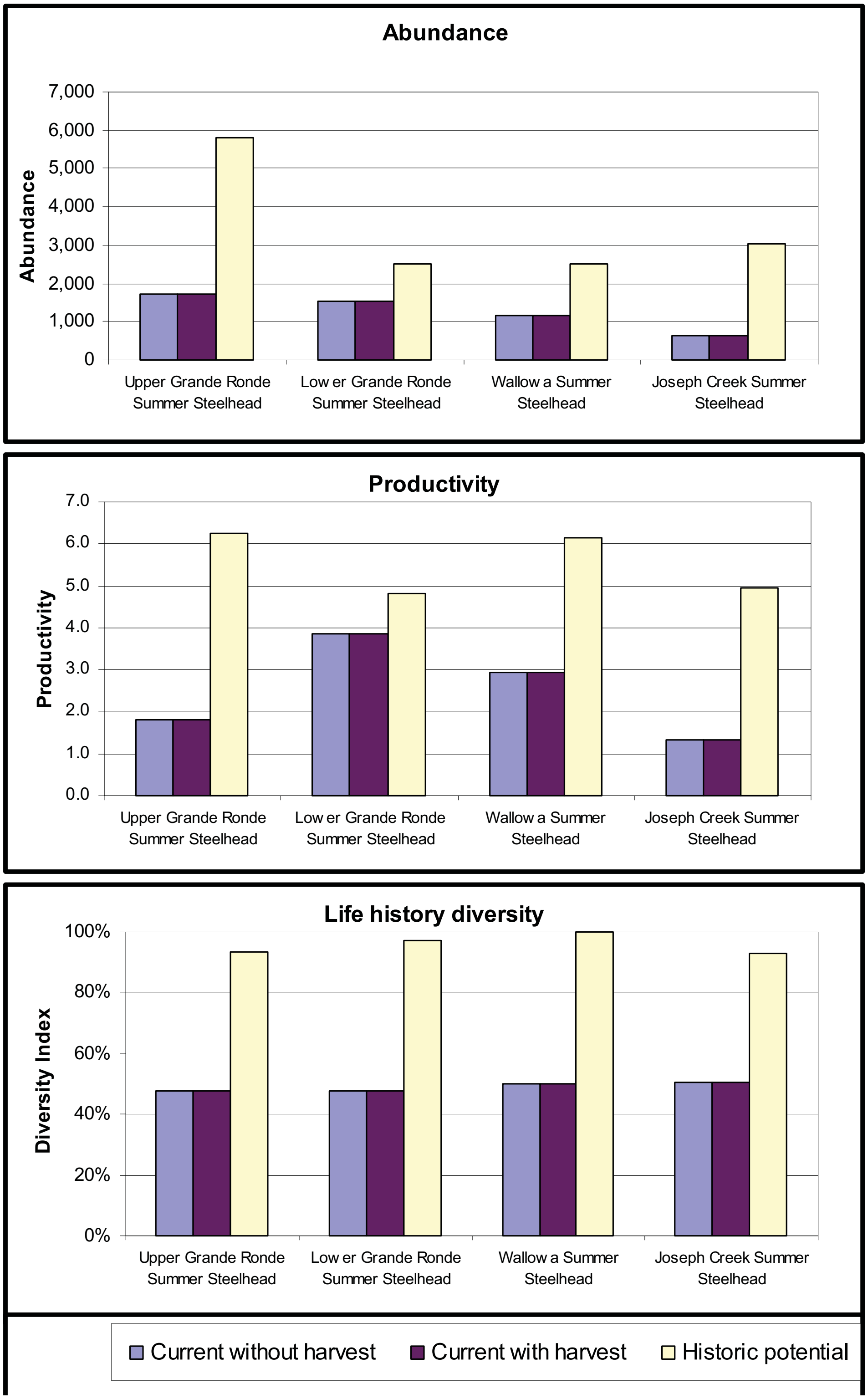


Figure 22. Graphs showing EDT estimates of habitat potential and decreases in abundance (spawners) and productivity (return/spawner) for Summer Steelhead populations in the Grande Subbasin.

The following is a brief overview of the EDT results for each individual population. In order to develop an overall plan conditions and opportunities throughout the Subbasin need to be considered. We attempted to place the EDT results in this broader perspective in the 'Environmental Conditions for Focal Species' section. Following is a brief overview of the EDT results for each individual population. These results will be further discussed in 'Environmental Conditions for Focal Species'.

EDT Habitat Priorities for Grande Ronde Steelhead by Population

Lower Grande Ronde Steelhead

This population includes summer steelhead spawning in tributaries up to GR-25 (below mouth of Wallowa), not including Joseph Creek. There were a total of 119 reaches identified as being used by this population for the EDT analysis. To facilitate review of the EDT analysis results these reaches were consolidated into 15 geographic areas (Appendix 8, Table 77).

Geographic Area	Protection benefit		Restoration benefit	
	Category/rank		Category/rank	
Lower Grnd Rnd R 1	A	7	A	1
Lower Grnd Rnd R 2	C	12	A	9
Lower Grnd Rnd tribs 1	C	11	A	2
Lower Wenaha R	A	3	A	7
Crooked (Wenaha)	A	5	C	13
Upper Wenaha R	A	4	A	10
Wenaha Forks	A	2	C	12
Wenaha misc tribs	A	1	C	11
Courtney Cr	A	9	A	5
Lower Mud Cr	A	10	A	4
Upper Mud Cr	A	8	A	4
Wildcat Cr	A	6	A	3
Grossman Cr	C	13	A	6
Lower Grnd Rnd tribs 2	C	11	A	8

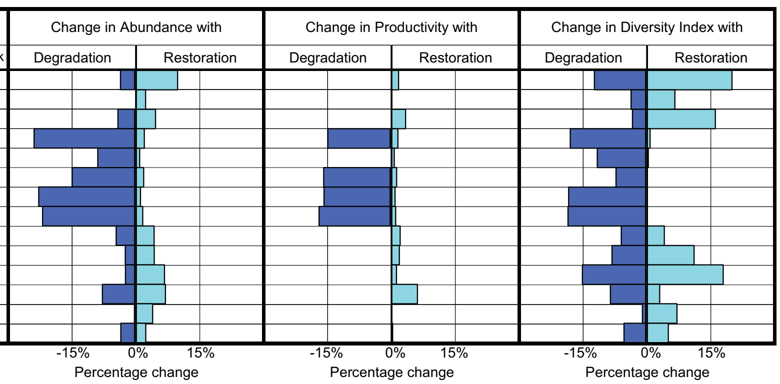


Figure 23. Lower Grande Ronde Summer Steelhead geographic area restoration and protection priorities

Because this population utilizes the Wenaha River which is in a relatively unimpacted wilderness area there are limited opportunities for changes in abundance through restoration in the Wenaha. The EDT model did not identify one restoration area that would result in large increases of abundance. However, the EDT Model identified a number of areas that are priorities for restoration indicating the relative importance of these tributaries in increasing the life history diversity of the population. The largest gains in abundance and life history diversity would be obtained through restoration of habitat conditions in, 1) The Lower Grande Ronde, 2) Lower Grande Ronde Tributaries, 3) Wildcat Creek and 4) Mud Creek (Figure 23). There would be big losses in productivity impacts in the Wenaha

The attributes with the largest impact over the broadest area is a reduction of key habitat quantity (Figure 24). The **Lower Grande Ronde geographic** area was identified by EDT as a priority for restoration due to a decrease in the habitat diversity attribute which is most likely due to a lack of woody debris in these reaches. In addition the impacts to the Key Habitat quantity and Flow attributes are also due to a lack of wood coupled with hydromodification in areas where the road is impacting the floodplain. Competition w/ hatchery fish**,** temperature and predation are other attributes also affecting survival in these reaches. In the **Lower Grande Ronde Tributaries** the primary attribute affecting survival was sediment impacting the egg incubation life history stage. In **Lower Wildcat, Walupa, and Bishop** creeks the age 0 active life history stage was impacted by the temperature, pathogens and key habitat quantity attributes. The key habitat quantity attribute is indicative of reduced channel wetted widths due to hydro modification/ road construction. In upper Wildcat the primary life stage impacted was egg incubation by sediment. In all reaches of the lower portion of **Mud Creek** egg incubation was the primary life stage impacted. The sediment attribute was the primary impact with some impacts from key habitat quantity which indicates limited suitable spawning gravel. Upper **Mud Creek** had a similar pattern with egg incubation being impacted from sediment, but the spawning life history stage was also impacted by a decrease in key habitat quantity. **Courtney Creek** is primarily impacted by sediment, key habitat quantity and habitat diversity. The key habitat quantity attribute is indicative of reduced channel wetted widths due to hydro modification/ road construction, the habitat diversity attribute indicates a decrease in woody debris.

It is important to consider when reviewing these results, the EDT model does not address routing of impacts. Tributary reaches are likely the source of the identified sediment impacts, thus restoration of the main stem sections would depend on stopping sediment delivery from upstream areas.

Geographic area priority			**Attribute class priority for restoration**															
Geographic area	**Protection benefit**	**Restoration benefit**	*Channel stability/landsc.1/*	*Chemicals*	*Competition (w/ hatch)*	*Competition (other sp)*	*Flow*	*Food*	*Habitat diversity*	*Harassment/poaching*	*Obstructions*	*Oxygen*	*Pathogens*	*Predation*	*Sediment load*	*Temperature*	*Withdrawals*	*Key habitat quantity*
Lower Grnd Rnd R 1	◯	◯			•		•		●				•	•	•	•		●
Lower Grnd Rnd R 2	∘	◯			•		•		•				•	•	•			
Lower Grnd Rnd tribs 1	∘	◯					•		•				•		⬤	•		●
Lower Wenaha R	◯	◯													•	•		•
Crooked (Wenaha)	◯	∘													•			•
Upper Wenaha R	◯	◯																
Wenaha Forks	◯	∘																
Wenaha misc tribs	◯	∘																
Courtney Cr	◯	◯					•		•				•		●	•		●
Lower Mud Cr	◯	◯					•		•				•		●	●		⬤
Upper Mud Cr	◯	◯					•		•				•		●	●		⬤
Wildcat Cr	◯	◯					•		•				•		•	●		●
Grossman Cr	∘	◯					•		•				•		•	●		⬤
Lower Grnd Rnd tribs 2	∘	◯					•		•				•		●	•		⬤

1/ "Channel stability" applies to freshwater areas; "channel landscape" applies to estuarine areas.

Key to strategic priority (corresponding Benefit Category letter also shown)

A		B		C		D & E	
◯	High	○	Medium	∘	Low		Indirect or General
⬤		●		•			

Figure 24. Lower Grande Ronde Summer Steelhead geographic area attribute impact summary.

Joseph Creek Steelhead

This population includes summer Steelhead spawning in Joseph Creek and passing through the lowest reach in the main Grande Ronde. There were a total of 63 reaches identified for the EDT analysis. To facilitate review of the EDT analysis results these reaches were consolidated into 9 geographic areas as indicated in Appendix 8, Table 78.

Geographic Area	Protection benefit		Restoration benefit	
	Category/rank		Category/rank	
Lower Grnd Rnd R 1	A	7	A	8
Lower Joseph Cr	A	5	A	2
Cottonwd Cr (Joseph)	A	6	A	6
Joseph misc tribs	A	9	A	7
Swamp Cr (Joseph)	A	4	A	4
Crow Cr (Joseph)	A	8	A	5
Upper Joseph Cr	A	3	A	3
Lower Chesnimnus Cr	A	2	A	1
Upper Chesnimnus Cr	A	1	A	6

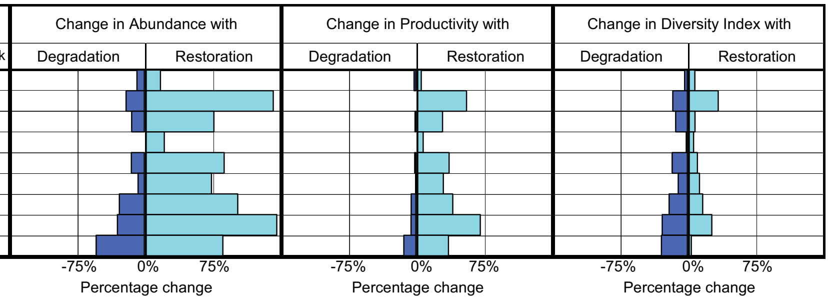


Figure 25. Joseph Creek Summer Steelhead geographic area restoration and protection priorities

The EDT model predicts relatively large (75%) changes in abundance through restoration of 1) Lower Chesnimius, 2) Lower Joseph Creek, 3) Upper Joseph, 4) Swamp Creek, 6) Crow Creek (Figure 25).

The EDT Model summary of attributes indicates, sediment and temperature are the biggest and most widespread impacts on the Joseph Creek summer steelhead (Figure 26). The attribute Key Habitat Quantity for rearing life stages is indicative of reduced channel wetted widths, due to hydro modification/ road construction, loss of flow. For incubation life history stage it is indicative of reduced presence of suitable gravels. Pathogens reflect presence of whirling disease in the basin however there is no indication it is impacting populations. Flow shows up consistently as a low impact in almost all areas. As part of the EDT database no changes in high or low flow conditions were identified in Joseph Creek. However this attribute is modified by hydromodifications, woody debris and riparian function all of which are consistent with conditions in Joseph Creek.

It is important to consider when reviewing these results the EDT model does not address routing of impacts. Tributary reaches are likely the source of the identified sediment impacts, thus restoration of the main Joseph Cr. sections would depend on stopping sediment delivery from upstream areas. Thus the more upstream tributaries should be given priority.

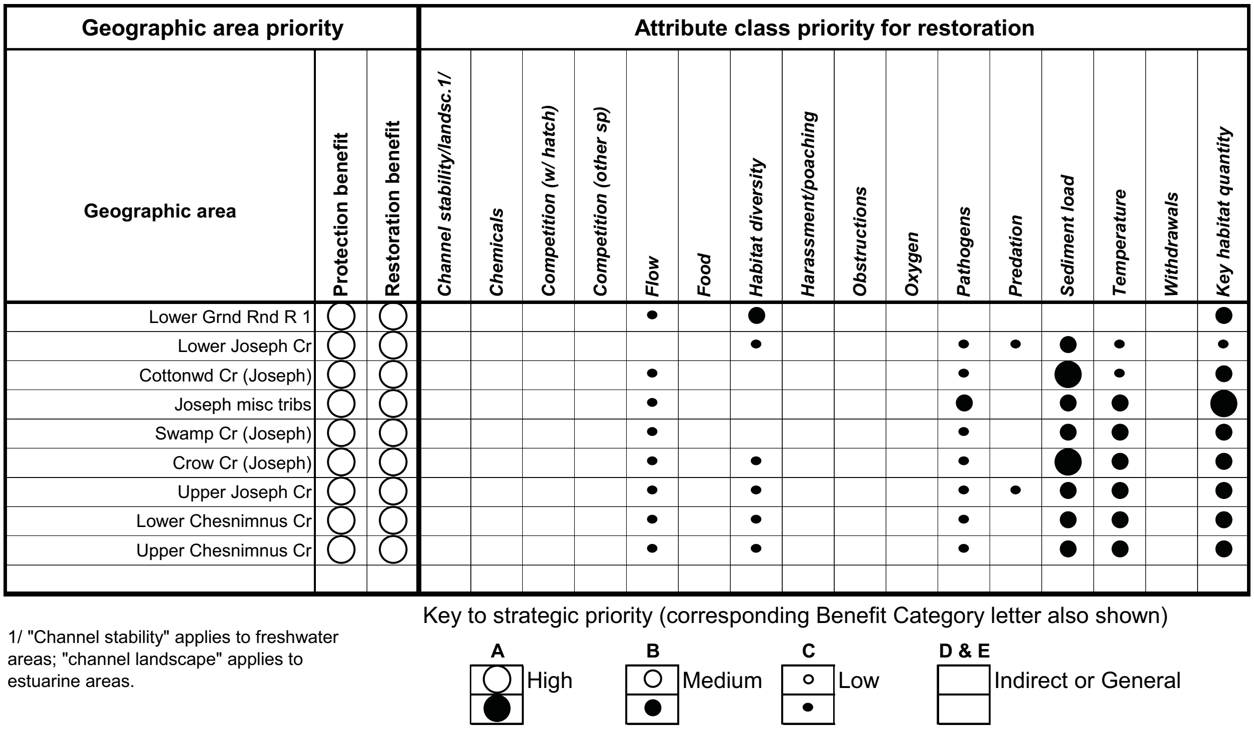


Figure 26. Joseph Creek Summer Steelhead geographic area attribute impact summary.

Wallowa Steelhead

This population includes summer Steelhead spawning in the Wallowa Watershed including the Minam and Lostine Rivers and tributaries up. There were a total of 134 reaches identified as being used by this population for the EDT analysis. To facilitate review of the EDT analysis results these reaches were consolidated into 26 geographic areas as indicated in Appendix 8, Table 79.

The mid and upper Minam is in the Eagle Cap Wilderness this area has been relatively unimpacted and is the highest priority for protection. Prairie Creek, Upper Wallowa River, Hurricane Creek, Whiskey Creek and the Lower Wallowa River are the priority areas identified by EDT for restoration (Figure 27).Figure 27. Wallowa Summer Steelhead geographic area restoration and protection priorities

Overall the EDT analysis indicated a decrease in key habitat quantity attributes occurred throughout habitat used by this population (Figure 28). This is largely indicative of reduced channel wetted widths due to hydro modification/ road construction and loss of flow. Specific priority areas and impacted attributes identified by the EDT model are:

1) **Prairie Creek –** sediment impacting egg incubation
2) **Upper Wallowa River –** mix of factors and life stages – sediment impacting egg incubation, predation impacting fry colonization, competition with hatchery outplants and

key habitat quantity **(indicative** of reduced channel wetted widths – due to hydro modification/ road construction, loss of flow) impacting age 0,1 life stages.

3) **Hurricane Creek** Sediment impacting Egg incubation
4) **Whiskey Creek –** mix of factors and life stages significant impacts on age 0, 1 inactive life stages from decrease in habitat diversity which is indicative of hydro mod reduced riparian fun and reduced wood.
5) **Lower Wallowa River –** the biggest impacts are from sediment on the egg incubation life history stage, with other significant impacts on age 0, 1 inactive life stages from decrease in habitat diversity which is indicative of hydro mod reduced riparian fun and reduced wood.

Geographic Area	Protection benefit		Restoration benefit	
	Category/rank		Category/rank	
Lower Grnd Rnd R 1	A	8	A	7
Lower Grnd Rnd R 2	A	9	A	10
Lower Wallowa R	C	12	A	4
Lower Wallowa tribs	C	11	C	14
Lower Minam R	A	6	C	14
Lower Minam tribs	D	19	C	18
Mid Minam R	A	2	C	16
Mid Minam tribs	A	3	E	20
Little Minam	A	4	A	8
Upper Minam	A	1	C	12
Mid Wallowa R	C	14	A	5
Deer Cr (Wallowa)	C	13	A	6
Mid Wallowa tribs	E	21	D	19
Rock Cr (Wallowa)	D	16	C	11
Lower Bear Cr (Wallowa)	A	10	A	9
Upper Bear Cr (Wallowa)	A	9	C	13
Whiskey Cr (Wallowa)	D	17	A	4
Lower Lostine R	A	5	A	3
Upper Lostine R	A	7	C	13
Spring Cr (Wallowa)	E	20	C	17
Upper Wallowa tribs	D	19	C	15
Upper Wallowa R	D	16	A	2
Hurricane Cr	D	18	A	3
Prairie Cr (Wallowa)	C	15	A	1

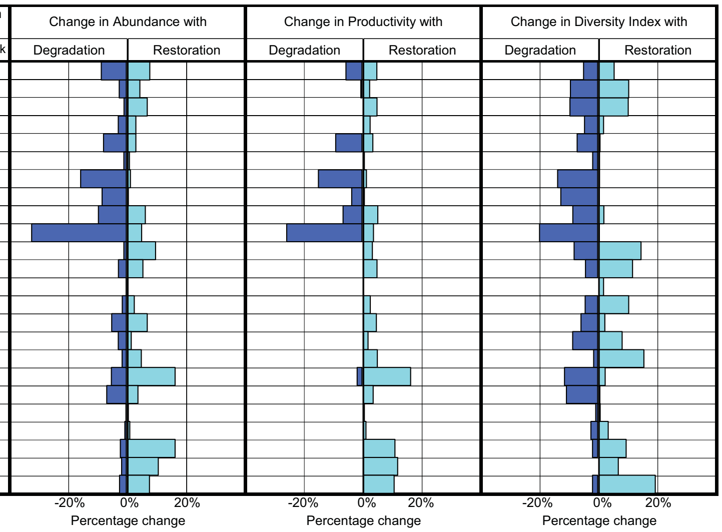


Figure 27. Wallowa Summer Steelhead geographic area restoration and protection priorities

Overall the EDT analysis indicated a decrease in key habitat quantity attributes occurred throughout habitat used by this population (Figure 28). This is largely indicative of reduced channel wetted widths due to hydro modification/ road construction and loss of flow. Specific priority areas and impacted attributes identified by the EDT model are:

6) **Prairie Creek –** sediment impacting egg incubation
7) **Upper Wallowa River –** mix of factors and life stages – sediment impacting egg incubation, predation impacting fry colonization, competition with hatchery outplants and key habitat quantity **(**indicative of reduced channel wetted widths – due to hydro modification/ road construction, loss of flow) impacting age 0,1 life stages.
8) **Hurricane Creek** Sediment impacting Egg incubation
9) **Whiskey Creek –** mix of factors and life stages significant impacts on age 0, 1 inactive life stages from decrease in habitat diversity which is indicative of hydro mod reduced riparian fun and reduced wood.
10) **Lower Wallowa River –** the biggest impacts are from sediment on the egg incubation life history stage, with other significant impacts on age 0, 1 inactive life stages from decrease in habitat diversity which is indicative of hydro mod reduced riparian fun and reduced wood.

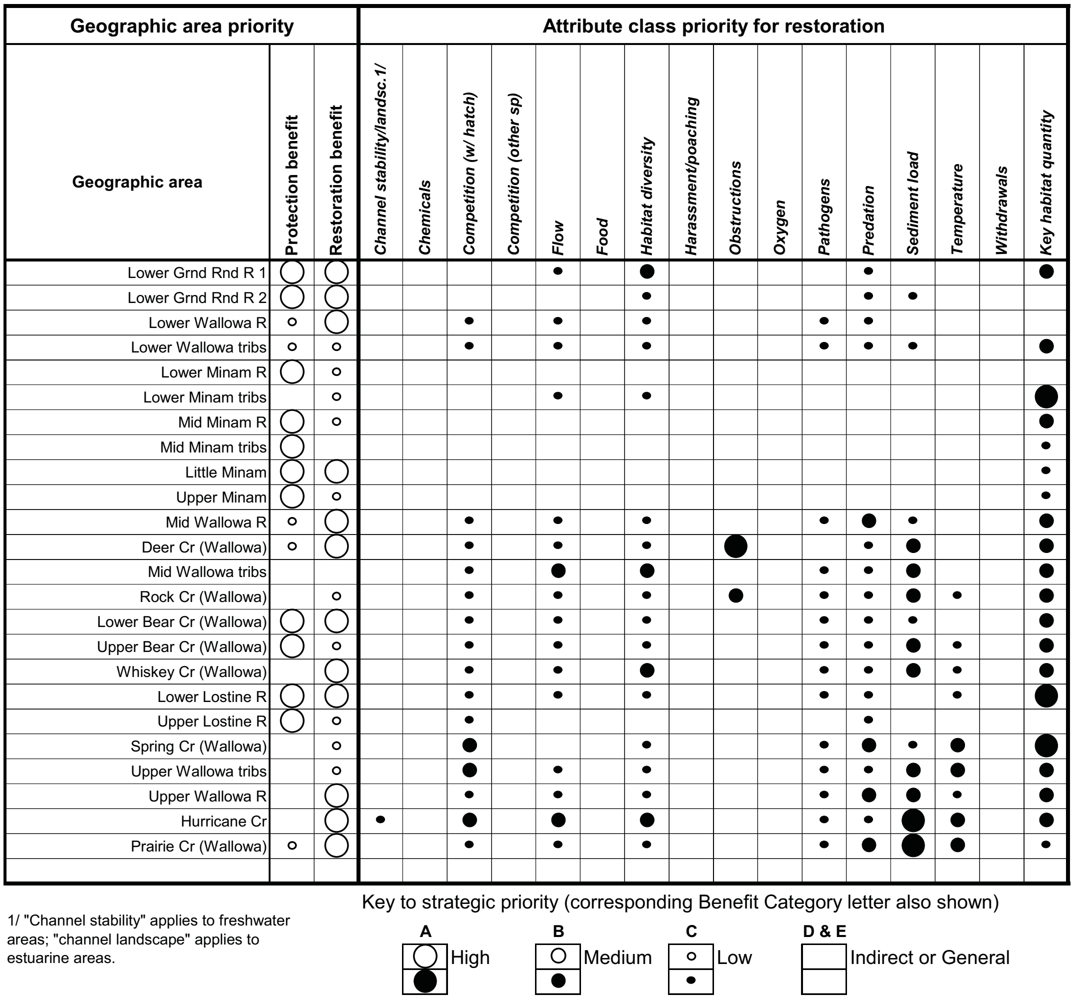


Figure 28. Wallowa Summer Steelhead geographic area attribute impact summary.

Upper Grande Ronde Steelhead

This population includes summer steelhead spawning in the Grande Ronde mainstem and tributaries above the Wallowa River (GR-26). There were a total of 167 reaches identified as being used by this population for the EDT analysis. To facilitate review of the EDT analysis results these reaches were consolidated into 38 geographic areas as indicated in Appendix 8, Table 80.

There was no one area indicated that restoration would create a large change in productivity. The EDT model predicts largest changes in abundance through restoration in the following geographic areas; 1) Mid Grand Ronde 4 (reaches 37 to 44 (mouth of Meadow Creek)), 2) Mid Grande Ronde Tribs 4 (including Whiskey, Spring, Jordan, Bear, Beaver, and Hoodoo), 3) Phillips Creek, 4) Mid Catherine Creek (reaches Catherine 2-9), 5) Upper GR Ronde 1 (Meadow Creek to Limber Jim), and 6) Mid Grande Ronde 3 – Grande Ronde Valley (Figure 29).

The EDT Model attribute summary indicates, sediment and key habitat quantity are the biggest and most widespread impacts on the Upper Grande Ronde summer steelhead (Figure 30). The attribute Key Habitat Quantity for rearing life stages is indicative of reduced channel wetted widths, due to hydro modification/ road construction, loss of flow. For incubation life history stage it is indicative of reduced presence of suitable gravels. Flow shows up consistently as a low impact in almost all areas. In addition to changes in low flows due to irrigation this attribute is modified by hydromodifications, woody debris and riparian function all of which are consistent with conditions in portions of the Upper Grande Ronde.

Geographic Area	Protection benefit		Restoration benefit	
	Category/rank		Category/rank	
Lower Grnd Rnd R 1	A	3	C	11
Lower Grnd Rnd R 2	A	7	C	14
Mid Grnd Rnd R 1	D	22	E	30
Mid Grnd Rnd tribs 1	D	27	E	27
Lower Lookglass Cr	D	20	D	19
Little Lookglass Cr	A	9	C	12
Upper Lookglass Cr	A	4	D	25
Mid Grnd Rnd tribs 2	D	18	E	28
Mid Grnd Rnd R 2	C	12	A	7
Phillips Cr	A	2	A	3
Lower Indian Cr	A	6	C	17
Upper Indian Cr	A	1	D	24
Lower Willow Cr	D	26	C	18
Upper Willow Cr	A	10	C	15
Lower Catherine Cr	D	29	D	22
Lower Catherine tribs	D	28	D	24
Mid Catherine Cr	C	11	A	4
Mid Catherine tribs	D	24	C	13
SF Catherine Cr	C	15	E	31
Mid Grnd Rnd R 3	D	25	A	6
Mid Grnd Rnd R 4	D	16	A	1
Mid Grnd Rnd tribs 4	D	17	A	2
Lower 5-points Cr	D	26	C	17
Upper 5-points Cr	D	19	D	23
Rock Cr (GR)	C	14	C	16
NF Caterine Cr.	C	14	E	29
Lower Meadow Cr	C	12	C	15
McCoy Cr	D	23	A	10
Upper Meadow Cr	A	5	A	9
Upper Grnd Rnd R 1	A	3	A	5
Fly Cr	D	21	A	8
Sheep Cr (GR)	A	8	A	7
Limber Jim Cr	D	24	D	20
Meadowbrook Cr	D	29	E	32
Upper Grnd Rnd R 2	C	13	D	21
Clear Cr (GR)	D	20	D	21
Upper Grnd Rnd R 3	D	24	D	26

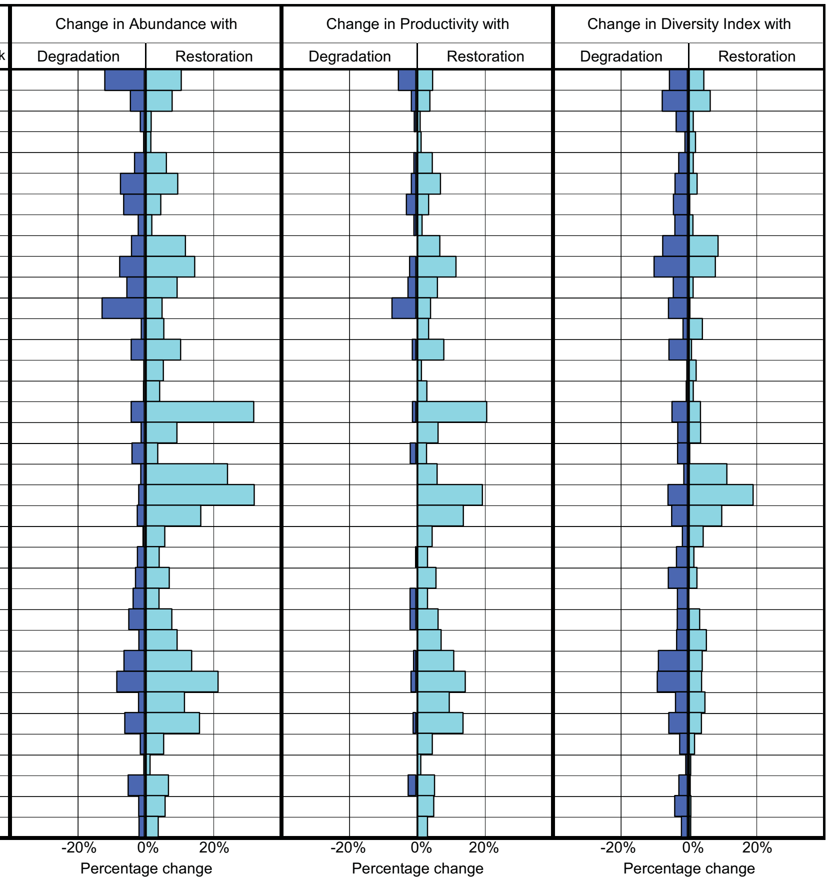


Figure 29. Upper Grande Ronde Summer Steelhead geographic area restoration and protection priorities

Geographic area priority			Attribute class priority for restoration																
Geographic area	**Protection benefit**	**Restoration benefit**	*Channel stability/landsc.1/*	*Chemicals*	*Competition (w/ hatch)*	*Competition (other sp)*	*Flow*	*Food*	*Habitat diversity*	*Harassment/poaching*	*Obstructions*	*Oxygen*	*Pathogens*	*Predation*	*Sediment load*	*Temperature*	*Withdrawals*	*Key habitat quantity*
Lower Grnd Rnd R 1	A	C					C		B					C				B
Lower Grnd Rnd R 2	A	C							C					C	C			
Mid Grnd Rnd R 1							C		C			C	C	C	C			B
Mid Grnd Rnd tribs 1							C		C						A	C		B
Lower Lookglass Cr							C		C					C	B			A
Little Lookglass Cr	A	C					C		C						B			B
Upper Lookglass Cr	A													C	C			A
Mid Grnd Rnd tribs 2							C		C						C	C		B
Mid Grnd Rnd R 2	C	A					C		A				C	C	A	B		A
Phillips Cr	A	A					C		C						B	B		B
Lower Indian Cr	A	C					C		C						C	C		B
Upper Indian Cr	A														B			B
Lower Willow Cr		C					C		B					C	A	B		B
Upper Willow Cr	A	C					C		C							C		B
Lower Catherine Cr			C		C		C		B				B	B	B	B		
Lower Catherine tribs							C		C					C	B	B	C	B
Mid Catherine Cr	C	A			C		C		A				C	C	B	B		B
Mid Catherine tribs		C					C		B					C	B	B		B
SF Catherine Cr	C														B			C
Mid Grnd Rnd R 3		A					C		C					C	C	C		A
Mid Grnd Rnd R 4		A	C				C		B	C			C	C	B	A		A
Mid Grnd Rnd tribs 4		A					C		C						A			B
Lower 5-points Cr		C					C		C						A			B
Upper 5-points Cr							C		C						B			C
Rock Cr (GR)	C	C													B			B
NF Caterine Cr.	C														B			B
Lower Meadow Cr	C	C					C		C						A	C		B
McCoy Cr		A					C		C						A			B
Upper Meadow Cr	A	A					C		C						B	C		B
Upper Grnd Rnd R 1	A	A					C		C						B	B		B
Fly Cr		A													A			C
Sheep Cr (GR)	A	A													A			B
Limber Jim Cr															A			B
Meadowbrook Cr							C		C						A			B
Upper Grnd Rnd R 2	C						C		C						B	C		B
Clear Cr (GR)															A			B
Upper Grnd Rnd R 3															A			B

1/ "Channel stability" applies to freshwater areas; "channel landscape" applies to estuarine areas.

Key to strategic priority (corresponding Benefit Category letter also shown)

A — High
B — Medium
C — Low
D & E — Indirect or General

Figure 30. Upper Grande Ronde Summer Steelhead geographic area attribute impact summary.

3.2.3.3 Bull Trout

Bull Trout Population Data and Status

There is limited information on the bull trout population productivity and abundance in the Grande Ronde subbasin. Historically, bull trout were distributed throughout the subbasin, and although they were never as abundant as other salmonids, they were certainly more abundant and more widely distributed than they are today (USFWS 2002). Current redd counts and captures of adult fish provide the best data on population status, trends and movement within and outside of the subbasin. Spawning ground surveys have recently been collected on four tributaries: Little Minam River, Lostine River, Wenaha River, and Lookingglass Creek (Table 34). Standard redd counts have not been collected on the other streams with bull trout populations, although there is some scattered information. For example, survey information from the mid-1990s on Deer Creek found 18 fish per 100 square meters and four miles of habitat supporting that density (USFWS 2002). Presence and absence data from Catherine Creek suggest low population densities (USFWS 2002). Based on preliminary spawning ground survey data and other information, there is not a sufficient interval of time to accurately assess trends for Grande Ronde bull trout population abundance and productivity.

Table 34. Standard bull trout spawning ground surveys conducted in the Grande Ronde Subbasin and information on population status and trends (USFWS 2002).

Stream	Survey Area	Survey Time	Population Status and Trends
Little Minam River	Complete	Every other week: Mid-Sept. to end of Oct.	Declining trend in redds between 1997 and 2000; increase in 2001, with 434 redds counted.
Lostine River	Complete	Once in Sept. and Oct.	Limited information. Nearly 100 adults were captured moving upstream in 2001.
Lookingglass Creek	Complete (on Forest Service land)	Once in Sept. and Oct.	54 redds observed in 2001. Surveys suggest that abundance is low.
Wenaha River	Partial	Once in Oct.	Most abundant and well distributed population in the Grande Ronde subbasin (Buchanan et al. 1997)

Bull Trout Unique Population Units

Based on geographical, physical, and thermal isolation of the spawning populations, two core areas – Little Minam and Grande Ronde – and nine unique Bull Trout population units have been designated in the Grande Ronde subbasin (Table 35) (USFWS 2002). For recovery planning, the local bull trout population units are based on the potential to reestablish connectivity and reduce threats. There is no information on whether these local populations are genetically distinct. There are anecdotal reports of bull trout in Wenatchee Creek, but additional inventories are necessary to determine if a local population exists and the relative risk of extinction. Wenatchee Creek is potentially a Core Area but lacks sufficient survey data to justify Core Area status.

The historic Wallowa River/Lake Complex local population appears to be extinct (USFWS 2002). Imnaha River bull trout were introduced into this complex, but the status of the population is unknown.

Table 35. Local populations of bull trout and relative risk of extinction in the Grande Ronde subbasin (USFWS 2002).

Core Area	Local Population Unit	Relative Risk of Extinction
Little Minam	Little Minam	Low
Grand Ronde	Wenaha River	Low
	Minam River/Deer Creek Complex	Low: Minam River Special concern: Deer Creek
	Upper Hurricane Creek	Special concern
	Lostine River/Bear Creek Complex	Moderate: Lostine River Special concern: Bear Creek
	Upper Grande Ronde Complex	Moderate
	Catherine Creek	Moderate
	Indian Creek	Moderate
	Lookingglass Creek	Moderate

Bull Trout Life History

Bull trout can live up to ten years, sexually maturing after four. Spawning every year or every other year, they require particularly silt-free gravel bars for redds. While even slight levels of silt can decrease egg survival, spawning success is even more sensitive to temperature. Although adults can withstand water temperatures up to 64º F, eggs do best with temperatures of no more than 36º F. In fact, temperatures above 46º F can reduce bull trout egg survival by at least 75 percent. Most bull trout spawning and juvenile rearing takes place in the tributaries and headwaters areas of the subbasin.

In the Grande Ronde bull trout currently exhibit two distinct life history forms:

- Fluvial bull trout mature in their natal streams and move to large streams and rivers after maturation.
- Resident bull trout live in their natal streams, small tributaries at high elevations, year round and are generally smaller in size.

Fluvial bull trout are components of the Catherine Creek, Lookingglass, Wenaha, Minam, and Lostine populations (Buchanan et al. 1997; Hemmingsen et al. 2001). The population in the Little Minam is considered resident as it is isolated above a barrier waterfall.

There are two main complicating factors in identifying and addressing negative effects on the species. Firstly, bull trout are highly mobile which makes studying and documenting bull trout very difficult. Secondly, migratory and resident forms of bull trout may be present in a single stream. Bull trout are able to move throughout the Grande Ronde during fall, winter and spring. Summer water temperature and flow in mainstem reaches seasonally limit population connectivity to some degree.

In addition there is evidence bull trout move in and out of the Grande Ronde Subbasin. Bull trout are often caught during the steelhead fishery in the Snake River from the mouth of the Grande Ronde to Asotin, Washington (G. Mendel, WDFW, personal communication, 2001). They are also documented to exist in the Snake River reservoirs downstream of Asotin.

Bull Trout Current & Historic Distributions

Historically, bull trout were distributed throughout the Grande Ronde subbasin. Limited information is available on historical distribution, but it is suspected that bull trout occurred in all major tributaries (West and Zakel 1993). The Streamnet map illustrating bull trout distribution (Figure x) is at such a large scale it does not include many of the smaller tributaries (including Wenatchee Creek) and should be considered a general overview.

The current distribution of bull trout is restricted to headwater areas and rivers with high quality habitat and water quality, primarily on National Forest lands, much of it in designated wilderness (e.g., Minam and Little Minam). A current systematic population estimate for the Grande Ronde subbasin bull trout is not available at this time. While many Grande Ronde tributaries have not been surveyed, bull trout are generally found wherever water quality and habitat permits. Grande Ronde bull trout were listed as threatened under the ESA in 1998, as part of the larger Columbia River Basin Distinct Population Segment (DPS).

Historically, fluvial bull trout were found far up Wenatchee Creek (also referred to on some maps as Menatchee Creek). In the 1960s a barrier waterfall formed at RM 2.5 and it was thought that fish could not pass above the falls. Recent surveys have not been able to confirm the presence of bull trout in Wenatchee Creek (USFWS 2002). Wenatchee Creek a tributary in the lower Grande Ronde in Washington; and Wallowa Lake populations have been extirpated.

Bull trout were also historically present in the Wallowa River above Wallowa Lake. This population was believed to have been extirpated by the 1950s (USFWS 2002). In 1997, 400 bull trout were transferred into Wallowa Lake from a salvage operation associated with the decommissioning of an Imnaha basin hydroelectric project. At this point it is unclear whether this reintroduction has been successful.

Table 36 outlines the current distribution patterns for known bull trout populations within the Grande Ronde subbasin.

Table 36. Current distribution of local bull trout populations within the Grande Ronde subbasin (USFWS 2002).

Local Population Unit	Current Distribution
Little Minam	Mainstem; Boulder and Dobbin Creeks
Wenaha River	Mainstem, South Fork, North Fork; Butte Crooked, Mill, First and Third Creeks
Minam River/Deer Creek Complex	Minam: Mainstem, North Fork; Elk Creek Deer: Mainstem; mouth of Sage Creek
Upper Hurricane Creek	Mainstem; fluvial population overwinters in Wallowa, Grande Ronde, and Snake Rivers
Lostine River/Bear Creek Complex	Lostine: Mainstem; Silver and Lake Creeks; fluvial population overwinters in Wallowa, Grande Ronde, and Snake Rivers Bear Creek: Mainstem; Little Bear; mouth of Goat Creek
Upper Grande Ronde Complex	Upper Mainstem; Limber Jim, Indiana, Clear, Hoodoo, and Lookout Creeks
Catherine Creek	Mainstem, North Fork, South Fork, Middle Fork; Sand Pass, Collins and Pole Creeks
Indian Creek	Mainstem, East Fork; Camp Creek
Lookingglass Creek	Mainstem, Little Lookingglass Creek

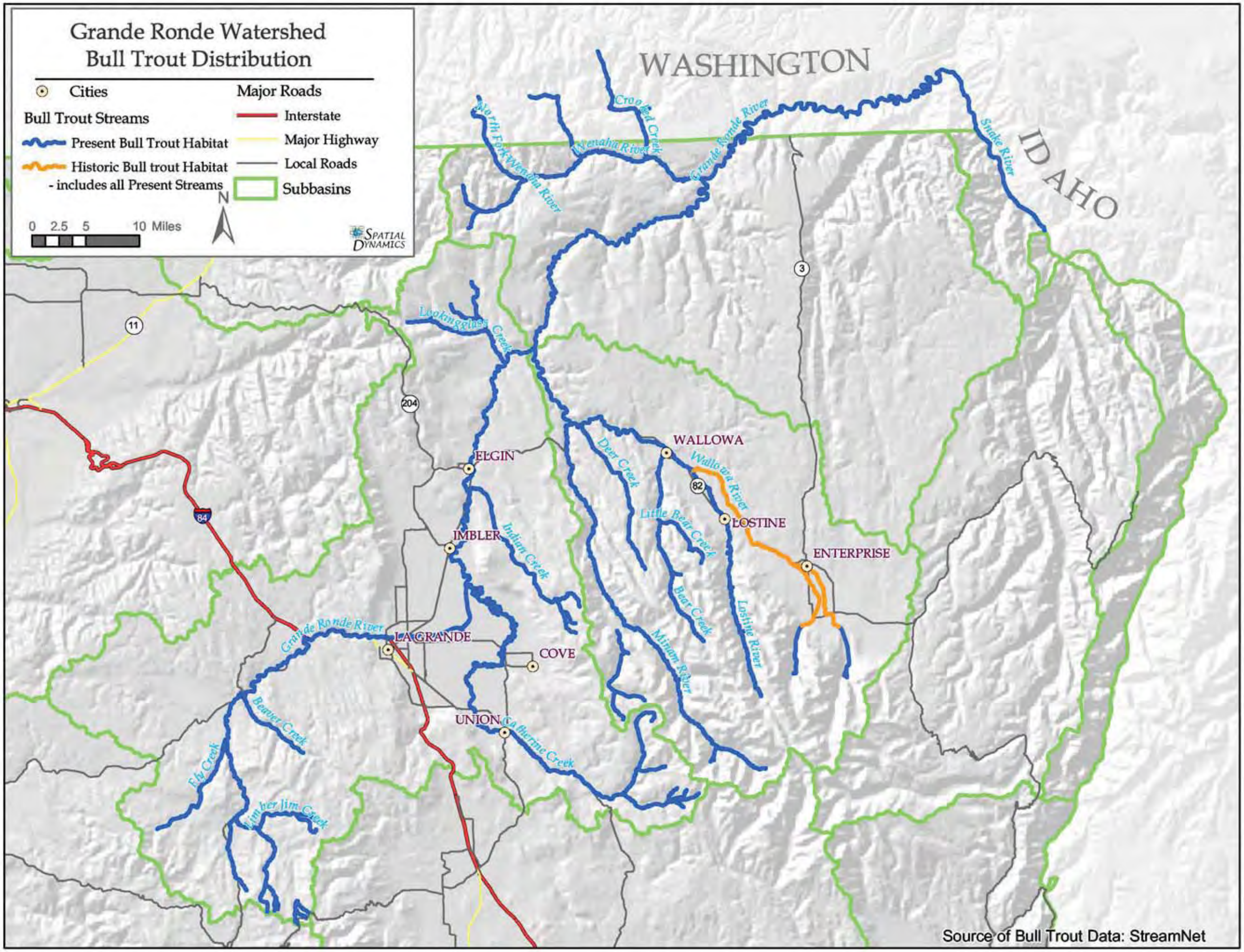


Figure 31. Historic and current distribution of bull trout in the Grande Ronde subbasin, Oregon.

Identification of Differences in Distribution Due to Human Disturbance

Passage barriers, limited in-channel water, thermal barriers, and degraded habitat have limited the distribution and movement of bull trout within the Grande Ronde subbasin.

Bull Trout Population Risk Assessment

The risk of any bull trout population going extinct varies by local population unit within the Grande Ronde subbasin. USFWS (2002) has designated two Core Areas and nine local population units in the subbasin (Table 35). Within these units only two population areas – Little Minam and Wenaha River – have a low relative risk of extinction. Five Bull Trout populations have a moderate risk of extinction and three population areas – Upper Hurricane Creek, Bear Creek, and Deer Creek – are special concern.

Bull Trout Habitat Priorities

Due to time constraints and difficulties running the EDT model for Chinook and Steelhead we were unable to run QHA for Bull Trout. In the 'Environmental Conditions for Focal Species', section we identify actions likely to benefit bull trout.

3.2.3.4 Description of Aquatic Introductions, Artificial Production and Captive-breeding Programs

3.2.3.4.1 Aquatic Introductions

The Grande Ronde River system hosts a complex of introduced species. Although the impacts of these species on native communities are largely undocumented, they likely have a negative effect. Direct impacts may be through predation, competition, disease vector, or interbreeding.

Brook trout, a species introduced to many lakes and streams, may interbreed with bull trout, a Threatened species and produce sterile offspring. Lake Trout, introduced to Wallowa Lake, prey on native kokanee in the lake. The past introduction of lake trout and subsequently mysis shrimp to Wallowa Lake may have consequences for the native kokanee population and for potential reintroduction of sockeye. In a number of Northwest lakes the combination of lake trout and mysis shrimp introductions has led to ecological changes and severe reduction in kokanee population productivity. In some cases kokanee populations have been eliminated. Recent changes in key population indicators suggest Wallowa Lake's kokanee population may be incurring similar impacts from those introductions. Over the past few years average size of kokanee caught in the fishery increased while catch rate declined. These factors indicate fewer kokanee in the lake. If survival of juvenile kokanee in the lake is being affected by mysis shrimp or lake trout, similar impacts could be expected for naturally produced sockeye. A better understanding of the current ecology of the lake is needed in order to make informed decisions regarding the potential success of sockeye introduction to the system.

Numerous introduced species occur near the mouth of the Grande Ronde River. Several of these introduced warm-water species are documented to be significant predators on juvenile salmonids in other areas of the Columbia Basin. More complete information regarding these species, their distribution and abundance, and their interactions with listed salmonids is needed in the lower Grande Ronde River.

3.2.3.4.2 Artificial Production: Current

In light of the precipitous decline of Grande Ronde salmon and steelhead populations, the Nez Perce Tribe, ODFW and CTUIR proposed implementing conservation hatchery and supplementation programs that functioned within the framework of regional programs. Many of the intended goals and biological objectives of the Columbia River Basin Fish and Wildlife Program (NPPC 2000) are furthered with the artificial production efforts of co-managers in northeast Oregon. The Fish and Wildlife Program (FWP) calls for artificial production strategies that are implemented within an experimental, adaptive management approach and use monitoring and evaluation to resolve key program uncertainties.

These production programs and their associated monitoring and evaluation plans are also consistent with and/or recommended by the Grande Ronde Subbasin Summary, NMFS Biological Opinion, Wy-Kan-Ush-Mi-Wa-Kish-Wit and NMFS Recovery Plan for Snake River Salmon.

Chinook Salmon

Hatchery production and acclimation of spring Chinook salmon in the Grande Ronde River occurs at Lookingglass Fish Hatchery and acclimation facilities on the Lostine River, Catherine Creek, and the upper Grande Ronde River. Three related hatchery initiatives are currently under way in the Grande Ronde: The Lower Snake River Compensation Plan (LSRCP), Northeast Oregon Hatchery Program (NEOH), and the Grande Ronde Endemic Supplementation Program (GRESP). Each of these is described below.

Lower Snake River Compensation Plan

The LSRCP was authorized by Congress in 1976 to mitigate for losses of Chinook salmon and steelhead resulting from construction of dams in the lower Snake River (Herrig 1998). Hatchery and satellite facilities were developed under LSRCP to provide "in-kind, in-place" mitigation for lost Chinook and steelhead production. The program is administered by US Fish and Wildlife Service (USFWS) and was expected to provide adult returns for sport and tribal harvest, hatchery broodstocks, and supplementation of natural production. LSRCP has provided harvestable returns of adult hatchery steelhead, but has not met expectations for adult Chinook returns or enhancement of natural production of Chinook or steelhead (Herrig 1998).

Lookingglass Fish Hatchery was built as part of the Lower Snake River Compensation Plan (LSRCP) to produce spring Chinook salmon for release in the Imnaha and Grande Ronde rivers. Lookingglass Fish Hatchery was constructed by the U.S. Army Corps of Engineers (COE) in 1982 and turned over to the U.S. Fish and Wildlife Service for operation. Oregon Department of Fish and Wildlife (ODFW) currently operates the facility. Lookingglass Fish Hatchery was initially designed and constructed to produce two stocks of fish; Imnaha stock for the Imnaha subbasin (490,000 smolts) and Lookingglass Creek stock for the Grande Ronde subbasin (900,000 smolts). Beginning in the early 1990's, co-managers of the LSRCP program (ODFW, Nez Perce Tribe [NPT], and the Confederated Tribes of the Umatilla Indian Reservation [CTUIR]) recognized that these populations were at imminent risk of extirpation and immediate action was necessary. In 1992, Snake River spring/summer Chinook salmon were listed as threatened under the Endangered Species Act (ESA). The Lookingglass Fish Hatchery mitigation program was redirected to a conservation and recovery program. This program is authorized by the National Oceanic and Atmospheric Administration (NOAA-Fisheries) under a Section 10 permit and is referred to as the Currently Permitted Program (CPP). The current goals of the CPP are to produce:

- 490,000 smolts of Imnaha River population origin
- 250,000 smolts of Upper Grande Ronde River population origin
- 250,000 smolts of Catherine Creek population origin
- 250,000 smolts of Lostine River population origin
- 150,000 smolts for Lookingglass Creek of Catherine Creek population origin

Because the total number of fish produced at Lookingglass Fish Hatchery did not change with the CPP, an assumption was made that the existing facility, with minor modifications, would be sufficient to meet the CPP needs. However, each of these programs has associated fish health and monitoring/evaluation needs that require additional space and water. Lookingglass Hatchery was not designed to meet the CPP requirements. Co-managers determined that without additional facilities and significant modifications to Lookingglass Hatchery, production would be reduced under the conservation and recovery programs.

Northeast Oregon Hatchery

To alleviate the burden at Lookingglass Fish Hatchery and correct facility problems, co-managers proposed new production facilities and modifications at Lookingglass in the Grande Ronde and Imnaha Spring Chinook Master Plan submitted to the NPPC in April, 2000. The NPPC approved the master plan and authorized preliminary design and NEPA analysis of the proposed alternative in September 2000.

The NEOH program was included in Section 700 of the 1987 amendment to the Columbia River Basin Fish and Wildlife Program. NEOH was intended provide additional hatchery facilities and contribute to NPPC's doubling goal for adult returns to the Columbia River Basin (NPPC 1987). NEOH focused on spring Chinook production in the Grande Ronde and Imnaha basins but is not strictly limited to spring Chinook. It also includes potential fall Chinook salmon production in the Grande Ronde subbasin. It called for development of master plans to outline construction, operation, and management of additional production and release facilities to supplement natural production in the target basins. Plans are to be developed cooperatively by fish and wildlife agencies and Tribes.

Thus, the Northeast Oregon Hatchery program represents an effort by co-managers to improve existing artificial propagation management actions that support mitigation, conservation and recovery of spring/summer Chinook salmon in northeast Oregon. As such, NEOH proponents have addressed the need to renovate/modify existing hatchery facilities in the Imnaha and Grande Ronde subbasins. The program proponents also recommend the construction of new facilities for an integrated restoration program. These renovated and new facilities will make it possible to meet the currently permitted and approved production program for spring/summer Chinook salmon in the Imnaha and Grande Ronde subbasins.

Northeast Oregon Hatchery is a conservation program that will spawn, incubate, rear, and release spring/summer Chinook salmon. The hatchery system will consist of three incubation and rearing facilities and four satellite acclimation sites. Juvenile fish will be reared to the smolt stage and released in the Imnaha River, Lostine River, Catherine Creek, Upper Grande Ronde River, and Lookingglass Creek. The hatchery production program (facilities, stream, life stage, number, and location of fish to be released) from NEOH facilities is summarized in Table 37. Hatchery production groups refer to total production for a given tributary. Treatments describe experimental/varied approach for subsets of each production group.

The goal of 250,000 smolts remains for the Lostine River, Catherine Creek and the upper Grande Ronde. These numbers are unchanged and are authorized by NMFS through Section 10 permits of the Endangered Species Act and established in the Grande Ronde Spring Chinook Hatchery Plan.

Northeast Oregon Hatchery will incorporate some components of Natural Rearing System (NATURES) techniques. A detailed summary of the NATURES design criteria can be found in the NEOH Preliminary Design Appendix B (MWH 2001). NATURES techniques provide juvenile hatchery fish with conditions more similar to those experienced in a natural stream.

Juveniles will be raised to smolts from incubation to release in variable water temperature conditions mimicking the natural regime. Rearing conditions will also include low density (0.1 to 0.13 lb/cf/in), cryptic substrate coloration, instream/water surface structure, and natural photo-period (indoors). Smolts will be acclimated and volitionally released into known natural production areas in their natal stream with the intent that the returning adults will spawn in their natural habitat rather than solely supporting hatchery production and harvest.

The co-managers are currently working with Fish Pro to develop and design new facilities on the Lostine River and modifications to Lookingglass Fish Hatchery and the Grande Ronde Acclimation facility to fully implement the spring Chinook programs for the Grande Ronde.

Table 37. Summary of Chinook salmon production proposed for NEOH Facilities

Stock	Brood Source	Treatment	Release Number	Spawning Location	Incubation Location	Early Rearing Location	Number of Early Rearing Containers	Final Rearing	Number of Rearing Containers	Acclimation	Number of Acclimation Ponds
Imnaha	Gumboot Weir	Conventional	370,000	Gumboot	Gumboot	Lostine	4	Lostine	4	Gumboot	1
		Out-of-Basin	120,000	Lookingglass	Lookingglass	Lookingglass	4	Lookingglass	2	Gumboot	
Lostine River	Captive Brood	Salt	60,000	Bonneville	Lostine	Lostine	4	Lostine	2	Lostine	NA
		Fresh	60,000	Bonneville	Lostine	Lostine	4	Lostine	2	Lostine	NA
	Lostine Weir	Conventional	130,000	Lostine	Lostine	Lostine	4	Lostine	4	Lostine	NA
Catherine Creek	Captive Brood	Salt	60,000	Bonneville	Lookingglass	Lookingglass		Lookingglass	2	Catherine Creek	
		Fresh	60,000	Bonneville	Lookingglass	Lookingglass		Lookingglass	2	Catherine Creek	4
	Catherine Creek Weir	Conventional	120,000	Lookingglass	Lookingglass	Lookingglass		Lookingglass	4	Catherine Creek	
Grande Ronde River	Captive Brood	Salt	60,000	Bonneville	Lookingglass	Lookingglass		Lookingglass	2	Upper Grande Ronde River	
		Fresh	60,000	Bonneville	Lookingglass	Lookingglass		Lookingglass	2	Upper Grande Ronde River	4
	UGR Weir	Conventional	120,000	Lookingglass	Lookingglass	Lookingglass		Lookingglass	4	Upper Grande Ronde River	
Lookingglass Creek	Catherine Creek Weir	Conventional	150,000	Lookingglass	Lookingglass	Lookingglass		Lookingglass	2	Lookingglass	NA

Table 38. Summary of the captive broodstock program in the Grande Ronde subbasin.

Captive Broodstock	Brood Source	Treatment	Collection Number	Parr-to-Smolt Rearing	Smolt -to-Adult Rearing	Spawning Location	F1 Progeny
Lostine Parr	Lostine River	Saltwater (natural)	500	Wallowa Fish Hatchery	Manchester	Bonneville	Lostine
		Saltwater (accelerated)		Wallowa Fish Hatchery	Manchester	Bonneville	Lostine
		Freshwater (natural)		Wallowa Fish Hatchery	Bonneville	Bonneville	Lostine
		Freshwater (accelerated)		Wallowa Fish Hatchery	Bonneville	Bonneville	Lostine
Catherine Creek Parr	Catherine Creek	Saltwater (natural)	500	Wallowa Fish Hatchery	Manchester	Bonneville	Lookingglass
		Saltwater (accelerated)		Wallowa Fish Hatchery	Manchester	Bonneville	Lookingglass
		Freshwater (natural)		Wallowa Fish Hatchery	Bonneville	Bonneville	Lookingglass
		Freshwater (accelerated)		Wallowa Fish Hatchery	Bonneville	Bonneville	Lookingglass
	Grande	Saltwater (natural)	500	Wallowa Fish Hatchery	Manchester	Bonneville	Lookingglass

Grande Ronde Parr	Ronde River	Saltwater (accelerated)	Wallowa Fish Hatchery	Manchester	Bonneville	Lookingglass
		Freshwater (natural)	Wallowa Fish Hatchery	Bonneville	Bonneville	Lookingglass
		Freshwater (accelerated)	Wallowa Fish Hatchery	Bonneville	Bonneville	Lookingglass

Grande Ronde Endemic Supplementation Program

The Grande Ronde Endemic Spring Chinook Supplementation Program began in 1995 with the development of the captive broodstock component. In 1997, the conventional component was initiated and integrated with the ongoing captive component. The GRESP received extensive scientific scrutiny during its development as well as during the process of acquiring funding and appropriate Endangered Species Act permits and consultations. Processes involved in this review were: Independent Scientific Panel review process through the U.S. v Oregon dispute resolution process, NMFS Endangered Species Act (ESA) Section 10 permit process, and NPPC 3-Step approval process.

The supplementation program in the Grande Ronde was based on recommendations of an Independent Scientific Panel (Currens et al. 1996), which was commissioned through U.S. v. Oregon forum to provide recommendations on the appropriate elements of a hatchery program to meet Grande Ronde spring Chinook recovery and management goals. Following the recommendations of Currens et.al. (1996), co-managers developed the GRESP.

The captive broodstock component of GRESP has been authorized by NMFS through ESA Section 10 Permits 973, 1011, 1164 and Modification 1011. The current program that integrates the conventional and captive broodstock components is described in ESA Section 10 Permit applications (BIA 1998, ODFW 1998b). NMFS conducted both peer and public review of these applications. In granting their permits, NMFS determined that the direct take of listed fish for hatchery broodstock will be beneficial to the threatened species.

Implementation of the GRESP was largely funded through the elements of the NPPC's Fish and Wildlife Program (FWP). In compliance with the Council's 3-step process, the GRESP program underwent independent scientific review in May 1998. This review used three independent reviewers facilitated by the Pacific Northwest National Laboratory and focused on determining if BPA, ODFW, NPT, and CTUIR had adequately addressed concerns raised by the Council's Fish and Wildlife Committee, Council staff and outside experts (PNNL 1998). In summarizing this review PNNL states that:

The project staff, for the most part, has responded to the technical questions of the Three-Step Process more than adequately. The various activities associated with the Grande Ronde Basin Endemic Spring Chinook Supplementation Projects appear to be well thought out and sufficiently coordinated. The provided documentation and the Project staff responses clearly demonstrate that the proposed program has been subjected to considerable technical and policy reviews. The Project staff appears to have good monitoring and evaluation protocols in place for diseases, genetic effects and other potential concerns.

The GRESP for spring Chinook salmon reflects a change in emphasis from a mitigation program to a conservation and recovery program. The LSRCP program in the Grande Ronde basin began in the early 1980's and used non-endemic Carson Hatchery and Rapid River Hatchery spring Chinook. Concerns about the potential effects of interactions between non-endemic hatchery Chinook and naturally produced Chinook in the basin led to a dispute among comanagers about use of the Rapid River stock for supplementation. The Independent Scientific Panel (ISP) was convened under US v. OR to resolve this dispute. As a result of recommendations from the ISP (Currens et al. 1996) and negotiations among comanagers, a program was initiated to develop endemic spring Chinook broodstocks from the upper Grande Ronde River, Catherine Creek, and Lostine River. The GRESP, has captive broodstock and conventional supplementation components. Collections of juveniles for the captive component of the program began as an emergency measure in 1995 and continued under a plan described in the

ESA Section 10 application for the captive broodstock program (ODFW 1996). Collection of adults for the conventional component began in 1997. These two programs are integrated. The captive brood portion serves in an experimental role while the conventional production component provides the production backbone. Production facility locations are indicated in Figure 32.

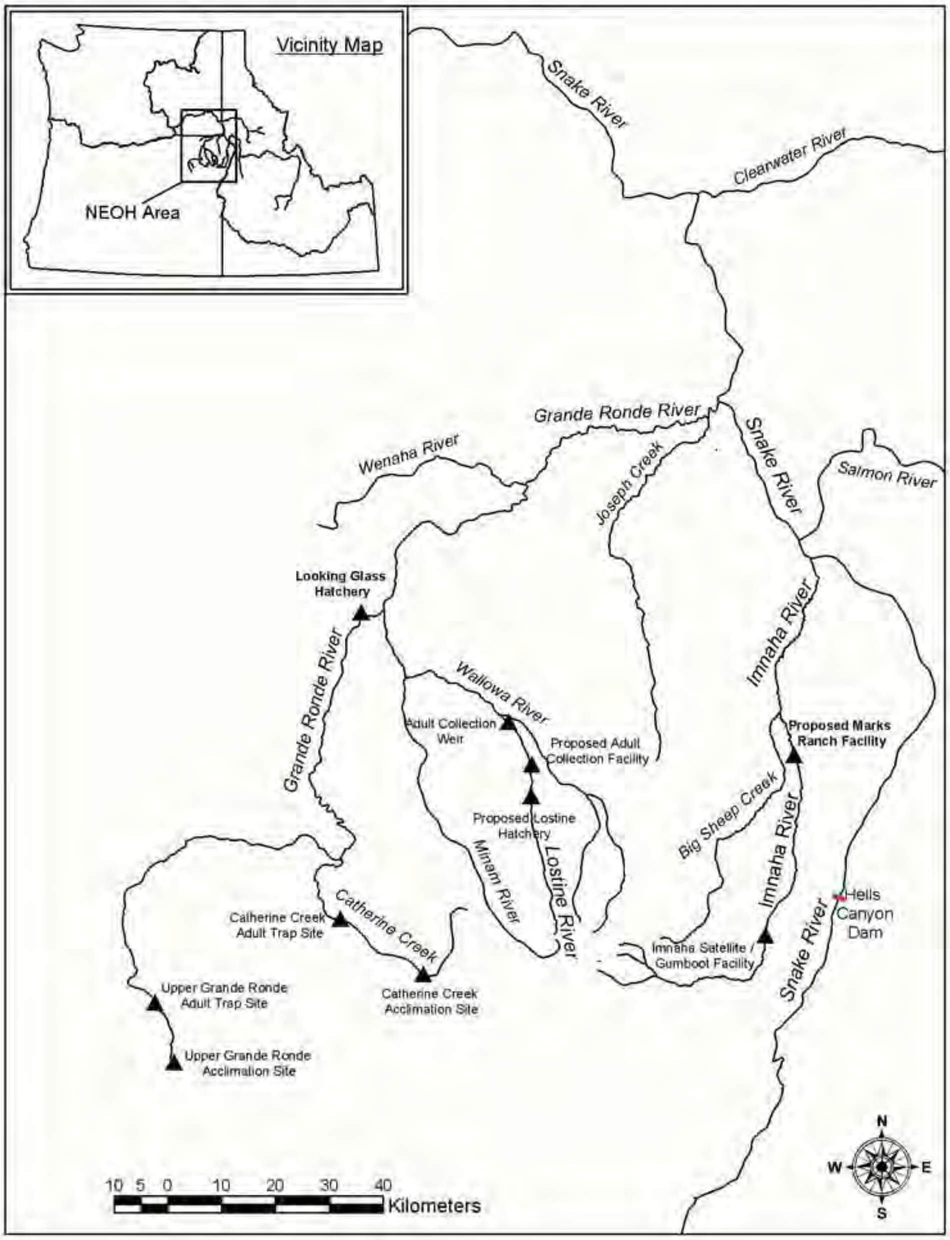


Figure 32. Chinook salmon rearing, acclimation and adult collection facility locations in the Grande Ronde subbasin.

Grande Ronde Spring Chinook Salmon Captive Broodstrock Program

In 1995 a spring Chinook salmon captive broodstock program was initiated in the Grande Ronde River subbasin in an effort to restore spring Chinook salmon populations in the basin. Spring Chinook salmon populations from Catherine Creek, Lostine River, and Upper Grande Ronde were below viable populations thresholds with spawning escapement below 50 fish during mid-1990 (LSRCP Symposium 1998). Today the captive broodstock program has become an important component in the conservation approach and strategy of co-managers. The Nez Perce Tribe (NPT), Oregon Department of Fish and Wildlife (ODFW) and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) work cooperatively as patrons of the Grande Ronde River subbasin captive broodstock program.

Five hundred wild Chinook salmon parr from each tributary are collected every summer from the Lostine River, Catherine Creek and upper Grande Ronde River. Fish are reared at Lookingglass Fish Hatchery until the smolt stage and then were transferred to facilities at Bonneville Hatchery and Manchester Research Station. When mature, the captive broodstock are brought together at Bonneville Hatchery and spawned. Semen from any excess captive males is cryopreserved. Half of these preserved gametes are stored on site for potential use in spawning and half are stored off site as a back-up repository. The F1 generation is reared at Lookingglass Hatchery, acclimated at satellite facilities on the respective natal streams and then volitionally released.

The intent of the Grande Ronde captive broodstock program is to prevent imminent extirpation and enhance the Chinook salmon population without a phenotypic or genetic change to the original population. Specific expected research outcomes of the program include an evaluation of saltwater and freshwater adult rearing. Within the freshwater strategy, accelerated and normal growth regimes are also compared. These rearing treatments are evaluated in terms of size, survival, disease, fecundity, fertility, sperm motility, egg size, egg survival. The F1 juvenile and adult performance are evaluated against the standards set by their wild counterparts.

Although captive broodstock technology continues to be a controversial recovery tool, captive propagation of non-fish endangered species is a widely accepted method (DeBlieu 1993; Gipps 1991; Olney et al. 1994; Ostermann et al. 2001). Almost 200 animal species are currently enhanced through captive breeding techniques (Flagg and McAuley 1994). For ESA listed fish populations, captive broodstock programs are also emerging as important components in recovery efforts. Captive broodstock programs differ from conventional fish culture in that fish of wild origin are maintained in captivity throughout their life to produce an F1 generation for the purpose of supplementing wild populations. Several endangered populations of Atlantic salmon, Chinook, coho, and sockeye salmon are now maintained by programs utilizing captive broodstock technology (Anders 1998; Bailey and Kincaid 1989; Flagg and Mahnaken 1995; Johnson and Jensen 1991). This technology holds promise as a means of accelerating recovery by maximizing the species reproductive potential.

A monitoring and evaluation study design for the captive broodstock program was included in the Section 10 Permit Application for Permit 1101 (ODFW 1996). Facilitation of that study design is guided by a Technical Oversight Team made up state, tribal, and federal co-managers that meet nine times annually. Annual review of the captive broodstock program by co-managers occurs through the Northeast Oregon Hatchery Annual Operation Plan (AOP).

Monitoring of the captive broodstock throughout their captivity allows for a measure of comparison among treatment groups and across years. Data used to determine outcomes are collected at each step of the process. Parr collected from the wild are PIT tagged for individual identification and fork length and weight recorded. Caudal tissue is also collected for genetic analysis. During smoltification fish are transferred to either Bonneville Hatchery or Manchester Research Station where they are given a visual implant (VI) tag for further identification. Two primary treatment evaluations compare fish reared exclusively in freshwater to those reared in freshwater as juveniles and in saltwater as adults. A secondary evaluation compares fish that as juveniles are grown at either an accelerated rate or natural rate. Length, weight and survival are measured on a quarterly basis and at spawning. Maturation schedule and spawn timing are determined according to treatment. Egg weight and eggs per female values are recorded during spawning. A random sample of embryos are used to estimate fertilization rates. Percent sperm motility is visually estimated during cryopreservation activities. Eyed egg survival is determined during egg picking. F1 generation juveniles are also monitored for in-hatchery parameters and post release performance against standards set by their wild counterparts.

Evaluation of the extensive information collected to date required the development of a captive broodstock database. Descriptive statistics such as mean length, mean weight and mean age-at-maturity and their associated variation, standard deviation, degrees of freedom, and confidence intervals are estimated using standard procedures described in Snedecor and Cochran (1980).

We utilize inferential statistics for hypothesis testing in which to compare treatment groups (cohorts, sex, growth regime, origins, etc.). To reject a null hypothesis we will use an $P = 0.05$. Two way analysis of variance (AVOVA) examines growth regime and origin effects on salmon survival, length and weight and fecundity. Independent t-Tests are used to compare group means of length according to sex and cohort. Pearson Product Moment Correlation Coefficient (r) tests examine the relationship between female weight and egg number. The relationship between sperm quality indices and fertilization are also examined.

Co-managers acknowledge that captive broodstock technology is largely unproven and that uncertainty exists in terms of its application to preserve threatened Chinook salmon populations. Limiting factors extrinsic to the captive broodstock program may preclude program success. Yet the captive broodstock program is an attempt to maintain these populations NPT and ODFW insist that monitoring and evaluation accompany their supplementation programs. Since the captive broodstock program is experimental in nature it will attempt to answer many uncertainties as the project progresses. Program uncertainties include: maturation of adults at the correct time and age, quality of adult gametes, potential domestication effects, genetic effect to both the artificially propagated population and the wild population once captive brood adults return to spawn, and the ability of Bacteria Kidney Disease (BKD) to effect program success.

The decision to use captive broodstock technology in the Grande Ronde Subbasin was made in the midst of considerable uncertainty. But one of the basic dictums of conservation biology states that in a crisis, as in the Grande Ronde, we must act before knowing all the facts (Soule□ 1991). This project will help address the uncertainty specific to captive broodstock technology and add to society’s knowledge regarding supplementation in general.

Chinook Broodstock Strategy and Management

Co-managers have agreed to a diverse approach for managing Chinook salmon stocks in the Grande Ronde subbasin that includes differing levels of supplementation; high – Upper Grande Ronde River, moderate - Lostine River, low – Catherine Creek, and no supplementation – Minam River and Wenaha rivers. The Grande Ronde Basin Spring Chinook Hatchery Management Plan (Zimmerman et al. 2001) provides further details of this hatchery intervention approach.

Grande Ronde endemic spring Chinook salmon of hatchery and natural-origin returning to the Grande Ronde Subbasin are always used for broodstock. Currently, a dual broodstock strategy is used for supplementation in the Grande Ronde river subbasin (captive broodstock and conventional programs). Progeny resulting from both broodstock methods are acclimated and released back into their stream of origin as smolts. Co-managers intend to shift to a conventional broodstock-only supplementation program as run strength increases.

All conventional broodstock spawning for both subbasins occurs at Lookingglass Fish Hatchery. Peak spawning usually takes place during the month of September. All surviving adults retained for broodstock are used. Fertilization involves a spawning matrix that uses the number of ripe males and females available on a specific spawning day. The spawning matrices are used to avoid giving any individual a selective advantage and to maximize the number of genetic crosses.

Lostine River Production: Co-managers obtain broodstock for the Lostine River from the captive broodstock program at Bonneville Hatchery and Manchester Research Station and from the conventional program at the two weir locations in the Lostine River. The entire production program from adult holding to juvenile release will occur at the Lostine Hatchery facility. The Lostine River captive broodstock production will be spawned at Bonneville Fish Hatchery and incubated to eye-up at Oxbow Hatchery. Eyed eggs will be transported to the Lostine Hatchery for final incubation, early and final rearing, and release.

Catherine Creek and Upper Grande Ronde Production: Broodstock for Catherine Creek and the Upper Grande Ronde River are obtained from two sources. The captive broodstock program will continue to provide F1 progeny for release into their natal streams and adult broodstock will be acquired from the weir locations in Catherine Creek and the Upper Grande Ronde River. The conventional production program for both Catherine Creek and Upper Grande Ronde River (adult holding, spawning, incubation, early and final rearing) will occur at the Lookingglass Hatchery Facility. The Catherine Creek and Upper Grande Ronde River Captive broodstock production is spawned and incubated to eye-up at Bonneville Hatchery. Eyed eggs will be transported to the Lookingglass hatchery for final incubation, early and final rearing. Smolts are transferred to acclimation sites in each respective stream in mid-March for holding and release in mid-April.

Lookingglass Creek Production: Broodstock for Lookingglass Creek will be developed from the Catherine Creek stock. After 2008, known origin adults from Catherine Creek stock returning to Lookingglass Creek will be used to support conventional production specific to Lookingglass Creek. The entire production program (adult holding, spawning, incubation, early and final rearing, and release) will occur at Lookingglass Fish Hatchery.

Co-managers use a Technical Oversight Team (TOT) for artificial production oversight and planning. The present TOT is responsible for overseeing daily activities, implementing technical and associated research aspects of the program, and making technical recommendations for program operations. The TOT recommends technical adjustments to the program to achieve program objectives. The TOT includes personnel from ODFW, NPT, CTUIR, and NMFS with expertise in fish culture, pathology, research, and management. There is also a member representing the TOT in a parallel process in Idaho, called the TOC (Technical Oversight Committee). Generally, the TOT and TOC are accepted by NMFS and BPA as the entities regulating the captive broodstock programs for salmon. The TOT meets about nine times per year.

The LSRCP, NEOH, GRESP and Captive Broodstock programs have been integrated together in the Grande Ronde subbasin and have undergone many changes since their respective inceptions. ESA listings, continued declines in natural production, poor performance of hatchery programs (especially for spring Chinook), and increasing concerns about hatchery/wild interactions have contributed to changes in hatchery mitigation programs. Although agencies and Tribes are continuing to pursue mitigation goals in the long-term, they are placing increasing short-term emphasis on use of hatcheries for conservation and recovery of ESA listed species.

<u>Steelhead</u>

Facilities presently in use for the Grande Ronde subbasin summer steelhead program are Wallowa Hatchery near Wallowa, Oregon, used for adult collection, holding and spawning; Big Canyon acclimation facility near Minam, Oregon, for adult collection and holding and acclimation; and Irrigon Hatchery, near Irrigon, Oregon, for rearing, and Cottonwood acclimation facility, a short distance downstream of the Oregon border, for rearing. Historically, Wallowa stock production has targeted 1.6M smolts released into the Wallowa River, Catherine Creek, upper Grande Ronde River and lower Grande Ronde River. Wallowa stock releases have been reduced to 890,000 smolts in Oregon and 200,000 in Washington (at Cottonwood). These programs may be further reduced in the future. The ODFW has prepared a Hatchery and Genetics Management Plan (HGMP) for Grande Ronde subbasin summer steelhead at the direction of NMFS. Although it is illustrative of the program and its past direction, this is not a consensus document; it was prepared by ODFW without input from comanagers. The HGMP is attached, as Appendix D. Future hatchery planning will focus on maintaining wild steelhead productivity, addressing listed species impacts and maintaining harvest opportunity.

Hatchery production and acclimation for summer steelhead supplementation in the Grande Ronde River subbasin is accomplished at Wallowa Hatchery, Irrigon Hatchery and the Big Canyon acclimation facility in Oregon and at the Lyons Ferry Hatchery and Cottonwood acclimation facility in Washington. The Wenaha and Minam rivers and Joseph Creek are wild fish management areas for summer steelhead in the subbasin and, thus, receive no hatchery supplementation.

Agencies and Tribes are reviewing how to modify LSRCP Wallowa Hatchery summer steelhead broodstocks for mitigation and enhancement programs in the Grande Ronde basin. The Wallowa Hatchery stock is a Snake River conglomerate stock (Wallowa stock) used by both Oregon and Washington. The LSRCP steelhead programs in Oregon and Washington portions of the Grande Ronde basin have been successful in reestablishing sport and tribal fisheries (Herrig 1998). It is important, however, to insure that the existing Wallowa and Lyons Ferry hatchery programs do not place wild stocks in jeopardy. Comanagers of the Grande Ronde basin will be working to redevelop hatchery broodstocks and programs as necessary to meet natural production and harvest augmentation objectives and meet NMFS requirements. This effort will require a thorough review of available information on steelhead status and stock structure in the basin as well as a review of existing and needed facilities for endemic steelhead programs.

3.2.3.4.3 Artificial Production: Historic

During the construction phases of Lookingglass Hatchery in the late 1970's, it was thought there were too few natural fish returning to Lookingglass Creek to develop adequate brood stock in a short time frame. ODFW decided that brood stock development and smolt production goals could be promptly achieved by importing hatchery stock from outside the basin. In 1978 the first eggs were taken from Rapid River stock (Idaho) and smolts were released in Lookingglass Creek in 1980. Due to egg availability and disease concerns, Carson stock replaced the Rapid River in the mid 1980's. Rapid River stock was imported through out the late 1980's and early 1990's (Lower Snake River Compensation Plan Status Review Symposium 1998).

In the early 1990's, two major policy rulings influenced the Grande Ronde spring Chinook salmon hatchery program. In 1990, ODFW adopted the Wild Fish Management Policy, which established guidelines for the maximum acceptable level of non-local origin hatchery fish that would spawn in nature with local populations. In 1992, naturally produced Grande Ronde Basin spring Chinook were listed as endangered by the National Marine Fisheries Service (NMFS) under the ESA. The hatchery operations were inconsistent with conservation and recovery opinions.

A genetic assessment by an Independent Scientific panel in the US v Oregon dispute resolution indicated that there remained significant genetic differentiation between natural populations and between hatchery populations and the natural populations; Even though significant out planting and straying of non-local hatchery fish had occurred. There was still significant genetic differentiation between hatchery and natural populations and between the Minam, Wenaha, Grande Ronde, Lostine rivers and Catherine Creek natural spawners (Currens et al. 1996; Waples et al 1993).

An Independent Scientific Panel (Currens et al. 1996) of geneticists reviewed and analyzed genetic data collected from Grande Ronde Subbasin spring Chinook salmon in 1996. Based on this analysis the Panel determined that despite hatchery releases in the subbasin of non-native stock (Rapid River and Carson stock) a substantial component of the native spring Chinook populations still exist. The Panel also found that the Lostine population was the most distinctive of the naturally-spawning populations in the Grande Ronde (Currens et al. 1996).

3.2.3.4.4 Artificial Production and Introduction: Ecological Consequences

One of the roles of a monitoring and evaluation program is to consider project uncertainty. Critical uncertainties are consequential because they often serve as a pretext for inappropriate management actions. Uncertainty is a function not only of unpredictability and ecosystem randomness but also of our state of knowledge and scientific understanding. Therefore, monitoring and evaluation have long been recognized as necessary components of natural resource management. Monitoring and evaluation activities are intended to address project uncertainty and to provide feedback for proper adaptive management (NPPC 1999). Thus, the monitoring and evaluation plan serves as an adaptive management tool for assessing the utility of supplementation as an endangered species recovery method. Monitoring and evaluation will address the uncertainty specific to hatchery intervention in the Grande Ronde subbasin and add to our knowledge regarding supplementation in general.

The importance of monitoring natural resource status and assessing the impact of management actions is also emphasized by multiple science groups (Botkin et al. 2000; Hesse and Cramer 2000; ISRP 2001, McElhany et al. 2000). Monitoring and evaluation activities then, should describe program status and to provide feedback to managers (Steward 1996, NPPC 1999). This is accomplished through annual monitoring of population trends, quantifying population abundance, small-scale studies, and controlled setting experiments. Feedback consists of collecting information describing with analytical and predictive power the distribution, condition, status, and trends of biological and environmental variables of interest. Management then has current data on a continuous basis in which to properly evaluate program effectiveness. Moreover, well-coordinated management actions, when coupled with relevant monitoring and evaluation programs, can reduce uncertainty about the effect of those actions on target and non-target populations.

<u>Pertinent Findings</u>

Ongoing projects have contributed to our understanding of Chinook supplementation in the Imnaha and Grande Ronde subbasins. Findings from these studies to date have given co-managers preliminary information upon which the NEOH program was developed. Prior supplementation efforts with non-endemic hatchery stocks had failed as indicated by low natural escapement and productivity in supplemented streams. Non-endemic hatchery-origin fish strayed at high rates into the Lostine, Minam, and Wenaha Rivers and in some years represented a high proportion of the natural spawners.

No significant differences in life history characteristics between natural and hatchery fish have been detected, except in adult age-composition. No significant differences in genetic characteristics between natural and hatchery fish have been detected

Initial release strategies at Lookingglass Hatchery were designed to mimic natural fish emigration times from Lookingglass Creek. All sub-smolt release strategies survived poorly. The spring yearling release strategy was the only strategy that consistently produced progeny-parent ratios above 1.0. All other strategies were dropped from production following the study completion.

Two release sizes were evaluated to determine size influence on survival and age structure. We have found no significant difference of survival of smolts released at 30g and 18g. Adults return at a slightly older age for the smaller smolts. Monitoring juvenile emigration through the hydrosystem revealed a consistent survival advantage of natural smolts over hatchery smolts.

3.2.3.4.5 Relationship between Naturally- and Artificially-produced Populations

While the Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation, and Oregon Department of Fish and Wildlife feel that supplementation may be capable of increasing natural production, the recovery benefits of supplementation are not universal. Indeed, traditional hatchery programs have not always met with success in the past. We know that hatchery smolts produced from localized salmon stocks perform better than hatchery smolts from distant stocks (Reisenbichler 1988), successful outplanting of hatchery fish depends on the hatchery's ability to produce fish qualitatively similar to natural fish (Lichatowich and McIntyre 1987), genetic fitness decreases as differences between hatchery and wild fish increase (Chilcote et al. 1986), and the production of wild stocks can be reduced after the introduction of poorly adapted fish (Vincent 1987). Hence, monitoring and evaluation are integral to managing the risk associated with supplementation.

Hatcheries play a significant role in meeting social and recovery goals of the Blue Mountain Province. Co-mangers have restructured Grande Ronde spring Chinook programs to support recovery (ODFW 1996). The general body of science regarding hatcheries as recovery tools suggest that natural spawning by hatchery fish can provide benefits as well as pose risks to wild populations (IMST 2001, ISAB 2001, and Brannon 2001). It is clear that hatcheries can provide a production boost for a host population, potentially preserving a population or rescuing it from a production bottleneck. The risks hatchery intervention poses to wild populations tend to be site specific and include management associated (i.e. over-harvest of weak stocks in mixed stock fisheries), genetic (i.e. outbreeding depression) and ecological impacts (i.e. increased competition). Given the current state of our knowledge of these benefits and risks, hatchery programs should be used appropriately considering site-specific needs to insure recovery goals are achieved. NMFS (2000a &b) [section 10 permits] concluded that the artificial propagation program in the Grande Ronde subbasin is appropriate for enhancement of Grande Ronde stocks and is not likely to jeopardize the continued existence of listed Snake River spring/summer Chinook salmon.

3.2.3.5 Environmental conditions for Aquatic Focal Species

For the purposes of this assessment "current" conditions were defined as the condition of the aquatic environment as it exists today. "Template" conditions were defined as what a given reach would be like if the system were restored to the fullest extent possible short of disrupting infrastructure that is vital to modern society and that is likely to remain in place for the foreseeable future. In those reaches with little cultural modification this reference condition might equate to "historic" conditions (i.e., conditions that were in place prior to European settlement).

Due to the large numbers of EDT variables (45) that needed to be rated for each reach (509 reaches) this was a large task. The final documentation and a summary of changes between current and template conditions has not been completed at this time.

3.2.4. Terrestrial Focal Species Population Delineation and Characterization

Terrestrial focal species accounts were prepared as a collaborative effort among several subbasins. For each species, a general region- or basin-wide account was prepared by the author noted at the beginning of each account, and then subbasin-specific information, if available, was added by each subbasin's technical team and writer/editor. The following focal species accounts are brief, edited versions of the comprehensive accounts found in Appendix 3. The authors of species accounts in this document are: Keith Paul, USFWS; Paul Ashley and Stacey Stovall, WDFW; Pat Matthews, ODFW; and M. Cathy Nowak, Cat Tracks Wildlife Consulting.

3.2.4.1 Columbia Spotted Frog (Rana lueiventris) Keith Paul, USFWS

3.2.4.1.1 Life History

The Columbia spotted frog (CSF) is olive green to brown in color, with irregular black spots. They may have white, yellow, or salmon coloration on the underside of the belly and legs (Engle 2004

The CSF eats a variety of food including arthropods (e.g., spiders, insects), earthworms and other invertebrate prey (Whitaker et al. 1982). Adult CSFs are opportunistic feeders and feed primarily on invertebrates (Nussbaum et al. 1983). Larval frogs feed on aquatic algae and vascular plants, and scavenged plant and animal materials (Morris and Tanner 1969).

The timing of breeding varies widely across the species range owing to differences in weather and climate, but the first visible activity begins in late winter or spring shortly after areas of ice-free water appear at breeding sites (Licht 1975; Turner 1958; Leonard et al 1996).

Based on recapture rates in the Owyhee Mountains, some individuals live for at least five years. Skeletochronological analysis in 1998 revealed a 9-year old female (Engle and Munger 2000). Mortality of eggs, tadpoles, and newly metamorphosed frogs is high, with approximately 5% surviving the first winter (David Pilliod, personal communication, cited in Amphibia Web 2004).

3.2.4.1.2 Habitat

This species is relatively aquatic and is rarely found far from water. It occupies a variety of still water habitats and can also be found in streams and creeks (Hallock and McAllister 2002). CSF's are found closely associated with clear, slow-moving or ponded surface waters, with little shade (Reaser 1997). CSF's are found in aquatic sites with a variety of vegetation types, from grasslands to forests (Csuti 1997). A deep silt or muck substrate may be required for hibernation and torpor (Morris and Tanner 1969). In colder portions of their range, CSF's will use areas where water does not freeze, such as spring heads and undercut streambanks with overhanging vegetation (IDFG et al. 1995). CSF's may disperse into forest, grassland, and brushland during wet weather (NatureServe 2003). They will use stream-side small mammal burrows as shelter. Overwintering sites in the Great Basin include undercut banks and spring heads (Blomquist and Tull 2002).

3.2.4.1.3 Present Distribution

Populations of the CSF are found from Alaska and British Columbia to Washington east of the Cascades, eastern Oregon, Idaho, the Bighorn Mountains of Wyoming, the Mary's, Reese, and Owyhee River systems of Nevada, the Wasatch Mountains, and the western desert of Utah (Green et al. 1997

Currently, Columbia spotted frogs appear to be widely distributed throughout southwestern Idaho (mainly in Owyhee County) and eastern Oregon, but local populations within this general area appear to be isolated from each other by either natural or human induced habitat disruptions.

Columbia spotted frogs may be found in appropriate habitat throughout the subbasin but few formal surveys have been conducted. A 1997 USFS survey found 12 breeding sites in Wallowa County (J. Hohmann, personal communication, 3/21/2004).

3.2.4.1.4 Current Population Data and Status

Extensive surveys since 1996 throughout southern Idaho and eastern Oregon, have led to increases in the number of known spotted frog sites. Although efforts to survey for spotted frogs have increased the available information regarding known species locations, most of these data suggest the sites support small numbers of frogs. Of the16 sites that are known to support Columbia spotted frogs in eastern Oregon, 81 percent of these sites appear to support fewer than 10 adult spotted frogs. Monitoring (since 1998) of spotted frogs in northeastern Oregon in Wallowa County indicates relatively stable, small local populations (less than five adults encountered) (Pearl 2000). All of the known local populations of spotted frogs in eastern Oregon appear to be functionally isolated (USFWS 2002c).

3.2.4.1.5 Historic Habitat Distribution

Due to habitat loss and alteration, fragmentation, water diversion, dams, and loss of beaver the current distribution and abundance of CSF and suitable habitat has dramatically decreased.

3.2.4.1.6 Current Habitat Distribution

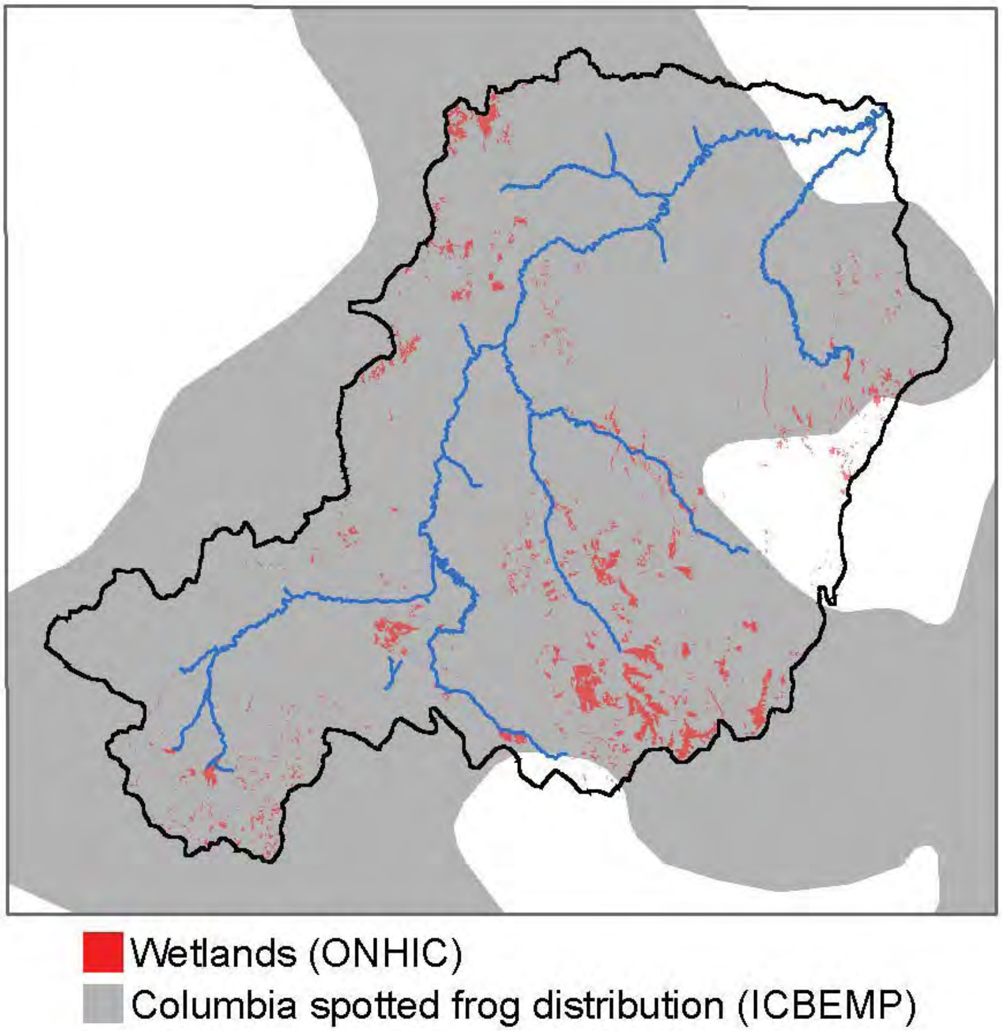


Figure 33. Potential distribution of Columbia spotted frogs (gray) and distribution of wetland habitat (red) in the Grande Ronde subbasin.

3.2.4.1.7 Limiting Factors

Habitat Loss and Degradation:

Spotted frog habitat degradation and fragmentation is probably a combined result of past and current influences of heavy livestock grazing, spring development, agricultural development, urbanization, and mining activities.

The reduction of beaver populations has also been noted as an important feature in the reduction of suitable habitat for spotted frogs. Beaver are important in the creation of small pools with slow-moving water that function as habitat for frog reproduction and create wet meadows that provide foraging habitat and protective vegetation cover, especially in the dry interior western United States (St. John 1994).

Disease and Predation:

Predation by fishes is likely an important threat to spotted frogs. The introduction of nonnative salmonid and bass species for recreational fishing may have negatively affected frog species throughout the United States.

The bull frog (*Rana catesbeiana*), a nonnative ranid species, occurs within the range of the spotted frog in the Great Basin. Bullfrogs are known to prey on other frogs (Hayes and Jennings 1986). They are rarely found to co-occur with spotted frogs, but whether this is an artifact of competitive exclusion is unknown at this time (USFWS 2002c).

3.2.4.1.8 Habitats Currently Protected on Public and Private Lands

Although 49% of combined wetland habitats within the subbasin are in high protection status, these are primarily the montane coniferous wetlands at higher elevations, many of which are located in Wilderness Areas. The wetlands utilized by beavers are mostly at lower elevations along lower gradient streams and enjoy a lower level of protection. About 27% of wetlands in the subbasin have no protection, 23% low protection and 1% medium protection; most habitat for American beaver enjoys little or no protection.

3.2.4.1.9 Potential and Projected Future Condition with No Further Actions

3.2.4.2 Great Blue Heron (Ardea herodias) Paul Ashley and Stacey Stovall, WDFW

3.2.4.2.1 Life History

Fish are preferred food items of the great blue heron in both inland and coastal waters (Kirkpatrick 1940; Palmer 1962; Kelsall and Simpson 1980), although a large variety of dietary items has been recorded. Frogs and toads, tadpoles and newts, snakes, lizards, crocodilians, rodents and other mammals, birds, aquatic and land insects, crabs, crayfish, snails, freshwater and marine fish, and carrion have all been reported as dietary items for the great blue heron (Bent 1926; Roberts 1936; Martin et al. 1951; Krebs 1974; Kushlan1978).

In the Grande Ronde subbasin, great blue herons are often seen hunting along rivers and streams as well as in wet meadows and marshes such as the Ladd Marsh Wildlife Area. At times, especially during winter and spring, great blue herons can be seen hunting in agricultural fields and pastures.

3.2.4.2.2 Habitat

Minimum habitat area for the great blue heron includes wooded areas suitable for colonial nesting and wetlands within a specified distance of the heronry where foraging can occur.

Short and Cooper (1985) provide criteria for suitable great blue heron foraging habitat. Suitable great blue heron foraging habitats are within 1.0 km of heronries or potential heronries. The suitability of herbaceous wetland, scrub-shrub wetland, forested wetland, riverine, lacustrine or estuarine habitats as foraging areas for the great blue heron is ideal if these potential foraging habitats have shallow, clear water with a firm substrate and a huntable population of small fish.

Short and Cooper (1985) describe suitable great blue heron nesting habitat as a grove of trees at least 0.4 ha in area located over water or within 250m of water. Trees used as nest sites are at least 5 m high and have many branches at least 2.5 cm in diameter that are capable of supporting nests. Trees may be alive or dead but must have an “open canopy” that allows an easy access to the nest.

3.2.4.2.3 Present Distribution

The great blue heron breeds throughout the U.S. and winters as far north as New England and southern Alaska (Bull and Farrand 1977). The nationwide population is estimated at 83,000 individuals (NACWCP 2001).

In the Grande Ronde subbasin, great blue herons are often seen hunting along rivers and streams as well as in wet meadows and marshes such as the Ladd Marsh Wildlife Area. At times, especially during winter and spring, great blue herons can be seen hunting in agricultural fields and pastures. Known heron rookeries in the Grande Ronde subbasin include nest colonies on Catherine Creek near La Grande, the Wallowa River south of Enterprise and on the Lostine River north of Lostine.

3.2.4.2.4 Current Population Data and Status

Breeding bird survey trend data show a stable to slightly declining trend in populations throughout Oregon. Surveys of blue heron populations are not conducted in the Grande Ronde subbasin. However, populations appear to be stable. Rookery surveys have been conducted annually in the Wallowa Valley since 1977. The Wallowa and Lostine River rookeries appear to have a stable number of birds and occupied nests.

3.2.4.2.5 Historic Habitat Distribution

3.2.4.2.6 Current Habitat Distribution

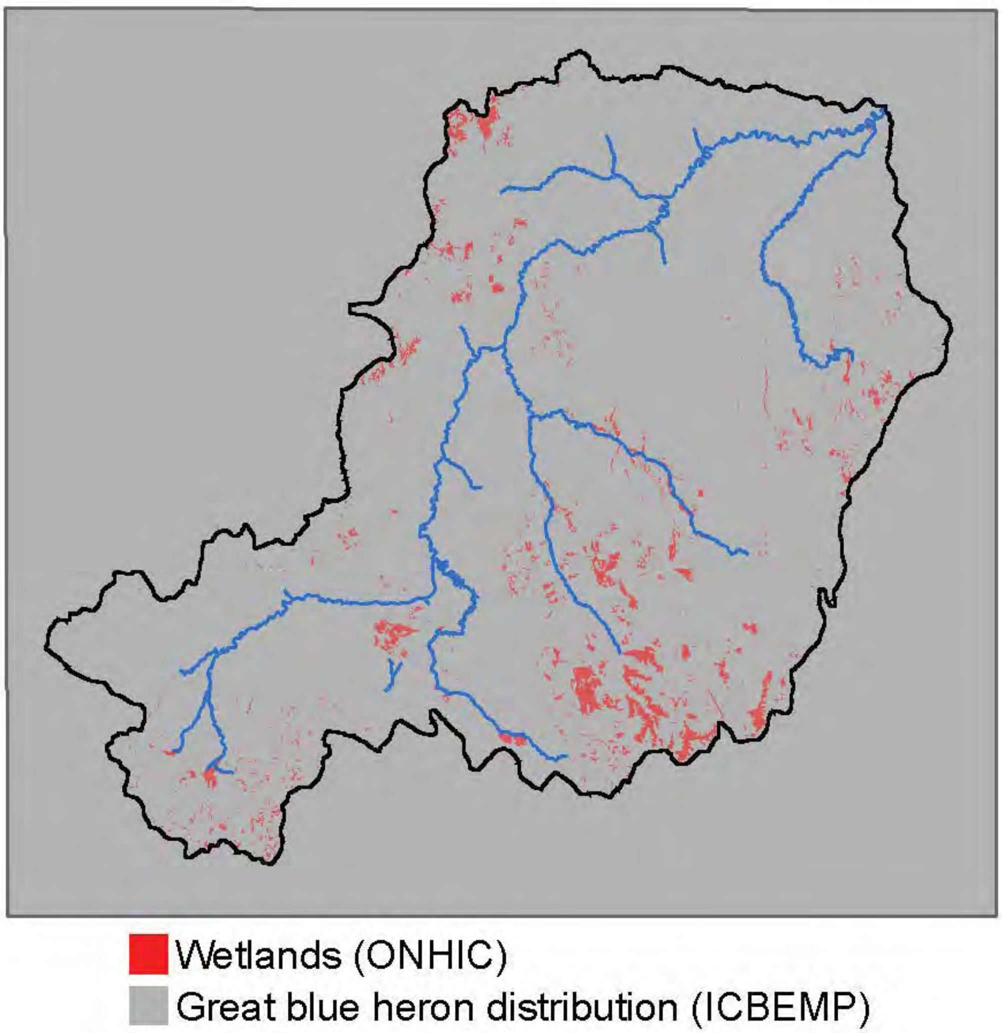


Figure 34. Potential distribution of great blue heron (gray) and distribution of wetland habitat (red) in the Grande Ronde subbasin.

3.2.4.2.7 Limiting Factors

Habitat destruction and the resulting loss of nesting and foraging sites, and human disturbance probably have been the most important factors contributing to declines in some great blue heron populations in recent years (Thompson 1979a; Kelsall and Simpson 1980; McCrimmon 1981).

Natural generation of new nesting islands, created when old islands and headlands erode, has decreased due to artificial hardening of shorelines with bulkheads. Loss of nesting habitat in certain coastal sites may be partially mitigated by the creation of dredge spoil islands (Soots and Landin 1978). Several species of wading birds, including the great blue heron, use coastal spoil islands (Buckley and McCaffrey 1978; Parnell and Soots 1978; Soots and Landin 1978). The amount of usage may depend on the stage of plant succession (Soots and Parnell 1975; Parnell and Soots 1978), although great blue herons have been observed nesting in shrubs (Wiese 1978), herbaceous vegetation (Soots and Landin 1978), and on the ground on spoil islands.

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. Although great blue herons currently appear to tolerate low levels of pollutants, these chemicals can move through the food chain, accumulate in the tissues of prey and may eventually cause reproductive failure in the herons.

Several authors have observed eggshell thinning in great blue heron eggs, presumably as a result of the ingestion of prey containing high levels of organochlorines (Graber et al. 1978; Ohlendorf et al. 1980). Konermann et al. (1978) blamed high levels of dieldrin and DDE use for reproductive failure, followed by colony abandonment in Iowa. Vermeer and Reynolds (1970) recorded high levels of DDE in great blue herons in the prairie provinces of Canada, but felt that reproductive success was not diminished as a result. Thompson (1979a) believed that it was too early to tell if organochlorine residues were contributing to heron population declines in the Great Lakes region.

Heronries often are abandoned as a result of human disturbance (Markham and Brechtel 1979). Werschkul et al. (1976) reported more active nests in undisturbed areas than in areas that were being logged. Tree cutting and draining resulted in the abandonment of a mixed-species heronry in Illinois (Bjorkland 1975). Housing and industrial development (Simpson and Kelsall 1979) and water recreation and highway construction (Ryder et al. 1980) also have resulted in the abandonment of heronries. Grubb (1979) felt that airport noise levels could potentially disturb a heronry during the breeding season.

3.2.4.2.8 Habitats Currently Protected on Public and Private Lands

Although 49% of combined wetland habitats within the subbasin are in high protection status, these are primarily the montane coniferous wetlands at higher elevations, many of which are located in Wilderness Areas. The wetlands utilized by herons are mostly at lower elevations along lower gradient streams and enjoy a lower level of protection. About 27% of wetlands in the subbasin have no protection, 23% low protection and 1% medium protection; most habitat for the great blue heron enjoys little or no protection.

3.2.4.2.9 Potential and Projected Future Condition with No Further Actions

- 3.2.4.3 Bald Eagle (*Haliaeetus leucocephalus*) Keith Paul, USFWS

3.2.4.3.1 Life History

As our national symbol, the bald eagle is widely recognized. Its distinctive white head and tail do not appear until the bird is four to five years old. These large powerful raptors can live for 30 or more years in the wild and even longer in captivity (USFWS 2003).

Bald eagles consume a variety of prey that varies by location and season. Prey are taken alive, scavenged, and pirated (Frenzel 1985, Watson et al. 1991). Fish were the most frequent prey among 84 species identified at nest sites in south-central Oregon, and a tendency was observed for some individuals or pairs to specialize in certain species (Frenzel 1985). Wintering and migrant eagles in eastern Oregon fed on large mammal carrion, especially road-killed mule deer, domestic cattle that died of natural causes, and stillborn calves, as well as cow afterbirth, waterfowl, ground squirrels, other medium-sized and small rodents, and fish. Proportions varied by month and location. Food habits are unknown for nesting eagles over much of the state (Isaacs and Anthony 2003a).

Bald eagles are most abundant in Oregon in late winter and early spring, because resident breeders (engaged in early nesting activities), winter residents, and spring transients are all present. Nest building and repair occur any time of year, but most often observed from February to June (Isaacs and Anthony unpublished data).

During the nest building, egg laying and incubating periods, eagles are extremely sensitive and will abandon a nesting attempt if there are excessive disturbances in the area during this time. The eaglets are able to fly in about three months and then, after a month, they are on their own.

3.2.4.3.2 Habitat

Bald eagles are generally associated with large bodies of water, but can occur in any habitat with available prey (Isaacs and Anthony 2003a).

Bald eagles nest in forested areas near the ocean, along rivers, and at estuaries, lakes, and reservoirs (Isaacs and Anthony 2001). Consequently, shoreline is an important component of nesting habitat; 84% of Oregon nests were within 1 mi (1.6 km) of water (Anthony and Isaacs 1989). All nests observed in Oregon have been in trees, primarily Sitka spruce and Douglas-fir west of the Cascades and ponderosa pine, Douglas-fir, and sugar pine in eastern Oregon (Anthony and Isaacs 1989). Use of black cottonwood for nesting has increased recently as Columbia and Willamette River populations have increased.

Habitat requirements for communal night roosting are different form those for diurnal perching. Communal roosts are invariably near a rich food resource and in forest stands that are uneven-aged and have at least a remnant of the old-growth forest component (Anthony et al. 1982). Roost tree species and stand characteristics vary considerably throughout the Pacific Northwest (Anthony et al 1982) (USFWS 1986).

3.2.4.3.3 Present Distribution

In Oregon, the bald eagle nested in 32 of 36 counties (**Error! Reference source not found.**). Those counties where breeding did not occur include Sherman, Gilliam, Morrow, and Malheur counties (Isaacs and Anthony 2001). However, an active eagle nest was observed in Malheur County in 2003. Bald eagles can be found throughout the state during non-breeding. Eagles are common in winter and early spring at Hells Canyon, Oxbow, and Brownlee reservoirs, and along the Wallowa and Grande Ronde Rivers (Isaacs et al. 1992). Recently, bald eagle nests have been documented in Wallowa County: one west of Wallowa and one on the shore of Wallowa Lake. Based on observations of both adult and juvenile birds, a nest was suspected in the upper Grande Ronde River in 2002 but it was never located (M. Penninger, USFS, personal communication, 2002).

3.2.4.3.4 Current Population Data and Status

Habitat protection and management, the ban on use of DDT (Greier 1982) and reduced direct persecution due to education were followed by a recent population increase. Improved nesting success and a population increase led to a 1999 proposal to delist federally (USDI 1999). Oregon also may propose to delist the species (Isaacs and Anthony 2003a).

As summarized in Steenhof et al. (2002), mid-winter population trends from 1986-2000 for the Pacific Northwest are: Oregon (+1.4%), Washington (+4.6%), Idaho (+1.9). Isaacs and Anthony (2003b) compiled information on bald eagle nest locations and history of use in the Washington and Oregon portions of the Columbia River Recovery Zone 1971 through 2003.

Nesting success was 64% in OR and 52% in WA, resulting in 5-year nesting success of 64% in OR and 58% in WA.

3.2.4.3.5 Historic Habitat Distribution

3.2.4.3.6 Current Habitat Distribution

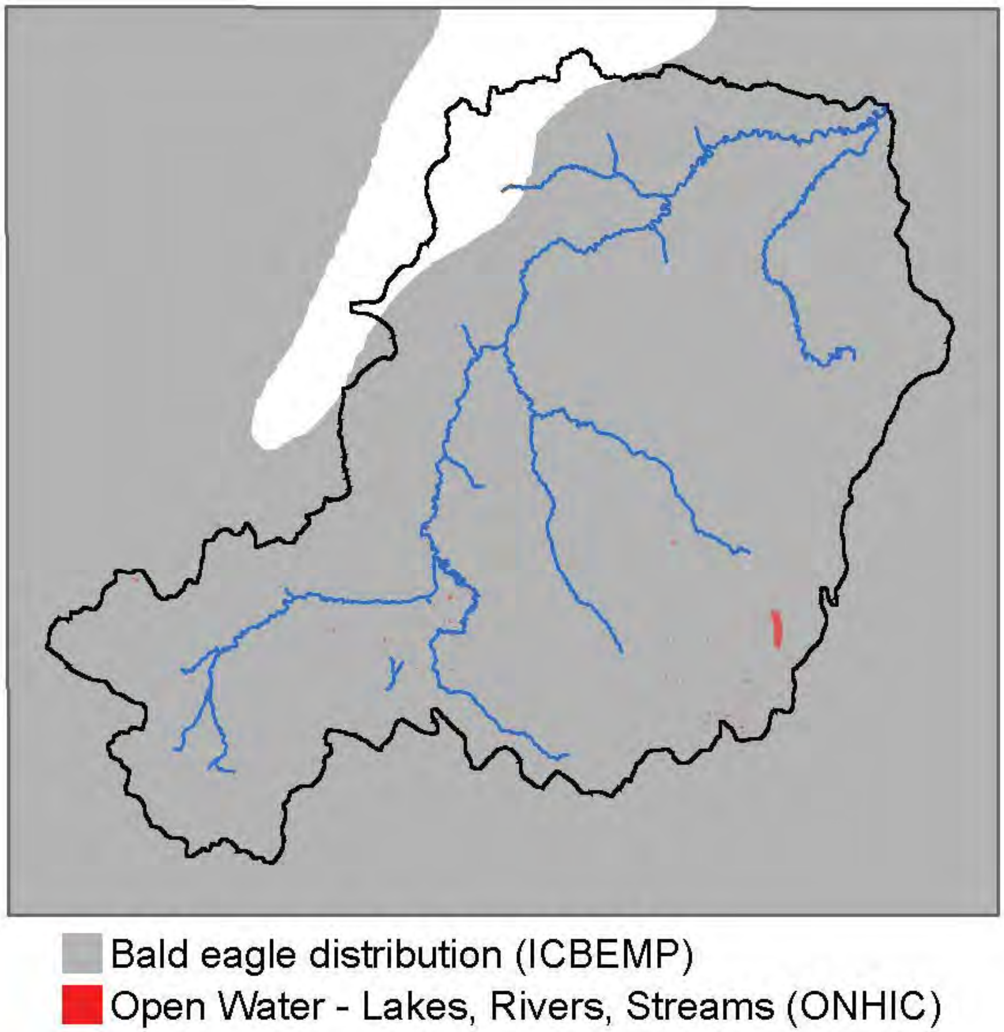


Figure 35. Potential distribution of bald eagle (gray) and distribution of open water habitat (red) in the Grande Ronde subbasin.

3.2.4.3.7 Limiting Factors

Currently, loss of habitat and human disturbance are still potential threats. Habitat loss results from the physical alteration of habitat as well as from human disturbance associated with development or recreation (i.e., hiking, camping, boating, and ORV use). Activities that can and have negatively impacted bald eagles include logging, mining, recreation, overgrazing (particularly in riparian habitats), road construction, wetland filling, and industrial development.

3.2.4.3.8 Habitats Currently Protected on Public and Private Lands

Of the open water habitat in the subbasin, 68% occurs in areas with no protection, 7% in areas with low protection, 10% with medium protection and 15% in areas with high protection status (status definitions page 223).

3.2.4.3.9 Potential and Projected Future Condition with No Further Actions

3.2.4.4 White-headed Woodpecker (Picoides albolarvatus) Paul Ashley and Stacey Stovall, WDFW.

3.2.4.4.1 Life History

The white-headed woodpecker (*Picoides albolarvatus*) is a year round resident in the Ponderosa pine (*Pinus ponderosa*) forests found at lower elevations (generally below 950m). They are particularly vulnerable due to their highly specialized winter diet of ponderosa pine seeds and the lack of alternate, large cone producing, pine species.

White-headed woodpeckers feed primarily on the seeds of large Ponderosa pines. This is makes the white-headed woodpecker quite different from other species of woodpeckers who feed primarily on wood boring insects (Blood 1997; Cannings 1987 and 1995). The existence of only one suitable large pine (ponderosa pine) is likely the key limiting factor to the white-headed woodpecker's distribution and abundance.

Other food sources include insects (on the ground as well as hawking), mullein seeds and suet feeders (Blood 1997; Joe et al. 1995). These secondary food sources are used throughout the spring and summer. By late summer, white-headed woodpeckers shift to their exclusive winter diet of ponderosa pine seeds.

White-headed woodpeckers are monogamous and may remain associated with their mate throughout the year. They build their nests in old trees, snags or fallen logs but always in dead wood. Every year the pair bond constructs a new nest.

Generally large ponderosa pine snags consisting of hard outer wood with soft heartwood are preferred by nesting white-headed woodpeckers. In British Columbia 80 percent of reported nests have been in ponderosa pine snags, while the remaining 20 percent have been recorded in Douglas-fir snags. Excavation activities have also been recorded in Quaking Aspen, live Ponderosa pine trees and fence posts (Cannings et al. 1987).

3.2.4.4.2 Habitat

White-headed woodpeckers live in montane, coniferous forests from British Columbia to California and seem to prefer a forest with a relatively open canopy (50-70 percent cover) and an availability of snags (a partially collapsed, dead tree) and stumps for nesting. The birds prefer to build nests in trees with large diameters with preference increasing with diameter. The understory vegetation is usually very sparse within the preferred habitat and local populations are abundant in burned or cut forest where residual large diameter live and dead trees are present.

Highest abundances of white-headed woodpeckers occur in old-growth stands, particularly ones with a mix of two or more pine species. They are uncommon or absent in monospecific ponderosa pine forests and stands dominated by small-coned or closed-cone conifers (e.g., lodgepole pine or knobcone pine).

3.2.4.4.3 Present Distribution

These woodpeckers live in montane, coniferous forests from southern British Columbia in Canada, to eastern Washington, southern California and Nevada and Northern Idaho in the United States. This species may be found in appropriate habitat throughout the Grande Ronde subbasin.

3.2.4.4.4 Current Population Data and Status

Although populations appear to be stable at present, this species is of moderate conservation importance because of its relatively small and patchy year-round range and its dependence on mature, montane coniferous forests in the West. Knowledge of this woodpecker’s tolerance of forest fragmentation and silvicultural practices will be important in conserving future populations.

3.2.4.4.5 Historic Habitat Distribution

3.2.4.4.6 Current Habitat Distribution

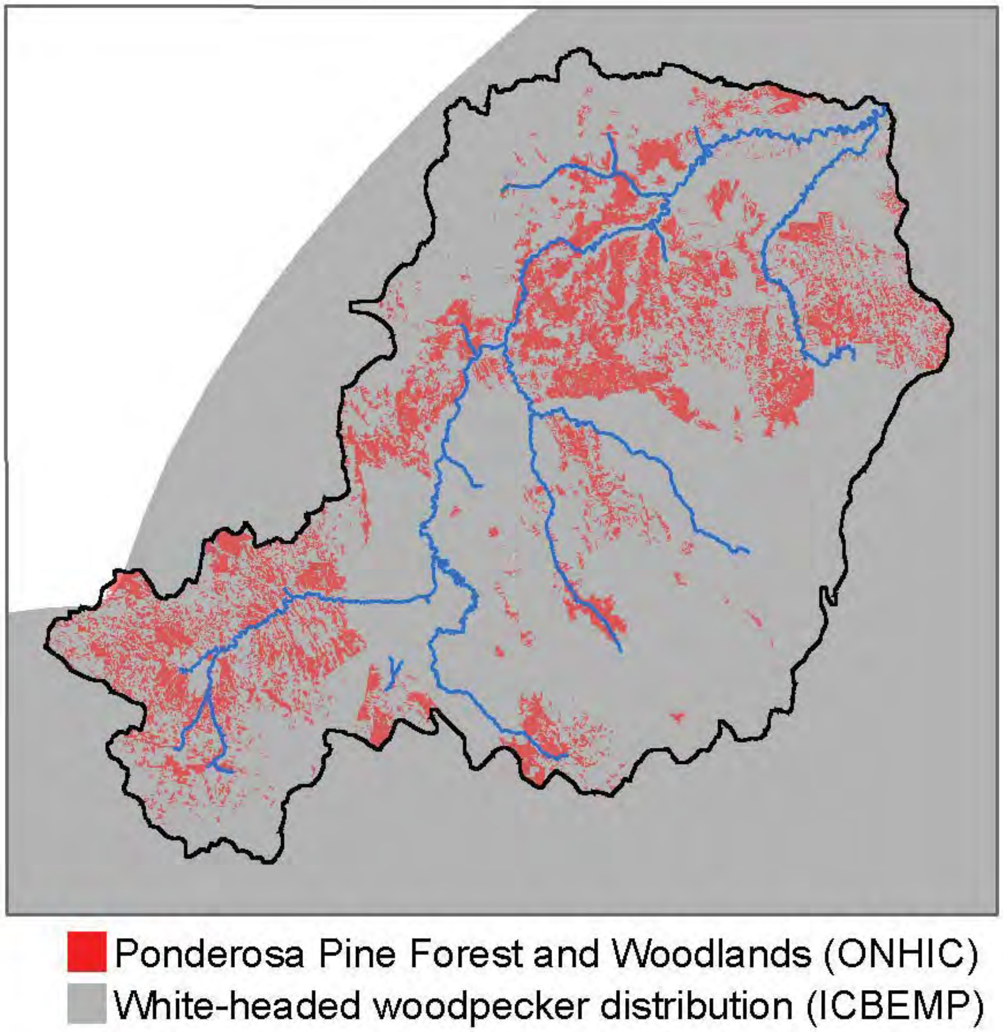


Figure 36. Potential distribution of white-headed woodpecker (gray) and distribution of ponderosa pine forest habitat (red) of white-headed woodpecker in the Grande Ronde subbasin.

3.2.4.4.7 Limiting Factors

Nesting and foraging requirements are the two critical habitat attributes limiting the population growth of this species of woodpecker. Both of these limiting factors are very closely linked to the habitat attributes contained within mature open stands of Ponderosa pine. Past land use practices, including logging and fire suppression, have resulted in significant changes to the forest structure within the Ponderosa pine ecosystem.

Fire suppression has altered the stand structure in many of the forests in the Grande Ronde subbasin. Lack of fire has allowed dense stands of immature ponderosa pine as well as the more shade tolerant Douglas-fir to establish. This has led to increased fuel loads resulting in more severe stand replacing fires where both the mature cone producing trees and the large suitable snags are destroyed. These dense stands of immature trees has also led to increased competition for nutrients as well as a slow change from a Ponderosa pine climax forest to a Douglas-fir dominated climax forest.

3.2.4.4.8 Habitats Currently Protected on Public and Private Lands

Ponderosa pine forests in the subbasin are largely unprotected (53%) or have a low level of protection (39%). Just 8% of this habitat is in medium or high protection status (status definitions page 223).

3.2.4.4.9 Potential and Projected Future Condition with No Further Actions

3.2.4.5 Olive-sided Flycatcher (Contopus cooperi) Keith Paul, USFWS

3.2.4.5.1 Life History

The olive-sided flycatcher (OSF) is one of the most recognizable breeding birds of Oregon's coniferous forests with its resounding, three-syllable, whistled song *quick, three beers*. OSFs prey almost exclusively on flying insects including flying ants, beetles, moths, and dragonflies, but with a particular preference for bees and wasps (Bent 1942, cited in Altman 2003).

Nest building is most evident during the first and second week of June, but completed nests have been reported as early as May 27 (Altman 2000). The nest area is aggressively defended by both members of the pair. OSFs are monogamous. They produce 3-4 eggs per clutch and one clutch per pair.

3.2.4.5.2 Habitat

The OSF breeds only in coniferous forests of North America and is associated with forest openings and forest edge. During migration OSFs have been observed in a great diversity of habitats compared to that of the breeding season, including lowland riparian, mixed or deciduous riparian at higher elevations and urban woodlots and forest patches. Olive-sided flycatchers have been observed moving north through sagebrush flats in Malheur and Harney Counties, OR (M. Denny, pers. comm.; Altman 2003). They winter in tropical forests of Central and South America.

3.2.4.5.3 Present Distribution

The olive-sided flycatcher breeds only in coniferous forests of North America. In Oregon, breeds in low densities throughout conifer forests from near sea level along the coast to timberline in the Cascades and Blue Mountains. It may be found in conifer forest habitat throughout the Grande Ronde subbasin (

).

3.2.4.5.4 Current Population Data and Status

Population trends for OSF based on Breeding Bird Surveys (BBS) data show highly significant declines for all continental (N. America), national (U.S. and Canada), and regional (e. and w. N. America) analyses, and for most state and physiographic region analyses (Sauer et al. 1997). In Oregon, there has been a highly significant ($p < 0.01$) statewide decline of 5.1% per year from 1966-96 (Altman 2003).

Table 39. Breeding Bird Survey (BBS) Routes in the Grande Ronde subbasin and Olive-sided Flycatchers detected on those routes 1986-2003 (Sauer et al. 1997).

BBS Survey Route	Years	Number Detected
Howard Meadows 69206	1992-94, 96, 98-2003	13, 12, 10, 15, 3, 3, 3, 3, 7, 7
Flora 69007	1986-2003	5, 6, 0, 0, 0, 0, 14, 12, 23, 20, 13, 21, 18, 19, 7, 14, 11, 8
Troy 69207	1992-98, 2000-02	3, 3, 3, 3, 0, 3, 3, 2, 1, 1

3.2.4.5.5 Historic Habitat Distribution

3.2.4.5.6 Current Habitat Distribution

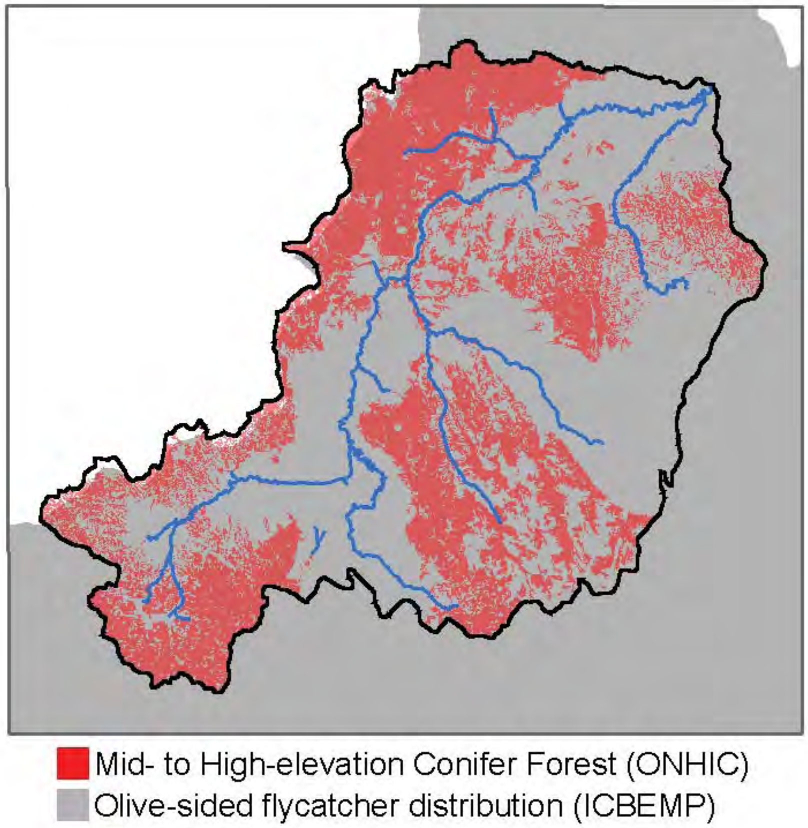


Figure 37. Potential distribution of olive-sided flycatcher (gray) and distribution of conifer forest habitat (red) of olive-sided flycatcher in the Grande Ronde subbasin.

3.2.4.5.7 Limiting Factors

Causes of population decline have focused on habitat alteration and loss on the wintering grounds, because declines are relatively consistent throughout the breeding range of the species (Altman and Sallabanks 2000). Other factors potentially contributing to declines on the breeding grounds include habitat loss through logging, alteration of habitat from forest management practices (e.g., clearcutting, fire suppression), lack of food resources, and reproductive impacts from nest predation or parasitism (Altman 2003). It has also been speculated that the olive-sided flycatcher may depend on early post-fire habitat, and has likely been negatively affected by fire-control policies of the past 50-100 years (Hutto 1995a).

3.2.4.5.8 Habitats Currently Protected on Public and Private Lands

Mid- to high-elevation conifer forests in the subbasin are afforded some protection from development although about 20% of them have no protection (status definitions page 223). About 51% of these habitats are in the low protection status, 2% in medium protection and 27% are in high protection status. Those areas with low protection are primarily in the National Forests.

3.2.4.5.9 Potential and Projected Future Condition with No Further Actions

3.2.4.6 Yellow Warbler Population (Dendroica petechia) P. Ashley and S. Stovall, WDFW

3.2.4.6.1 Life History

The yellow warbler is a common species strongly associated with riparian and wet deciduous habitats throughout its North American range. It occurs along most riverine systems, including the Grande Ronde River, where appropriate riparian habitats have been protected. The yellow warbler is a good indicator of functional subcanopy/shrub habitats in riparian areas.

Yellow warblers capture and consume a variety of insect and arthropod species. The species taken vary geographically. Yellow warblers consume insects and occasionally wild berries (Lowther et al. 1999). Food is obtained by gleaning from subcanopy vegetation; the species also sallies and hovers to a much lesser extent (Lowther et al. 1999) capturing a variety of flying insects.

Pair formation and nest construction may begin within a few days of arrival at the breeding site (Lowther et al. 1999). The responsibility of incubation, construction of the nest and most feeding of the young lies with the female, while the male contributes more as the young develop.

3.2.4.6.2 Habitat

The yellow warbler is a riparian obligate species most strongly associated with wetland habitats and deciduous tree cover. Yellow warbler abundance is positively associated with deciduous tree basal area, and bare ground; abundance is negatively associated with mean canopy cover, and cover of Douglas-fir (*Pseudotsuga menziesii*), Oregon grape (*Berberis nervosa*), mosses, swordfern (Polystuchum munitum), blackberry (*Rubus discolor*), hazel (*Corylus cornuta*), and oceanspray (*Holodiscus discolor*; Rolph 1998).

3.2.4.6.3 Present Distribution

The yellow warbler breeds across much of the North American continent, from Alaska to Newfoundland, south to western South Carolina and northern Georgia, and west through parts of the southwest to the Pacific coast (AOU 1998). This species is a long-distance migrant and has a winter range extending from western Mexico south to the Amazon lowlands in Brazil (AOU 1998). Neither the breeding nor winter ranges appear to have changed (Lowther et al. 1999).

3.2.4.6.4 Current Population Data and Status

Yellow warblers are demonstrably secure globally. Yellow warbler is one of the more common warblers in North America (Lowther et al. 1999). Information from Breeding Bird Surveys indicates that the population is stable in most areas.

3.2.4.6.5 Historic Habitat Distribution

3.2.4.6.6 Current Habitat Distribution

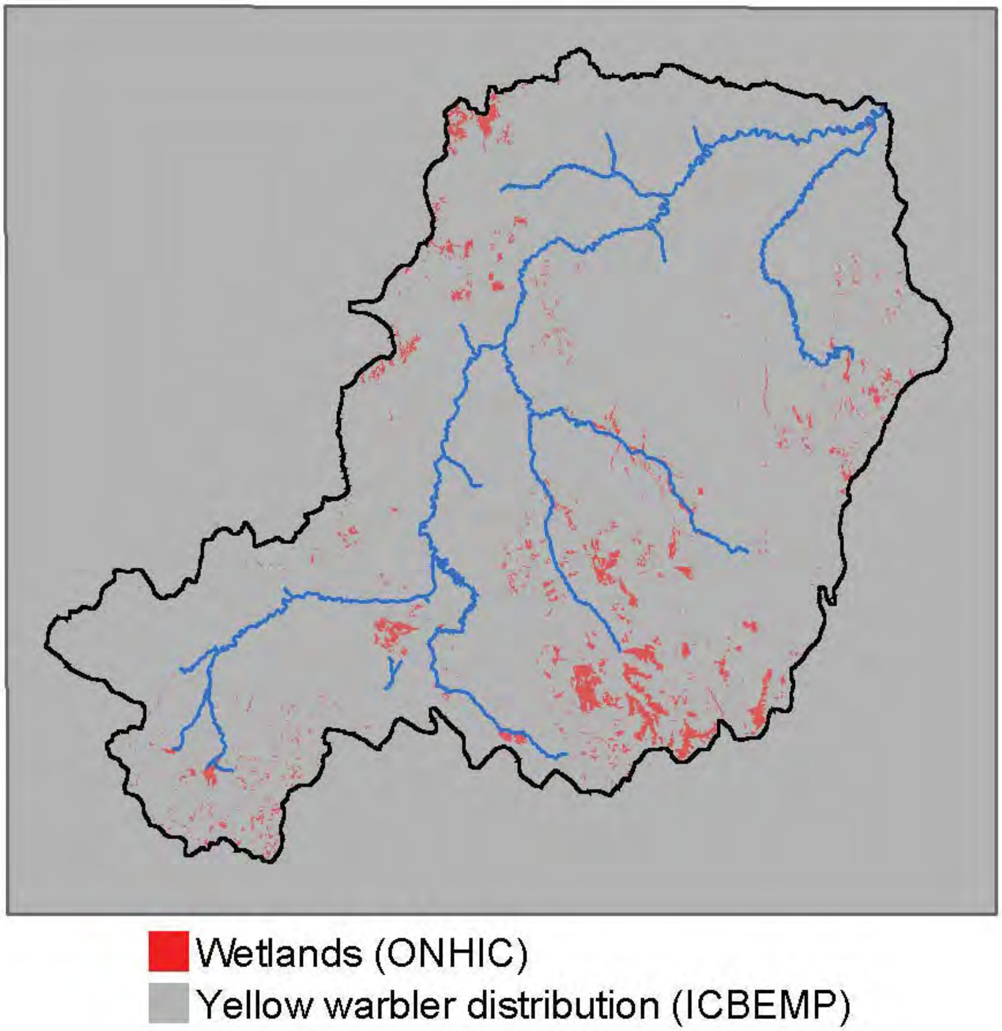


Figure 38. Potential distribution of yellow warbler (gray) and distribution of wetland habitat (red) in the Grande Ronde subbasin.

3.2.4.6.7 Limiting Factors

Habitat loss due to hydrological diversions and control of natural flooding regimes (e.g., dams) resulting in reduction of overall area of riparian habitat, conversion of riparian habitats, inundation from impoundments, cutting and spraying for ease of access to water courses, gravel mining, etc.

Habitat degradation from: loss of vertical stratification in riparian vegetation, lack of recruitment of young cottonwoods, ash, willows, and other subcanopy species; stream bank stabilization (e.g., riprap) which narrows stream channel, reduces the flood zone, and reduces extent of riparian vegetation; invasion of exotic species such as reed canary grass and blackberry; overgrazing which can reduce understory cover; reductions in riparian corridor widths which may decrease suitability of the habitat and may increase encroachment of nest predators and nest parasites to the interior of the stand.

Hostile landscapes, particularly those in proximity to agricultural and residential areas, may have high density of nest parasites (brown-headed cowbird) and domestic predators (cats), and be subject to high levels of human disturbance.

Increased use of pesticide and herbicides associated with agricultural practices may reduce insect food base.

3.2.4.6.8 Habitats Currently Protected on Public and Private Lands

Of the combined wetland and riparian areas in the subbasin, 27% are unprotected, 23% are in low protection, 1% are in medium protection and 49% are highly protected (status definitions page 223).

3.2.4.6.9 Potential and Projected Future Condition with No Further Actions

3.2.4.7 Sage Sparrow (Amphispiza belli) Paul Ashley and Stacey Stovall, WDFW

3.2.4.7.1 Life History

Sage sparrow is a species of concern in the West due to population decline in some regions and the degradation and loss of breeding and wintering habitats. Vulnerable to loss and fragmentation of sagebrush habitat, sage sparrows may require large patches for breeding. Sage sparrow can likely persist with moderate grazing and other land management activities that maintain sagebrush cover and the integrity of native vegetation.

3.2.4.7.2 Habitat

Similar to other shrub-steppe obligate species, sage sparrows are associated with habitats dominated by big sagebrush (*Artemisia tridentata*) and perennial bunchgrasses (Paige and Ritter 1999). In shrub-steppe habitat in southwestern Idaho, habitat occupancy by sage sparrows increased with increasing spatial similarity of sites, shrub patch size, and sagebrush cover; landscape features were more important in predicting presence of sage sparrows than cover values of shrub species and presence of sagebrush was more important than shadscale (Knick and Rotenberry 1995).

3.2.4.7.3 Present Distribution

During the breeding season, sage sparrows are found in central Washington, eastern Oregon, southern Idaho, southwestern Wyoming, and northwestern Colorado south to southern California, central Baja California, southern Nevada, southwestern Utah, northeastern Arizona, and northwestern New Mexico (AOU 1983; Martin and Carlson 1998).

During the non-breeding season, sage sparrows are found in central California, central Nevada, southwestern Utah, northern Arizona, and central New Mexico south to central Baja California, northwestern mainland of Mexico, and western Texas (AOU 1983; Martin and Carlson 1998).

3.2.4.7.4 Current Population Data and Status

North American Breeding Bird Survey (BBS) data indicate that sage sparrows have declined 1.0-2.3 percent in recent decades (1966-1991); greatest declines have occurred in Arizona, Idaho, and Washington (Martin and Carlson 1998). Sage sparrows are listed by the Oregon-Washington chapter of Partners in Flight as a priority species, and on the National Audubon Society Watch List.

3.2.4.7.5 Historic Habitat Distribution

3.2.4.7.6 Current Habitat Distribution

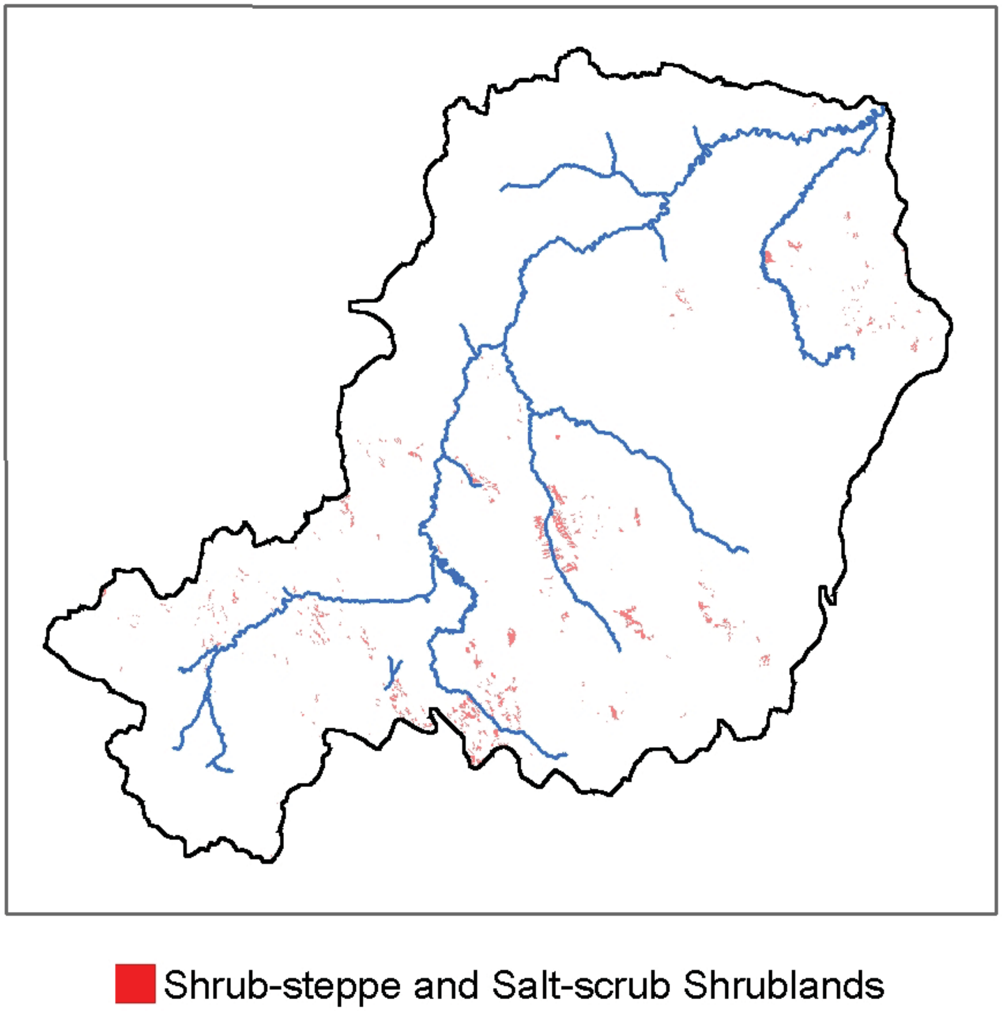


Figure 39. Current distribution of potential habitat for sage sparrow in the Grande Ronde subbasin.

3.2.4.7.7 Limiting Factors

Habitat Loss

Sage sparrows are shrub-steppe obligates. Sagebrush shrublands are vulnerable to a number of activities that reduce or fragment sagebrush habitat, including land conversion to tilled agriculture, urban and suburban development, and road and powerline rights of way. Range improvement programs remove sagebrush by burning, herbicide application, and mechanical treatment, replacing sagebrush with annual grassland to promote forage for livestock.

Response to variation in grazing intensity is mixed. Sage sparrows respond negatively to heavy grazing of greasewood/Great Basin wild rye and shadscale/Indian ricegrass communities. They respond positively to heavy grazing of Nevada bluegrass/sedge communities, moderate grazing of big sage/bluebunch wheatgrass community, and to unspecified grazing intensity of big sage communities (see review by Saab et al. 1995).

Cheatgrass has altered the natural fire regime in the western range, increasing the frequency, intensity, and size of range fires. Fire kills sagebrush and, where non-native grasses dominate, the landscape can be converted to annual grassland as the fire cycle escalates, removing habitat for sage sparrow (Paige and Ritter 1998).

Sage sparrow is an occasional host for brown-headed cowbird (*Molothrus ater*), and may abandon the nest (e.g., see Reynolds 1981).

In Oregon, predation by Townsend ground squirrel (*Spermophilus townsendi*) affected sage sparrow reproductive success when squirrel densities were high. Feral cats near human habitations may increase predation (Martin and Carlson 1998).

3.2.4.7.8 Habitats Currently Protected on Public and Private Lands

About 47% of shrub-steppe habitat in the subbasin is unprotected (status definitions page 223), 19% is in low protected status, 3% in medium protection and 31% is in high protected status.

3.2.4.7.9 Potential and Projected Future Condition with No Further Actions

3.2.4.8 Western Meadowlark (Sturnella neglecta) Keith Paul, USFWS

3.2.4.8.1 Life History

The western meadowlark (WM) is one of the most familiar and endearing avian images of grass- or sagebrush-dominated habitats throughout Oregon. WMs take mostly insects in late spring and summer, seeds in the fall, and where available, grain in winter and early spring (Altman 2003). They eat beetles, crickets, grasshoppers, caterpillars, craneflies, sow bugs, spiders, snails, a few bird eggs, and some carrion (Csuti et al. 1997).

Most nesting begins in late April, with the peak of nesting activity throughout May, although there is an early egg date of April 3 (Gabrielson and Jewett 1940). In eastern Oregon, migrants first arrive in late February and most are on territories by April (Gilligan et al. 1994).

3.2.4.8.2 Habitat

WMs use a variety of habitats including grasslands, savanna, cultivated fields, and pastures (Subtropical and Temperate zones; AOU 1998). They prefer high forb and grass cover, low to moderate litter cover, and little or no woody cover (Sample 1989, Kimmel et al. 1992, Anstey et al. 1995, Hull et al. 1996, Madden 1996). In shrub-steppe and desert grasslands, WMs prefer mesic areas; low shrub cover and density; patchiness in vegetative structure and in heights of forbs and shrubs; and high coverage of grass, forb, and litter (Lanyon 1962, Rotenberry and Wiens 1980, Wiens and Rotenberry 1981, Wiens et al. 1987, McAdoo et al. 1989, Knick and Rotenberry 1995).

3.2.4.8.3 Present Distribution

The WM breeds in grassland and shrub-grassland habitats south from c. British Columbia, east to w. Ontario and n. Minnesota, Michigan, and Wisconsin, south through the eastern edge of the Great Plains to westcentral Texas, and west through northwest Sonora, Mexico to northwest Baja California (Lanyon 1994). In eastern Oregon, WMs enjoy a ubiquitous breeding distribution throughout unforested habitat up to 6,000 ft (1,830 m; Gilligan et al. 1994), and they are one of the most common breeding species in all habitat types in shrub-steppe country (Altman 2003).

3.2.4.8.4 Current Population Data and Status

Population trends in Oregon based on BBS data indicate relatively stable long-term (1966-96) trends (1%/year decline, but non-significant ($p<0.01$) short-term (1980-96) declining trends (2.9%/year) (Sauer et al. 1997). Population trends based on Christmas Bird Count (CBC) data also indicate declining populations (Altman 2003).

3.2.4.8.5 Historic Habitat Distribution

3.2.4.8.6 Current Habitat Distribution

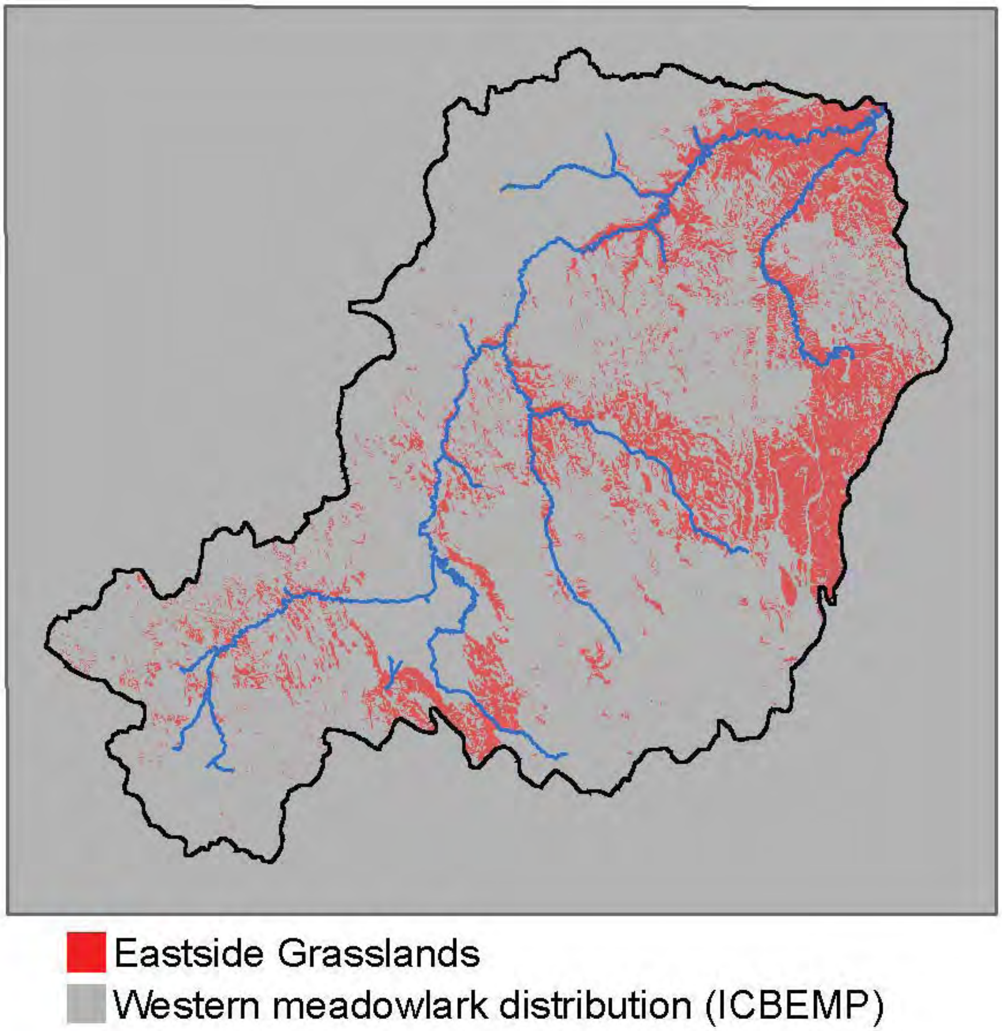


Figure 40. Potential distribution of western meadowlark and distribution of eastside grassland habitat of western meadowlark in the Grande Ronde subbasin.

3.2.4.8.7 Limiting Factors

Factors suspected to contribute to declines include conversion of native grasslands and shrub-steppe to non-suitable agriculture (e.g., rowcrops); habitat degradation from grazing; mortality at nest from trampling by livestock and agricultural practices such as mowing; a high degree of sensitivity to human disturbance near nest sites; and potential reproductive failures from use of pesticides or other contaminants (Lanyon 1994).

3.2.4.8.8 Habitats Currently Protected on Public and Private Lands

Eastside grasslands are largely unprotected in the subbasin. Less than 9% of this habitat is in high or medium protection status (status definitions page 223) while 13% is in low protection and 79% has no protection. Meadow larks also use shrub-steppe habitat which is somewhat more protected.

3.2.4.8.9 Potential and Projected Future Condition with No Further Actions

3.2.4.9 American Beaver (Castor canadensis) Keith Paul, USFWS and M. Cathy Nowak, CTWC.

3.2.4.9.1 Life History

An adult Castor canadensis is 90-117 cm long, and weighs between 13 and 35 kg. Beavers have a dark brown coat with long glossy guard hairs overlying a very dense, insulating undercoat.

Beavers are herbivorous. In summer, a variety of green herbaceous vegetation, especially aquatic species, is eaten (Jenkins and Busher 1979; Svendsen 1980, cited in Verts and Carraway 1998). In autumn and winter as green herbaceous vegetation disappears, beavers shift their diet to stems, leaves, twigs, and bark of many of the woody species that grow near the water (Verts and Carraway 1998).

3.2.4.9.2 Habitat

The beaver almost always is associated with riparian or lacustrine habitats bordered by a zone of trees, especially cottonwood and aspen (Populus), willow (Salix), alder (Alnus), and maple (Acer) (Verts and Carraway 1998). Small streams with a constant flow of water that meander through relatively flat terrain in fertile valleys and are subject to being dammed seem especially productive of beavers (Hill 1982, cited in Verts and Carraway 1998).

3.2.4.9.3 Present Distribution

Beavers are found throughout all of North America except for the northern regions of Canada, the deserts of the southern United States, Mexico, and Florida. (Frazier, 1996). In Oregon, the American beaver can be found in suitable habitats throughout the state (Verts and Carraway 1998).

3.2.4.9.4 Current Population Data and Status

Little is known of the actual population numbers of beaver in Oregon or in the Grande Ronde subbasin.

3.2.4.9.5 Historic Habitat Distribution

3.2.4.9.6 Current Habitat Distribution

3.2.4.9.7 Limiting Factors

Loss of woody, streamside vegetation for consumption and dam building. Potential for overharvest, especially in response to damage complaints.

3.2.4.9.8 Habitats Currently Protected on Public and Private Lands

Although 49% of combined wetland habitats within the subbasin are in high protection status, these are primarily the montane coniferous wetlands at higher elevations, many of which are located in Wilderness Areas. The wetlands utilized by beavers are mostly at lower elevations along lower gradient streams and enjoy a lower level of protection. About 27% of wetlands in the subbasin have no protection, 23% low protection and 1% medium protection; most habitat for American beaver enjoys little or no protection.

3.2.4.9.9 Potential and Projected Future Condition with No Further Actions

3.2.4.10 American Marten (Martes Americana) Charles Gobar, USFS

3.2.4.10.1 Life History

The American marten is a small carnivorous mammal about the size of a small house cat. Although males are larger than females, the sexes otherwise look alike. Martens consume a variety of foods including bird eggs and nestlings, insects, fish, mammals, fruits and berries (Buskirk and Ruggiero 1994). Martens tend to be shy and have been called “wilderness animals” (Thompson-Seton 1925 cited in Buskirk and Ruggiero 1994). They are flexible in their activity patterns and may be active at various times of the day or night (Hauptman 1979).

3.2.4.10.2 Habitat

The marten is a forest species capable of tolerating a variety of habitat types if food and cover are adequate (Strickland and Douglas 1987, cited in Verts and Carraway 1998). The threat of predation is thought to be strong in shaping habitat selection behavior by martens (Buskirk and Powell 1994). Martens associate closely with late-successional stands of mesic conifers, especially those with complex physical structure near the ground (Buskirk and Powell 1994).

There is no known published quantitative information regarding habitats used by martens in Oregon (Verts and Carraway 1998).

3.2.4.10.3 Present Distribution

In eastern Oregon, martens can be found in the Blue and Wallowa mountains (

Figure 41; Verts and Carraway 1998).

3.2.4.10.4 Current Population Data and Status

There are no estimates of density of martens for Oregon (Verts and Carraway 1998). Oregon Department of Fish and Wildlife has harvest data on marten.

3.2.4.10.5 Historic Habitat Distribution

3.2.4.10.6 Current Habitat Distribution

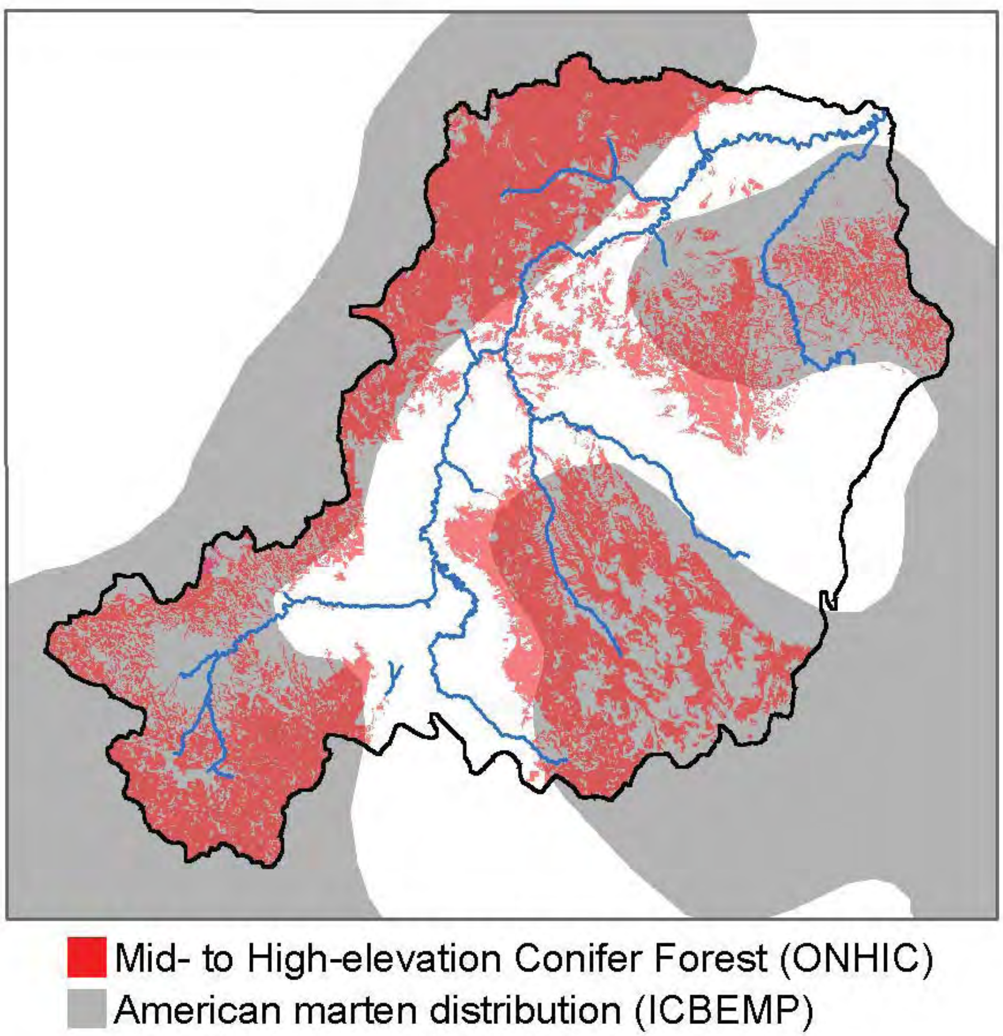


Figure 41. Potential distribution of American marten and distribution of conifer forest habitat of American marten in the Grande Ronde subbasin.

3.2.4.10.7 Limiting Factors

Extensive logging and forest fires reduce the value of areas to martens, sometimes for many years (Strickland and Douglas 1987, cited in Verts and Carraway 1998). In addition to these areas supporting fewer individuals, martens in these areas have shorter life spans, are less productive, and suffer higher natural and trapping mortality than those in undisturbed forest (Thompson 1994, cited in Verts and Carraway 1998). In addition, martens captured significantly less mass of food per kilometer of foraging travel in logged forests (Thompson and Colgan, 1994, cited in Verts and Carraway 1998).

3.2.4.10.8 Habitats Currently Protected on Public and Private Lands

Mid- to high-elevation conifer forests in the subbasin are afforded some protection from development although about 20% of them have no protection (status definitions page 223). About 51% of these habitats are in the low protection status, 2% in medium protection and 27% are in high protection status. Those areas with low protection are primarily in the National Forests.

3.2.4.10.9 Potential and Projected Future Condition with No Further Actions

3.2.4.11 Rocky Mountain Elk (Cervus elaphus) Paul Ashley and Stacey Stovall, WDFW

3.2.4.11.1 Life History

Rocky Mtn. elk are a common game species associated with forested habitats in the foothills and mountainous areas of the Blue Mountains of Washington and Oregon.

Elk are herbivores and year around main food sources can be categorized into three basic plant types; browse, grasses, and forbs. On predominately grass ranges, up to 90% of the summer diet can consist of grasses or grass like plants (Boyd 1970). In agricultural areas, elk are fond of peas, wheat, garbonzo beans, and oats, causing problems for farmers and wildlife personnel.

The elk rut, or breeding season, occurs in September to early October, with the peak of breeding in healthy populations occurring about the third week of September.

3.2.4.11.2 Habitat

The vegetative communities of the Blue Mountains are a mixture of forests and bunch-grasses on the ridges. The lowlands comprise mostly agricultural crops and range land. This combination of habitats is very attractive to elk.

3.2.4.11.3 Present Distribution

Elk are distributed throughout the foothills and higher elevations of the Blue Mountains (

Figure 42).

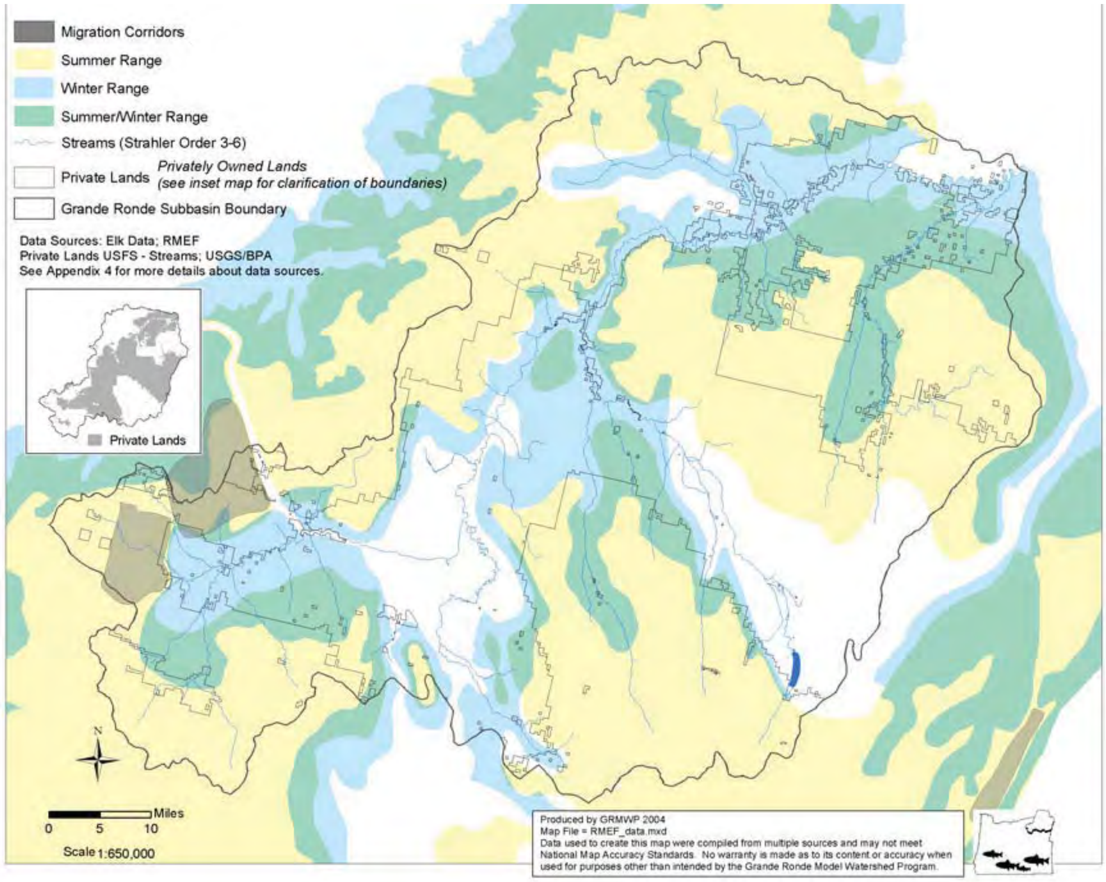


Figure 42. Rocky Mountain elk summer range, winter range and migration corridors in the Grande Ronde subbasin.

3.2.4.11.4 Current Population Data and Status

3.2.4.11.5 Historic Habitat Distribution

3.2.4.11.6 Current Habitat Distribution

3.2.4.11.7 Limiting Factors

Recent studies (Myers et. al. 1999) have documented how road densities, forage:cover ratios, stand composition, amount of edge, and opening size influence seasonal elk use, especially in the eastern Blue Mountains.

3.2.4.11.8 Habitats Currently Protected on Public and Private Lands

Rocky Mountain elk use a variety of habitats on public and private land. Agriculture, pasture and mixed environs are, by definition, largley (99%) unprotected. Other habitats used by elk including mixed conifer forest range from no protection to low protection (status definitions on page 223).

3.2.4.11.9 Potential and Projected Future Condition with No Further Actions

3.2.4.12 Mountain Goat (Oreamnos americanus) Keith Paul, USFWS and P. Matthews, ODFW

3.2.4.12.1 Life History

The only living species of its genus, *Oreamnos americanus* is closely related to the chamois (*Rupicapra rupicapra*) of Europe, and the serow (*Capricornus* sp.) and goral (*Naemorhedus* sp.) of Asia (Casebeer it al. 1950, Wigal and Coggins 1982, Chadwick 1983).

The Rocky Mountain goat (RMG) is stocky, with a slender neck, thin black horns, and a short tail. The feet are larger than those of mountain sheep, with oval hooves and prominent dew "claws." RMGs consequently are able to traverse weaker snow crusts than are mountain sheep (Geist 1971; Rideout and Hoffman 1975).

RMGs have a broad food tolerance and eat almost any forage including species not normally used by other ungulates (ODFW 2003). However, they tend to select flower-heads, buds, or foliage parts that are presumably more nutritious (Casebeer et al. 1950). Grasses are preferred in most areas and are used year round if available (Saunders 1955, Chadwick 1973, Smith 1976).

RMGs are polygamous and breed between early November and Mid-December (Geist 1964). Dominant males are very active, moving between herds in search of estrous females, and tending such females throughout their 2-3 day receptive period (DeBock 1970, Chadwick 1983).

3.2.4.12.2 Habitat

Mountain goat habitat varies throughout North America ranging from dense coastal forests at sea level in Alaska (Smith 1986) and British Columbia (Hebert and Turnbull 1977) to alpine basins in Colorado (Hibbs 1967) and Oregon (Matthews and Coggins 1994). Goat habitats are dominated by cliffs or extremely steep rocky slopes (Kerr 1965, Holroyd 1967, Johnson 1983, Chadwick1983). Cliff habitat is often broken by narrow chutes of talus or lush avalanche slopes. These steep rocky cliff areas are interspersed with or adjacent to less precipitous areas of quality forage. Sun and wind swept south to west facing slopes limit snow depth and provide greatest food availability during winter months. North and east facing slopes often have greater snow, water accumulations and provide succulent forage for summer utilization.

3.2.4.12.3 Present Distribution

As a result of reintroduction efforts mountain goats now exist in the Wallowa and Elkhorn Mountains and upper Hells Canyon (Figure 43).

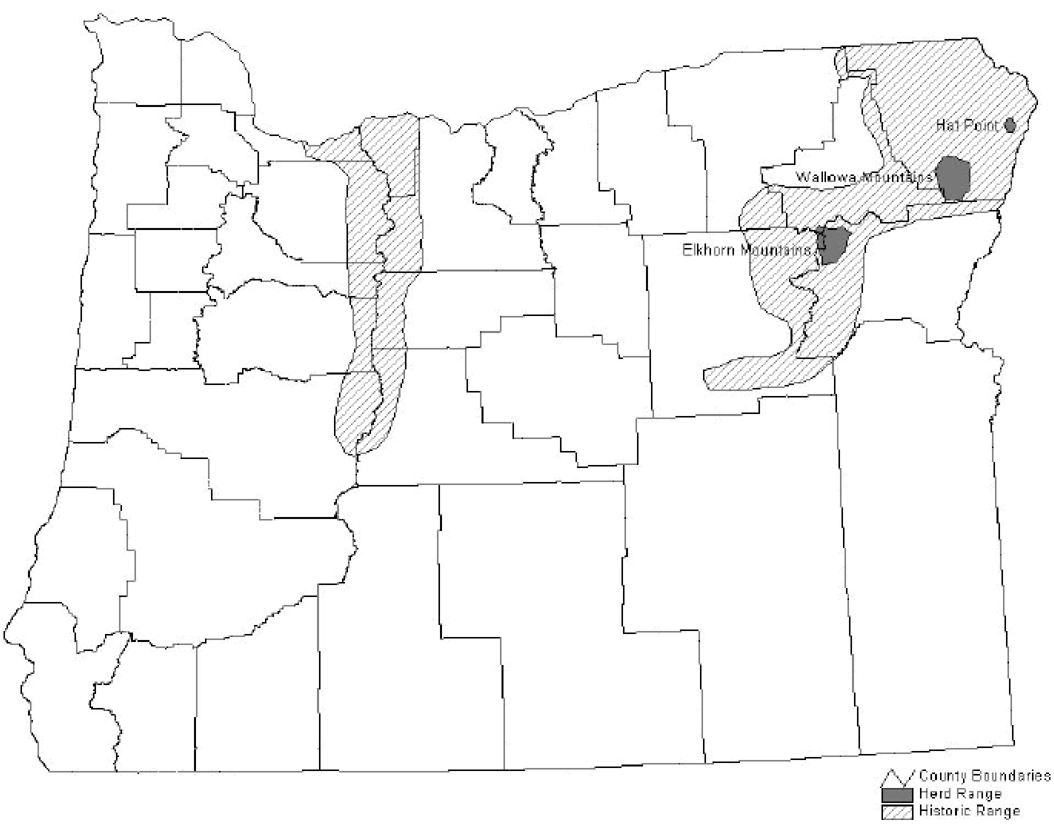


Figure 43. Current and historic distribution of Rocky Mountain goats in Oregon (ODFW 2003).

3.2.4.12.4 Current Population Data and Status

The 2003 population estimate for the Wallowa Mountains was 230 goats. Goats are beginning to pioneer vacant habitat adjacent to traditional core use areas, which will help to establish subpopulations throughout the Wallowa's. Habitat is available for an estimated 600 mountain goats in the Wallowa Mountains.

The 2003 population estimate for the Elkhorn Mountains was 150 goats. Individuals from this population continue to move into adjacent habitat including Vinegar Hill and the Strawberry Mountains. The Elkhorn's are capable of maintaining an estimated 200 goats.

Mountain goats transplanted to Hells Canyon in July 2000 and 2003 are continuing to be monitored. Reproduction in the Sluice Creek herd has been good and the population estimate for 2003 was 40 animals.

3.2.4.12.5 Historic Habitat Distribution

Probably no other large mammal has prompted more controversial discussions over its' historical presence in Oregon than has the Mountain goat. There are numerous reasons for the controversy; mountain goats have always occurred in remote, inaccessible, patchy, and disjunct habitats. The habitats where the mountain goat would have occurred were not areas the first American/European explorers, and settlers, would have normally been traveling, hunting, camping, or living in.

3.2.4.12.6 Current Habitat Distribution

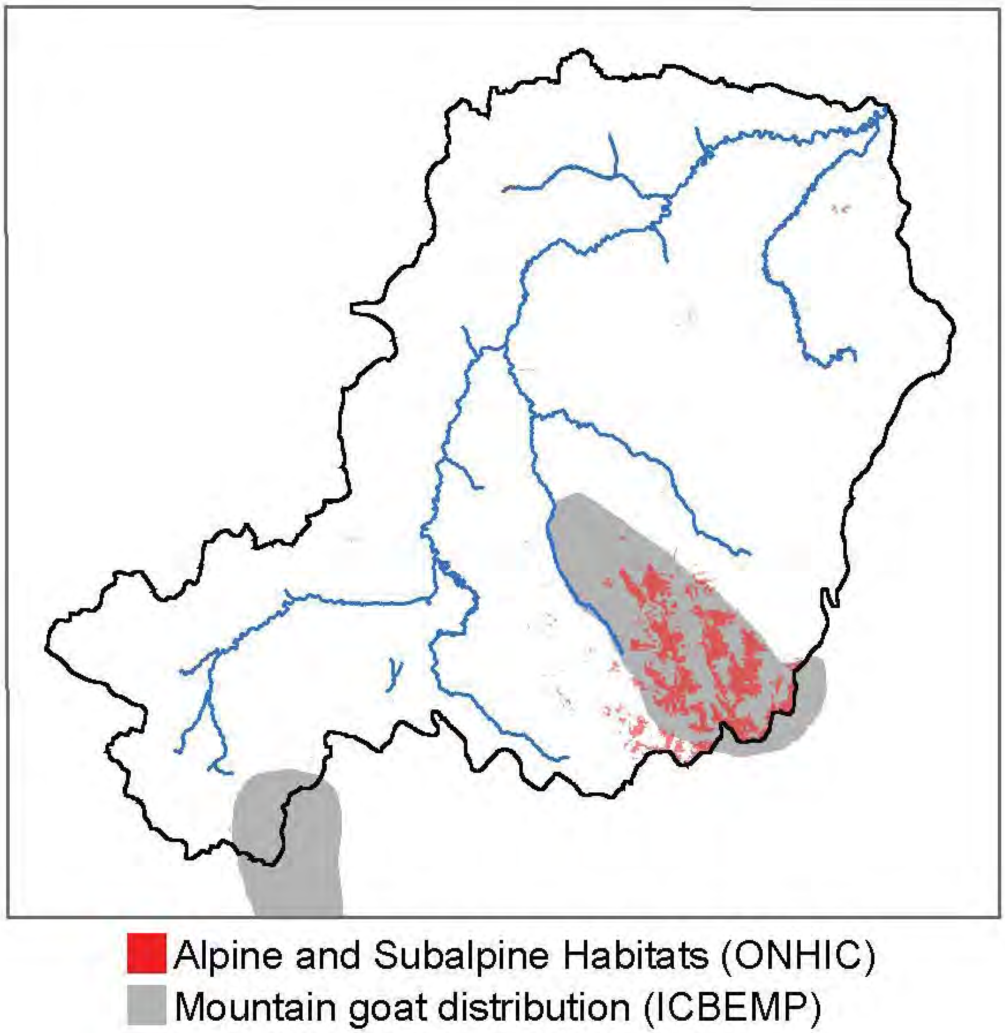


Figure 44. Potential distribution of mountain goats and current distribution of alpine and subalpine mountain goat habitat in the Grande Ronde subbasin.

3.2.4.12.7 Limiting Factors

Because of the habitats that goats prefer, very little landscape manipulation is possible. Therefore, habitat that is available for RMG should be protected (if not already) and human access to that habitat should be limited by discouraging trails and roads that allow motorized vehicles. In areas where monitoring indicates overuse of forage species, goat management may include density reduction, use of techniques to discourage goat use or redistribute animals, or protection of specific plant communities (ODFW).

Research in Oregon by Vaughan (1975), found that low productivity was more likely responsible for lack of population growth rather than high mortality. Research also indicates that RMG populations are very sensitive to over-harvest, and goats cannot sustain harvest rates typical of other ungulate species (Haywood et al. 1980, Adams and Bailey 1982, Gonzalez-Voyer et al. in press).

3.2.4.12.8 Habitats Currently Protected on Public and Private Lands

Combined alpine and subalpine habitats within the subbasin are highly protected. Nearly 96% of these habitats are in high protection status (staus definitions page 223); the remaining 4% is divided among medium, low and no protection. Most of the alpine and subapline habitats in the subbasin are within Wilderness Areas.

3.2.4.12.9 Potential and Projected Future Condition with No Further Actions

3.2.4.13 Rocky Mountain Bighorn Sheep (Ovis canadensis) Angela Sondenaa, Nez Perce Tribe.

Bighorn sheep is a game species in Oregon and the adjacent states of Washington and Idaho. Sportsmen consider it a premier game species but hunting opportunities are limited due to low population numbers. Once common in many parts of the Basin, bighorns were extirpated throughout the Northwest earlier in the century due to over harvest, disease, and habitat loss. Reintroduction efforts have brought bighorns back to the Columbia Basin but many populations remain small and isolated.

3.2.4.13.1 Life History

Bighorn sheep are opportunistic foragers that utilize whatever plant species are available to them (Todd 1972). The primary component of bighorn sheep diet is grasses, although forbs and shrubs may contribute significantly to the diet in some regions or seasons (Shackleton et al. 1999). Diet varies seasonally (Shackleton et al. 1999, and references therein) and among individuals (Hickey 1975), and sex classes (Shank 1982).

Mating occurs during the fall rut, which typically lasts from 2-3 weeks. Timing of the rut varies geographically. In Alberta, Canada females were in estrous from mid November through mid December (Geist 1971), while herds in the Steens and Hart Mountains of Oregon are estimated to begin the rut in mid-October and continue through November (Verts and Carraway 1998).

3.2.4.13.2 Habitat

Gregarious and extremely loyal to their home range, bighorns typically inhabit river canyons, talus slopes, cliffs, open meadows, and clear-cut or burned forests. The use of each habitat type varies seasonally and with requirements such as breeding, lambing, and thermal cover (Valdez and Krausman 1999). Habitat use also varies by sex with mature males occupying separate ranges from females, lambs, and immature rams. Males tend to inhabit areas of higher forage quality but greater predation risk, while maternal groups select habitat with greater security cover, even if this results in poorer forage quality or availability (Shackleton et al. 1999).

3.2.4.13.3 Present Distribution

Current distribution is restricted to four geographic areas within the Blue Mountains: Asotin Creek, Black Butte, Wenaha, and Cottonwood Creek (Fowler 1999). An additional 11 populations occur within northeast Oregon (Figure 45, ODFW 2003;

Figure 46).

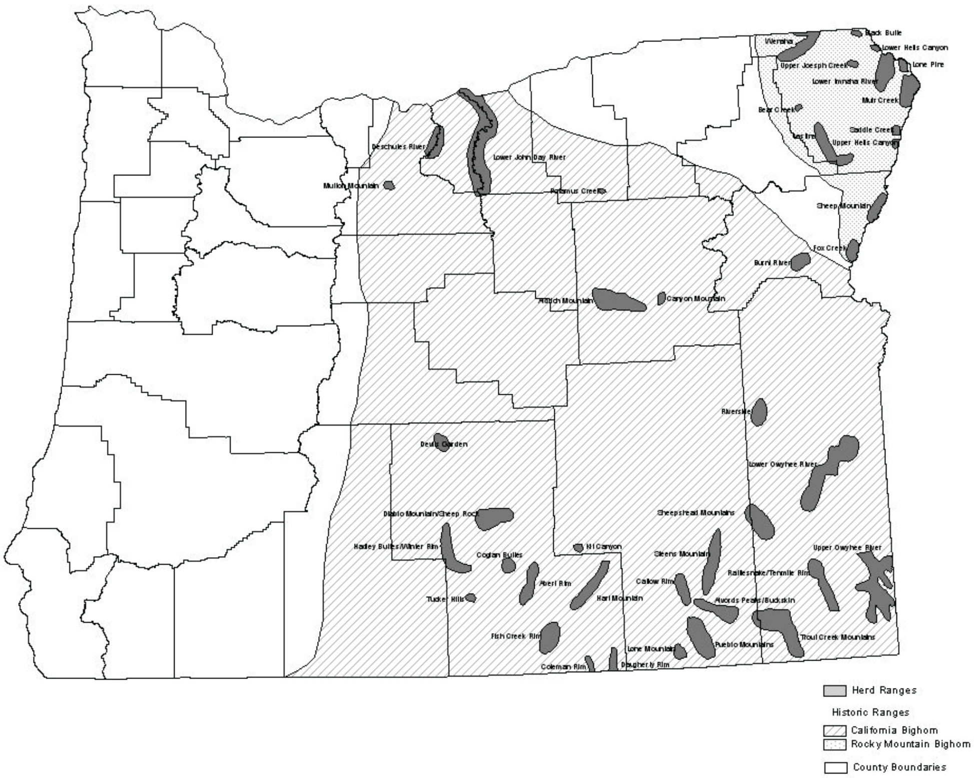


Figure 45. Historic and current distribution of Rocky Mountain and California bighorn sheep in Oregon (Adapted from Williams and Schommer 2001).

3.2.4.13.4 Current Population Data and Status

There are currently four extant Rocky Mountain bighorn sheep herds within the Blue Mountains of southeast Washington: Asotin Creek, Black Butte, Wenaha, and Cottonwood Creek (Fowler 1999). An additional 11 herds occur in northeast Oregon (Table 40.

Table 40. Bighorn sheep population status within or adjacent to the Grande Ronde Subbasin in NE Oregon and SE Washington (ODFW 2003, WDFW 2003).

Herd	# Releases (# animals)	2002-3 Pop. Estimate	Current Status
Asotin Creek	3 (25)	45[a]	Increasing
Bear-Minam	4 (48)	35	Static
Black Butte	No Data	80	?
Cottonwood Creek	No Data	27	Static
Fox Creek	2 (24)	90	Increasing
Lone Pine	None[b]	12	Increasing
Lostine	1 (20)	80	Increasing
Lower Hells Canyon	3 (45)	35	Increasing
Lower Imnaha	3 (36)	165	Increasing
Muir Creek	2 (27)	25	Declining
Saddle Creek	None	12	Increasing

Sheep Mountain	4 (42)	35	Static
Upper Hells Canyon	2 (54)	45	Static
Upper Joseph Canyon	None	40	Increasing
Wenaha	2 (430)	65	Static

a) P. Fowler, WDFW, Personal Communication, 2004.
b) Established by natural dispersal from other herds.

3.2.4.13.5 Historic Habitat Distribution

Historical distribution of bighorns in Washington State is not entirely clear (WDFW 1995), but there is general agreement that Rocky Mountain bighorns inhabited the Blue Mountains region where they occupied all suitable habitat within the rugged river canyons of the area. In Oregon, Rocky Mountain bighorn sheep occupied suitable habitat from the John Day-Burnt River divide north and east to the Snake River and the Oregon-Washington state line (Figure 45).

Much of the bighorns' historic range is no longer suitable habitat because urbanization, cultivation, and fire suppression have permanently changed it. Native shrub and grasslands that were used as winter range have been converted to agriculture, and many of the important source habitats such as whitebark pine forests have gone through a successional transition to Engleman spruce-subalpine fir forests (Wisdom et al. 2000). These closed canopy forests offer a decrease in available forage and poor visibility for predator detection and are not preferred habitat. Some cliff areas and corridors between winter and summer ranges are currently inaccessible because bighorns will not cross through dense stands of closed timber (Wisdom et al. 2000).

3.2.4.13.6 Current Habitat Distribution

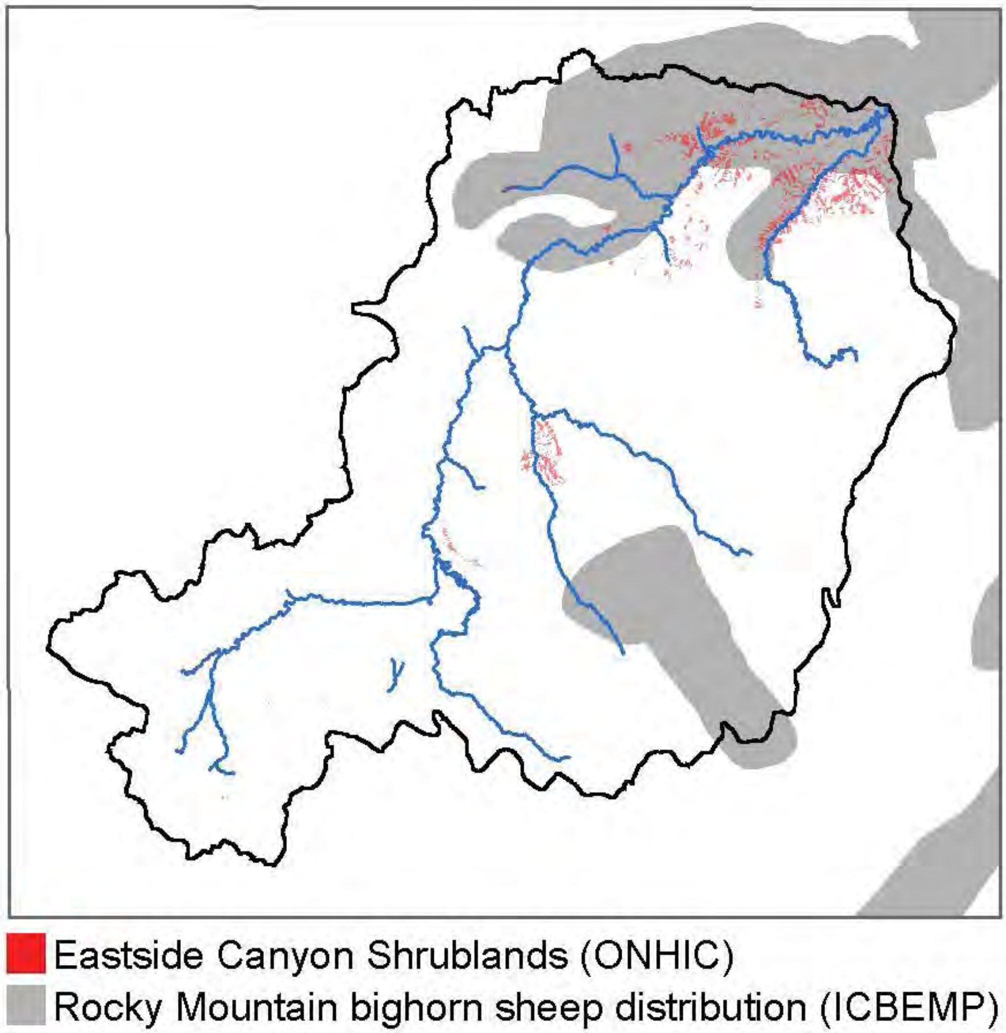


Figure 46. Potential distribution of Rocky Mountain bighorn sheep and current distribution of eastside canyon shrubland bighorn sheep habitat in the Grande Ronde subbasin.

3.2.4.13.7 Limiting Factors

Currently there are three key factors which threaten the successful re-establishment of a population of Rocky Mountain bighorn sheep in the Grande Ronde subbasin. They are: 1) the continuing threat of disease transmission from domestic sheep and goats; 2) a large portion of the bighorn sheep habitat not being in protected status and vulnerable to land management changes negative to bighorn sheep; and 3) the continued threat of noxious weed invasion on core Rocky Mountain bighorn sheep habitat in the Grande Ronde subbasin.

3.2.4.13.8 Habitats Currently Protected on Public and Private Lands

Eastside canyon shrublands are largely unprotected in the subbasin with 74% unprotected, 10% low protection, 3% medium protection and 13 in high protection status (status definitions page 223). Eastside grasslands are 79% unprotected, 13% low protection, 5% medium protection and 4% in high protection status.

3.2.4.13.9 Potential and Projected Future Condition with No Further Actions

3.2.5 Plant Focal Species

3.2.5.1 Quaking Aspen (Populus tremuloides)

Aspens reach 40-70 feet (12-21 m) in height, with a smooth, white trunk 1-2 feet (30-60 cm) in diameter. Aspens are deciduous with bright green, rounded leaves that turn yellow in the fall. Aspens flower early in the spring, producing small cones that split to release tiny, cottony seeds to be dispersed by the wind. Importantly, however, in the western U.S., reproduction is almost entirely vegetative. Suckers sprout from existing root systems; the aspen is a clone and it tends to grow in pure stands because of this reproductive strategy. In some areas, aspen is considered a "nurse crop" because of its tendency to shelter conifers and other broadleaf species which can, eventually take over the stand.

Distribution:

The aspen is the most widely distributed tree in North America (Johnson 1999; Figure 47). In the western U.S., distribution is disjunct based on suitable habitat, fire regime, and historic climatic variation (Johnson 1999).

Habitat Requirements:

Quaking aspen prefers sheltered sites (Farrar 1995). They prefer cool, relatively dry summers with ample sun, and winters with abundant snow to recharge soil moisture for growth during spring and early summer (Johnson 1999). Growth takes place at temperatures between 40° and 90° F (Johnson 1999). Quaking aspen occurs on a variety of soils although it seems to do best in moist, fertile loams with abundant calcium and a water table at 3 to 6 feet in depth (Mueggler 1984). Aspen stands often occur as islands or inclusions within other habitat types including mixed conifer, grassland and shrub-steppe types.

Figure 47. North American Distribution of Quaking Aspen (*Populus tremuloides*; Johnson 1999).

Limiting Factors:

Where aspen are present, nitrogen is, apparently, the most important factor limiting growth (Chen et al. 1998). Fire has historically been the disturbance factor that enabled aspen to out-compete taller, more shade-tolerant tree species. In post-fire habitats, aspen has the advantage over other tree species with its clonal reproduction; the root mass immediately puts energy into sprouting suckers which grow quickly in the open sun and nutrient rich soil (Johnson 1999). Fire suppression and the resultant increase in fire return interval has effectively eliminated this competitive advantage in some areas and allowed invasion of aspen stands by conifers.

When aspen sprouts occur, either by clonal or sexual reproduction, browsing by both native and non-native species slows or prevents recruitment to larger structural stages (Johnson 1999, M. Penninger, personal communication, 2/23/2004). As large trees grow older, decay and fall, young trees are unable to attain a height to escape browsing by ungulates and replace them. Conifers, less preferred by browsers and uncontrolled by fire, can then invade the stand and, eventually, shade out the sun-loving aspens.

3.2.5.2 Curlleaf Mountain Mohogany (Cercocarpus ledifolius)

Curlleaf mountain mahogany occurs as a shrub to small or medium-sized tree usually 3 to 20 feet (1- 7 m) high, but occasionally up to 45 feet (15 m) tall. The species is evergreen; it provides both cover and forage throughout the year. Trees may be extremely long-lived in the absence of external sources of mortality and are often by far the oldest members of the communities in which they occur (Ross 1999).

Distribution:

Curlleaf mountain mahogany is widely distributed in western North America. It occurs from Montana to Baja California and from southwest Oregon to the Bighorn Mountains in Wyoming. Mountain mahogany is found at elevations from 2,013 to 4,528 feet (610-1372 m) in the northern portion of its range including northeast Oregon.

Habitat Requirements:

Curlleaf mountain mahogany occurs on a variety of soils (Davis and Brotherson 1991). It is found on warm, dry, rocky slopes, ridges and outcrops; often in areas with little or no apparent soil development (Ross 1999). This species occurs in a variety of plant associations including sagebrush, pinyon/juniper, aspen, ponderosa pine, lodgepole pine and spruce/fir (Martin 1950, Ross 1999). Curlleaf mountain mahogany often occurs in isolated, pure patches that may become very dense (Marshall and McMurray 1995). In the Grande Ronde subbasin, it often occurs at the sagebrush-forest or grassland-forest ecotone.

Limiting Factors:

Curlleaf mountain mahogany reproduces by seed. Seed production is episodic but may be very high at times. In central Oregon, observations of 2 stands for 12 years showed 3 years of high seed production. Seed predation by insects may be nearly complete at times (Dealy 1975). Germination is sporadic, occurring usually on bare mineral soil and is very uncommon in established plant communities. The increase in cheatgrass and other annuals in much of its range have apparently reduced reproduction in many areas (Ross 1999).

First year seedling survival may be very low. In north-central Idaho, overall first-year survival was 25 % although survival increased to 45 % when seedlings were protected from browsing by big game and rabbits (Scheldt and Tisdale 1970). Curlleaf mountain mahogany is browsed by a variety of wildlife as well as domestic livestock. It is one of a few species that meet or exceed the protein requirements for wintering big game animals (Davis 1990). When germination does take place, browsing by both native and non-native species slows or prevents recruitment to larger structural stages (M.Penninger, personal communication 2/23/2004). As large trees grow older, decay and fall, young trees are unable to attain a height to escape browsing by ungulates and replace them.

Curlleaf mountain mahogany may depend on fire to reduce conifer competition and prepare the soil for seedling establishment (Bradley et al. 1992). However, individual plants are invariably killed by fire regardless of intensity and never resprout in spite of being considered a weak resprouter after fire. Even very light burns that do not appear to damage mature trees result in complete mortality within 1 year (Ross 2004).

The episodic nature of curlleaf mountain mahogany reproduction, episodic mortality due to fire and girdling by sapsuckers (Ross 2004) and heavy browsing of young trees by wildlife and domestic livestock may create even-age stands with little diversity of size or age class.

3.3. Out-of Subbasin Effects

3.3.1. Aquatic

Anadromous focal species in the Grande Ronde Subbasin are limited primarily by out-of-subbasin factors involving hydropower development, ocean productivity, predation and harvest. Hydropower development and operation increases mortality in Snake River stocks of spring/summer and fall Chinook. Fluctuations of ocean productivity in combination with the hydrosystem have caused severe declines in productivity and survival rates. Predation, especially within reservoirs, is also a potential limiting factor to salmonid smolts. Out of subbasin harvest is also a potential limiting factor for naturally produced Chinook and steelhead stocks within the subbasin.

It is generally accepted that hydropower development on the lower Snake River and Columbia River is the primary cause of decline and continued suppression of Snake River salmon and steelhead (WDFW et al. 1990; CBFWA 1991; NPPC 1992; NMFS 1995, 1997; NRC 1995; IDFG 1998; Williams et al. 1998). However, less agreement exists about whether the hydropower system is the primary factor limiting recovery (Mamorek et al. 1998).

Adult escapement of anadromous species to the Snake River basin remains relatively low despite significant hatchery production/reintroduction efforts. Smolt-to-adult return rates (SAR), from smolts at the uppermost dam to adults returning to the Columbia River mouth, averaged 5.2% in the 1960s before hydrosystem completion and only 1.2% from 1977-1994 (Petrosky et al. 2001) (Figure 1). This is below the 2%-6% needed for recovery (Mamorek et al. 1998).

In contrast to the decline in SAR, numbers of smolts per spawner from Snake River tributaries did not decrease during this period, averaging 62 smolts per spawner before hydrosystem completion and 100 smolts per spawner afterward (Petrosky et al. 2001; Figure 48). In this summary both spawner escapement and smolt yield are measured at the uppermost mainstem dam (currently Lower Granite). The increase in smolts per spawner was due to a reduction in density dependent mortality as spawner abundance declined. Accounting for density dependence, a modest decrease occurred in smolts per spawner from Snake River tributaries over this period, but not of a magnitude to explain the severe decline in life-cycle survival (Petrosky et al. 2001).

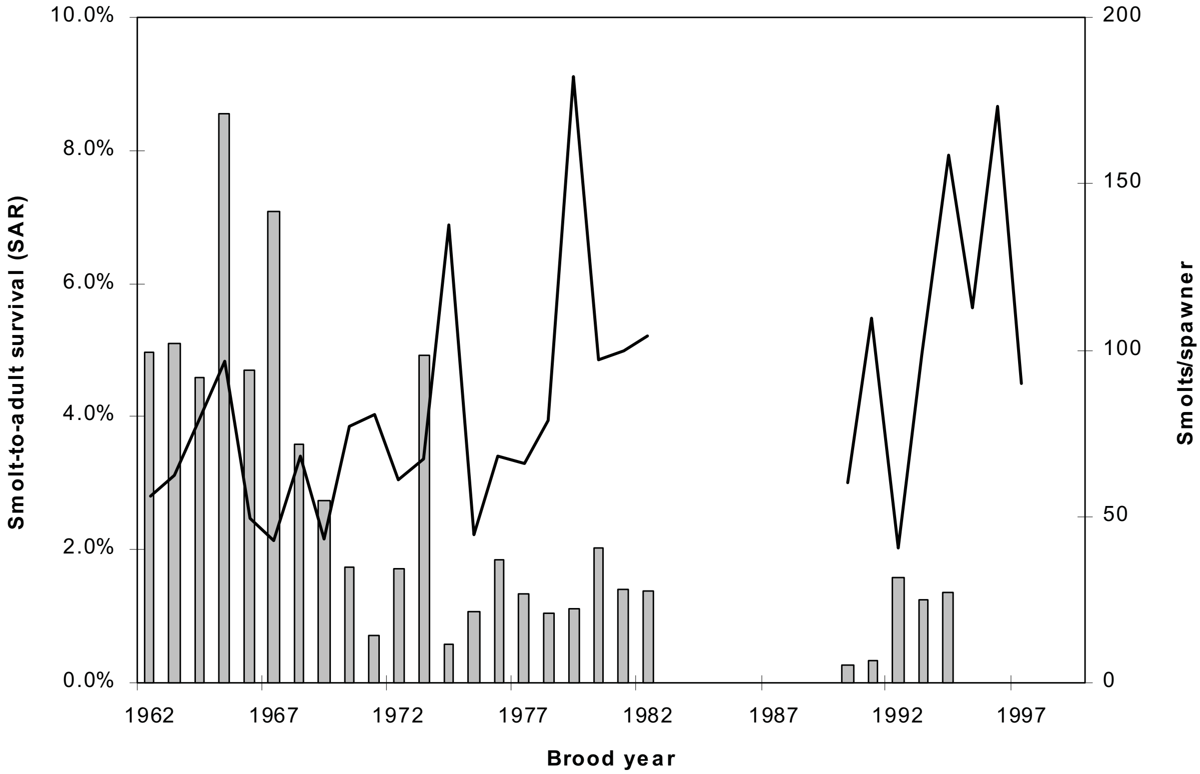


Figure 48. Smolt-to-adult survival rates (bars; SAR) and smolts/spawner (solid line) for wild Snake River spring and summer chinook. The SAR describes survival during mainstem downstream migration to adult returns whereas the number of smolts per spawner describes freshwater productivity in upstream freshwater spawning and rearing areas (from Petrosky et al. 2001).

The dams cause direct, indirect, or delayed mortality, mainly to emigrating juveniles (IDFG 1998, Nemeth and Kiefer 1999). As a result of this increased mortality, Snake River spring and summer Chinook declined at a greater rate than downriver stocks, coincident with completion of the federal hydropower system (Schaller et al. 1999). Schaller et al. (1999) concluded that factors other than hydropower development have not played a significant role in the differential decline in performance between upriver and downriver stocks. The Snake River stocks above eight dams survived one-third as well as downriver stocks migrating through 3 dams for this time period after taking into account factors common to both groups (Schaller et al. 1999; Deriso 2002). The additional decline in productivity of upriver stocks relative to downriver stocks indicates this portion of the mortality is related to factors unique to upriver stocks.

Patterns of Pacific Decadal Oscillation and salmon production would indicate that poor ocean conditions existed for Columbia River salmon after the late 1970s (Hare et al. 1999). However, the natural fluctuations of ocean productivity affecting all Columbia River stocks, in combination with mortality as a result of the hydrosystem, appear to have caused the severe declines in productivity and survival rates for the Snake River stocks. Temporal and spatial patterns of hatchery release numbers did not coincide with the differential changes in survival rates between upriver and downriver stocks (Schaller et al. 1999). Harvest rates were drastically reduced in the early 1970s, in response to declines in upriver stream-type Chinook abundance. Given that changes in smolts per spawner cannot explain the decreases in SAR or overall survival rates for Snake River stocks, it appears the altered migration corridor has had a strong influence on the mortality that causes these differences in stock performance.

The SAR and smolt per spawner observations (Figure 48) indicate that the overall survival decline is consistent primarily with hydrosystem impacts and poorer ocean (out-of-subbasin factors), rather than large-scale impacts within the subbasins between the 1960s and present (Schaller et al. 1999; Petrosky et al. 2001). Because the smolt/spawner data represent aggregate populations from a mix of habitat qualities throughout the Snake River basin, and are from a period after hydropower development, they do not imply there is no room for survival improvement within the Snake River subbasins. However, because of limiting factors outside the subbasins, and critically reduced life-cycle survival for populations even in pristine watersheds, it is unlikely that potential survival improvements within the Snake River subbasins alone can increase survival to a level that ensures recovery of anadromous fish populations

The Technical Outreach and Assistance Team (TOAST 2004) provides a regional overview of out of subbasin factors impacting anadromous fish in the Columbia Basin, including the Snake River. The TOAST (2004) utilized the most current studies and information reviewing mainstem passage effects on juvenile and adult salmonids to model hydrosystem effects on survival of anadromous fish. Juvenile survival through the mainstem Columbia and Snake rivers depends upon habitat quality and quantity, river flow, juvenile travel time, juvenile migration timing, dam survival, transportation survival, survival of naturally migrating fish, and competitive interactions with hatchery fish.

For example, survival of yearling Chinook migrating in-river from above Lower Granite Dam (past eight hydroelectric projects) averages 36% (88% per project) and subyearling Chinook in-river survival averages 29% (~85% per project). For juveniles that are transported, TOAST (2004) assumed 98% of the juveniles survive to the point of release (NMFS 2000 White Paper Transportation). However, once transported Snake River yearling and subyearling Chinook are released from the barges survival is 50% for yearlings (Bouwes et al. 1999) and 35% for subyearlings (PATH 1999) compared to that of juveniles migrating in-river, respectively.

Adult Chinook survival past each mainstem dam under current conditions was assumed to average 93% (PATH 2000). Thus, total adult survival through mainstem river reaches is highly dependent on the number of dams each adult must pass. For example, adult Chinook returning to the Grande Ronde Subbasin would have to pass eight mainstem dams, and thus their overall survival rate would be 56%. Historically, adult Chinook survival through the mainstem Columbia and Snake Rivers was assumed to average 92% (TOAST 2004). TOAST also incorporated impacts to survival in the estuary and ocean and through mainstem fisheries.

Smolt-to-Adult (SAR) survival rates of juvenile fish from the mouth of the subbasin to their return to the subbasin as adults were calculated from intermediate EDT results. Results of SAR rates calculated for fish that originated above Lower Granite Dam were:

- yearling Chinook juveniles - 0.9% with a range of 0.3% to 2.97%.
- subyearling Chinook - 0.4% with a range of 0.13% to 1.32%.
- steelhead juveniles – 1.69% with a range of 1.04% to 4.68%

TOAST (2004) compared the estimates of survival derived from EDT to actual smolt-to-adult survival estimates for spring Chinook (yearling) populations above Lower Granite Dam (C. Petrosky, Idaho Department of Fish and Game January 9, 2004 e-mail; Table 41). These data update the earlier run reconstruction data reported by Marmorek et al. (1998). Since 1992 (the period used for the Multi-Species Framework project), the SAR geometric mean has been 0.8% and with an SAR range of 0.19% to 3.0%. The SAR rates derived from EDT of 0.9% with a range of 0.3% to 2.97% is similar to the post 1992 geometric mean. Therefore, SAR rates derived from the EDT are probably a reasonable point estimate for yearling Chinook SARs for those life history types entering each of the mainstem Columbia/Snake river reservoirs.

Table 41. Estimated smolt to adult survival from Lower Granite Dam to Lower Granite Dam for spring Chinook and steelhead smolt outmigration years 1964-2000 based on run reconstruction. (C. Petrosky, Idaho Department of Fish and Game January 9, 2004 e-mail as cited in TOAST 2004).

Smolt Outmigration Year	Chinook SAR	Steelhead SAR
1964	2.35%	4.21%
1965	2.32%	3.68%
1966	2.31%	3.93%
1967	4.49%	4.01%
1968	2.58%	3.39%
1969	3.83%	3.66%
1970	1.92%	2.55%
1971	1.53%	2.27%
1972	1.02%	1.52%
1973	0.49%	0.63%
1974	1.39%	1.29%
1975	3.11%	1.84%
1976	0.92%	1.70%
1977	0.35%	0.90%
1978	0.98%	3.07%
1979	1.09%	3.18%
1980	0.55%	2.54%
1981	1.39%	1.11%
1982	1.70%	3.37%
1983	1.83%	2.63%
1984	2.56%	3.66%
1985		3.07%
1986		3.05%
1987		3.63%
1988		2.01%
1989		1.02%
1990		2.33%
1991		1.55%
1992	0.19%	1.04%
1993	0.38%	1.07%
1994	1.02%	1.18%
1995	0.31%	1.40%
1996	0.36%	1.61%
1997	1.72%	1.39%
1998	1.15%	1.89%
1999	2.91%	3.16%
2000	3.00%	4.68%

3.3.2. Terrestrial

3.3.2.1 Harvest

Although ODFW establishes species Management Objectives at the level of the Wildlife Management Unit, State- and range-wide consideration of population abundance, distribution and status is of primary importance in management of species for sustainable harvest. State-wide coordination of species management and harvest precludes the potential for undue influence of out-of-subbasin harvest on Grande Ronde subbasin managed species populations.

3.3.2.2 Hydropower

Reductions in naturally spawning, native anadromous fish populations may have undocumented and poorly understood effects on terrestrial species in the subbasin. Salmon provide enrichment to natal streams and the adjacent terrestrial environment through both direct consumption of carcasses and through decomposition. Salmon carcasses may be essential to the health of both aquatic and terrestrial systems. Salmon transport marine nutrients to natal streams, and deposit those nutrients as carcasses when they die. Salmon carcasses have been shown to increase production at several trophic levels in streams, including: periphyton production (Foggin and McClelland 1983; Kline et al. 1993; Schuldt and Hershey 1995), invertebrate production (Schuldt and Hershey 1995; Wipfli et al. 1998), and fish production (Bilby et al 1996; and Bilby et al. 1998). Nutrients from salmon are available through direct consumption by invertebrates, juvenile salmonids, and terrestrial animals or as dissolved nutrients following decomposition. Reductions in salmon biomass in natal streams may limit production at one or more trophic levels.

Salmon carcasses may be an essential source of nutrients for both aquatic and terrestrial communities. Willson and Halupka (1995) note that the availability of anadromous fish may be a critical factor in the survival and reproduction of some wildlife species. They note that wildlife species may change their distribution and breeding biology to capitalize on the abundance of anadromous fish. In addition, Cederholm (1989) described 22 species of mammals and birds that consumed coho salmon carcasses. In the Grande Ronde subbasin, a number of species including bald eagles, black bears and American marten consume salmon carcasses when they are available and others prey on live salmon, primarily juveniles and subadults.

Approximately 70 species in the subbasin have been identified as having some relationship, direct or indirect, with salmonids (IBIS 2004). Of these species, three are focal species in this planning effort: bald eagle, great blue heron and American marten. These species may feed on live fish or spawned-out carcasses or both. Changes in timing and abundance of available fish and or carcasses may have had and may continue to have an effect on the productivity of these species. Additionally, although not identified in IBIS, several other focal species may have been affected by reductions in marine-derived nutrients from migratory salmonids. Insect-eating birds such as the olive-sided flycatcher and yellow warbler may have suffered reductions in availability of insect prey due to reduced productivity of the ecosystem. Wetland and open water species such as the Columbia spotted frog and American beaver may be affected by reduced productivity of both invertebrates and vegetation with the loss of these nutrients.

3.3.2.3 Habitat

Loss of wintering habitat for neotropical migrant birds, including yellow warbler and olive-sided flycatcher, is thought to be an important factor limiting numbers of birds that return to the subbasin to breed. Such out-of-basin effects are likely to continue resulting in declines in populations occurring in the vicinity of the Grande Ronde subbasin.

Bald eagle wintering populations are influenced by alteration to breeding habitat and specific territories outside the subbasin. Throughout North America bald eagle breeding populations have been increasing due to intensive recovery efforts and, specifically, restrictions on the use of pesticides such as DDT. This pronounced out-of-subbasin effect will likely result in increased establishment of bald eagle breeding territories within the subbasin in the near future (K. Paul, USFWS Biologist, pers. comm.).

Species that may exhibit seasonal movements into adjacent regions outside of the subbasin are likely to experience out-of-subbasin effects similar to those factors influencing population dynamics within the subbasin. Most notably in regard to big game species included within this migrant category, degradation of shrub-steppe habitat resulting from juniper encroachment and subsequent elimination of shrub forage species in adjacent areas outside of the subbasin will increase pressure on herds to congregate in areas where suitable forage does exist. Adjacent subbasins and habitat in northeast Oregon are experiencing problems similar to those noted in the Grande Ronde subbasin. This continued trend will likely result in increased conflicts between regional migrant herd species and residents in agricultural and developed areas.

3.4 Environment/Population Relationships

3.4.1 Aquatic

See discussions in Section 3.2.3 *Focal Species Population Delineation and Characterization.*

3.4.2 Terrestrial

Terrestrial wildlife habitats in the Grande Ronde subbasin were considered based on the habitat types used by the Northwest Habitat Institute (NHI) in the Interactive Biodiversity Information System (IBIS) database. In some cases, the subbasin technical team combined two or more IBIS habitat types for discussion due to similarity of management issues and disturbance factors. The Grande Ronde terrestrial technical team believed the current and historic (pre-European settlement) acreages of several of the habitat types presented by IBIS were in error and, instead turned to data from the Oregon Natural Heritage Information Center (ONHIC; Table 42). These data were cross-walked by ONHIC from vegetation cover maps to the habitat types used by IBIS (Table 43 and Table 44). Further, the technical team made modifications to the ONHIC data based on professional judgment and local knowledge.

The scale of the available data makes it extremely difficult to precisely delineate the current size and extent of any specific wildlife habitat type. Similarly, the range of historic habitats can only be estimated and the scale is likewise very coarse. Therefore, within the time frame of this effort, the wildlife habitat acreages and trends resulting from the work of the subbasin Technical Team can not, with any level of certainty, be made any more accurate. While generally representative of the conditions in the subbasin, these acreages may not accurately demonstrate the direction and/or magnitude of change from historic times to the present day (Table 45). Discussions of habitat status and trends in this document are undertaken in the context of a primarily qualitative assessment based on the local knowledge and professional judgment of the subbasin terrestrial Technical Team.

Table 42. A comparison of habitat coverage based on data from the Oregon Natural Heritage Information Center (ONHIC) and the Interactive Biodiversity Information System (IBIS) of the Northwest Habitat Institute. Modifications were made to the ONHIC data by the subbasin Technical Team based on local knowledge.

NHI (IBIS) Code	Wildlife Habitat Class	ONHIC Historic Habitat – with modifications	ONHIC Current Habitat – with modifications	IBIS Historic Wildlife Habitat	IBIS Current Wildlife Habitat
1	Westside lowlands conifer-hardwood forest	0	0	0	0
4	Montane mixed conifer forest	255,445	89,013	74,379	190,877
5	Eastside (interior) mixed conifer forest	655,684	830,100	369,423	824,626
6	Lodgepole pine forest and woodlands	138,705	99,999	95,630	81
7	Ponderosa pine forest and woodlands	734,858	498,705	958,522	524,589
8	Upland aspen forest	153	53	13,097	0
9	Subalpine parkland	2,571	35,923	44,726	0
10	Alpine grassland and shrublands	23,609	32,138	14,826	93,255
13	Western juniper and mountain mahogany woodlands	176	687	11,614	678
14	Eastside (interior) canyon shrublands	15,292	35,696	0	67
15	Eastside (interior) grasslands	641,553	486,002	769,980	496,529
16	Shrub-steppe	1,558	15,030	227,831	163,816
17	Dwarf shrub-steppe	6,214	12,181	0	0
18	Desert playa and salt scrub shrublands	8,529	0	0	0
19	Agriculture, pasture and mixed environs	0	383,575	0	299,264
20	Urban and mixed environs	0	8,412	0	8,157
21	Open water - lakes, rivers, streams	9,486	7,045	5,189	6,289
22	Herbaceous wetlands	84,848	16,148	0	11,211
24	Montane coniferous wetlands	0	56,100	0	2,726
25	Eastside (interior) riparian wetlands	46,910	18,785	38,301	430
	Total Acres	2,625,590	2,625,591	2,623,518	2,622,595

Table 43. Historic habitat acreages derived by classifying the Oregon Natural Heritage Information System (ONHIC) Historic Vegetation Map into Interactive Biodiversity Information System (IBIS) Wildlife Habitat Classes (C. Noyes, Grande Ronde Model Watershed Program, Personal Communication, 1/28/2004).

IBIS Habitat Class Code & Description	ONHIC Vegetation Code & Description	Historic Acres
4- Montane mixed conifer	72 - Subalpine fir	255,445
5 – Eastside (interior) mixed conifer forest	20 – Douglas fir 25 – Grande fir 36 – Mixed conifer	5,524 421,334 228,826 655,684
6 – Lodgepole pine forest and woodlands	31 – Lodgepole pine	138,705
7 – Ponderosa pine forest and woodlands	50 – Ponderosa pine	734,858
8 – Upland aspen forest	7 – Quaking aspen	153
9 – Subalpine parkland	80 – Whitebark pine	2,571
10 – Alpine grassland and shrublands	3 – Alpine tundra – barren[1]	23,609
13 – Western juniper and mountain mahogany woodlands	75 – Western juniper woodland	176
14 – Eastside (interior) Canyon Shrublands	41 – Ninebark-snowberry[1]	15,292
15 – Eastside (interior) grasslands	15 – Bluebunch wheatgrass[2]	25,072
16 – Shrub-steppe	37 – Mountain big sagebrush 83 – Wyoming big sagebrush 84 – Wyoming big sagebrush-squawapple	464 763 330 1,558
17 – Dwarf shrub-steppe	56 – Rigid sagebrush	6,214
18 – Desert playa and salt scrub shrublands	10 – Basin wildrye 13 – Black greasewood	3,093 5,435 8,529
21 - Open water – lakes, rivers, streams	46 – Open water	9,486
22 – Herbaceous wetlands	77 – Wet meadow	84,848
25 – Eastside (interior) riparian wetlands	12 – Black cottonwood riparian woodland 27 – Hawthorn 58 – Riparian hardwoods 81 – Willows	3,832 28,700 4,159 10,218 46,910
Total Acres		2,625,590

[1] Changed wildlife habitat classification from Eastside (Interior) Riparian Wetlands to Eastside (interior) Canyon Shrublands.
[2] Based on information from the subbasin Technical Team, 16,997 acres classified by ONHIC as Idaho fescue in the Eagle Cap Wilderness Area were changed to alpine tundra-barren thus changing the habitat classification on those acres from Eastside (interior) Grasslands to Alpine Grasslands and Shrublands.

Table 44. Current habitat acreages derived by classifying the Oregon Natural Heritage Information System (ONHIC) Historic Vegetation Map into Interactive Biodiversity Information System (IBIS) Wildlife

Habitat Classes. Some classifications were modified by the subbasin Technical Team to better represent existing conditions (C. Noyes, Grande Ronde Model Watershed Program, Personal Communication, 1/28/2004).

IBIS Habitat Class Code & Description	ONHIC Vegetation Code & Description	Current Acres
4- Montane mixed conifer	72 - Subalpine fir 38 – Mountain hemlock	87,052 1,961 89,013
5 – Eastside (interior) mixed conifer forest	20 – Douglas fir 25 – Grande fir 36 – Mixed conifer 51 – Regenerating young forest[1] 70 – Western larch 74 – White fir 79 – Dead trees[1]	342,728 225,988 192,020 2,965 61,398 563 4,438 830,100
6 – Lodgepole pine forest and woodlands	31 – Lodgepole pine 72 – Western white pine	99,930 69 99,999
7 – Ponderosa pine forest and woodlands	50 – Ponderosa pine	498,705
8 – Upland aspen forest	7 – Quaking aspen	53
9 – Subalpine parkland	80 – Whitebark pine 61 – Sitka alder	35,919 4 35,923
10 – Alpine grassland and shrublands	3 – Alpine tundra – barren[2] 2 – Alpine communities	31,683 454 32,138
13 – Western juniper and mountain mahogany woodlands	75 – Western juniper scrubland	687
14 – Eastside (interior) canyon shrublands	11 – Canyon shrubland 33 – Mesic shrubland[3] 39 - Mountain mahogany	9,933 25,532 231 35,696
15 – Eastside (interior) grasslands	15 – Bluebunch wheatgrass grassland 21 – Forbland 40 – Native bunchgrass 82 – Idaho fescue grassland	198,978 2,707 59,034 225,284 486,002

IBIS Habitat Class Code & Description	ONHIC Vegetation Code & Description	Current Acres
16 – Shrub-steppe	37 – Mountain big sagebrush 83 – Wyoming big sagebrush 5 – Bitterbrush 29 – Lava 36 – Montane shrubland 58 – Shrubland	523 4,117 4,663 52 2,751 2,924 15,030
17 – Dwarf shrub-steppe	56 – Rigid sagebrush 31 – Low sagebrush	11,671 510 12,181
19 – Agriculture, pasture and mixed environs	1 – Agricultural/pasture 13 – Alkali grassland[4] 20 – Exotics 33 – Mesic shrubland[5]	357,761 1,148 23,870 796 383,575
20 – Urban and mixed environs	1 – Agricultural/pasture[6] 3 – Barren[6] 6 – Black greasewood[6] 14 – Developed 37 – Mountain big sagebrush[6] 42 – Open water[6] 46 – Ponderosa pine[6] 52 – Rigid sagebrush[6] 53 – Riparian[6] 55 – Riparian shrubland[6] 81 – Bluebunch wheatgrass grassland[6] 82 – Idaho fescue grassland[6]	6,948 17 3 614 8 33 7 39 220 36 35 451 8,412
21 - Open water – lakes, rivers, streams	46 – Open water	7,045
22 – Herbaceous wetlands	77 – Wet meadow 6 – Black greasewood[7] 32 - Marsh/wetland	4,800 4,668 6,681 16,148
24 – Montane coniferous wetlands	19 – Englemann spruce	56,100
25 – Eastside (interior) riparian wetlands	58 – Hardwoods 33 – Mesic shrubland 53 – Riparian 55 – Riparian shrubland 76 – Willows	30 9,395 3,490 5,520 350 18,785
Total Acres		2,625,591

Modifications made to the habitat coverage derived from ONHIC vegetation data based on professional judgment and knowledge of the local area:

[1] Changed wildlife habitat classification from Westside Lowland Conifer-hardwood forest to Eastside Mixed conifer Forest.

[2] Changed wildlife habitat classification from Eastside Grasslands to Alpine Grasslands and Shrublands.

[3] In the northeast corner of the subbasin (Joseph Creek), changed wildlife habitat classification from Eastside Riparian Wetlands to Eastside Canyon Shrublands

[4] Changed wildlife habitat classification from Desert Playa and Salt Scrub Shrublands to Agriculture (only occurred in Wallowa Valley).

[5] In area surrounding Wallowa Lake, changed wildlife habitat classification from Eastside Riparian Wetlands to Agriculture, Pasture and Mixed Environs.

[6] The IBIS data were thought to be more accurate in the amount and placement of Urban and Mixed Environs. These reflect the vegetation classes and acreage changed from the ONHIC data to more accurately reflect the area currently occupied by this wildlife habitat classification.

[7] Changed wildlife classification from Desert Playa and Salt Scrub Shrublands to Herbaceous Wetlands (only occurred in the Grande Ronde Valley).

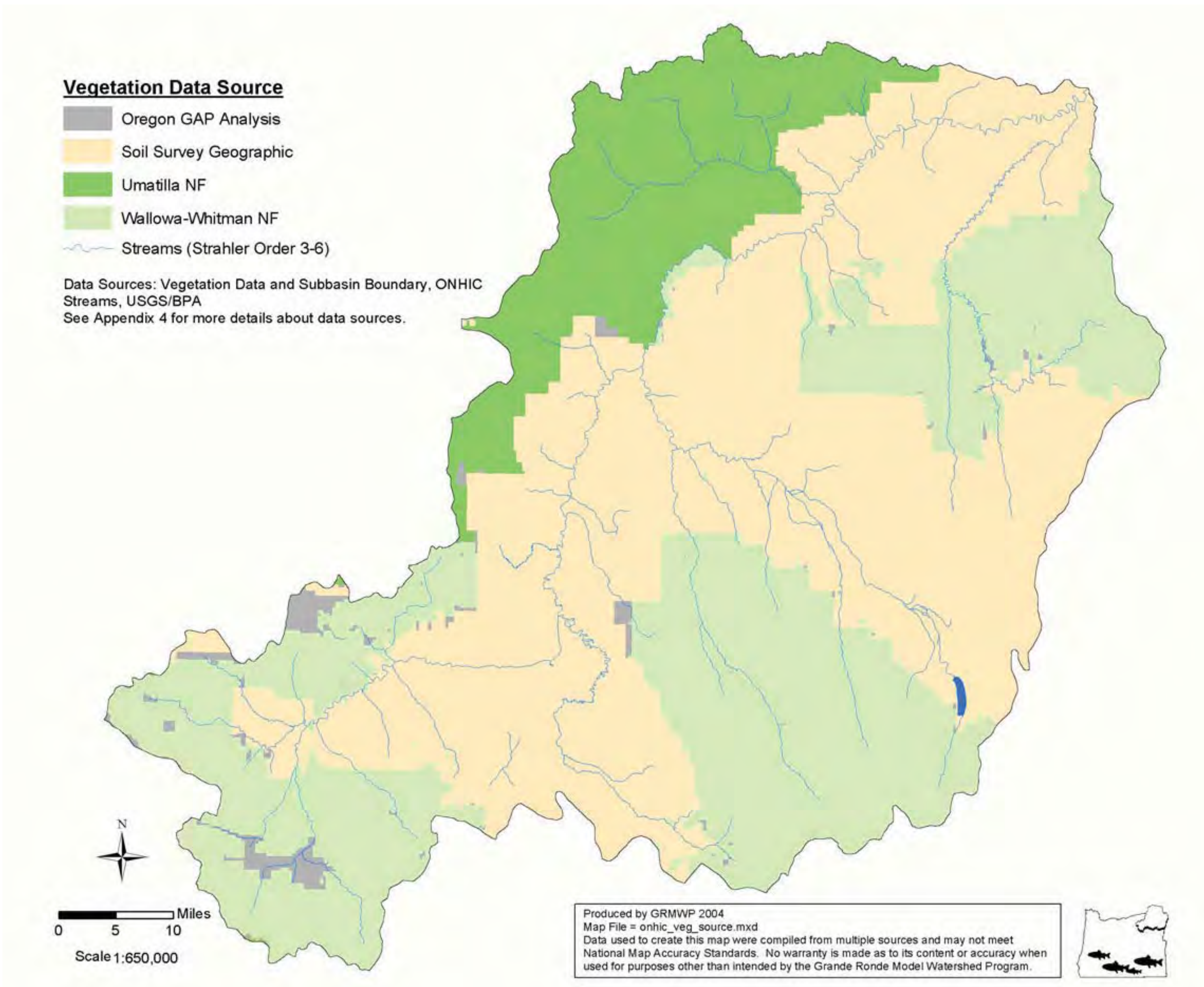


Figure 49. Sources of vegetation data for wildlife habitat types in the Grande Ronde subbasin.

Table 45. Estimated change in extent of 19 wildlife habitat types in the Grande Ronde subbasin including change in habitats combined by the subbasin Technical Team for subbasin planning and comments from the Team regarding the accuracy of the habitat trends depicted.

Wildlife Habitat Type	Historic Acres	Current Acres	Change from Historic	Subbasin Technical Team Comments
4 - Montane Mixed Conifer Forest	255,445	89,013	-166,432	Acreages likely inaccurate.
5 – Eastside Mixed Conifer Forest	655,684	830,100	+174,416	Increase due to conversion of former ponderosa pine habitat.
6 – Lodgepole Pine Forest and Woodlands	138,705	99,999	-38,706	
Combined Mid- to High-elevation Conifer Forest	1,049,834	1,019,112	-30,722	
7 – Ponderosa Pine Forest and Woodlands	734,858	498,705	-236,153	Direction and magnitude of change are realistic.
8 – Upland Aspen Forest	153	53	-100	Likely underrepresented in both historic and current data due to small patch size.
13 – Western Juniper and Mountain Mahogany Woodlands	176	687	+511	Increasing trend reflects juniper encroachment into grasslands. Mountain mahogany woodlands are decreasing.
Combined Rare or Unique Habitats	329	740	+411	
9 – Subalpine Parkland	2,571	35,923	+33,352	Likely underrepresented in historic data. Trend should be a gradual, minor increase.
10 – Alpine Grasslands and Shrublands	23,609	32,138	+8,529	Likely underrepresented in historic data. Trend should show no change or a minor decrease.
Combined Alpine and Subalpine Habitats	26,180	68,061	+41,881	The trend of these two combined habitats should be stable or declining slightly.
14 – Eastside Canyon Shrublands	15,292	35,696	+20,404	Likely underrepresented in historic data. Fire history and other factors indicate this habitat was present historically. Trend should be stable or declining slightly.
15 – Eastside Grasslands	641,553	486,002	-155,551	Direction and magnitude of change is realistic.
16 – Shrub-steppe	1,558	15,030	+13,472	Direction of change is realistic; magnitude may be

				exaggerated.
17 – Dwarf Shrub-steppe	6,214	12,181	+5,967	May be underrepresented in historic data; magnitude of change is too extreme.
18 – Desert Playa and Salt Scrub Shrublands	8,529	0	-8,529	Likely over represented in historic data, underrepresented in current data. Trend should show decline but not 100%.
Combined Shrub-steppe and Salt Scrub Shrublands	16,301	27,211	+10,910	Magnitude of change is too extreme; unsure if underrepresented in historic data or over represented in current data.
19 – Agriculture, Pasture and Mixed Environs	0	383,575	+383,575	
20 – Urban and Mixed Environs	0	8,412	+8,412	
21 – Open Water – Lakes, Rivers, Streams	9,486	7,045	-2,441	Trend should be increasing due to impoundments and water development.
22 – Herbaceous Wetlands	84,848	16,148	-68,700	Both direction and magnitude of change realistic.
24 – Montane Coniferous Wetlands	0	56,100	+56,100	Likely underrepresented historically and over represented in current data.
25 – Eastside Riparian Wetlands	46,910	18,785	-28,125	Likely underrepresented in both historic and current data due to narrow, linear character of habitat. Magnitude of decline may be exaggerated; new riparian areas have been created adjacent to ditches.
Combined Wetlands	131,758	91,033	-40,725	Wetland habitats have declined substantially.

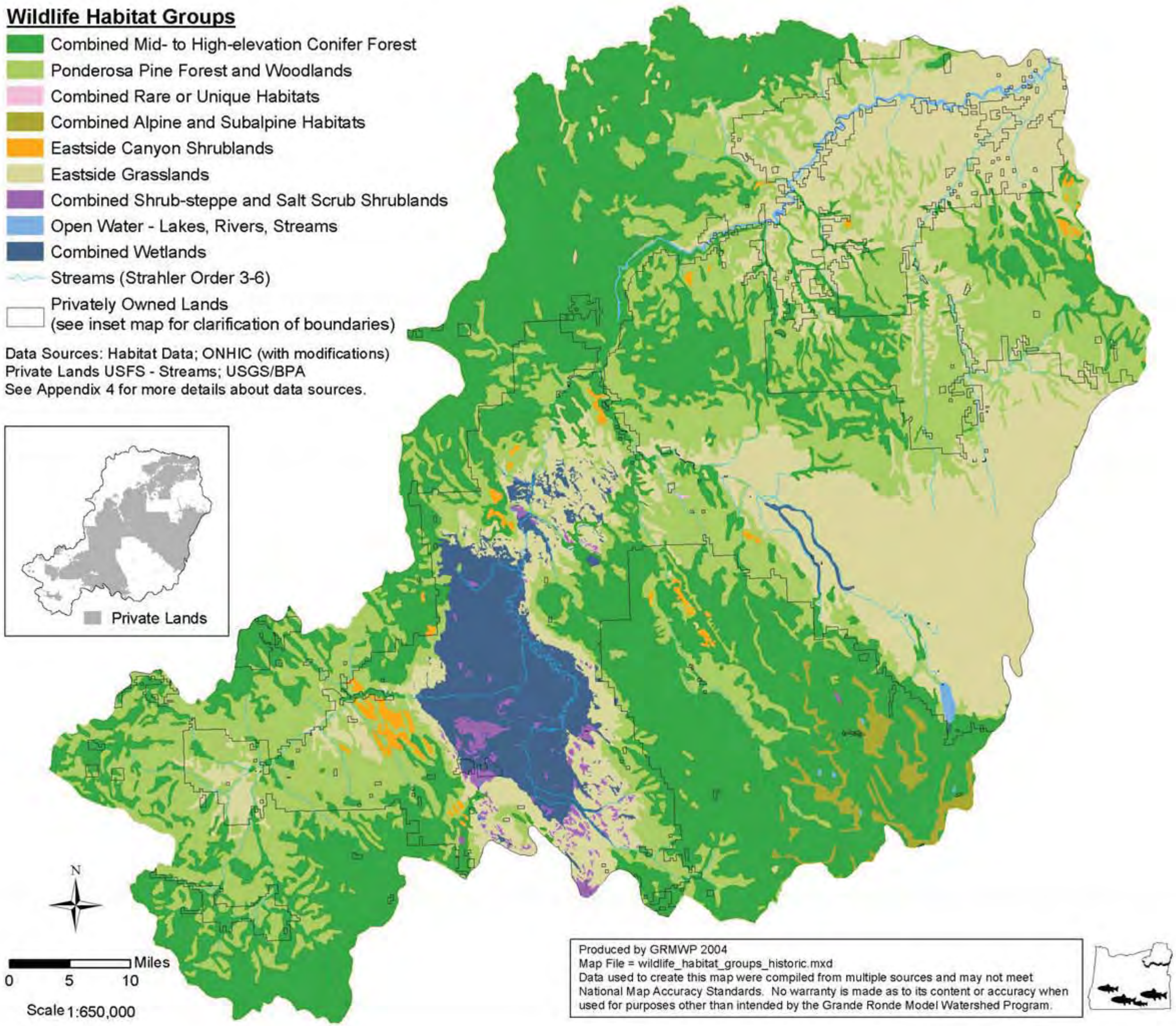


Figure 50. Historic distribution of wildlife habitat types in the Grande Ronde subbasin.

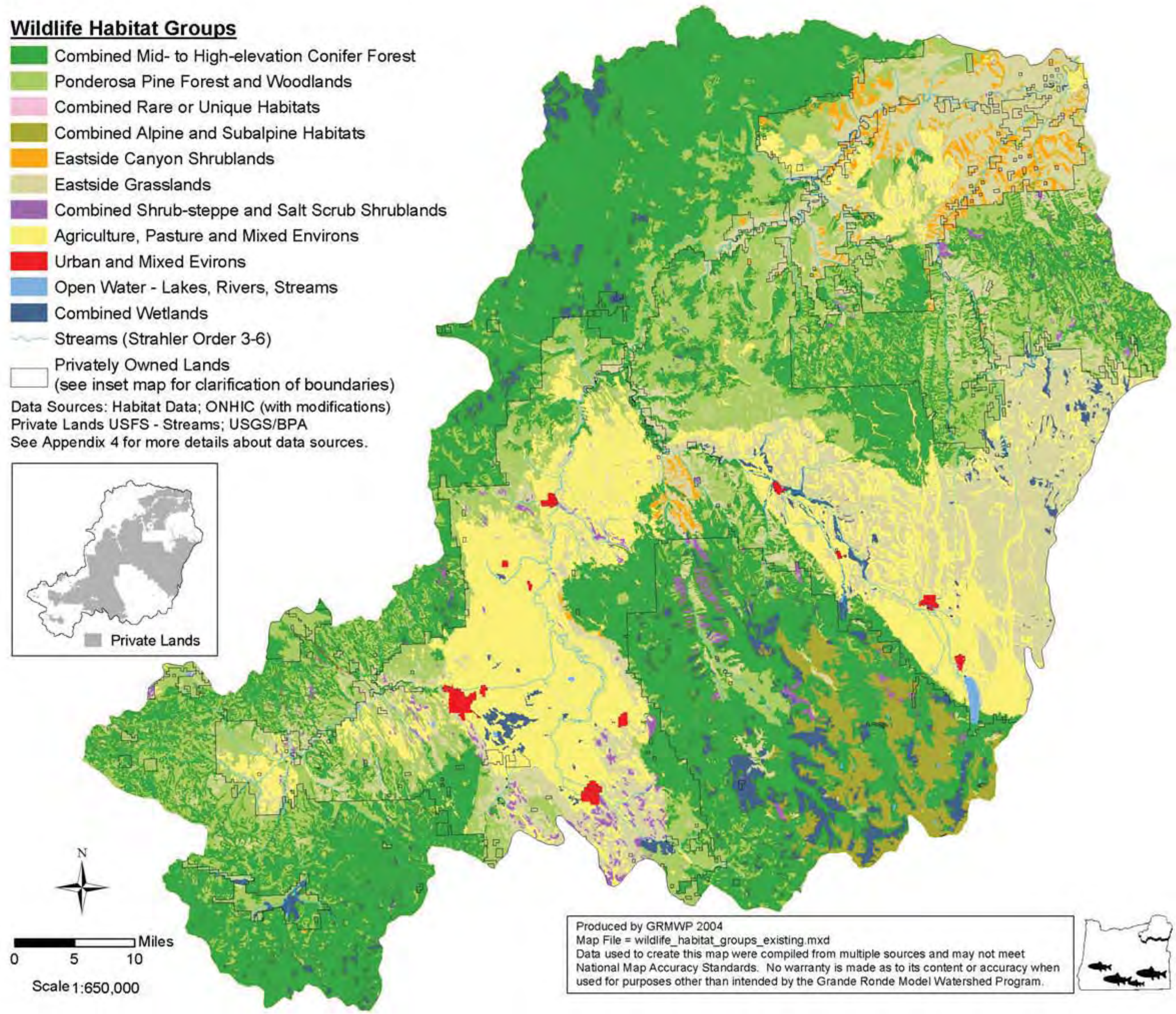


Figure 51. Current distribution of wildlife habitat types in the Grande Ronde subbasin.

Wildlife Habitat Types

Wildlife habitat type definitions have been extracted from IBIS (2003) Wildlife-Habitat Data supplemented with local data and knowledge. Complete definitions/ descriptions of cover types as well as data sources are available at (http://ibis.nwhi.org). All photos are from the IBIS cover type definitions documents. As defined in IBIS, both key environmental correlates (KECs) and ecological functions (KEFs) support as well as influence Ecosystem Services, which are the beneficial outcomes that result from ecosystem functions. Some examples of ecosystem services are support of the food chain, fishing and hunting, clean water, better human health, or scenic views. Ecosystem Services help sustain life and are critical to human welfare. Negative influences to Ecosystem Services, like through KECs or KEFs, often result in a loss of biodiversity processes and functions of natural ecosystems. KECs are defined as environmental elements that are key or critical factors thought to most influence a species distribution, abundance, fitness and viability. These can be thought of as the fine feature elements that a species principally relies on or are influenced by. KEFs are the principal or key roles performed by each species. Or, the main ways organisms use, influence and alter the environments in which they live.

Mid- to High Elevation Conifer Forest - For the purposes of subbasin planning in general and this document, in particular, three mid-to high-elevation forested wildlife habitats will be considered together due to the strong similarity of management issues in all three types. Further, the Subbasin Technical Team feels that there is ongoing homogenization of forest types in the region, largely due to fire suppression, resulting in the loss of characteristics specific to a given type and an increase in overlap between them. Therefore, any attempt to clearly divide them for planning purposes would be artificial and would imply a level of knowledge not in evidence at this time (Grande Ronde Subbasin Technical Team, personal communication 2/12/2004). IN the Grande Ronde subbasin, these forest types are found in the Blue and Wallowa mountains (Figure 52).

Grande Ronde Historic acreage: 1,049,834
Grande Ronde Current acreage: 1,019,112
Decreased acreage: 30,722

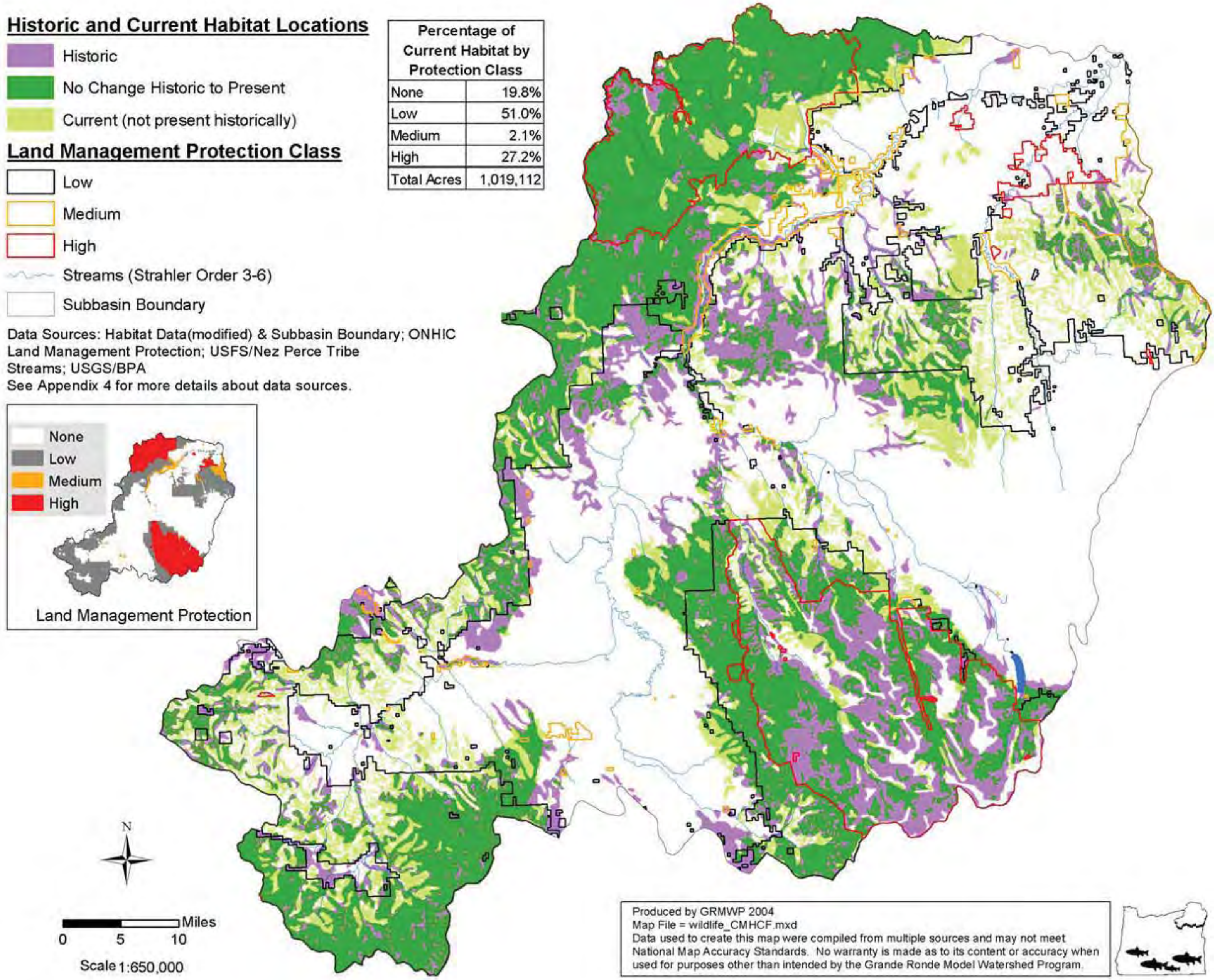


Figure 52. A comparison of historic and current distribution of combined mid- to high-elevation conifer forest habitat in the Grande Ronde subbasin with current protection status.

Focal Species. Two focal species, American marten and olive-sided flycatcher, have been selected to represent upland forests in the Grande Ronde subbasin in order to capture both the older, more complex structural stage and the younger structural stage and understory species in these habitats.

The **American marten** is designated as Sensitive – Vulnerable in Oregon. It is closely associated only with these cover types (IBIS 2004) and primarily utilizes the older structural stage with complex physical structure near the ground (Buskirk and Powell 1994). Martens are associated with 15 of 26 forest structural conditions for feeding. These range from "small tree-single story" with "moderate" canopy closure to "giant tree-multi-story." They will reproduce in those same structural conditions if the necessary habitat elements are present (IBIS 2004). Martens have been found to be associated with 29 Key Environmental Correlates (KECs; IBIS 2004), most of which relate to the structural diversity of the stand. These include down wood in several different contexts, trees, snags, large branches, mistletoe brooms and dead portions of live trees. In California, the average size of snags, logs and stumps used by martens for diurnal resting sites was significantly greater than the average size of those available (Martin and Barrett 1991). Additional KECs martens are associated with include burrows, freshwater riparian and aquatic habitat elements and wetlands.

American martens perform 9 Key Ecological Functions (KEFs) involving their trophic and organismal relationships to other species (IBIS 2004). Martens consume terrestrial invertebrates, vertebrates and eggs. They are secondary cavity users and will use burrows and runways created by other species. Martens also control populations of terrestrial vertebrates through predation or displacement and aid in dispersal of seeds or fruits.

American martens occasionally feed on the carcasses of salmonids although this behavior is relatively rare (IBIS 2004). It is unknown whether the rarity of this behavior is related to availability of carcasses or preference on the part of martens although Buskirk and Ruggiero (1994) discuss the migratory nature and thus, seasonal availability, of fish as well as some birds (and their eggs) in the diets of marten.

Habitat/Focal Species Interaction – Extensive logging and wildfires have a negative impact on populations of American martens. Forests that have been logged or burned support fewer martens and those individuals have shorter life spans, are less productive, and suffer higher mortality, both natural and from trapping, than martens in undisturbed forests (Thompson 1994). Thompson and Colgan (1994) reported that martens also captured significantly lower mass of food per kilometer of travel in logged forests.

Martens are opportunistic predators, taking a wide variety of prey. Of the 19 other species listed as closely associated with these habitats, more than half (10) are potential prey for martens, 3 are less likely to be hunted but could be prey given the right circumstances and the remainder (5) compete with martens for prey. Three of the competing species, northern goshawk, great gray owl and Canada lynx may, if rarely, also prey on American martens.

The **olive-sided flycatcher** is designated Sensitive – Vulnerable in Oregon and is a Partners in Flight (PIF) species. The olive-sided flycatcher is closely associated only with the mixed conifer cover types and breeds primarily in riparian areas, ecotones between early and late successional stages and open or semi-open stands with low percentage of canopy cover (Altman and Sallabanks 2000). Olive-side flycatchers are associated with 17 of 26 forest structural conditions for breeding (IBIS 2004); non-breeding habitat has not been studied (Marshall et al. 2003). Of those 17 structural stage associations, 3 are close associations (IBIS 2004). A "close association" is defined as "(a) species is widely known to depend on a habitat or structural condition for part or all of its life history requirements. Identifying this association implies that the species has an essential need for this habitat or structural condition for its maintenance and viability" (O'Neil and Johnson 2001, pg 4). The three closely associated structural stages are, "small tree-single story-open" canopy, "sapling/pole-open" canopy and "medium tree-single story-open" canopy.

Olive-sided flycatchers have been found to be associated with 11 KECs (IBIS 2004), most of which describe the vegetation elements and canopy of the stand. These include trees, snags, canopy layer and edges. Additional KECs Olive-sided flycatchers are associated with are freshwater riparian and aquatic habitat elements, wetlands and fire as a habitat element.

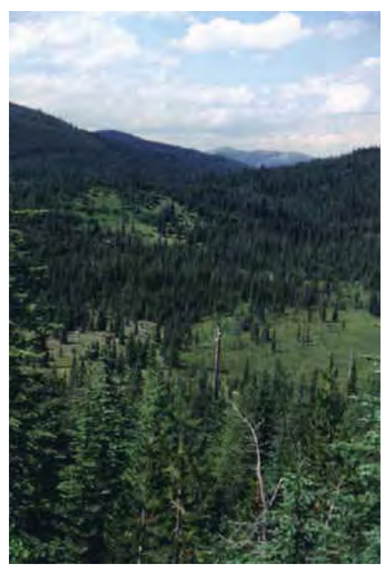
Olive-sided flycatchers perform 3 KEFs involving their trophic and organismal relationships to other species. They consume terrestrial invertebrates and serve as a common host for nest parasites, especially the brown-headed cowbird. Although it is not their primary role, and therefore not a KEF, olive-sided flycatchers are preyed upon by other species. Avian, mammalian and even reptilian predators will take birds or their eggs if given the opportunity.

Habitat/Focal Species Interaction – Olive-sided flycatchers may depend upon post-fire habitat and they have likely been negatively affected by fire suppression and changes in fire frequency (Hutto 1995a). Forest management practices such as selective cutting and clearcutting, once thought to mimic natural disturbance, may provide only the appearance of early post-fire habitats but be lacking in some characteristics required by olive-sided flycatchers (Altman 2003a).

Forest management practices that have, over the past 50 years, resulted in an increase in forest openings and edge habitat would seem to have increased available habitat for the olive-sided flycatcher (Altman 2003a). However, this apparent increase in habitat has been coincident with declining populations, indicating that harvested forests may represent an "ecological trap" (Hutto 1995b); the habitat may appear suitable but reproductive success and/or survival is poor due to factors such as limited food resources, predation or parasitism (Altman 2003a). Research in northwest Oregon suggests that nest success may be higher in post-fire habitat than in forest edge habitats and harvest units (Altman 2000). Further, Altman (2003a) suggests that to maintain viable populations, olive-sided flycatchers may require nest success rates greater than 40-45%.

4 Montane Mixed Conifer Forest

Definition/Description:



Physical Setting. This habitat is typified by a moderate to deep winter snow pack that persists for 3 to 9 months. The climate is moderately cool and wet to moderately dry and very cold. Mean annual precipitation ranges from about 40 inches (102 cm) to >200 inches (508 cm). Elevation is mid- to upper montane, as low as 2,000 ft (610 m) in northern Washington, to as high as 7,500 ft (2,287 m) in southern Oregon.

Composition. This forest habitat is recognized by the dominance or prominence of 1 of the following species: Pacific silver fir (*Abies amabilis*), mountain hemlock (*Tsuga mertensiana*), subalpine fir (*A. lasiocarpa*), Shasta red fir (*A. magnific var. shastensi*), Engelmann spruce (*Picea engelmannii*), noble fir (*A. procera*), or Alaska yellow-cedar (*Chamaecyparis nootkatensis*). Several other trees may co-dominate: Douglas-fir (*Pseudotsuga menziesii*), lodgepole pine (*Pinus contorta*), western hemlock (*Tsuga heterophylla*), western redcedar (*Thuja plicata*), or white fir (*A. concolor*). Tree regeneration is typically dominated by subalpine fir in cold, drier eastside zones.

Subalpine fir and Engelmann spruce are major species only east of the Cascade Crest in Washington, in the Blue Mountains ecoregion, and in the northeastern Olympic Mountains (spruce is largely absent in the Olympic Mountains). Lodgepole pine is important east of the

Cascade Crest throughout and in central and southern Oregon. Douglas-fir is important east of the Cascade Crest and at lower elevations on the westside.

Deciduous shrubs that commonly dominate or co-dominate the understory are big huckleberry (*V. membranaceum*), grouseberry (*V. scoparium*), dwarf huckleberry (*V. cespitosum*), fools huckleberry (*Menziesia ferruginea*), Important evergreen shrubs include dwarf Oregongrape (*Mahonia nervosa*) and Oregon boxwood (*Paxistima myrsinites*).

Grande Ronde Historic acreage: 255,445
Grande Ronde Current acreage: 89,013
Decreased acreage: 166,432

Status & trend: The above acreages of montane mixed conifer forest are likely inaccurate. However, given that the mid-to high-elevation forest types have been lumped together for consideration and given limited time and resources to make corrections to the map, the inaccuracy was thought to be insignificant to this assessment. This habitat type is located primarily on federal (U.S. Forest Service) land and is thus highly protected and not imperiled. Reduced diversity, decreased coarse woody debris, continued road building and forest practices in unprotected areas are a threat to late and old structural stages.

Key disturbance factors: fire (dominant), fungi, insects.

Species Closely Associated in the Grande Ronde subbasin: tailed frog, bufflehead, Barrow's goldeneye, olive-sided flycatcher, long-legged myotis, big brown bat, snowshoe hare, golden-mantled ground squirrel, bushy-tailed woodrat, American marten.

No. 5. Eastside (Interior) Mixed Conifer Forest

Definition/Description:

Geographic Distribution. The Eastside Mixed Conifer Forest habitat appears primarily in the Blue Mountains, East Cascades, and Okanogan Highland Ecoregions of Oregon, Washington, adjacent Idaho, and western Montana. It also extends north into British Columbia.

Physical Setting. The Eastside Mixed Conifer Forest habitat is primarily mid-montane with an elevation range of between 1,000 and 7,000 ft (305-2,137 m), mostly between 3,000 and 5,500 ft (914-1,676 m). Parent materials for soil development vary. This habitat receives some of the greatest amounts of precipitation in the inland northwest, 30-80 inches (76-203 cm)/year. Elevation of this habitat varies geographically, with generally higher elevations to the east.

Composition. This habitat contains a wide array of tree species (9) and stand dominance patterns. Douglas-fir (*Pseudotsuga menziesii*) is the most common tree species in this habitat. It is almost always present and dominates or co-dominates most overstories. Lower elevations or drier sites may have ponderosa pine (*Pinus ponderosa*) as a co-dominant with Douglas-fir in the overstory and often have other shade-tolerant tree species growing in the undergrowth. On moist sites, grand fir (*Abies grandis*), western redcedar (*Thuja plicata*) and/or western hemlock (*Tsuga heterophylla*) are dominant or co-dominant with Douglas-fir. Other conifers include western larch (*Larix occidentalis*) and western white pine (*Pinus monticola*) on mesic sites, Engelmann spruce (*Picea engelmannii*), lodgepole pine (*Pinus contorta*), and subalpine fir (*Abies lasiocarpa*) on colder sites. Rarely, Pacific yew (*Taxus brevifolia*) may be an abundant undergrowth tree or tall shrub.

Undergrowth vegetation varies from open to nearly closed shrub thickets with 1 to many layers. Throughout the eastside conifer habitat, tall deciduous shrubs include Rocky Mountain maple (*A. glabrum*), serviceberry (*Amelanchier alnifolia*), oceanspray (*Holodiscus discolor*), mallowleaf ninebark (*Physocarpus malvaceus*), and Scouler's willow (*Salix scouleriana*) at mid- to lower elevations. Medium-tall deciduous shrubs at higher elevations include fools huckleberry (*Menziesia ferruginea*), and big huckleberry (*Vaccinium membranaceum*). Widely distributed, generally drier site mid-height to short deciduous shrubs include baldhip rose (*Rosa gymnocarpa*), shiny-leaf spirea (*Spiraea betulifolia*), and snowberry (*Symphoricarpos albus, S. mollis*, and *S. oreophilus*). Low shrubs of higher elevations include low huckleberries (*Vaccinium cespitosum,* and *V. scoparium*) and five-leaved bramble (*Rubus pedatus*). Evergreen shrubs represented in this habitat are low to mid-height dwarf Oregongrape (*Mahonia nervosa* in the east Cascades and *M. repens* elsewhere), tobacco brush (*Ceanothus velutinus*), an increaser with fire, Oregon boxwood (*Paxistima myrsinites*) generally at mid- to lower elevations, beargrass (*Xerophyllum tenax*), pinemat manzanita (*Arctostaphylos nevadensis*) and kinnikinnick (*A. uva-ursi).*

Grande Ronde Historic acreage: 655,684

Grande Ronde Current acreage: 830,100

Increased acreage: 174,416

Status & trend: Roads, timber harvest, periodic grazing, and altered fire regimes have compromised these forests. Even though this habitat is more extensive than pre-1900, natural processes and functions have been modified enough to alter its natural status as functional habitat for many species. Compositional changes including loss of western white pine which is considered imperiled, threaten diversity. Note: IBIS write up discusses many sps that don't occur in GR subbasin.

Key disturbance factors: timber harvesting and fire suppression. Timber harvesting has focused on large shade-intolerant species in mid- and late-seral forests, leaving shade-tolerant species. Fire suppression enforces those logging priorities by promoting less fire-resistant, shade-intolerant trees. The resultant stands at all seral stages tend to lack snags, have high tree density, and are composed of smaller and more shade-tolerant trees

Species Closely Associated: northern goshawk, flammulated owl, northern pygmy owl, olive-sided flycatcher, long-legged myotis, big brown bat, snowshoe hare, golden-mantled ground squirrel, red squirrel, northern pocket gopher, deer mouse, bushy-tailed woodrat, American marten, Canada lynx.

6 Lodgepole Pine Forest and Woodlands

Definition/Description:

Geographic Distribution. This habitat is found along the eastside of the Cascade Range, in the Blue Mountains, the Okanogan Highlands and ranges north into British Columbia and south to Colorado and California.

Physical Setting. This habitat is located mostly at mid- to higher elevations (3,000-9,000 ft [914-2,743 m]). These environments can be cold and relatively dry, usually with persistent winter snowpack. A few of these forests occur in low-lying frost pockets, wet areas, or under edaphic control (usually pumice) and are relatively long-lasting features of the landscape. Lodgepole pine is maintained as a dominant by the well-drained, deep Mazama pumice in eastern Oregon.

Composition. The tree layer of this habitat is dominated by lodgepole pine (*Pinus contorta* var. *latifolia* and *P. c. var. murrayana*), but it is usually associated with other montane conifers (*Abies concolor, A. grandis, A. magnifici var. shastensi, Larix occidentalis, Calocedrus decurrens, Pinus lambertiana, P. monticola, P. ponderosa, Pseudotsuga menziesii*). Subalpine fir (*Abies lasiocarpa),* mountain hemlock (*Tsuga mertensiana*), Engelmann spruce (*Picea engelmannii*), and whitebark pine (*Pinus albicaulis*), indicators of subalpine environments, are present in colder or higher sites. Quaking aspen (*Populus tremuloides*) sometimes occur in small numbers.

Shrubs can dominate the undergrowth. Tall deciduous shrubs include Rocky Mountain maple (*Acer glabrum*), serviceberry (*Amelanchier alnifolia*), oceanspray (*Holodiscus discolor*), or Scouler's willow (*Salix scouleriana*). These tall shrubs often occur over a layer of mid-height deciduous shrubs such as baldhip rose (*Rosa gymnocarpa*), russet buffaloberry (*Shepherdia canadensis*), shiny-leaf spirea (*Spiraea betulifolia*), and snowberry (*Symphoricarpos albus* and/or *S. mollis).* At higher elevations, big huckleberry (*Vaccinium membranaceum*) can be locally important, particularly following fire. Mid-tall evergreen shrubs can be abundant in some stands, for example, creeping Oregongrape (*Mahonia repens*), tobacco brush (*Ceanothus velutinus*), and Oregon boxwood (*Paxistima myrsinites*). Colder and drier sites support low- growing evergreen shrubs, such as kinnikinnick (*Arctostaphylos uva-ursi*) or pinemat manzanita (*A. nevadensis*). Grouseberry (*V. scoparium*) and beargrass (*Xerophyllum tenax*) are consistent evergreen low shrub dominants in the subalpine part of this habitat. Manzanita (*Arctostaphylos patula*), kinnikinnick, tobacco brush, antelope bitterbrush (*Purshia tridentata*), and wax current (*Ribes cereum*) are part of this habitat on pumice soil.

Grande Ronde Historic acreage: 138,705
Grande Ronde Current acreage: 99,999
Decreased acreage: 38,706

Status & trend: Region wide, the same as before 1900 and in regions may exceed its historical extent. Five percent of Pacific Northwest lodgepole pine associations listed in the National Vegetation Classification are considered imperiled.

Key disturbance factors: Fire and fire suppression; Mean fire interval of 112 years. Summer drought areas generally have low to medium-intensity ground fires occurring at intervals of 25-50 years. After the stand opens up (due to fire), shade-tolerant trees increase in number. Because lodgepole pine cannot reproduce under its own canopy, old unburned stands are replaced by shade-tolerant conifers.

Species Closely Associated: northern goshawk, great gray owl, three-toed woodpecker, black-backed woodpecker, snowshoe hare, red squirrel, northern pocket gopher, deer mouse, American marten, Canada lynx.

<u>7 Ponderosa Pine & Interior White Oak Forest and Woodlands</u>

Given that white oak is virtually absent from the Grande Ronde subbasin, this habitat in our area would more accurately be called simply **Ponderosa Pine Forest and Woodlands.**
Definition/Description:

Geographic Distribution. This habitat occurs in much of eastern Washington and eastern Oregon, including the eastern slopes of the Cascades, the Blue Mountains and foothills, and the Okanogan Highlands. Variants of it also occur in the Rocky Mountains, the eastern Sierra Nevada, and mountains within the Great Basin. It extends into south-central British Columbia as well. In the Grande Ronde subbasin ponderosa pine woodlands are generally found at the interface between mid- and high-elevation coniferous forest and other lower elevation habitats including, shrub-steppe, grassland and agricultural land. This habitat is found in the Wallowa Mountains, in the Blue Mountains in the Upper and Lower Grande Ronde drainages and in the upper Joseph Creek drainage.

Physical Setting. This habitat generally occurs on the driest sites supporting conifers in the Pacific Northwest. It is widespread and variable, appearing on moderate to steep slopes in canyons, foothills, and on plateaus or plains near mountains. In Oregon, this habitat can be maintained by the dry pumice soils. Average annual precipitation ranges from about 14 to 30 inches (36 to 76 cm) on ponderosa pine sites in Oregon and Washington and often as snow. This habitat can be found at elevations of 100 ft (30m) in the Columbia River Gorge to dry, warm areas over 6,000 ft (1,829 m).

Composition. Ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) are the most common evergreen trees in this habitat. The deciduous conifer, western larch (*Larix occidentalis*), can be a co-dominant with the evergreen conifers in the Blue Mountains of Oregon, but seldom as a canopy dominant. Grand fir (*Abies grandis*) may be frequent in the undergrowth on more productive sites giving stands a multilayer structure. In rare instances, grand fir can be co-dominant in the upper canopy.

The undergrowth can include dense stands of shrubs or, more often, be dominated by grasses, sedges, and/or forbs. Some Douglas-fir and ponderosa pine stands have a tall to medium-tall deciduous shrub layer of mallowleaf ninebark (*Physocarpus malvaceus*) or common snowberry (*Symphoricarpos albus*). Grand fir seedlings or saplings may be present in the undergrowth.

Grande Ronde Historic acreage: 734,858

Grande Ronde Current acreage: 498,705

Decreased acreage: 236,153

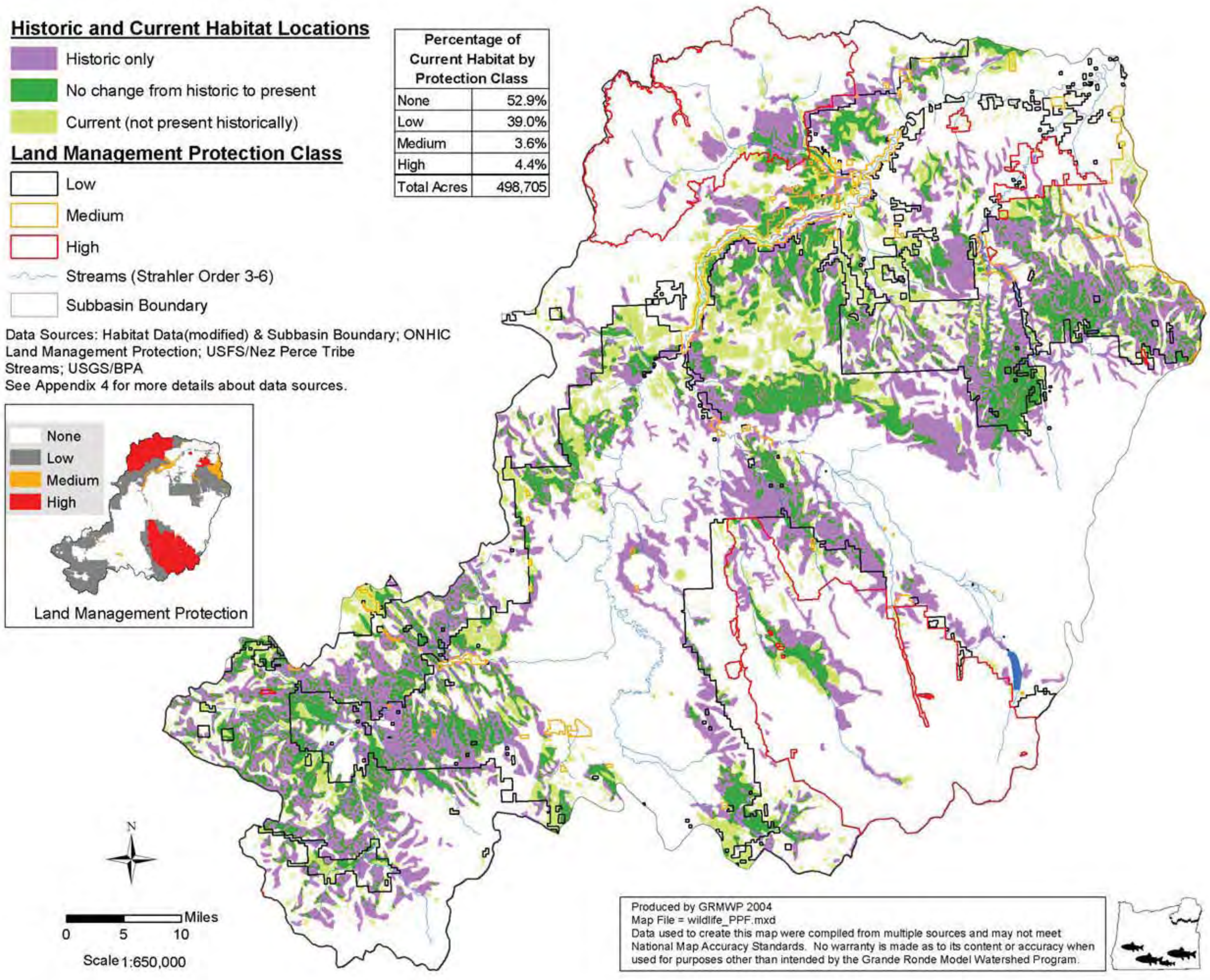


Figure 53. A comparison of historic and current distribution of ponderosa pine wildlife habitat in the Grande Ronde subbasin with current protection status.

Status & trend: In the Columbia Basin overall, interior Ponderosa Pine cover type is significantly less in extent than pre-1900. The greatest structural change in this habitat is the reduced extent of the late-seral, single-layer condition. This habitat is generally degraded because of increased exotic plants and decreased native bunchgrasses. One third of Pacific Northwest Oregon white oak, ponderosa pine, and dry Douglas-fir or grand fir community types listed in the National Vegetation Classification are considered imperiled or critically imperiled. The status and trend of this habitat in the Grande Ronde subbasin generally follows that of the Columbia Basin as a whole. Ponderosa pine habitats are in decline due to largely to fire suppression allowing encroachment of Douglas-fir and other less fire-tolerant species as well as clearing for conversion to agricultural land.

Key disturbance factors: Fire, fire suppression, grazing; A mean fire interval of 20 years for ponderosa pine is the shortest of the vegetation types listed by Barrett et al. Currently, much of this habitat has a younger tree cohort of more shade-tolerant species that gives the habitat a more closed, multilayered canopy. For example, this habitat includes previously natural fire-maintained stands in which grand fir can eventually become the canopy dominant. Fire suppression has lead to a buildup of fuels that in turn increase the likelihood of stand-replacing fires. Heavy grazing, in contrast to fire, removes the grass cover and tends to favor shrub and conifer species.

Species Closely Associated: northern goshawk, flammulated owl, great gray owl, white-headed woodpecker, white-breasted nuthatch, pygmy nuthatch, western bluebird, long-legged myotis, big brown bat, golden-mantled ground squirrel, northern pocket gopher, deer mouse.

Focal Species. The **white-headed woodpecker** has been selected as the focal species in ponderosa pine dominated forests. The white-headed woodpecker is closely associated with just this one habitat type in the Grande Ronde subbasin. It is designated a federal *Species of Concern* by the USFWS, *Sensitive – Critical* in Oregon and is a *Candidate* for listing in Washington.

White-headed woodpeckers show some degree of association with all 26 forest structural stages in IBIS (IBIS 2004) and is not considered closely associated with any of them. However, white-headed woodpeckers are dependent upon ponderosa pine dominated forests (Bull et al. 1986, Dixon 1995a, 1995b) and research indicates they primarily use late successional stages. In the central Oregon Cascades, white-headed woodpecker population density increased with increasing volumes of old growth ponderosa pine (Dixon 1995a, 1995b). The same author reported a positive association with large diameter ponderosa pines in both contiguous and fragmented sites.

White-headed woodpeckers are associated with 20 KECs including trees, snags, decay class, tree size, fruits/seeds/nuts, insect population irruptions and fire as a habitat element (IBIS 2004). The relatively low number of KECs used by this species suggests relatively high vulnerability to disturbance. That vulnerability is enhanced by the species' dependence on those KECs being present in stands dominated by ponderosa pine.

Nest cavities are typically excavated in snags although other substrates are used including stumps, leaning logs and dead tops of live trees (Milne and Hejl 1989, Frederick and Moore 1991, Dixon 1995a, 1995b). Mean diameter (dbh) of nest trees is relatively large compared with other western woodpeckers (Marshall 2003). In Oregon, mean nest tree or snag diameters of 25.6 in. (65 cm; Dixon 1995a), 31.5 in. (80 cm; Dixon 1995b) and 26.2 in. (66.5 cm; Frenzel 2000) have been reported.

White-headed woodpeckers perform 8 KEFs including seed consumption and dispersal, terrestrial invertebrate consumption, primary cavity excavation in snags or live trees and physical fragmentation of standing or down wood.

Habitat/Focal Species Interaction – The Grande Ronde subbasin has undergone at least 30% reduction in ponderosa pine dominated forest with the greatest loss in the late-seral single-layer stands (IBIS 2004). It is those late seral stands that white-headed woodpeckers are most dependent upon (Bull et al. 1986, Dixon 1995a, 1995b) although they have been documented to use areas that have undergone silvicultural treatment if large-diameter ponderosa pines and other old-growth components remain (Dixon 1995s, 1995b, Frenzel 2000).

The decline of ponderosa pine habitats has occurred due to fire suppression, which has allowed the encroachment of Douglas fir and other less fire tolerant conifer species, and to development for agriculture, especially in the lower elevation areas with moderate slopes. White-headed woodpeckers are vulnerable to the loss of this habitat given their degree of dependence upon ponderosa pine in general and late-successional and/or large diameter stands in particular.

Rare or Unique Habitats – Two wildlife habitat types, Upland Aspen Forest and Western Juniper and Mountain Mahogany Woodlands, have been combined for consideration in subbasin planning. For the purpose of this document and the composite "rare or unique habitats," only the mountain mahogany component of the western juniper and mountain mahogany woodlands will be discussed. The range of western juniper is expanding, although in the Grande Ronde subbasin that expansion is minimal. Thus, juniper presents management challenges very different from those posed by mountain mahogany and quaking aspen. These two habitat types present similar management issues and are subject to similar disturbance factors. Both quaking aspen and mountain mahogany exist within the Grande Ronde subbasin as relatively small inclusions within other habitats. In both habitats, grazing prevents or reduces regeneration; as stands age and trees fall, they are not replaced by new growth.

Grande Ronde Historic acreage: 329
Grande Ronde Current acreage: 740
Increased acreage: 411

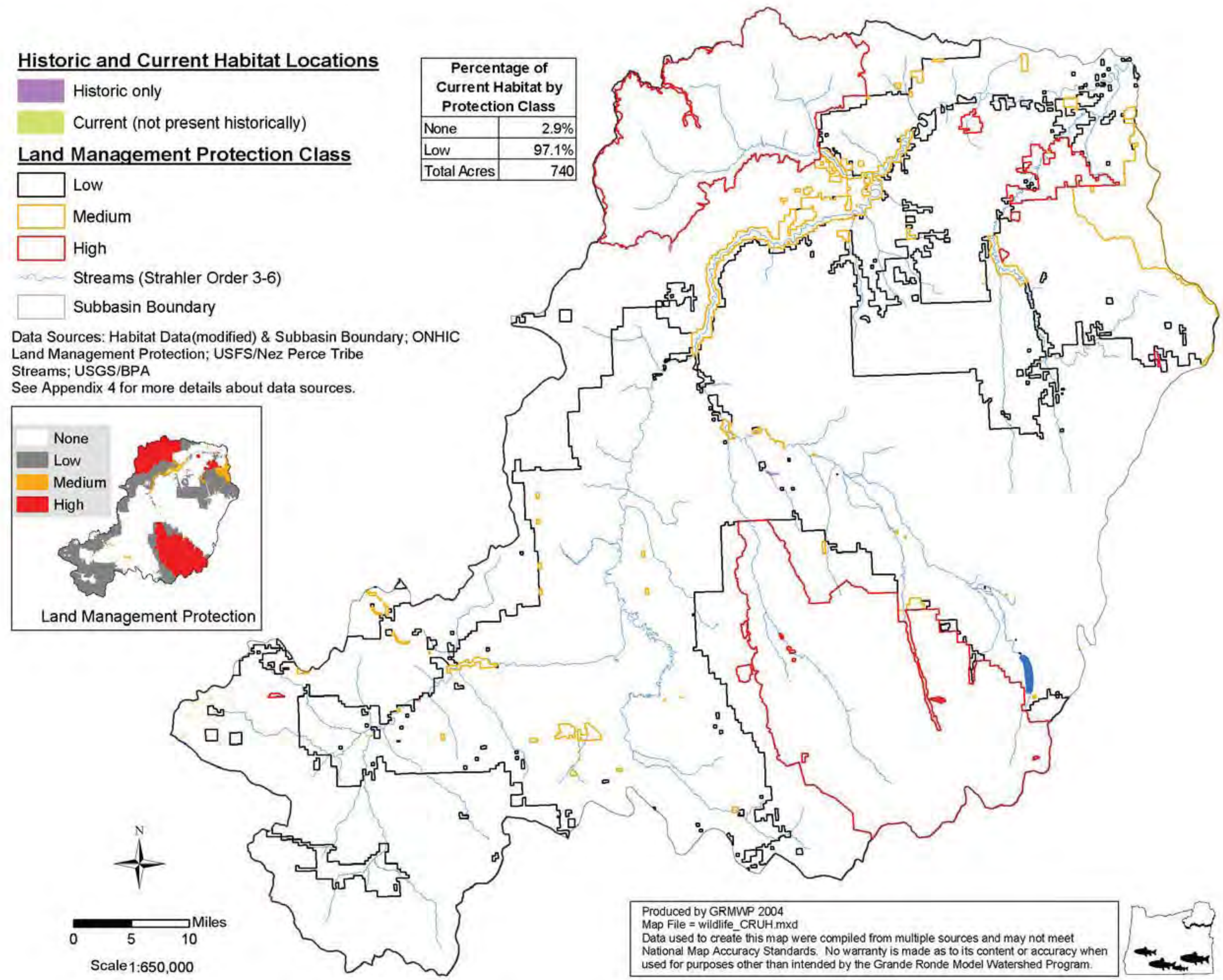


Figure 54. A comparison of historic and current distribution of combined rare and unique wildlife habitat in the Grande Ronde subbasin with current protection status.

Status and Trend. The above increase in the acreage of these combined habitats reflects an increase in the western juniper component of the Western Juniper and Mountain Mahogany Woodlands habitat type. Both the aspen and mountain mahogany types are most likely underrepresented in the data, both historic and current, due to their relatively small patch sizes and the coarse nature of the data. Nevertheless, both habitats have declined in the Grande Ronde subbasin since pre-European settlement and continue to decline today.

Focal Species. Quaking aspen and mountain mahogany, themselves were selected as the focal species for these habitats, they provide the dominant vegetative cover in their respective habitats and thus, define the habitat. In both habitats, providing for recruitment of young trees is a necessary management consideration.

Habitat/Focal Species Interaction. In the case of both curlleaf mountain mahogany and quaking aspen, the focal species defines the habitat.

8 Upland Aspen Forest

Definition/Description:

Geographic Distribution. Quaking aspen groves are the most widespread habitat in North America, but are a minor type throughout eastern Washington and Oregon. Aspen groves are found throughout the Grande Ronde subbasin as small inclusions within other habitat types.

Physical Setting. This habitat generally occurs on well-drained mountain slopes or canyon walls that have some moisture. Rockfalls, talus, or stony north slopes are often typical sites. It may occur in steppe on moist microsites. This habitat is not associated with streams, ponds, or wetlands. This habitat is found from 2,000 to 9,500 ft (610 to 2,896 m) elevation.

Composition. Quaking aspen (*Populus tremuloides)* is the characteristic and dominant tree in this habitat. It is the sole dominant in many stands although scattered ponderosa pine *(Pinus ponderosa*) or Douglas-fir (*Pseudotsuga menziesii*) may be present. Snowberry (*Symphoricarpos oreophilus* and less frequently, *S. albus*) is the most common dominant shrub. Tall shrubs, Scouler's willow (*Salix scouleriana*) and serviceberry (*Amelanchier alnifolia*) may be abundant. On mountain or canyon slopes, antelope bitterbrush (*Purshia tridentata*), mountain big sagebrush (*Artemisia tridentata ssp. vaseyana),* low sagebrush (*A. arbuscula*), and curl-leaf mountain mahogany (*Cercocarpus ledifolius*) often occur in and adjacent to this woodland habitat.

In some stands, pinegrass (*Calamagrostis rubescens*) may dominate the ground cover without shrubs. Other common grasses are Idaho fescue *(Festuca idahoensis*), California brome (*Bromus carinatus*), or blue wildrye (*Elymus glaucus*). Characteristic tall forbs include horsemint (*Agastache spp*.), aster (*Aster spp.),* senecio (*Senecio spp*.), coneflower (*Rudbeckia spp.).* Low forbs include meadowrue (*Thalictrum spp*.), bedstraw (*Galium spp*.), sweetcicely (*Osmorhiza spp*.), and valerian (*Valeriana spp*.).

Grande Ronde Historic acreage: 153

Grande Ronde Current acreage: 53

Decreased acreage: 100

Status & trend: With fire suppression and change in fire regimes, the Aspen Forest habitat is less common than before 1900. None of the 5 Pacific Northwest upland quaking aspen community types in the National Vegetation Classification is considered imperiled. In the Grande Ronde subbasin, although never widespread, quaking aspen stands are both smaller and less common than they were historically due to changes in fire regime and grazing by both wild and domestic ungulates.

Key disturbance factors: Livestock grazing, fire suppression; Heavy browsing by livestock and wild ungulates can adversely impact aspen growth and regeneration. With fire suppression and alteration of fine fuels, fire rejuvenation of aspen habitat has been greatly reduced since about 1900. Conifers now dominate many seral aspen stands and extensive stands of young aspen are uncommon.

Species Closely Associated: Although not listed as closely associated by IBIS, several species in the Grande Ronde subbasin use this habitat extensively including common porcupine woodpeckers, sapsuckers, mule deer and elk.

13 Western Juniper and Mountain Mahogany Woodlands

Definition/Description:

Geographic Distribution. In Oregon and Washington, this dry woodland habitat appears primarily in the Owyhee Uplands, High Lava Plains, and northern Basin and Range ecoregions. Secondarily, it develops in the foothills of the Blue Mountains and East Cascades ecoregions, and seems to be expanding into the southern Columbia Basin ecoregion, where it was naturally found in outlier stands. Many isolated mahogany communities occur throughout canyons and mountains of eastern Oregon. Juniper-mountain mahogany communities are found in the Ochoco and Blue Mountains. In the Grande Ronde subbasin, western juniper and mountain mahogany are essentially two separate habitats. Stands of western juniper are uncommon and are found primarily in the Wallowa Valley while similarly uncommon small mountain mahogany stands can be found throughout the subbasin.

Physical Setting. Western juniper and/or mountain mahogany woodlands are often found on shallow soils, on flats at mid- to high elevations, usually on basalts. Other sites range from deep, loess soils and sandy slopes to very stony canyon slopes. At lower elevations, or in areas outside of shrub-steppe, this habitat occurs on slopes and in areas with shallow soils. Mountain mahogany can occur on steep rimrock slopes, usually in areas of shallow soils or protected slopes. This habitat can be found at elevations of 1,500- 8,000 ft (457-2,438 m), mostly between 4,000-6,000 ft (1,220-1,830 m). Average annual precipitation ranges from approximately 10 to 13 inches (25 to 33 cm), with most occurring as winter snow.

Composition. Western juniper and/or mountain mahogany dominate these woodlands either with bunchgrass or shrub-steppe undergrowth. Western juniper (*Juniperus occidentalis*) is the most common dominant tree in these woodlands. Part of this habitat will have curl-leaf mountain mahogany (*Cercocarpus ledifolius*) as the only dominant tall shrub or small tree. Mahogany may be co-dominant with western juniper. Ponderosa pine (*Pinus ponderosa*) can grow in this habitat and in some rare instances may be an important part of the canopy.

The most common shrubs in this habitat are basin, Wyoming, or mountain big sagebrush (*Artemisia tridentata ssp. tridentata, ssp. wyomingensis*, and *ssp. vaseyana*) and/or bitterbrush (*Purshia tridentata*). They usually provide significant cover in juniper stands. Low or stiff sagebrush (*Artemisia arbuscula* or *A. rigida*) are dominant dwarf shrubs in some juniper stands. Mountain big sagebrush appears most commonly with mountain mahogany and mountain mahogany mixed with juniper. Snowbank shrubland patches in mountain mahogany woodlands are composed of mountain big sagebrush with bitter cherry (*Prunus emarginata*), quaking aspen (*Populus tremuloides*), and serviceberry (*Amelanchier alnifolia*). Shorter shrubs such as mountain snowberry (*Symphoricarpos oreophilus*) or creeping Oregongrape (*Mahonia repens*) can be dominant in the undergrowth. Rabbitbrush (*Chrysothamnus nauseosus* and *C. viscidiflorus*) will increase with grazing.

Grande Ronde Historic acreage: 176
Grande Ronde Current acreage: 687
Increased acreage: 51

Status & trend: This habitat is dominated by fire-sensitive species, and therefore, the range of western juniper and mountain mahogany region wide has expanded because of an interaction of livestock grazing and fire suppression. Quigley and Arbelbide concluded that in the Inland Pacific Northwest, Juniper/Sagebrush, Juniper Woodlands, and Mountain Mahogany cover types now are significantly greater in extent than before 1900. In the Grande Ronde Subbasin, western juniper was, historically, virtually absent. As this species' range has expanded region wide, it has expanded into the Grande Ronde subbasin as it encroaches into former grassland habitats. Mountain mahogany is likely underrepresented in the historic data due to the small size of stands. Curlleaf mountain mahogany stands are both smaller and less common in the Grande Ronde subbasin than they were historically. Grazing by both wild and domestic ungulates has a negative effect on regeneration of mountain mahogany. One third of Pacific Northwest juniper and mountain mahogany community types listed in the National Vegetation Classification are considered imperiled or critically imperiled.

Key disturbance factors: Fire suppression, overgrazing, changing climate

Species Closely Associated: loggerhead shrike, western small-footed myotis, golden-mantled ground squirrel, deer mouse, bushy-tailed woodrat.

<u>Alpine and Subalpine Habitats</u> – Two wildlife habitat types, Subalpine Parkland and Alpine Grasslands and Shrublands, have been combined for discussion in subbasin planning. In the Grande Ronde subbasin, both habitats occur in designated Wilderness and are protected from disturbances such as logging, road building and development although they are not immune to the effects of human use. Recreational pressure combined with slow regeneration of the dominant vegetation may significantly degrade these habitats over time.

Grande Ronde Historic acreage: 26,180
Grande Ronde Current acreage: 68,061
Increased acreage: 41,881

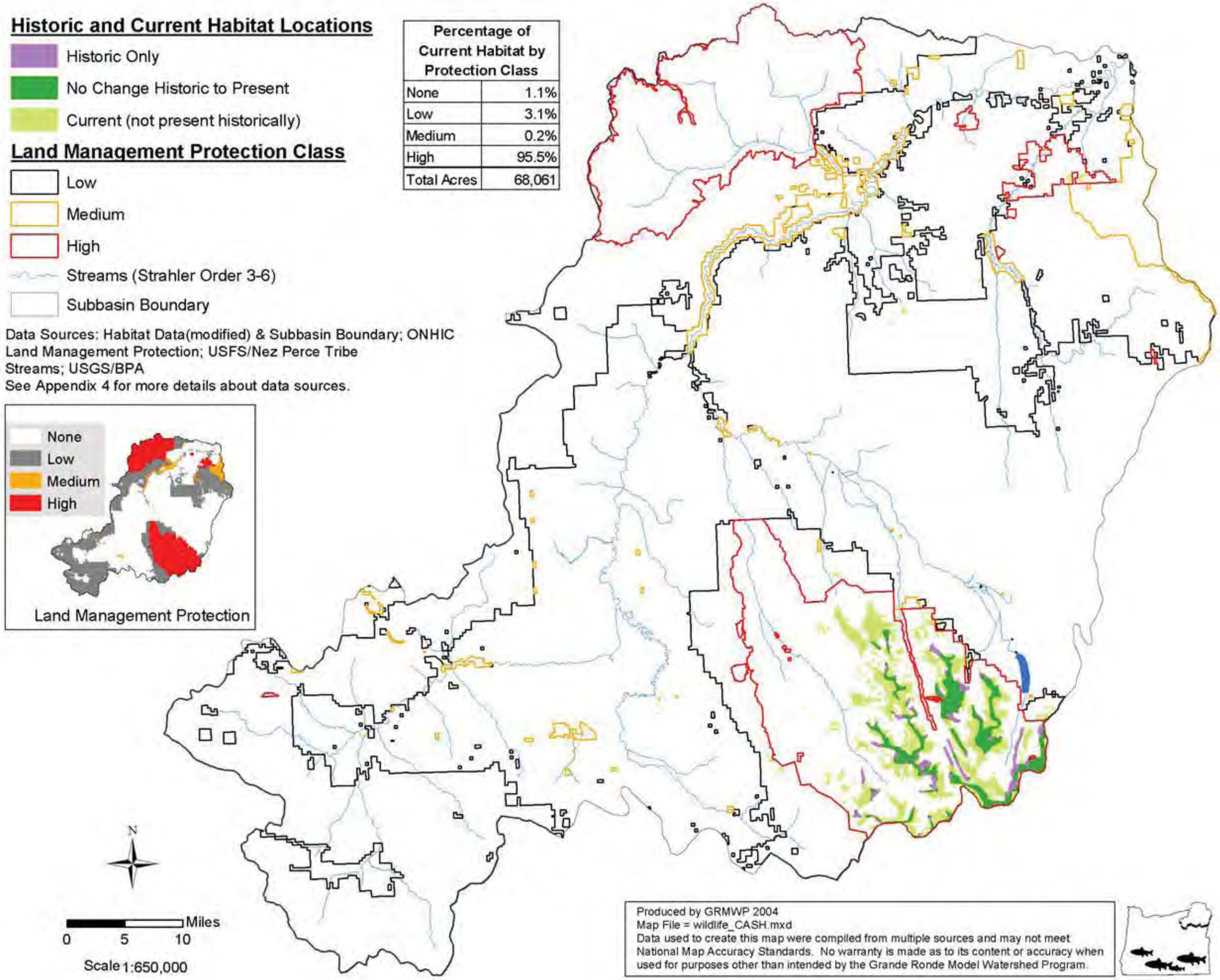


Figure 55. A comparison of historic and current distribution of alpine and subalpine wildlife habitat in the Grande Ronde subbasin with current protection status.

Status and Trend. Both habitats are likely underrepresented in the historic vegetation data. This makes it appear as though there has been a substantial increase in alpine and subalpine habitats since pre-European settlement. In the judgment of the subbasin Technical Team, this is inaccurate; alpine and subalpine habitats have remained essentially static since before Europeans came to the area.

Focal Species. The mountain goat (*Oreamnos americana*) has been selected as the focal species for these high elevation habitats. It is closely associated only with these habitats. The mountain goat is a game species managed by the Oregon Department of Fish and Wildlife.

Mountain goats are associated with 5 of 20 non-forest and 16 of 26 forest structural conditions in IBIS although not closely associated with any of them (IBIS 2004). Mountain goats feed in the various forest and non-forest structural conditions and will breed in the non-forest structural conditions if the necessary habitat elements are present. Cliffs and rock outcrops provide security cover. Nannies utilize the least accessible and most secure crannies for parturition and the first days with new born kids (von Elsner-Schack 1986). Nursery groups and even large adult males stay close to such cliffs most of the time. Cliffs are important for thermal regulation. Overhangs, caves, lee sides of rocks or ridges, and dense conifers near cliffs provide shelter from sever weather. These features also provide protection from cold soaking rains and excessive heat during summer. In the Wallowa Mountains, Wallowa County, the area intensively used by mountain goats had less timber and more slide rock and cliff rock than did the entire area available to the goats. Use of forest and rock structural features varied seasonally with timbered areas used primarily during the winter (Vaughan 1975).

Rocky Mountain goats are associated with 26 KECs including trees; tree canopy; ecotones; moss; lichens; rock cliffs, outcrops and ridges; snow fields and free water. Timbered areas are generally used in the winter for thermal cover or to avoid deep snow. Ecotones appear to be important KECs as mountain goats are associated with edges in both forested and non-forested habitats. Cliffs and rock outcrops provide security cover. Nannies utilize the least accessible and most secure crannies for parturition and the first days with new born kids (von Elsner-Schack 1986). Nursery groups and even large adult males stay close to such cliffs most of the time.

Rocky Mountain goats perform 4 KEFs involving their trophic and organismal relationships with other species. Mountain goats are grazers; they eat grasses and forbs. They also both create runways used by other species and use runways created by other species. Although it is not their primary role, and therefore not a KEF, mountain goats are preyed upon by other species. A variety of large carnivores prey on mountain goats; cougars (*Puma concolor*) are likely the most serious predator (Rideout and Hoffmann 1975).

Habitat/Focal Species Interaction. Mountain goats feed on a variety of vegetation. Some forage species are used seasonally based on availability. Where foraging areas are restricted, mountain goats may have a negative effect on areas of the habitat. In the Wallowa Mountains, the primary winter feeding area was, by March, "overgrazed to the point that practically all vegetative material was removed" (Vaughan 1975: 63-64). Alpine ecosystems are fragile, due in part to shallow, rocky soils and a short growing season. The impact mountain goats have had on them since their reintroduction has not been assessed (Verts and Carraway 1998).

Rocky Mountain goats and other species closely associated with alpine and subalpine habitats (e.g., pika, bushy-tailed woodrat and bighorn sheep) make extensive use of the rock features common to these habitats for escape and hiding cover. These species forage in forest, shrub and grassland areas adjacent to these rock features and are thus dependent upon a mosaic of vegetative and non-vegetative habitat elements.

9 Subalpine Parkland

Definition/Description:

Geographic Distribution. The Subalpine Parkland habitat occurs throughout the high mountain ranges of Washington and Oregon (e.g., Cascade crest, Olympic Mountains, Wallowa and Owyhee Mountains, and Okanogan Highlands), extends into mountains of Canada and Alaska, and to the Sierra Nevada and Rocky Mountains. In the Grande Ronde subbasin, it is found in the high elevation portions of the Eagle Cap Wilderness Area in the Wallowa Mountains.

Physical Setting. Climate is characterized by cool summers and cold winters with deep snowpack, although much variation exists among specific vegetation types. Mountain hemlock sites receive an average precipitation of >50 inches (127 cm) in 6 months and several feet of snow typically accumulate. Whitebark pine sites receive 24-70 inches (61-178 cm) per year and some sites only rarely accumulate a significant snowpack. Summer soil drought is possible in eastside parklands but rare in westside areas. Elevation varies from 5,000 to 8,000 ft (1,524 to 2,438 m) in the eastern Cascades and Wallowa mountains.

Composition. Species composition in this habitat varies with geography or local site conditions. The tree layer can be composed of 1 or several tree species. Subalpine fir (*Abies lasiocarpa*), Engelmann spruce (*Picea engelmannii*) and lodgepole pine (*Pinus contorta*) are found throughout the Pacific Northwest. Whitebark pine (*P. albicaulis*) is found primarily in the eastern Cascade mountains Okanogan Highlands, and Blue Mountains.

Drier areas are woodland or savanna like, often with low shrubs, such as common juniper (*Juniperus communis*), kinnikinnick (*Arctostaphylos uva-ursi*), low whortleberries or grouseberries (*Vaccinium myrtillus* or *V. scoparium*) or beargrass (*Xerophyllum tenax*) dominating the undergrowth. Wetland shrubs in the Subalpine Parkland habitat include bog-laurel (*Kalmia microphylla*), Booth's willow (*Salix boothii*), undergreen willow (*S. commutata*), Sierran willow (*S. eastwoodiae*), and blueberries (*Vaccinium uliginosum* or *V. deliciosum*)

Undergrowth in drier areas may be dominated by pinegrass (*Calamagrostis rubescens*), Geyer's sedge (*Carex geyeri*), Ross' sedge (*C. rossii*), smooth woodrush (*Luzula glabrata var. hitchcockii*), Drummond's rush (*Juncus drummondii*), or short fescues (*Festuca viridula, F. brachyphylla, F. saximontana*). Various sedges are characteristic of wetland graminoid-dominated habitats: black (*Carex nigricans*), Holm's Rocky Mountain (*C. scopulorum*), Sitka (*C. aquatilis var. dives*) and Northwest Territory (C. utriculatia) sedges. Tufted hairgrass (*Deschampsia caespitosa*) is characteristic of subalpine wetlands.

Grande Ronde Historic acreage: 2,571

Grande Ronde Current acreage: 35,923

Increased acreage: 33,352

Status & trend: This habitat type is very likely underrepresented in the historic vegetation data. The Grande Ronde subbasin has experienced a gradual, minor increase in this type compared with the historic condition. Whitebark pine maybe declining in other portions of the region because of the effects of blister rust or fire suppression that leads to conversion of parklands to more closed forest. However, in the Grande Ronde subbasin, fire suppression has allowed the encroachment of whitebark pine into areas previously dominated by grasslands increasing the coverage of this habitat. Global climate warming will likely have an amplified effect throughout this habitat. Less than 10% of Pacific Northwest subalpine parkland community types listed in the National Vegetation Classification are considered imperiled.

Key disturbance factors: Fire suppression, pathogens (blister rust), logging. livestock, recreation. Virtually all of this habitat in the Grande Ronde subbasin is located within the Eagle Cap Wilderness Area and is thus protected from logging. Blister rust, an introduced pathogen, is increasing whitebark pine mortality in these woodlands. During wet cycles, fire suppression can lead to tree islands coalescing and the conversion of parklands into a more closed forest habitat. Livestock use and heavy horse or foot traffic can lead to trampling and soil compaction. Slow growth in this habitat prevents rapid recovery.

Species Closely Associated: Long-legged myotis and American pika.

10 Alpine Grasslands and Shrublands

Definition/Description:

Geographic Distribution. This habitat occurs in high mountains throughout the region, including the Cascades, Olympic Mountains, Okanogan Highlands, Wallowa Mountains, Blue Mountains, Steens Mountain in southeastern Oregon, and, rarely, the Siskiyous. In the Grande Ronde subbasin, this habitat occurs within the Eagle Cap Wilderness Area of the Wallowa Mountains.

Physical Setting. The climate is the coldest of any habitat in the region. Winters are characterized by moderate to deep snow accumulations, very cold temperatures, and high winds. Summers are relatively cool. Growing seasons are short because of persistent snow pack or frost. Blowing snow and ice crystals on top of the snow pack at and above treeline prevent vegetation such as trees from growing above the depth of the snow pack. Snow pack protects vegetation from the effects of this winter wind-related disturbance and from excessive frost heaving. Community composition is much influenced by relative duration of snow burial and exposure to wind and frost heaving. Elevation ranges from a minimum of 5,000 ft (1,524 m) in parts of the Olympics to 10,000 ft (3,048 m). The topography varies from gently sloping broad ridgetops, to glacial cirque basins, to steep slopes of all aspects. Soils are generally poorly developed and shallow, though in subalpine grasslands they may be somewhat deeper or better developed.

Composition. Most subalpine or alpine bunchgrass grasslands are dominated by Idaho fescue (*Festuca idahoensis*), alpine fescue (*F. brachyphylla*), green fescue (*F. viridula*), Rocky Mountain fescue (*F. saximontana*), or timber oatgrass (*Danthonia intermedia*), and to a lesser degree, purple reedgrass (*Calamagrostis purpurascens*), downy oat-grass (*Trisetum spicatum*) or muttongrass (*Poa fendleriana*). Forbs are diverse and sometimes abundant in the grasslands. Alpine sedge turfs may be moist or dry and are dominated by showy sedge (*Carex spectabilis*), black alpine sedge (*C. nigricans*), Brewer's sedge (*C. breweri*), capitate sedge (*C. capitata*), nard sedge (*C. nardina*), dunhead sedge (*C. phaeocephala*), or western single-spike sedge (*C. pseudoscirpoidea*).

One or more of the following species dominates alpine heaths: pink mountain-heather (*Phyllodoce empetriformis*), green mountain-heather (*P. glanduliflora*), white mountain-heather (*Cassiope mertensiana*), or black crowberry (*Empetrum nigrum*). Other less extensive dwarf-shrublands may be dominated by the evergreen coniferous common juniper (*Juniperus communis*), the evergreen broadleaf kinnikinnick (*Arctostaphylos uva-ursi*), the deciduous shrubby cinquefoil (*Pentaphylloides floribunda*) or willows (*Salix cascadensis* and *S. reticulata ssp. nivalis*). Tree species occurring as shrubby krummholz in the alpine are subalpine fir (*Abies lasiocarpa*), whitebark pine (*Pinus albicaulis*), mountain hemlock (*Tsuga mertensiana*), Engelmann spruce (*Picea engelmannii*), and subalpine larch (*Larix lyallii*).

Grande Ronde Historic acreage: 23,609

Grande Ronde Current acreage: 32,138

Increased acreage: 8,529

Status & trend: This habitat is likely underrepresented in the Grande Ronde subbasin historic vegetation data. It is naturally very limited in extent in the subbasin and in the region and there has been little to no change in abundance over the last 150 years. Most of this habitat is still in good condition and dominated by native species. Threats include increasing recreational pressures, continued grazing at some sites, and, possibly, global climate change resulting in expansion of trees into this habitat. Only 1 out of 40 plant associations listed in the National Vegetation Classification is considered imperiled.

Key disturbance factors: Recreation, grazing. The major human impacts on this habitat are trampling and associated recreational impacts (e.g., tent sites). Resistance and resilience of vegetation to impacts varies by life form. Domestic sheep grazing has also had dramatic effects, especially in the bunchgrass habitats east of the Cascades. Most natural disturbances seem to be small scale in their effects or very infrequent. Herbivory and associated trampling disturbance by elk, mountain goats, and occasionally bighorn sheep seems to be an important disturbance in some areas, creating patches of open ground, though the current distribution and abundance of these ungulates is in part a result of introductions.

Species Closely Associated: black rosy-finch, American pika, bushy-tailed woodrat, mountain goat, Rocky Mountain bighorn sheep.

14 Eastside (Interior) Canyon Shrublands

Definition/Description:

Geographic Distribution. This habitat occurs primarily on steep canyon slopes in the Blue Mountains and the margins of the Columbia Basin in Idaho, Oregon, and Washington. In teh Grande Ronde subbasin, it is found primarily in the Minam River, Lower Grande Ronde and Joseph Creek drainages.

Physical Setting. This habitat develops in hot dry climates in the Pacific Northwest. Annual precipitation totals 12-20 inches (31-51 cm); only 10% falls in the hottest months, July through September. Snow accumulation is low (1-6 inches [3-15 cm]), persisting only a few weeks. Sites are generally steep (>60%) on all aspects but most common on northerly aspects in deep, dry canyons. Columbia River basalt is the major geologic substrate although many sites are underlain with loess deposits mixed with colluvium. This habitat is found from 500 to 5,000 ft (152 to 1,524 m) in elevation.

Composition. Mallowleaf ninebark (*Physocarpus malvaceus*), a major dominant, bitter cherry (*Prunus emarginata*), chokecherry (*Prunus virginiana),* oceanspray (*Holodiscus discolor*) or Rocky Mountain maple (*Acer glabrum*) are the most common tall shrubs in this habitat. In moist areas, black hawthorn (*Crataegus douglasii*) may appear and can dominate some sites as a tall shrub or small tree. Other tall shrubs such as syringa (*Philadelphus lewisii*) or serviceberry (*Amelanchier alnifolia*) often dominate sites associated with talus. Common medium-tall shrubs are common snowberry (*Symphoricarpos albus*), rose (*Rosa nutkana, R. woodsii*), smooth sumac (*Rhus glabra*), and currants (*Ribes spp.).* Basin or Wyoming big sagebrush (*Artemisia tridentata ssp. tridentata* or *A. t. ssp. wyomingensis*), along with rabbitbrush (*Chrysothamnus spp*.), may be important members of these thickets in weedy sites, dry areas, or transitions with grasslands. Scattered ponderosa pine (*Pinus ponderosa*), black cottonwood (*Populus balsamifera ssp. trichocarpa*) and rarely Douglas-fir (*Pseudotsuga menziesii*) trees may be found in and adjacent to this habitat.

Grande Ronde Historic acreage: None
Grande Ronde Current acreage: 35,696
Increased acreage: 35,696

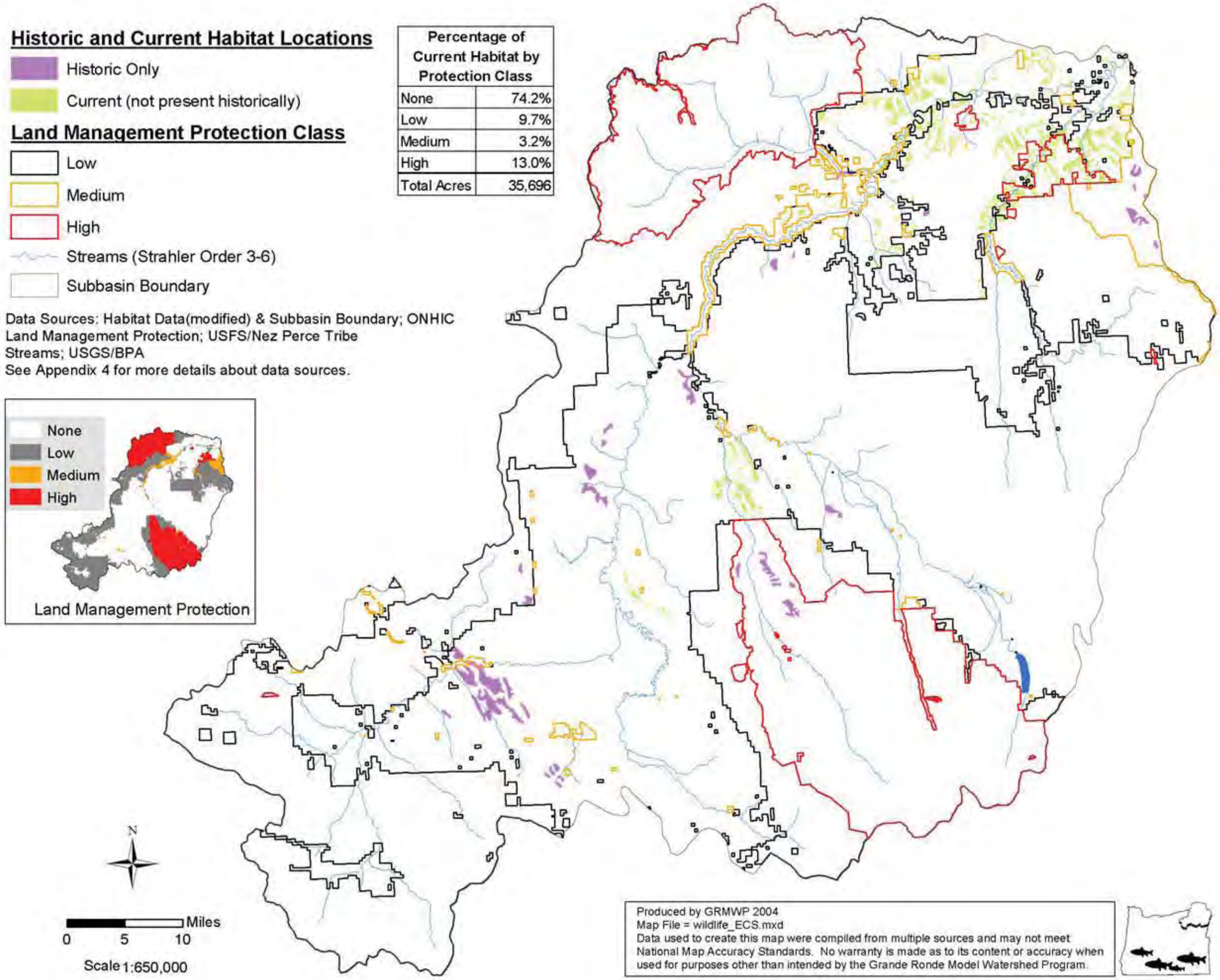


Figure 56. A comparison of historic and current distribution of eastside canyon shrubland wildlife habitat in the Grande Ronde subbasin with current protection status.

Status & trend: This habitat is almost certainly underrepresented in the historic Grande Ronde vegetation data. Fire history and other factors indicate it was present historically. The trend in this habitat in the Grande Ronde subbasin is stable to slightly decreasing in the judgment of the subbasin Technical Team. Region wide, it is restricted in range and probably has increased locally in area. Johnson and Simon reported increases in common snowberry-rose communities as a response to fire suppression and heavy grazing that depleted bunchgrass cover. One of the three Eastside Canyon Shrubland community types in the National Vegetation Classification is considered imperiled.

Key disturbance factors: Fire, grazing, talus movement.

Species Closely Associated: western small-footed myotis, western pipistrelle, big brown bat, pallid bat, golden-mantled ground squirrel, deer mouse, bushy-tailed woodrat, montane vole, Rocky Mountain bighorn sheep.

Focal Species. The Rocky Mountain bighorn sheep has been selected as the focal species for this habitat. This is one of two habitats in the Grande Ronde subbasin that bighorn sheep are closely associated with. Bighorn sheep are a game species managed by the Oregon Department of Fish and Wildlife.

Bighorn sheep are associated with 5 of 26 forest and 6 of 20 non-forest structural conditions listed by IBIS. They are considered closely associated with only 2 non-forest structural conditions, Grass/Forb-Closed and Grass/Forb-Open. They are considered “generally associated” with the other 9 structural conditions (IBIS 2004). All of the structural conditions, including Grass/Forb, Low Shrub, Medium Shrub and forested types, noted for bighorn sheep use allow for visibility to detect potential danger.

Rocky Mountain bighorn sheep are associated with 42 KECs including forest and woodland vegetative elements, shrub and grassland vegetative elements and non-vegetative habitat elements (IBIS 2004). Bighorn sheep are associated with a variety of rock substrates and structure including talus, avalanche chutes, cliffs, outcrops and ridges (IBIS 2004). Open areas with some form of rock substrate or structure with adjacent grasslands or meadows are the primary habitat for this species (Verts and Carraway 1998).

Bighorn sheep perform 4 KEFs involving their role as consumer of grasses and forbs; prey for primary or secondary predators and potential carrier, transmitter or reservoir of vertebrate diseases (IBIS 2004). Bighorn sheep diet varies seasonally and may include forbs and shrubs, but it is primarily made up of grasses (Verts and Carraway 1998). Coyotes, bobcats, cougars and wolverines are known to take bighorn sheep occasionally (Shackleton 1985). In southwestern Alberta, Ross et al. (1997) found that individual cougars may “specialize” in preying on bighorn sheep and thus may have an intense negative impact on local populations.

Habitat/Focal Species Interaction. Rocky Mountain bighorn sheep are closely associated with both Interior Canyon Shrublands and Interior Grassland habitat. Combined, these two habitats have declined substantially in the Grande Ronde subbasin. Bighorn sheep require habitats that offer “visibility, escape terrain and abundant continuous forage” (Risenhoover et al. 1988:347). Fire suppression has allowed the encroachment of conifers into canyon shrublands, decreasing visibility and rendering them unsuitable as bighorn sheep habitat (Verts and Carraway 1998). In some areas occupied by bighorn sheep, prescribed burning is utilized as a management tool to maintain habitat values (Coggins and Matthews 1992).

15 Eastside (Interior) Grasslands

Definition/Description:

Geographic Distribution. This habitat is found primarily in the Columbia Basin of Idaho, Oregon, and Washington, at mid- to low elevations and on plateaus in the Blue Mountains, usually within the ponderosa pine zone in Oregon. It is found throughout the Grande Ronde subbasin but is most common in Wallowa County in the eastern and northeastern portions of the subbasin.

Physical Setting. This habitat develops in hot, dry climates in the Pacific Northwest. Annual precipitation totals 8-20 inches (20-51 cm); only 10% falls in the hottest months, July through September. Snow accumulation is low (1-6 inches [3-15 cm]) and occurs only in January and February in eastern portions of its range and November through March in the west. More snow accumulates in grasslands within the forest matrix. The grassland habitat is typically upland vegetation but it may also include riparian bottomlands dominated by non-native grasses. This habitat is found from 500 to 6,000 ft (152-1,830 m) in elevation.

Composition. Bluebunch wheatgrass (*Pseudoroegneria spicata*) and Idaho fescue (*Festuca idahoensis*) are the characteristic native bunchgrasses of this habitat and either or both can be dominant. Idaho fescue is common in more moist areas and bluebunch wheatgrass more abundant in drier areas. Rough fescue (*F. campestris*) is a characteristic dominant on moist sites in northeastern Washington. Sand dropseed (*Sporobolus cryptandrus*) or three-awn (*Aristida longiseta)* are native dominant grasses on hot dry sites in deep canyons. Sandberg bluegrass *(Poa sandbergii*) is usually present, and occasionally codominant in drier areas. Bottlebrush squirreltail (*Elymus elymoides*) and Thurber needlegrass (*Stipa thurberiana*) can be locally dominant. Annual grasses are usually present; cheatgrass (*Bromus tectorum*) is the most widespread. In addition, medusahead (*Taeniatherum caput-medusae*), and other annual bromes (*Bromus commutatus, B. mollis, B. japonicus*) may be present to co-dominant. Moist environments, including riparian bottomlands, are often co-dominated by Kentucky bluegrass (*Poa pratensis*).

A dense and diverse forb layer can be present or entirely absent; >40 species of native forbs can grow in this habitat including balsamroots (*Balsamorhiza spp*.), biscuitroots (*Lomatium spp.*), buckwheat (*Eriogonum spp*.), fleabane (*Erigeron spp*.), lupines (*Lupinus spp*.), and milkvetches (*Astragalus spp.).* Smooth sumac (*Rhus glabra*) is a deciduous shrub locally found in combination with these grassland species. Rabbitbrushes (*Chrysothamnus nauseosus, C. viscidiflorus*) can occur in this habitat in small amounts, especially where grazed by livestock.

Grande Ronde Historic acreage: 641,553

Grande Ronde Current acreage: 486,002

Decreased acreage: 155,551

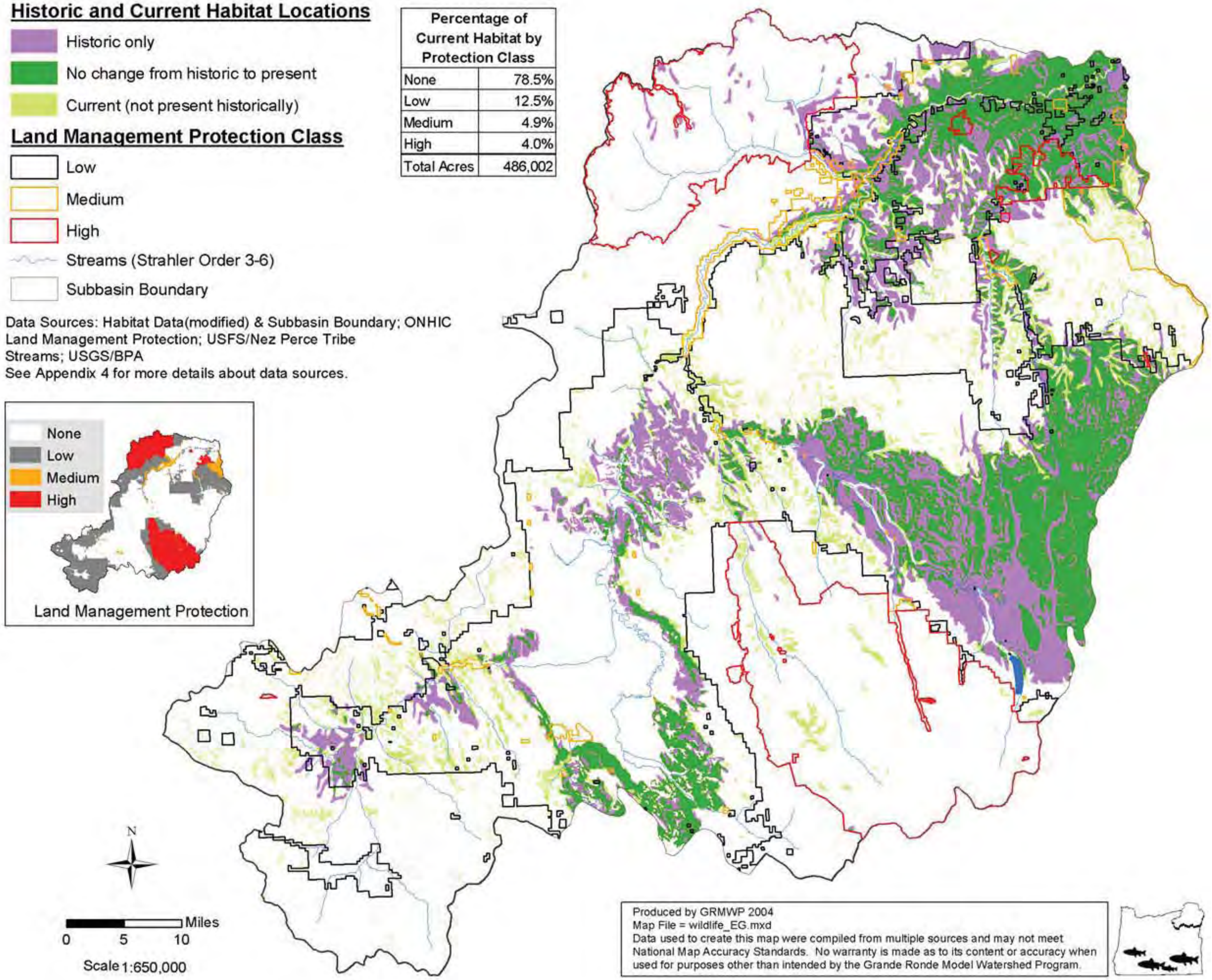


Figure 57. A comparison of historic and current distribution of eastside grassland wildlife habitat in the Grande Ronde subbasin with current protection status.

Status & trend: Most of the Palouse prairie of southeastern Washington and adjacent Idaho and Oregon has been converted to agriculture. Remnants still occur in the foothills of the Blue Mountains and in isolated, moist Columbia Basin sites. The Palouse is one of the most endangered ecosystems in the U.S. with only 1% of the original habitat remaining; it is highly fragmented with most sites <10 acres. In the Grande Ronde subbasin, this habitat has declined since pre-European settlement and those areas that remain are often in a degraded condition due to invasion by noxious weeds, especially cheat grass, and changes in the fire regime. Fifty percent of the plant associations recognized as components of eastside grassland habitat listed in the National Vegetation Classification are considered imperiled or critically imperiled.

Key disturbance factors: Grazing, conversion to cropland, invasion by non-native species; Large expanses of grasslands are currently used for livestock ranching. Deep soil Palouse sites are mostly converted to agriculture.

Species Closely Associated: Swainson's hawk, ferruginous hawk, sage grouse, sharp-tailed grouse, upland sandpiper, long-billed curlew, burrowing owl, horned lark, vesper sparrow, grasshopper sparrow, western meadowlark, western small-footed myotis, western pipistrelle, white-tailed jackrabbit, northern pocket gopher, deer mouse, montane vole, pronghorn antelope.

Focal Species. The **western meadowlark** has been selected as the focal species for this habitat. Interior grasslands represent the largest area of natural habitat of the three Grande Ronde habitats this species is closely associated with. The western meadowlark is designated as Sensitive – Critical in Oregon and is a HEP species used in habitat loss assessments associated with Columbia River hydropower projects. The western meadowlark is also the Oregon State Bird.

Meadowlarks are associated with 8 of 26 forest and 14 of 20 non-forest structural conditions (IBIS 2004). Of the non-forest structural conditions, they are "closely" associated with Grass/Forb-closed canopy, 3 Low Shrub-open canopy and 3 Medium Shrub-open canopy; they are "generally" associated with the 7 remaining classifications. While the species is closely associated with open canopy shrub habitats, meadowlark abundance is negatively associated with the percent of open ground (Holmes and Geupel 1998) and they have shown a preference for habitats with good grass and litter cover (Wiens and Rotenberry 1981). Singing perches such as trees, shrubs, boulders, fences and power poles, are essential components of meadowlark territories (Altman 2003b).

Western meadowlarks are associated with 21 KECs related to their use of a variety of vegetative elements, interactions with exotic species and their use of anthropogenic habitat elements such as fence posts and hedgerows.

Western meadowlarks perform 3 KEFs, all of which involve trophic relationships (IBIS 2004). Their diet varies seasonally with insects taken mostly in the spring and summer and seeds consumed more in the fall. Where it is available, meadowlarks feed on grain during winter and early spring (Altman 2003b). Meadowlarks are prey for a variety of predators. Nests are constructed on the ground and both eggs and nestlings are vulnerable to predation by foxes, domestic cats and dogs, coyotes, snakes, skunks, raccoons and other small mammals (Lanyon 1957, Bent 1958). Adult birds may be taken by various species of hawks (Lanyon 1994).

Habitat/Focal Species Interaction. On the Boardman Bombing Range in northern Oregon, the meadowlark is the most abundant species in annual grass and shrub habitats including both grazed and ungrazed sagebrush, bitterbrush and other low shrub habitats. However, their relative abundance is greatest in bitterbrush and ungrazed sagebrush habitats (Holmes and Geupel 1998). Meadowlark abundance is greater in bunchgrass and sagebrush habitats that are free from grazing (Altman 2003b). In habitats grazed by livestock or subject to other agricultural practices, nests may be trampled or destroyed by equipment such as mowers (Altman 2003b). Conversion of native habitats to non-suitable agriculture may contribute to declines in this species (Altman 2003b).

Shrub-steppe and Salt Scrub Shrublands – Three wildlife habitat types, Shrub-steppe, Dwarf Shrub-Steppe and Desert Playa and Salt Scrub Shrublands, have been combined for discussion in subbasin planning due to their overall similarity and the similarity of management issues among them. The habitat maps from available vegetation data fail to give an accurate picture of the status of these types. While shrub-steppe habitat may be increasing slightly, the desert playa and salt scrub shrublands are most likely decreasing slightly. These three types together and individually, occupy a very small portion of the Grande Ronde subbasin.

Grande Ronde Historic acreage: 16,301
Grande Ronde Current acreage: 27,211
Increased acreage: 10,910

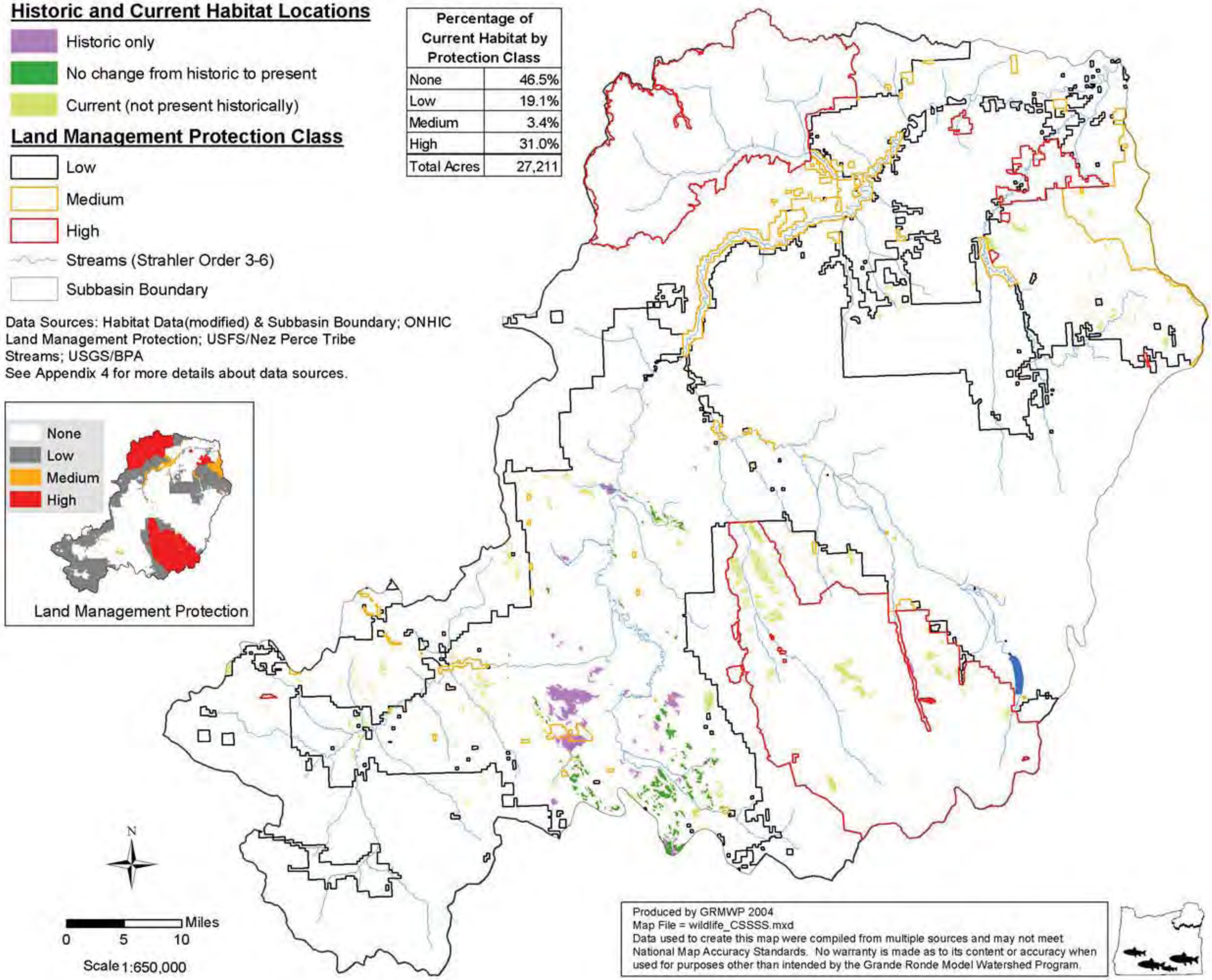


Figure 58. A comparison of historic and current distribution of shrub-steppe and salt scrub shrubland wildlife habitat in the Grande Ronde subbasin with current protection status.

Focal Species. The **sage sparrow** has been selected as the focal species for this habitat. The sage sparrow is closely associated only with shrub-steppe habitat in the Grande Ronde subbasin. The sage sparrow is designated Sensitive – Critical in Oregon and is a Candidate for listing in Washington. It is also a PIF species.

Sage sparrows are associated with none of the 26 forest and 12 of 20 non-forest structural conditions. They are "generally" associated with low shrub conditions and "closely" associated with medium shrub conditions including both open and closed canopy types. This species prefers semi-open habitats with evenly spaced shrubs 1-2 m high. Vertical structure, habitat patchiness and vegetation density may be more important in habitat selection than specific shrub species (numerous authors cited in Martin and Carlson 1998).

Sage sparrows are associated with 10 KECs related to their use of shrubland/grassland vegetative elements, relationship with exotic plants, and use of non-vegetative habitat elements such as rock and barren ground. In Oregon, the species is most commonly associated with big sagebrush communities that may include a mix of other shrubs or, rarely, juniper (Martin and Carlson 1998). Invasion of shrub-steppe habitats by exotic annuals such as cheatgrass reduces or eliminates the suitability of the habitat for sage sparrows; they abandon former habitats once they have been invaded by cheatgrass (Wiens 1985, Rogers et al. 1988).

Sage sparrows perform 6 KEFs involving trophic functions and organismal relationships (IBIS 2004). The species consumes both seeds and terrestrial invertebrates and serves as prey for primary or secondary predators. They also disperse seeds and fruits and are a common interspecific host. Sage sparrows forage on the ground, usually near or under the edges of shrubs (Martin and Carlson 1998). The sage sparrow diet consists primarily of insects during the months when they are available but is mostly seeds the rest of the year (Rotenberry 1980). Sage sparrow nests may be parasitized by brown-headed cowbirds (Martin and Carlson 1998). In some reported cases, sage sparrows abandoned nests with cowbird eggs in them, but in others the birds attempted to raise or successfully fledged cowbird young (several authors cited in Martin and Carlson 1998).

Habitat /Focal Species Interaction. This species prefers semi-open shrub habitat, a habitat that is uncommon in the Grande Ronde subbasin. Livestock grazing likely has a direct negative effect on nesting success by disturbing nesting birds and damaging nests and an indirect effect by enabling cowbird parasitism (Rich 1978, Miller 2003). Also, efforts to increase forage by replacing native shrub steppe communities with non-native grasses result in local population declines (Wiens and Rotenberry 1985).

<u>16 Shrub-steppe</u>

Definition/Description:

Geographic Distribution. Shrub-steppe habitats are common across the Columbia Plateau of Washington, Oregon, Idaho, and adjacent Wyoming, Utah, and Nevada. It extends up into the cold, dry environments of surrounding mountains. In the Grande Ronde subbasin, this habitat is limited to small, scattered areas in the southern portion of the subbasin and in the Minam River, Indian Creek and other drainages.

Physical Setting. Generally, this habitat is associated with dry, hot environments in the Pacific Northwest although variants are in cool, moist areas with some snow accumulation in climatically dry mountains. Elevation range is wide (300-9,000 ft [91-2,743 m]) with most habitat occurring between 2,000 and 6,000 ft (610-1,830 m). Habitat occurs on deep alluvial, loess, silty or sandy-silty soils, stony flats, ridges, mountain slopes, and slopes of lake beds with ash or pumice soils.

Composition. Characteristic and dominant mid-tall shrubs in the shrub-steppe habitat include all 3 subspecies of big sagebrush, basin (*Artemisia tridentata ssp. tridentata*), Wyoming (*A. t. ssp. wyomingensis*) or mountain (*A. t. ssp. vaseyana*), antelope bitterbrush (*Purshia tridentata*), and 2 shorter sagebrushes, silver (*A. cana*) and three-tip (*A. tripartita*). Each of these species can be the only shrub or appear in complex seral conditions with other shrubs. Common shrub complexes are bitterbrush and Wyoming big sagebrush, bitterbrush and three-tip sagebrush, Wyoming big sagebrush and three-tip sagebrush, and mountain big sagebrush and silver sagebrush. Wyoming and mountain big sagebrush can codominate areas with tobacco brush (*Ceanothus velutinus*). Rabbitbrush (*Chrysothamnus viscidiflorus*) and short-spine horsebrush (*Tetradymia spinosa*) are common associates and often dominate sites after disturbance. Big sagebrush occurs with the shorter stiff sagebrush (*A. rigida*) or low sagebrush (*A. arbuscula*) on shallow soils or high elevation sites. Many sandy areas are shrub-free or are open to patchy shrublands of bitterbrush and/or rabbitbrush. Silver sagebrush is the dominant and characteristic shrub along the edges of stream courses, moist meadows, and ponds. Silver sagebrush and rabbitbrush are associates in disturbed areas.

Grande Ronde Historic acreage: 1,558
Grande Ronde Current acreage: 15,030
Increased acreage: 13,472

Status & trend: It is likely that this habitat has increased somewhat since historic times but the magnitude of the increase shown is unrealistic. This exaggerated change may be because the habitat is underrepresented in the historic vegetation data. Region wide, big Sagebrush and Mountain Sagebrush cover types are significantly smaller in area than before 1900, and Bitterbrush/Bluebunch Wheatgrass cover type is similar to the pre-1900 extent. More than half of the Pacific Northwest shrub-steppe habitat community types listed in the National Vegetation Classification are considered imperiled or critically imperiled.

Key disturbance factors: Fire suppression and heavy grazing of grasslands may result in sagebrush encroachment of those habitats. Grazing, Invasion by non-natives, Conversion to agriculture; Shrub density and annual cover increase, whereas bunchgrass density decreases with livestock use. Repeated or intense disturbance, particularly on drier sites, leads to cheatgrass dominance and replacement of native bunchgrasses. Dry and sandy soils are sensitive to grazing, with needle-and-thread replaced by cheatgrass at most sites.

Species Closely Associated: Swainson's hawk, ferruginous hawk, sage grouse, sharp-tailed grouse, long-billed curlew, burrowing owl, loggerhead shrike, sage thrasher, vesper sparrow, sage sparrow, western meadowlark, western small-footed myotis, western pipistrelle, pallid bat, pygmy rabbit, black-tailed jackrabbit, deer mouse, bushy-tailed woodrat, pronghorn antelope.

17 Dwarf Shrub-steppe

Definition/Description:

Geographic Distribution. Dwarf-shrub and related scabland habitats are located throughout the Columbia Plateau and in adjacent woodland and forest habitats. They are more common in southern Oregon than in Washington. Stiff sagebrush/Sandberg bluegrass is a major type widely distributed in the Columbia Basin, particularly associated with the channeled scablands, High Lava Plains, and in isolated spots throughout the Blue Mountains and the Palouse. In the Grande Ronde subbasin, this habitat occurs in small, isolated patches primarily in the southern portion of the subbasin.

Physical Setting. This habitat appears on sites with little soil development that often have extensive areas of exposed rock, gravel, or compacted soil. The habitat is characteristically associated with flats, plateaus, or gentle slopes although steep slopes with rock outcrops are common. Scabland types within the shrub-steppe area occur on barren, usually fairly young basalts or shallow loam over basalt <12 inches (30 cm) deep. In woodland or forest mosaics, scabland soils are deeper (still <26 inches [65 cm]) but too droughty or extreme soils for tree growth. Topoedaphic drought is the major process influencing these communities on ridge tops and gentle slopes around ridgetops. Spring flooding is characteristic of scablands in concave topographic positions. This habitat is found across a wide range of elevations from 500 to 7,000 ft (152 to 2,134 m).

Composition. Several dwarf-shrub species characterize this habitat: low sagebrush (*Artemisia arbuscula*), black sagebrush (*A. nova*), stiff sagebrush (*A. rigida*), or several shrubby buckwheat species (*Eriogonum douglasii, E. sphaerocephalum, E. strictum, E. thymoides, E. niveum, E. compositum*). These dwarf-shrub species can be found as the sole shrub species or in combination with these or other low shrubs. Purple sage (*Saliva dorrii*) can dominate scablands on steep sites with rock outcrops.

Sandberg bluegrass (*Poa sandbergii*) is the characteristic and sometimes the dominant grass making up most of this habitat's sparse vegetative cover. Taller bluebunch wheatgrass (*Pseudoroegneria spicata*) or Idaho fescue (*Festuca idahoensis*) grasses may occur on the most productive sites with Sandberg bluegrass. Bottlebrush squirreltail (*Elymus elymoides*) and Thurber needlegrass (*Stipa thurberiana*) are typically found in low cover areas, although they can dominate some sites. One-spike oatgrass (*Danthonia unispicata*), prairie junegrass (*Koeleria macrantha*), and Henderson ricegrass *(Achnatherum hendersonii*) are occasionally important. Exotic annual grasses, commonly cheatgrass (*Bromus tectorum*), increase with heavy disturbance and can be locally abundant. Common forbs include serrate balsamroot (*Balsamorhiza serrata*), Oregon twinpod (*Physaria oregana*), Oregon bitterroot (*Lewisia rediviva*), big-head clover (*Trifolium macrocephalum*), and Rainier violet (*Viola trinervata*). Several other forbs *(Arenaria, Collomia, Erigeron, Lomatium,* and *Phlox* spp.) are characteristic, early blooming species. A diverse lichen and moss layer is a prominent component of these communities.

Medium-tall shrubs, such as big sagebrush (*Artemisia tridentata*), Silver sagebrush (*A. cana*), antelope bitterbrush (*Purshia tridentata*), and rabbitbrush (C*hrysothamnus* spp.) occasionally appear in these scablands.

Lower Middle Snake Historic acreage: 6,214

Lower Middle Snake Current acreage: 12,181

Increased acreage: 5,967

Status & Trend: This habitat is likely underrepresented in the historic vegetation data, giving the appearance that it ahs doubled in extent. In the judgment of the subbasin Technical Team, this habitat may have increased slightly since before European settlement. Quigley and Arbelbide concluded that, region wide, the low sagebrush cover type is as abundant as it was before 1900. They concluded that "Low Sagebrush-Xeric" successional pathways have experienced a high level of change from exotic invasions and that some pathways of "Low Sagebrush-Mesic" are unaltered. Twenty percent of Pacific Northwest dwarf shrub-steppe community types listed in the National Vegetation Classification are considered imperiled or critically imperiled.

Key Disturbance Factors: Scabland habitats often do not have enough vegetation cover to support wildfires. Bunchgrass sites with black or low sagebrush may burn enough to damage shrubs and decrease shrub cover with repetitive burns. Many scabland sites have poorly drained soil and because of shallow soil are prone to winter flooding. Freezing of saturated soil results in "frost-heaving" that churns the soil and is a major disturbance factor in vegetation patterns. Stiff sagebrush is a preferred browse for elk as well as livestock. Native ungulates use scablands in early spring and contribute to churning of the soil surface. Scabland habitats provide little forage and consequently are used only as a final resort by livestock. Heavy use by livestock or vehicles disrupts the moss/lichen layer and increases exposed rock and bare ground that create habitat for exotic plant invasion. Exotic annual bromes have become part of these habitats with natural soil churning disturbance.

Species Closely Associated: sage grouse, long-billed curlew, vesper sparrow, western meadowlark, pallid bat, Nuttall's cottontail, deer mouse, bushy-tailed woodrat, sagebrush vole, kit fox, pronghorn antelope.

18 Desert Playa and Salt Scrub Shrublands

Geographic Distribution. In the Pacific Northwest, this habitat is most common and abundant in the larger, alkaline lake basins in southeastern Oregon, although it is represented throughout the Columbia Plateau, Basin and Range, and Owyhee Provinces. Black greasewood salt desert scrub and alkaline/saline bottomland grasslands and wetlands appear throughout the Columbia Plateau of Washington and Oregon.

Physical Setting. This habitat typically occupies the lowest elevations in hydrologic basins in the driest regions of the Pacific Northwest. Elevation range is highly variable, from 3,000 to 7,500 ft (914 to 2.286 m) in southeastern Oregon to 500 to 5,500 ft (152-1,676 m) in central Washington. Structural and compositional variation in this habitat is related to changes in salinity and fluctuations in the water table. Areas with little or no vegetative cover have highly alkaline and saline soils and are poorly drained or irregularly flooded. The wettest variants of the habitat are usually found at the mouths of stream drainages or in areas with some freshwater input into a playa. These have finer, deeper alluvial soils that occur in low alkaline dunes, around playas, on slopes above alkaline basins or in small, poorly drained basins in sagebrush steppe. Topographically, this habitat occurs on playas or desert pavement, or on low benches above playas with occasional low alkaline dune ridges. This habitat is typically surrounded by shrub-steppe habitat but may be associated with Herbaceous Wetland habitat.

Composition. Characteristic medium-tall shrubs that dominate well-drained sites are shadscale (Atriplex confertifolia), bud sagebrush (Artemisia spinescens), and hopsage (Grayia spinosa). Characteristic low shrubs are greenmolly (Kochia americana), saltbush (Atriplex gardneri or A. nuttallii), and winter fat (Krascheninnikovia lanata). Other medium-tall shrubs, big sagebrush (Artemisia tridentata), or rabbitbrush (Chrysothamnus nauseosus or C. viscidiflorus) can be co-dominant. The medium-tall shrub black greasewood (Sarcobatus vermiculatus can be dominant or co-dominant on less well drained, generally more saline parts of this habitat.

Grande Ronde Historic acreage: 8,529

Grande Ronde Current acreage: 0

Decreased acreage: 8,529

Status and Trend. Agricultural development is generally not feasible; consequently, little of this habitat is converted to other uses. Most of this habitat is used for livestock grazing, which overall has increased shrub and annual cover and decreased bunchgrass cover. Quigley and Arbelbide concluded that the Salt Desert Shrub cover type is less abundant now than before 1900. They further noted that the cover type has undergone a moderate level of change, so that some successional pathways have been unaltered. In the Grande Ronde subbasin, this habitat was historically associated with the herbaceous wetlands of the Grande Ronde Valley where small patches remain in the form of black greasewood dominated stands. Approximately one third of Pacific Northwest salt desert and related community types listed in the National Vegetation Classification are considered imperiled or critically imperiled.

Key Disturbance Factors. Many of these areas are prone to irregular flooding and prolonged droughts; both factors lead to a redistribution of component species and creation of sparsely or unvegetated areas. Several exotic species invade this habitat with grazing. Halogeton, a toxic exotic plant, is found most commonly in this habitat. Other noxious but nontoxic exotics that increase with grazing are Russian thistle (*Salsola kali*), tall tumblemustard (*Sisymbrium altissimum*), and cheatgrass. These can replace native grasses and change the structure of the native habitat.

Species Closely Associated. The IBIS database did not recognize this habitat as present in the Grande Ronde subbasin either historically or currently and therefore did not designate any species as closely associated with it in the subbasin. However, where the habitat was recognized to occur, species closely associated included sage grouse, least chipmunk, Piute ground squirrel, Great Basin pocket mouse, pronghorn antelope, long-nosed leopard lizard and night snake.

<u>19 Agriculture, Pastures, and Mixed Environs</u>

Definition/Description:

Geographic Distribution. Agricultural habitat is widely distributed at low to mid-elevations (<6,000 ft [1,830 m]) throughout both states. This habitat is most abundant in broad river valleys throughout both states and on gentle rolling terrain east of the Cascades. In the Grande Ronde subbasin, this habitat is found primarily in the Grande Ronde and Wallowa River valleys.

Physical Setting. This habitat is maintained across a range of climatic conditions typical of both states. Climate constrains agricultural production at upper elevations where there are <90 frost-free days. Agricultural habitat in arid regions east of the Cascades with <10 inches (25 cm) of rainfall require supplemental irrigation or fallow fields for 1-2 years to accumulate sufficient soil moisture. Soils types are variable, but usually have a well developed A horizon.

Composition. Agricultural habitat varies substantially in composition among the cover types it includes. Cultivated cropland includes >50 species of annual and perennial plants in Oregon and Washington, and hundreds of varieties ranging from vegetables such as carrots, onions, and peas to annual grains such as wheat, oats, barley, and rye. Row crops of vegetables and herbs are characterized by bare soil, plants, and plant debris along bottomland areas of streams and rivers and areas having sufficient water for irrigation. Annual grains, such as barley, oats, and wheat are typically produced in almost continuous stands of vegetation on upland and rolling hill terrain without irrigation.

Improved pastures are used to produce perennial herbaceous plants for grass seed and hay. Alfalfa and several species of fescue (*Festuca spp*.) and bluegrass (*Poa spp*.), orchardgrass (*Dactylis glomerata*), and timothy (*Phleum pratensis*) are commonly seeded in improved pastures. Grass seed fields are single-species stands, whereas pastures maintained for haying are typically composed of 2 to several species. The improved pasture cover type is one of the most common agricultural uses in both states and produced with and without irrigation.

Unimproved pastures include rangelands planted to exotic grasses that are found on private land, state wildlife areas, federal wildlife refuges and U.S. Department of Agriculture Conservation Reserve Program (CRP) sites. Grasses commonly planted on CRP sites are crested wheatgrass (*Agropyron cristatum*), tall fescue (*F. arundinacea*), perennial bromes (*Bromus spp*.) and wheatgrasses (*Elytrigia spp*.). Intensively grazed rangelands, which have been seeded to intermediate wheatgrass (*Elytrigia intermedia*), crested wheatgrass, or are dominated by increaser exotics such as Kentucky wheatgrass (*Poa pratensis*) or tall oatgrass (*Arrhenatherum elatius*) are unimproved pastures. Other unimproved pastures have been cleared and intensively farmed in the past, but are allowed to convert to other vegetation. These sites may be composed of uncut hay, litter from previous seasons, standing dead grass and herbaceous material, invasive exotic plants (tansy ragwort [*Senecio jacobea*], thistle [*Cirsium spp*.], Himalaya blackberry [*Rubus discolor*], and Scot's broom [*Cytisus scoparius*]) with patches of native black hawthorn (*Crataegus douglasii*), snowberry (*Symphoricarpos spp*.), spirea (*Spirea spp*.), poison oak (*Toxicodendron diversilobum*), and encroachment of various tree species, depending on seed source and environment.

Grande Ronde Historic acreage: None
Grande Ronde Current acreage: 383.575
Increased acreage: 383.575

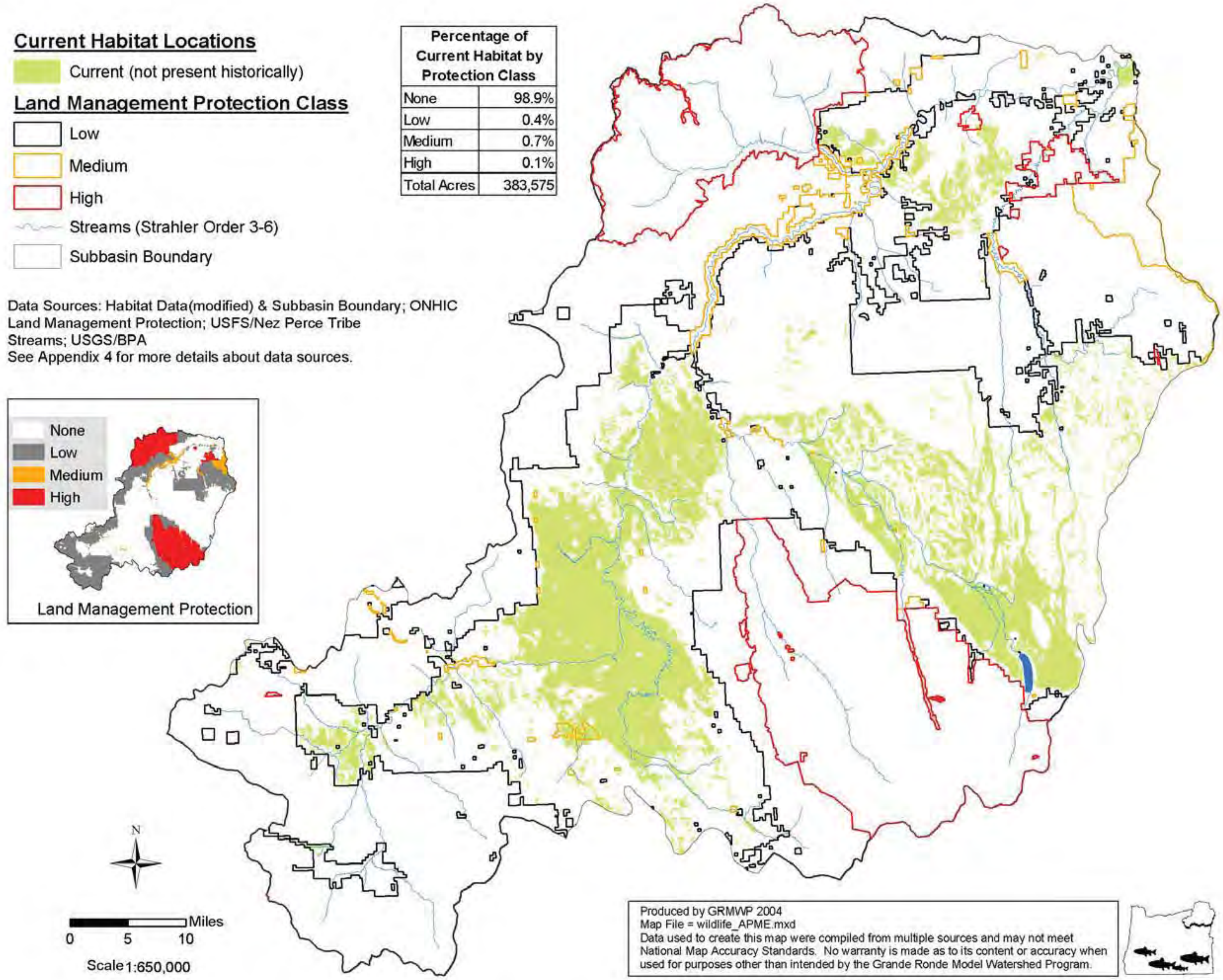


Figure 59. Current distribution of agriculture, pasture and mixed environs in the Grande Ronde subbasin with current protection status.

Status & trend: Agricultural habitat has steadily increased in amount and size since Eurasian settlement of the region. Conversion to agricultural habitat threatens several native habitat types. Since the 1985 Farm Bill and the economic downturn of the early to mid 1980's, the amount of land in agricultural habitat has stabilized and begun to decline.

Key disturbance factors: The dominant characteristic of agricultural habitat is a regular pattern of management and vegetation disturbance.

Species Closely Associated: great blue heron, Canada goose, Swainson's hawk, sandhill crane, long-billed curlew, loggerhead shrike, American crow, vesper sparrow, grasshopper sparrow, bobolink, western meadowlark, house finch, Virginia opossum, big brown bat, northern pocket gopher, deer mouse, bushy-tailed woodrat, montane vole, raccoon.

Focal Species. Wildlife damage management is one of the largest, most difficult issues facing agricultural producers and wildlife managers. For that reason, **Rocky Mountain elk** has been selected as the focal species for this habitat type. Elk are habitat generalists and are, therefore, not "closely" associated with any of the habitats in the Grande Ronde subbasin; they are "generally" associated with many (IBIS 2004). Elk are a critical functional link species and a managed (game) species in Oregon.

As elk are habitat generalists, so are they structural condition generalists; elk are "generally" associated with all of the forest and non-forest structural conditions in IBIS (IBIS 2004). This generalist description stems from their use of a mosaic of habitat types and structural conditions including early seral, forage producing stands and later, cover-forming stands in forested zones and forage producing areas with adjacent cover in non-forested zones (Verts and Carraway 1998). Approximately 90% of use of foraging areas by elk occurs within ≈ 120 m of cover sufficient to hide 90% of a standing elk at ≈ 60 m. Hiding cover provides security for elk but thermal cover is also needed to shelter the animals from summer heat or winter cold (Verts and Carraway 1998).

Rocky Mountain elk are associated with 39 KECs reflecting their generalist habitat requirements and interaction with anthropogenic features such as roads, guzzlers, and supplemental food sources (IBIS 2004). Elk are known to use some form of a wide variety of habitat types including forests, shrubland/grassland and wetlands provided their requirements for forage and cover are met. They have some association (negative or positive) with several ecological habitat elements such as exotic plants, mountain pine beetle irruptions and snow depth (IBIS 2004). They exhibit a complex relationship with anthropogenic features as they will use guzzlers and other developed water sources but avoid open roads. Elk take advantage of supplemental food sources and will tolerate relatively close approach of people supplying the feed but avoid people in most other circumstances.

Elk perform 13 KEFs related to their roles as browser/grazer and prey for primary or secondary predators as well as their effect on the physical environment and vegetation structure by their wallowing and foraging habits. Elk in northeastern Oregon consumed a wide variety of plant species including grasses, sedges, forbs and woody plants. Seasonal variation in forage selection was related to differences in phenological development of the various plant types (Korfhage et al. 1980). Elk are subject to predation by large and midsize carnivores. In the Grande Ronde subbasin, these are primarily cougar and black bear although coyotes and bobcats may be capable of taking neonate or very young, naive calves.

Habitat/Focal Species Interaction. In northeastern Oregon, most elk summer range is on public land, but winter range is on private land (Skovlin and Vavra 1979). This is the context in which most damage complaints arise and in which elk damage to crops and property has become one of the most difficult and costly that wildlife managers contend with. Ongoing efforts to minimize damage include supplemental feeding, hazing and translocation of problem animals. Elk damage to agricultural crops may occur in conjunction with an inadequate supply of natural forage. In these cases, efforts to disperse the elk provide a poor solution if the animals do not have access to an adequate food source (Lyon and Ward 1982).

21 Open Water - Lakes, Rivers, and Streams

Definition/Description:

Geographical Distribution. Lakes in Oregon and Washington occur statewide and are found from near sea level to about 10,200 ft (3,110 m) above sea level. There are 6,000 lakes, ponds, and reservoirs in Oregon including almost 1,800 named lakes and over 3,800 named reservoirs, all amounting to 270,641 acres (109,571 ha).

Physical Setting. The lakes in the Cascades and Olympic ranges were formed through glaciation and range in elevation from 2,500 to 5,000 ft (762 to 1,524 m). Beavers create many ponds and marshes in Oregon and Washington. Human-made reservoirs created by dams impound water that creates lakes behind them, like Bonneville Dam on the main stem of the Columbia River. Wallowa Lake forms the largest impoundment of open water in the Grande Ronde subbasin, but other lakes, rivers streams, ponds, and ditches are found throughout the subbasin.

Grande Ronde Historic acreage: 9,486
Grande Ronde Current acreage: 7,045
Decreased acreage: 2,441

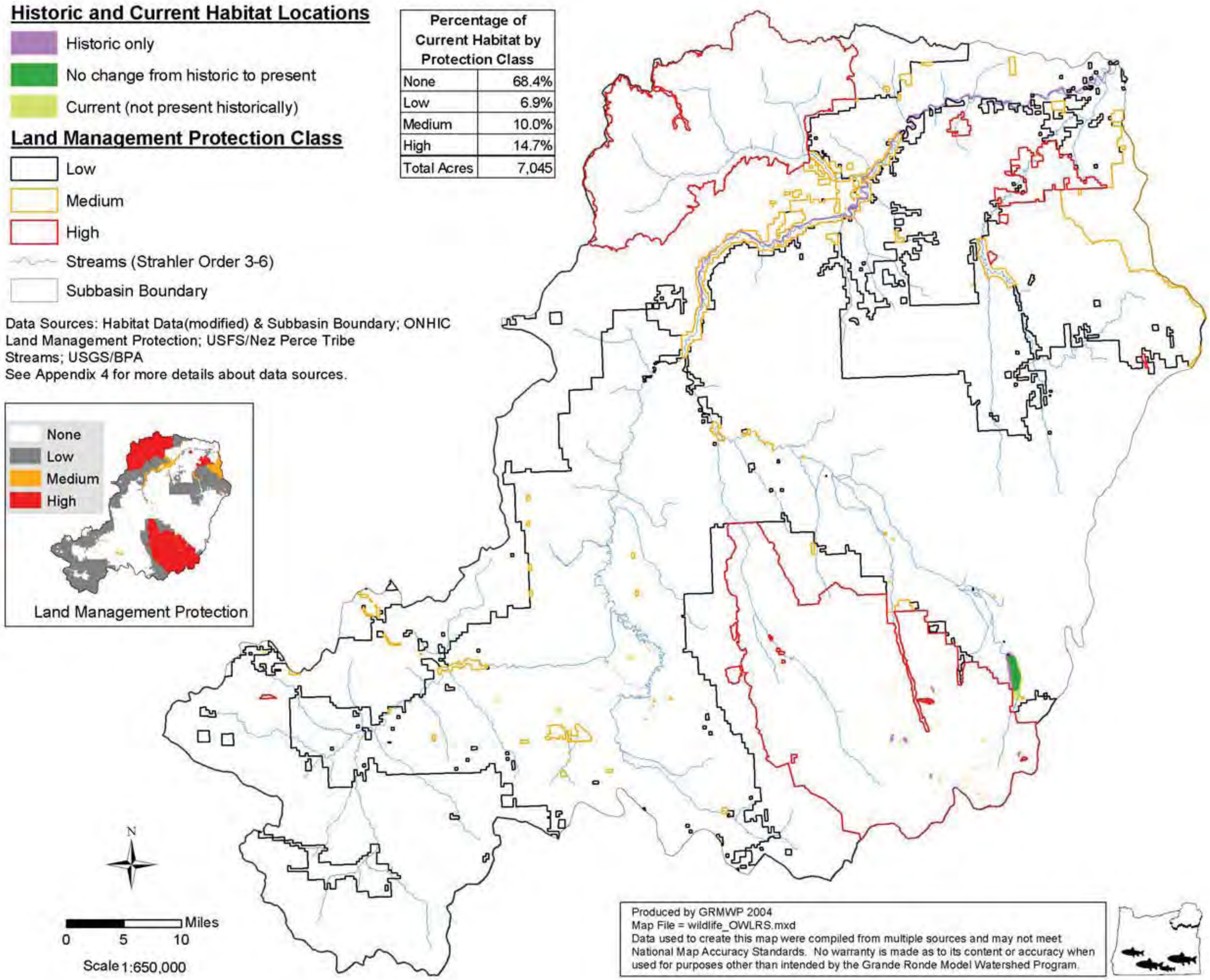


Figure 60. A comparison of historic and current distribution of open water – lakes, rivers, stream wildlife habitat in the Grande Ronde subbasin with current protection status.

Status & trend: Although the above acreages suggest a decline in open water habitat, it is believed that there has actually been a slight increase due to impoundments and water development for agriculture, livestock and human use. The principal trend has been in relationship to dam building or channelization for hydroelectric power, flood control, or irrigation purposes.

Key disturbance factors: Overgrazing, loss of vegetation (logging), channelization, eutrophication, irrigation withdrawal, over-appropriation.

Species Closely Associated: long-toed salamander, western toad, Woodhouse's toad, Columbian spotted frog, northern leopard frog, painted turtle, western pond turtle, horned grebe, red-necked grebe, western grebe, American white pelican, great blue heron, Canada goose, redhead, greater scaup, harlequin duck, bufflehead, Barrow's goldeneye, bald eagle, mew gull, Vaux's swift, bank swallow, western small-footed myotis, western pipistrelle, Townsend's big-eared bat, pallid bat, American beaver, mink.

Focal Species. The **bald eagle** has been selected as the focal species for this cover type. This is the only Grande Ronde subbasin habitat the bald eagle is closely associated with. The technical team identified the bald eagle as epitomizing the interrelationship between aquatic and terrestrial habitats. The species is federally listed as *Threatened* and is listed as *Threatened* in both Oregon and Washington. Bald eagles are a species that eats salmonids.

Bald eagles are associated with 19 of 26 forest and all 20 non-forest structural conditions although it is not identified as being "closely" associated with any of them (IBIS 2004). However, Buehler (2000:6) described nesting habitat as "mature and old-growth forest with some habitat edge, relatively close (<2 km) to water with suitable foraging opportunities." Further, preferred diurnal perch and nocturnal roost trees are super-canopy trees with easy access (Buehler 2000). Therefore, although bald eagles are generally associated with a variety of structural conditions, there is a preference for habitat that provides large or giant trees suitable for nesting, perching or roosting relatively close to foraging areas.

Bald eagles are associated with 70 KECs related to the diversity of structural conditions utilized, their relationship with fresh water riparian and aquatic and marine habitat elements, and their interaction with anthropogenic habitat elements (IBIS 2004). This species utilizes large trees and snags in both forest and non-forest contexts. They also utilize a variety of freshwater habitats, primarily for foraging, and a number of anthropogenic elements including power poles, mooring piles and hatchery facilities (IBIS 2004).

Bald eagles perform 8 KEFs related to their trophic and organismal relationships with other species (IBIS 2004). The species consumes a diversity of prey that varies by season and location. Although little is known of the food habits of nesting birds in Oregon (Isaacs and Anthony 2003), several authors (cited in Isaacs and Anthony 2003) recorded fish, waterfowl, seabirds, small mammals and carrion in the diets of bald eagles. The carrion included livestock that died of natural causes and the afterbirth of both sheep and cattle but no recorded cases of live-caught domestic stock were noted. In addition to utilizing available carrion, bald eagles pirate food from other species (IBIS 2004); they capture their own prey only as a last resort (Buehler 2000).

Bald eagles are among 3 Grande Ronde subbasin focal species and about 70 species in the subbasin overall with some relationship to salmonids (IBIS 2004). They have a "strong, consistent relationship," through consumption, with all saltwater life stages, freshwater spawning stage and carcasses (IBIS 2004). Bald eagles also have an "indirect relationship" to several fresh and saltwater life stages and carcasses (IBIS 2004). In the Pacific Northwest, including Oregon, salmon carcasses are scavenged as salmon die after spawning (Buehler 2000). However, due to timing of spawning runs in the northwest, salmon are less available to nesting eagles in Oregon and more available to wintering birds (Ofelt 1975).

Habitat/Focal Species Interaction. Bald eagles represent the interconnectedness of terrestrial and aquatic habitats in the Grande Ronde subbasin. They utilize large trees in wetland, riparian and upland situations for roosting, nesting and perching while requiring wetland and open water habitat for foraging. Bald eagles may be affected by impacts to any of these habitat types including loss of large trees, contamination by pesticides or other toxins, presence (and ingestion) of lead and other foreign substances and disturbance at nest and roost sites (Buehler 2000).

Combined Wetlands – All three wetland habitat types in the subbasin; Herbaceous Wetlands, Montane Coniferous Wetlands and Eastside Riparian Wetlands; have been combined for discussion in subbasin planning. These habitats are being considered together due to their functional similarities and the similarity of management issues across the three types. All three have declined since before European settlement but the greatest losses have been to herbaceous and riparian wetland habitats due to their generally lower elevation, greater accessibility and location in areas desired for agricultural development, road building and other human activities.

Grande Ronde Historic acreage: 147,050
Grande Ronde Current acreage: 91,033
Decreased acreage: 56,017

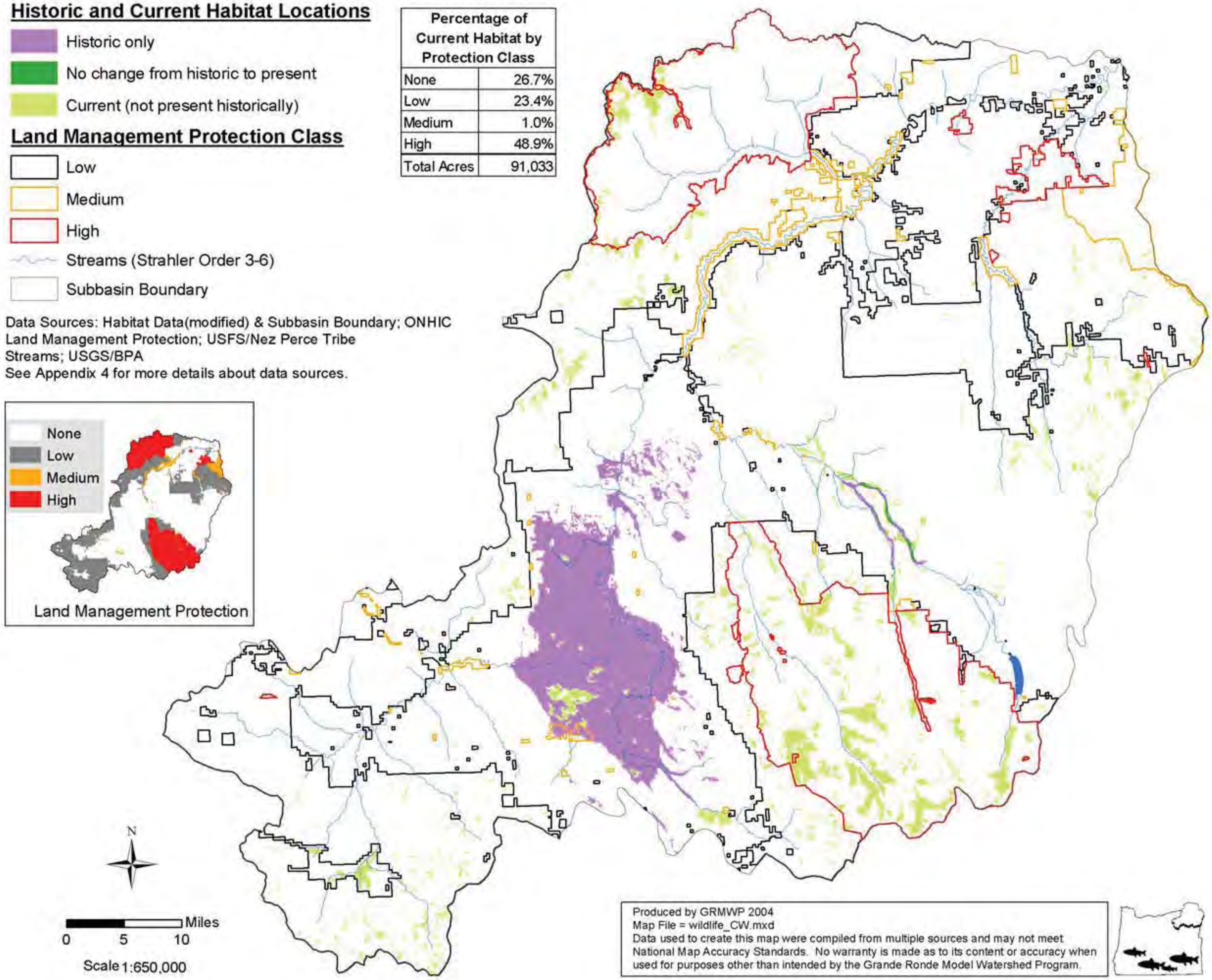


Figure 61. A comparison of historic and current distribution of wetland wildlife habitat in the Grande Ronde subbasin with current protection status.

Given that is it believed the acreages given for Montane Coniferous Wetland are inaccurate, the overall loss of wetland habitats is likely much higher that the above numbers indicate (Grande Ronde Subbasin Technical Team, personal communication 2/12/2004).

Focal Species. In spite of their functional and management similarities, wetlands have various structural, vegetative and hydrologic components. Therefore, to capture that variability, four focal species have been selected to represent wetland habitats in the Grande Ronde subbasin: great blue heron, yellow warbler, Columbia spotted frog and American beaver.

The **great blue heron** (GBH) utilizes nearly every component of wetlands although they may be most dependent on the presence of large overstory structure for construction of communal nesting areas or rookeries. Great blue herons are a critical functional link species in the Grande Ronde subbasin and are a species that eats salmonids. Like bald eagles, great blue herons demonstrate the connectedness of aquatic and terrestrial habitats.

Great blue herons are generally associated with or present in 13 of 26 forest structural conditions, all of which are used for reproduction if the necessary habitat elements are present. They are associated with 10 of 20 non-forest structural conditions, 6 for foraging only and 4 for foraging and reproduction if the necessary habitat elements are present (IBIS 2004). Average height of nest trees was 79 ft (24 m) and average dbh was 4.5 ft (1.36 m); herons nest in the top one-third of the nest tree (Henny and Bethers 1971).

Great blue herons are associated with 65 KECs related to their use of forest, shrubland, freshwater, marine and anthropogenic habitat elements (IBIS 2004). Short and Cooper (1985) provide criteria for suitable great blue heron foraging habitat. Suitable great blue heron foraging habitats are within 1.0 km of heronries or potential heronries. The suitability of herbaceous wetland, scrub-shrub wetland, forested wetland, riverine, lacustrine or estuarine habitats as foraging areas for the great blue heron is ideal if these potential foraging habitats have shallow, clear water with a firm substrate and a huntable population of small fish. Short and Cooper (1985) describe suitable great blue heron nesting habitat as a grove of trees at least 0.4 ha in area located over water or within 250m of water. These potential nest sites may be on an island with a river or lake, within a woodland dominated swamp, or in vegetation near a river or lake. Trees used as nest sites are at least 5m high and have many branches at least 2.5 cm in diameter that are capable of supporting nests. Trees may be alive or dead but must have an "open canopy" that allows an easy access to the nest.

Great blue herons perform 11 KEFs involving their trophic and organismal relationships with other species and the physical transfer of nutrients (IBIS 2004). They consume a variety of prey including terrestrial and aquatic invertebrates and terrestrial and aquatic vertebrates. GBHs also create opportunities for feeding, nesting, roosting or denning for other species through their foraging and nest building activities (IBIS 2004).

Great blue herons have a "recurrent" relationship with salmonids at various life stages in both fresh- and saltwater environments (IBIS 2004). Although herons feed on a variety of animals, fish, including salmonids, are the primary prey.

Habitat/Focal Species Interaction. Habitat destruction and the resulting loss of nesting and foraging sites, and human disturbance probably have been the most important factors contributing to declines in some great blue heron populations in recent years (Thompson 1979a; Kelsall and Simpson 1980; McCrimmon 1981). 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. Although great blue herons currently appear to tolerate low levels of pollutants, these chemicals can move through the food chain, accumulate in the tissues of prey and may eventually cause reproductive failure in the herons.

Great blue herons live at the interface of aquatic and terrestrial habitats; their nesting colonies are in trees and shrubs in upland or riparian areas and foraging takes place in shallow open water and wetland communities and in upland fields. Herons feed on both terrestrial and aquatic prey.

The **yellow warbler** is found primarily in riparian wetlands with a forest understory or shrub component and here represents that shrubby understory. It is a PIF species and a HEP species used in habitat loss assessments associated with Columbia River hydropower projects.

Yellow warblers are associated with 16 of 26 forest and 6 of 20 non-forest structural conditions. Although most of these associations are "general," they are "closely" associated with mature and old tall shrub overstory with both open and closed canopies (IBIS 2004).

Yellow warblers are associated with 15 KECs related to their use of forest, shrubland and freshwater riparian habitats and their relationship with exotic species, insect population irruptions and anthropogenic habitat elements (IBIS 2004). The species is strongly associated with riparian and wet deciduous habitats throughout its North American range. It occurs along most riverine systems, including the Columbia River, where appropriate riparian habitats have been protected. The yellow warbler is a good indicator of functional subcanopy/shrub habitats in riparian areas.

Yellow warblers perform 5 KEFs involving their consumption of terrestrial invertebrates and role as prey for primary or secondary predators. They may also help control insect populations and serve as a common interspecific host. Yellow warblers feed primarily on insects and other arthropods although wild fruits occasionally are eaten (Stevenson and Anderson 1994). Adults, eggs and nestlings are preyed upon by a variety of predators including jays, weasels, snakes, foxes, crows, skunks and domestic cats (several authors cited in Lowther et al. 1999). Yellow warblers are common hosts for nest parasitism by brown-headed cowbirds. Where the two species are sympatric, warblers respond aggressively to cowbird presence (several authors cited in Lowther et al. 1999). They frequently respond to cowbird parasitism by building over the parasitized clutch creating multi-tiered nests (Peck and James 1987).

Habitat/Focal Species Interaction. Yellow warblers in eastern Oregon breed and generally forage within or from perches in deciduous riparian vegetation (Scheuering 2003). Because of its close association with this habitat type, this species is vulnerable to habitat destruction, especially by grazing (Taylor and Littlefield 1986, Sanders and Edge 1998). Further, conversion of forest and scrubland to agricultural uses has benefited the brown-headed cowbird and may have increased the negative impacts of these brood parasites on yellow warbler populations (Ortega and Ortega 2000).

The **Columbia spotted frog** is closely associated with herbaceous and riparian wetlands in the Grande Ronde subbasin and here represents the herbaceous component of wetlands. It is a federal *Candidate* for listing, is designated *Sensitive – Unclear Status* in Oregon and is a *Candidate* for listing in Washington.

Columbia spotted frogs are associated with all 26 forest and 14 of 20 non-forest structural conditions although none of these are "close" associations. The only structural conditions with which spotted frogs are not associated are the "low shrub" types, those habitats dominated by shrubs < 1.6 ft tall (IBIS 2004). With the exception of apparently little use or avoidance of low shrub communities, spotted frogs could be considered structural condition generalists.

Columbia spotted frogs are associated with 36 KECs including the influence of exotic species, their use of numerous freshwater riparian and aquatic habitat elements and the effects of anthropogenic habitat elements. The bull frog (*Rana catesbeiana*), a nonnative ranid species, occurs within the range of the spotted frog in the Great Basin. Bullfrogs are known to prey on other frogs (Hayes and Jennings 1986). They are rarely found to co-occur with spotted frogs, but whether this is an artifact of competitive exclusion is unknown at this time (USFWS 2002c). Columbia spotted frogs are found in a variety of freshwater habitats including rivers and streams, oxbows, ephemeral pools, lakes, ponds, reservoirs and wetlands.

This species performs 6 KEFs related to their consumption of aquatic vegetation, terrestrial invertebrates and aquatic macroinvertebrates; their role as prey for primary or secondary predators and the transfer of nutrients. In a study by Whitaker et al. (1982) in Grant

County, OR (Blue Mountains) Columbia spotted frogs ate a wide variety of food items covering 98 food categories. Seventy-three categories consisted of insect materials, which represented 90.7% of the food by volume. Other invertebrates formed seven categories, and plant material formed three categories, representing 3.9% of the total volume. Frogs from the four variously managed sites displayed different dietary habits, indicating that land management practices may have caused changes in the abundance or composition of local insect populations.

Habitat/Focal Species Interaction: Spotted frog habitat degradation and fragmentation is probably a combined result of past and current influences of heavy livestock grazing, spring development, agricultural development, urbanization, and mining activities. These activities eliminate vegetation necessary to protect frogs from predators and UV-B radiation; reduce soil moisture; create undesirable changes in water temperature, chemistry and water availability; and can cause restructuring of habitat zones through trampling, rechanneling, or degradation which in turn can negatively affect the available invertebrate food source (IDFG et al. 1995; Munger et al. 1997; Reaser 1997; Engle and Munger 2000; Engle 2002).

Springs provide a stable, permanent source of water for frog breeding, feeding, and winter refugia (IDFG et al. 1995). Springs provide deep, protected areas which serve as hibernacula for spotted frogs in cold climates. Springs also provide protection from predation through underground openings (IDFG et al. 1995; Patla and Peterson 1996). Most spring developments result in the installation of a pipe or box to fully capture the water source and direct water to another location such as a livestock watering trough.

The reduction of beaver populations has been noted as an important feature in the reduction of suitable habitat for spotted frogs. Beaver are important in the creation of small pools with slow-moving water that function as habitat for frog reproduction and create wet meadows that provide foraging habitat and protective vegetation cover, especially in the dry interior western United States (St. John 1994).

The **American beaver** is closely associated with herbaceous and riparian wetlands as well as open water and here represents a link between these habitats. It is a critical functional link species and a furbearer managed by the Oregon Department of Fish and Wildlife. Like bald eagles and great blue herons, American beavers demonstrate the interconnectedness between aquatic and terrestrial habitats

Beavers are associated with 25 of 26 forest and 18 of 20 non-forest structural conditions (IBIS 2004). Most of these are “general” associations with the exception of “giant tree-multi-story,” “grass/forb-closed” and “grass/forb-open” among the forest structural conditions. They are noted as simply “present” in those classifications. The only IBIS structural conditions with which beavers are not associated are “medium tree multi-story-moderate” of the forest and both “grass/forb-open” and grass/forb-closed” of the non-forest structural conditions. That beavers are generally associated with a variety of structural conditions, indicates they are not particularly dependent on any of them; as long as there is a zone of woody vegetation adjacent to their freshwater habitat, the structural condition of that zone is not critical to their success.

American beavers are associated with 61 KECs related to their use of forest, shrubland and grassland habitat elements; freshwater riparian and aquatic habitat elements and anthropogenic habitat elements (IBIS 2004). The relatively large number of KECs is indicative of the species’ adaptability.

Beavers perform 15 KEFs related to their consumption of vegetation and the changes they cause in the environment through creation of snags, impoundment of water and burrowing in the soil. By building dams and impounding water, beavers create wetland habitats. As noted above, the reduction of beaver populations has been noted as an important feature in the reduction of suitable habitat for spotted frogs. Beaver are important in the creation of small pools with slow-moving water that function as habitat for frog reproduction and create wet meadows that provide foraging habitat and protective vegetation cover, especially in the dry interior western United States (St. John 1994). Many other wetland species use habitats created by beavers.

Habitat/Focal Species Interaction. American beavers manipulate the environment by damming streams, usually relatively low elevation, low gradient ones. This activity begins habitat succession from open water ponds to emergent wetlands to wet meadows over time and creates a variety of habitats for other species. This same activity puts beavers into conflict with humans as their preferred lower elevation streams tend to be in areas also preferred by people for agriculture or other development. Additionally, those “streams” may often be ditches or culverts. When beavers come into conflict with humans, their dams may be destroyed and the animals may be trapped and removed.

22 Herbaceous Wetlands

Definition/Description:

Geographic Distribution. Herbaceous wetlands are found throughout the world and are represented in Oregon and Washington wherever local hydrologic conditions promote their development. Sedge meadows and montane meadows are common in the Blue and Ochoco mountains of central and northeastern Oregon, and in the valleys of the Olympic and Cascade Mountains and Okanogan Highlands.

Physical Setting. This habitat is found on permanently flooded sites that are usually associated with oxbow lakes, dune lakes, or potholes. Seasonally to semi-permanently flooded wetlands are found where standing freshwater is present through part of the growing season and the soils stay saturated throughout the season. Some sites are temporarily to seasonally flooded meadows and generally occur on clay, pluvial, or alluvial deposits within montane meadows, or along stream channels in shrubland or woodland riparian vegetation. In general, this habitat is flat, usually with stream or river channels or open water present. Elevation varies from sea level to 10,000 ft (3,048 m), although infrequently above 6,000 ft (1,830 m).

Composition. Various grasses or grass-like plants dominate or co-dominate these habitats. Cattails (*Typha latifolia*) occur widely, sometimes adjacent to open water with aquatic bed plants. Several bulrush species (*Scirpus acutus, S. tabernaemontani, S. maritimus, S. americanus, S. nevadensis)* occur in nearly pure stands or in mosaics with cattails or sedges (*Carex spp.).* Burreed *(Sparganium angustifolium , S. eurycarpum*) are the most important graminoids in areas with up to 3.3 ft (1m) of deep standing water. A variety of sedges characterize this habitat. Some sedges (*Carex aquatilis, C. lasiocarpa, C. scopulorum, C. simulata, C. utriculata, C. vesicaria*) tend to occur in cold to cool environments. Other sedges (*C. aquatilis var. dives, C. angustata, C. interior, C. microptera, C. nebrascensis*) tend to be at lower elevations in milder or warmer environments. Slough sedge (*C. obnupta*), and several rush species (*Juncus falcatus, J. effusus, J. balticus*) are characteristic of coastal dune wetlands that are included in this habitat. Several spike rush species (*Eleocharis spp.)* and rush species can be important. Common grasses that can be local dominants and indicators of this habitat are American sloughgrass (*Beckmannia syzigachne*), bluejoint reedgrass (*Calamagrostis canadensis*), mannagrass (*Glyceria spp*.) and tufted hairgrass (*Deschampsia caespitosa*). Important introduced grasses that increase and can dominate with disturbance in this wetland habitat include reed canary grass (*Phalaris arundinacea*), tall fescue (*Festuca arundinacea*) and Kentucky bluegrass *(Poa pratensis*).

Grande Ronde Historic acreage: 84,848
Grande Ronde Current acreage: 16,148
Decreased acreage: 68,700

Status & trend: Nationally, herbaceous wetlands have declined and the Pacific Northwest is no exception. A keystone species, the beaver, has been trapped to near extirpation in parts of the Pacific Northwest and its population has been regulated in others. Herbaceous wetlands have decreased along with the diminished influence of beavers on the landscape. Herbaceous wetlands have also declined in the Grande Ronde subbasin. Historic accounts as well as present soil types indicate that much of the Grande Ronde Valley was once herbaceous wetland. Most of that wetland was drained for agricultural development. Quigley and Arbelbide concluded that herbaceous wetlands are susceptible to exotic, noxious plant invasions.

Key disturbance factors: Direct alteration of hydrology (i.e., channeling, draining, damming) or indirect alteration (i.e., roading or removing vegetation on adjacent slopes) results in changes in amount and pattern of herbaceous wetland habitat. This habitat is maintained through a variety of hydrologic regimes that limit or exclude invasion by large woody plants. Beavers play an important role in creating ponds and other impoundments in this habitat.

Species Closely Associated: long-toed salamander, western toad, Woodhouse's toad, Columbia spotted frog, northern leopard frog, painted turtle, western pond turtle, common loon, horned grebe, red-necked grebe, western grebe, great blue heron, Canada Goose, redhead, bufflehead, Barrow's goldeneye, sandhill crane, Franklin's gull, black tern, tri-colored blackbird, pallid bat, American beaver, deer mouse, montane vole, raccoon, mink.

<u>24 Montane Coniferous Wetlands</u>

Definition/Description:

Geographic Distribution. This habitat occurs in mountains throughout much of Washington and Oregon. This includes the Cascade Range, Olympic Mountains, Okanogan Highlands, Blue and Wallowa mountains. In the Grande Ronde subbasin, this habitat occurs in scattered areas within the mid- to high-elevation coniferous forest zone but is most common in the Eagle Cap and Wenaha Wilderness Areas.

Physical Setting. This habitat is typified as forested wetlands or floodplains with a persistent winter snow pack, ranging from moderately to very deep. The climate varies from moderately cool and wet to moderately dry and very cold. Mean annual precipitation ranges from about 35 to >200 inches (89 to >508 cm). Elevation is mid- to upper montane, as low as 2,000 ft (610 m) in northern Washington, to as high as 9,500 ft (2,896 m) in eastern Oregon. Topography is generally mountainous and includes everything from steep mountain slopes to nearly flat valley bottoms. Gleyed or mottled mineral soils, organic soils, or alluvial soils are typical. Subsurface water flow within the rooting zone is common on slopes with impermeable soil layers. Flooding regimes include saturated, seasonally flooded, and temporarily flooded. Seeps and springs are common in this habitat.

Composition. Indicator tree species for this habitat, any of which can be dominant or co-dominant, are Engelmann spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*), lodgepole pine (*Pinus contorta*), western hemlock (*T. heterophylla*), or western redcedar (*Thuja plicata*) on the eastside. Lodgepole pine is prevalent only in wetlands of eastern Oregon. Douglas-fir (*Pseudotsuga menziesii*) and grand fir (*Abies grandis*) are sometimes prominent on the eastside. Quaking aspen *(Populus tremuloides*) and black cottonwood (*P. balsamifera ssp. trichocarpa*) are in certain instances important to co-dominant, mainly on the eastside.

Dominant or co-dominant shrubs include swamp gooseberry (R. lacustre), red-osier dogwood (*Cornus sericea*), Douglas' spirea (*Spirea douglasii*), common snowberry (*Symphoricarpos albus*), mountain alder (*Alnus incana*), Sitka alder (*Alnus viridis ssp. sinuata*). The dwarf shrub bog blueberry (*Vaccinium uliginosum*) is an occasional understory dominant. Shrubs more typical of adjacent uplands are sometimes co-dominant, especially big huckleberry (*V. membranaceum*), oval-leaf huckleberry (*V. ovalifolium*), grouseberry (*V. scoparium*), and fools huckleberry (*Menziesia ferruginea*).

Grande Ronde Historic acreage: None

Grande Ronde Current acreage: 56,100

Increased acreage: 56,100

Status & trend: This habitat is likely underrepresented in the historic vegetation data and over represented in the current vegetation data (Grande Ronde Subbasin Technical Team, personal communication, 2/12/2004). It has probably declined slightly since pre-European settlement but much of the remaining range is protected within designated wilderness. This habitat is naturally limited in its extent and has probably declined little in area over time. This type is probably relatively stable in extent and condition, although it may be locally declining in condition because of logging and road building. Five of 32 plant associations representing this habitat listed in the National Vegetation Classification are considered imperiled or critically imperiled.

Key disturbance factors: Roads, logging, insects, fungi.

Species Closely Associated: long-toed salamander, western toad, bufflehead, Barrow's goldeneye, big brown bat, snowshoe hare, deer mouse, mink.

25 Eastside (Interior) Riparian-Wetlands

Definition/Description:

Geographic Distribution. Riparian and wetland habitats dominated by woody plants are found throughout eastern Oregon and eastern Washington including the Grande Ronde subbasin.

Mountain alder-willow riparian shrublands are major habitats in the forested zones of eastern Oregon and eastern Washington. Eastside lowland willow and other riparian shrublands are the major riparian types throughout eastern Oregon and Washington at lower elevations. Black cottonwood riparian habitats occur throughout eastern Oregon and Washington, at low to middle elevations.

Physical Setting. Riparian habitats appear along perennial and intermittent rivers and streams. This habitat also appears in impounded wetlands and along lakes and ponds. Their associated streams flow along low to high gradients. The riparian and wetland forests are usually in fairly narrow bands along the moving water that follows a corridor along montane or valley streams. The most typical stand is limited to 100-200 ft (31-61 m) from streams. Riparian forests also appear on sites subject to temporary flooding during spring runoff. Irrigation of streamsides and toeslopes provides more water than precipitation and is important in the development of this habitat, particularly in drier climatic regions. Hydrogeomorphic surfaces along streams supporting this habitat have seasonally to temporarily flooded hydrologic regimes. Eastside riparian and wetland habitats are found from 100- 9,500 ft (31-2,896 m) in elevation.

Composition. Black cottonwood (*Populus balsamifera ssp. trichocarpa*), quaking aspen (*P. tremuloides*), white alder (*Alnus rhombifolia*), peachleaf willow (*Salix amygdaloides*) are dominant and characteristic tall deciduous trees. Water birch (*B. occidentalis*), shining willow (*Salix lucida ssp. caudata*) and, rarely, mountain alder (*Alnus incana*) are co-dominant to dominant mid-size deciduous trees. Each can be the sole dominant in stands. Conifers can occur in this habitat, rarely in abundance, more often as individual trees. The exception is ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) that characterize a conifer-riparian habitat in portions of the shrub-steppe zones.

A wide variety of shrubs are found in association with forest/woodland versions of this habitat. Red-osier dogwood (*Cornus sericea*), mountain alder, gooseberry (*Ribes spp.),* rose (*Rosa spp.),* common snowberry (*Symphoricarpos albus*) and Drummonds willow *(Salix drummondii*) are important shrubs in this habitat. Bog birch (*B. nana*) and Douglas spirea (*Spiraea douglasii*) can occur in wetter stands. Red-osier dogwood and common snowberry are shade-tolerant and dominate stand interiors, while these and other shrubs occur along forest or woodland edges and openings. Mountain alder is frequently a prominent shrub, especially at middle elevations. Tall shrubs (or small trees) often growing under or with white alder include chokecherry (*Prunus virginiana*), water birch, shining willow, and netleaf hackberry (*Celtis reticulata*).

Shrub-dominated communities contain most of the species associated with tree communities. Willow species (*Salix bebbiana, S. boothii, S. exigua, S geyeriana*, or *S. lemmonii*) dominate many sites. Mountain alder can be dominant and is at least codominant at many sites. Chokecherry, water birch, serviceberry (*Amelanchier alnifolia*), black hawthorn (*Crataegus douglasii)*, and red-osier dogwood can also be codominant to dominant. Shorter shrubs, Woods rose, spirea, snowberry and gooseberry are usually present in the undergrowth.

Grande Ronde Historic acreage: 62,202

Grande Ronde Current acreage: 18,785

Decreased acreage: 43,417

Status & trend: Quigley and Arbelbide concluded that the Cottonwood-Willow cover type covers significantly less in area now than before 1900 in the Inland Pacific Northwest. The trend is similar in the Grande Ronde subbasin although perhaps not as extreme as the above acreages seem to indicate (Grande Ronde Subbasin Technical Team, personal communication, 2/12/2004). Approximately 40% of riparian shrublands occurred above 3,280 ft (1,000 m) in elevation pre-1900; now nearly 80% is found above that elevation. This change reflects losses to agricultural development, roading, dams and other flood-control activities. Additionally, channelization and straightening of streams has reduced both the length and breadth of their associated riparian zones. Conversely, new riparian areas have been created along ditches and diversions in some areas, especially Wallowa County. The current riparian shrublands contain many exotic plant species and generally are less productive than historically. Quigley and Arbelbide found that riparian woodland was always rare and the change in extent from the past is substantial.

Key disturbance factors: Management effects on woody riparian vegetation can be obvious, e.g., removal of vegetation by dam construction, roads, logging, or they can be subtle, e.g., removing beavers from a watershed, removing large woody debris, or construction of a weir dam for fish habitat. Grazing and trampling is a major influence in altering structure, composition, and function of this habitat.

Species Closely Associated: long-toed salamander, tailed frog, western toad, Woodhouse's toad, Columbia spotted frog, northern leopard frog, painted turtle, great blue heron, harlequin duck, sharp-tailed grouse, yellow-billed cuckoo, willow flycatcher, bank swallow, pygmy nuthatch, yellow-breasted chat, western small-footed myotis, long-legged myotis, western pipistrelle, big brown bat, pallid bat, snowshoe hare, American beaver, deer mouse, bushy-tailed woodrat, raccoon, mink.

3.4.3 Interspecies Relationships

3.4.3.1 Identification of Fish Interspecies Relationships

The range of relationships among aquatic wildlife includes predation, competition, displacement and others. Many relationships among the species of the subbasin are subtle and may not be visible to the casual observer. Nevertheless, the stability of aquatic ecosystems rests on these relationships. Reductions in naturally spawning anadromous fish in the subbasin has disrupted many of the interspecies relationships by removing some of the "players." This disruption may have had undocumented and poorly understood effects on the remaining aquatic species of the subbasin.

3.4.3.2 Identification of Wildlife Interspecies Relationships

The range of interspecies relationships among terrestrial wildlife includes predation, competition, displacement, creation and use of physical structures and others. Many of the relationships among the species of the subbasin are subtle and may not be visible to the casual observer. The terrestrial focal species considered in this plan have been selected by habitat type; those that utilize habitats widely separated geographically, climatically and/or vegetatively are less likely to interact than those that occupy the same or similar habitats. Of the focal species utilizing similar habitats, American beavers create and manipulate wetland habitats by impounding water in streams and ditches. This activity creates habitat used by Columbia spotted frogs, great blue heron, yellow warbler and many other species. Columbia spotted frogs may serve as prey for great blue herons and great blue herons (particularly the young) may be preyed upon by bald eagles.

3.4.3.3 Identification of Key Relationships between Fish and Wildlife

As with the relationships between wildlife species, there is a wide range of relationships between fish and terrestrial wildlife. The most obvious type of relationship is trophic including consumption of fish by bald eagles and great blue herons, consumption of fish carcasses by bald eagles and American martens and consumption of Columbia spotted frogs and their eggs by fish. Carcasses of spawned-out anadromous fish also contribute natural, marine nutrients to the terrestrial ecosystem (see section 3.3, *Out of Subbasin Effects*). In addition to trophic relationships, yellow warbler and other riparian habitat species dislodge invertebrates from streamside shrubs and trees making them available to aquatic predators, and beavers create wetland and backwater habitats that produce vegetation and invertebrates for consumption by fish and provide security areas for rearing young fish. Further, wildlife use of riparian areas affects bank structure and water quality.

3.5. Identification and Analysis of Limiting Factors/Conditions

3.5.1. Description of Historic Factors Leading to Decline of Focal Species/Ecological Function-Process – Aquatic

3.5.1.2 Prioritizing Enhancement and Protection at the Watershed and Subbasin Scales

Part of the output from the EDT model is relative protection and restoration ratings for each reach that a given focal species currently uses, or historically used. These results are presented in section 3.2.3. The output from EDT provides a first approximation of where and in what order restoration and protection might proceed within the subbasin. However, the results from EDT in the Grande Ronde subbasin were difficult to interpret, due to several technical factors. First of all, a separate output page was developed for each of the ten focal species populations. It was difficult to compare among these separate tables and graphics, particularly since there were different numbers of reaches assessed for different focal species. Secondly, the volume of output when considered at the subbasin scale was just too much to meaningfully interpret. In addition there were numerous difficulties getting the EDT model to run at the scale of the Grande Ronde and produce realistic outputs for all ten populations as of May 15th we received the following message from Mobrand; '*We found a bug in the Application that really throws off patient and template values for Reports 1 and 2. The fix I made for Scenarios works correctly for Report 3, but curiously produced spurious results for baseline and reach analyses*." (Rick Paquette, 5/15/2004 email). Having to resubmit reports at this late date has severely limited the time available to digest, interpret and cogently present the results.

In an effort to synthesize the results, the EDT output has been summarized at the watershed scale to display the results for each focal species together in the same table. We felt that, given the overall size of the subbasin, as well as the regional focus of the primary agencies involved, that the watershed was an appropriate scale for synthesis. Eight key watersheds were identified based on population groupings. Steelhead populations generally covered larger areas than chinook salmon or bull trout so in some cases the same steelhead population is contained in several watersheds. This information is summarized in Table 46 and discussed for each watershed below.

Table 46. Grande Ronde Subbasin restoration priorities by watershed and focal fish populations.

Watershed	Population(s)	EDT Priority Geographic Area(s) highlighted areas are priorities for multiple pops.	EDT Priority Attributes/ Life History Stages	Considerations	Recommendations
Wenaha	Wenaha Spring chinook Lower Grande Ronde Steelhead Wenaha Bull Trout	** loss in steelhead & chinook productivity with impacts Wenaha conditions.		Good Quality Unimpacted Habitat	Maintain Protection
Lower Grande Ronde	Lower Grande Ronde Steelhead Possibly bull trout in tributary headwaters	Lower Grande Ronde(1-12) – Wenaha Chin Lower Grande Ronde Tribs Wildcat Creek , Mud Creek	*Mainstem* **Rearing** - habitat diversity key habitat quantity (wood, hydromod.) *Trib* **Egg Incubation** - Sediment	No one reach an overwhelming priority. Improving conditions in tributaries will help establish broader life history diversity.	Identify largest tributary sediment sources. Protect riparian & remove roads from riparian.
Joseph Creek	Joseph Creek Steelhead	Lower Chesnimius Lower Joseph Creek Upper Joseph Swamp Creek, Crow Creek	**egg incubation & 0,1 inactive** sediment & temp	Tributary reaches are likely the source of the identified sediment impacts. Restoration main Joseph Cr. depends sediment delivery from upstream areas.	Upstream tributaries should be given priority Almost all streams have roads. Protect Riparian & remove roads from riparian.
Wallowa River	Wallowa Steelhead Wallowa-Lostine chinook Lostine/ Bear Ck Bull Trout	**Steelhead Priorities** Prairie Creek Upper Wallowa River –Wallowa Chin. Hurricane Creek Whiskey Creek Lower Wallowa (1-3) -Minam Sthd **chinook Priorities** Lower Lostine Mid-Wallowa	*Prairie, Hurricane Lower Wallowa:* **egg incubation** - sediment **age 0, 1 inactive** - habitat diversity (reduced channel wetted widths from hydro mod) riparian fun & wood. *Upper Wallowa, Whiskey:* **mix** of factors and life stages (sthd), **egg inc** – sediment (chiun) *Lower Lostine* – **prespwaning holding** - key habitat quantity (primary pools) *Mid-Wallowa* - **age o active** - habitat diversity sediment, temperature, predation, food, flow	No one reach an overwhelming priority (steelhead) presence of primary pools hydromodifications, riparian function and wood (chinook)	Identify largest tributary sediment sources. Protect riparian & remove roads from riparian. Mid-Upper Wallowa address sediment load from decreased flows. Prairie – address sediment from increased flows Lower Lostine – address functions to increase pools, pool quality. Address water withdrawals.
Minam River	Wallowa Steelhead Minam chinook Minam/ Deer Ck Bull Trout Little Minam Bull Trout	Lower Minam Lower Wallowa (1-3) Lower Grande Ronde 2 (13-25) (Chin.)	*Mainstem Grande Ronde & Wallowa* **Rearing** - habitat diversity key habitat quantity (wood, hydromod.) *Lower Minam* - key habitat quantity , habitat diversity	presence of primary pools hydromodifications, riparian function and wood ** loss in steelhead & chinook productivity with impacts Wenaha conditions.	Maintain Protection in Wilderness area Mainstem impacts difficult to address and related to trib conditions. Identify process affecting key habitat quality in mainstem. Lower Minam – address road impacts
Lookingglass Creek	Upper Grande Ronde Steelhead Lookingglass chinook Lookingglass Bull Trout	Lower GR 2 (GR 13 – 25) - chinook No priority areas for steelhead	**0-age inactive -& 0 age active reasring** - key habitat quantity habitat diversity, sediment, predation	Tributary reaches are likely the source of the identified sediment impacts.	Restoration options limited in lower main Grande Ronde. Continue efforts to establish endemic chinook pop.
Catherine Creek/ Middle Grande Ronde	Upper Grande Ronde Steelhead Catherine Creek chinook Catherine Creek Bull Trout Indian Creek Bull Trout	Mid Cattherine Creek (2-9) – UGR Sthd	**Age 0 active rearing, prespawning holding** -Habitat diversity, key habitat quality temperature, competition with hatchery fish, flow, food, pathogens, predation and sediment	EDT found this area to have a huge Impact on chinook abundance (5000%). Local ODFW bio's not sure they agree (J..Zakel pers comm.)	Important for chinook & steelhead. Address sediment & waterwithdrawal impacts. Improve riparian.
Upper Grande Ronde	Upper Grande Ronde Steelhead Upper Grande Ronde chinook Upper Grande Ronde Complex Bull Trout	Mid GR 4 (GR 37 - 44) - chin Mid GR Tribs 4 (Whiskey, Spring, Jordan, Bear, Beaver, Hoodoo…) Phillips Creek Upper GR Ronde 1 (45-48) - chin Mid GR 3 (GR – 34-36) Valley Sheep Creek, Fly Creek -	chinook –*Mid GR 4* - **Prespawning Holding -** Key Habitat Quant., **Egg Inc.** - Sediment Sthd *All areas* – **age 1 active** – mix of attributes, temperature, sediment, flow **Egg Inc. -** Sediment	No one reach an overwhelming priority. Sediment & temperature consistent impacts	Find opportunities to restore functions. Reduce sediment delivery, improve riparian (decrease temps, increase wood inputs).

		chinook	*Fly Ck* – **Egg Inc –** sediment, temp *Sheep Creek* - **mix of life stages** - sediment, temp, key habitat quality & flow		

3.5.1.3 Wenaha

This watershed is almost entirely within the Wenaha-Tucannon Wilderness. This watershed is one of the most important containing all three focal species. The bull trout population in the Wenaha is considered a low risk of extinction.

This watershed has had few impacts and has no ongoing land use activity other than dispersed recreation. Habitat conditions are generally good and are unlikely to change. This area was the highest area for protection for both the Wenaha chinook and Lower Grande Ronde Steelhead populations. With no new actions within this watershed it is likely the conditions will remain stable.

3.5.1.4 Lower Grande Ronde

This watershed supports a summer steelhead population. There may be some isolated bull trout in the headwaters of tributaries. Chinook pass, migrate and rear in the main Grande Ronde but do not utilize the tributaries.

Priority Attributes:	Habitat Diversity (primary pools, glides, spawning gravels)
	Key Habitat Quantity (wood, hydromodifications to channel)
	Sediment

The Lower GR 1 geographic area includes the main Grande Ronde reaches 1-12 to the mouth of the Wenaha. This area is a relatively confined canyon reach with some road access, a few bridges and isolated ranches. There is some gazing, pretty good riparian, no logging, and isolated ranches. This area was identified as a restoration priority for both Lower Grande Ronde steelhead and Wenaha chinook. The EDT model noted a decrease in Habitat Diversity likely due to a decrease in wood which the model identified as reducing rearing habitat quality. However, large wood is not a major habitat component in this reach and likely never was. It is affected by high flows, ice, and general lack of large trees in the riparian zone. It is possible the major flood in 1996 may have reduced in-channel wood. In general there are limited opportunities for restoration in these reaches other than reducing transport of sediment from upstream reaches.

The Lower Grande Ronde 2 geographic area contains Grande Ronde reaches 13-25 (from the mouth of the Wenaha to the mouth of the Wallowa) this area is confined canyon stretch with road access only in the lower portion from the Wenaha to Wildcat Creek. It is similar to Lower Grande Ronde 1. Most of the area is in Forest Service ownership. There are limited opportunities for restoration in these reaches.

The following geographic areas are all tributaries to the main Grande Ronde. Any reductions in sediment inputs or improvements in riparian conditions will likely result in improvements to mainstem conditions where restoration opportunities are limited.

The Lower GR tribs 1 geographic area includes Shumaker Creek, Deer Creek (GR), Buford Creek & Applegate Canyon, Rattlesnake Creek, Cottonwood Creek (GR), and Bear Creek (1st GR). These are all on private lands and almost all of the tributaries have a road along the stream accessing the main Grande Ronde. Sediment impacts to egg incubation and spawning were identified in almost all tributaries. This area was identified as a priority for restoration of steelhead habitat by EDT, while it would only have a moderate change in steelhead abundance it would have a significant benefit in life history diversity of the Lower Grande Ronde steelhead population.

The Wildcat Creek geographic area contains, Wildcat Cr, Wallupa and Bishop Creeks. There is a road along the lower portion of Wildcat Creek going up Walupa Creek to access private timber lands with extensive roading. The upper Wildcat Creek segment is in Forest Service ownership with some roading in the headwaters areas. Impacts to the riparian function and sediment inputs from grazing and roads along the stream are the key factors limiting habitat.

The Courtney Creek geographic area contains Courtney Cr, Little Courtney, Bobcat and Shamrock Creeks. The terrain is steep canyons with moderate gradient confined stream reaches. The upper portion of Courtney and Shamrock Creeks are extensively roaded private timber lands. Land use in the lower portion of Courtney Creek is ranching and grazing. Maintaining riparian integrity for shade and wood inputs and minimizing sediment impacts from roads and grazing should be priority actions in this area.

Mud Creek contains two geographic areas Lower Mud Creek, containing, Mud 1, 2, Buck and Burnt Creeks. Upper Mud Creek contains Mud 3 – 7, McAlister, Sled, Evans, Tepee and McCubbin Creeks. Lower Mud Creek is in private ownership with ranching and grazing as the primary land use activities. The middle portion is in Forest Service ownership and the headwaters are private timberlands. Much of the upper area flows through low gradient meadows, roads and grazing are the major land use activities. This area is also impacted by current and past logging. Maintaining riparian integrity for shade and wood inputs and minimizing sediment impacts from roads and grazing should be priority actions in this area.

The Lower Grande Ronde Tribs 2 geographic area contains Ward Canyon, Sickfoot Cr, Elbow, Bear Cr (3rd GR), Alder Creek (GR), Meadow Cr (1st GR), Clear Cr (1st GR) and Sheep Cr (1st GR). These are mostly short tributaries along the steep canyon reach below the Wallowa. The EDT model identified some impacts from key habitat quantity (likely due to a reduction in woody debris) and sediment.

The Grossman geographic area contains Grossman and Deep Creeks. Most of this area is in private timberlands with roads along many of the main creeks. Key habitat quantity and temperature were identified by EDT as moderate impacts. Maintaining riparian integrity for shade and wood inputs and minimizing sediment impacts from roads and grazing should be priority actions in this area

3.5.1.5 Joseph Creek

This watershed only supports summer steelhead populations. It is one of the most stable steelhead production areas in the Grande Ronde despite extensive heavy land use. There is evidence conditions in this watershed are deteriorating (B.Knox ODFW pers. comm.). The EDT model under predicted the population numbers for Joseph Creek.

Priority Attributes: Sediment
Temperature

Overall this is one of the most heavily roaded watersheds in the Grande Ronde Subbasin. When the roads were originally constructed along streams large wood was typically cleaned out leaving only a few short reaches with adequate LWD. Private ranching and grazing is the primary land use and many of the observed impacts can be tied to these activities. Below is a short summary of the key features and land use activities in each geographic area, they are organized according to the restoration priorities assigned by the EDT Model.

The Lower Chesnimius geographic area contains reaches Chesnimus 1,2,3, 4, Gooseberry Creek, Butte Creek, Pine Cr, Alder Cr (Chesnimnus), Salmon Cr, and Dry Salmon Creek. These are all mostly private lands with extensive areas of grazing and ranching.

Lower Joseph below Cottonwood Creek (JC1 to JC-3) is mostly private lands in a relatively confined canyon. There is a road along JC -1 and limited road access to JC-2 and JC-3. There is some grazing , pretty good riparian, no logging, and isolated ranches. It is likely the sediment and habitat impacts in this area are from activities upstream, there are limited opportunities for restoration in these reaches.

Upper Joseph contains reaches JC-4,5,6, the upper mainstem of Joseph Creek. These reaches are relatively low gradient passing through a mix of Forest Service and private lands. There are some large ranches with extensive grazing on the private lands.

The Swamp Creek drainage has a mix of Forest Service and private lands, including, extensive grazing on the private lands.

Crow Creek, this geographic area contains the Crow and Elk creek drainages. There is a mix of Forest Service and private lands, including, some large ranches with extensive grazing on the private lands. Significant sediment impacts have been observed in Crow Creek. This is one of the areas with the best opportunities for restoration (B. Knox, ODFW pers. comm.. 2004).

The Upper Chesnimius geographic area contains reaches Chesnimus 5 – 9, NF & SF, Peavine Creek (Chesnimus), McCarty Gulch, Telephone Gulch, Doe Cr, Billy Creek, Devils Run Creek, Poison Creek, Summit Creek, TNT Gulch and Vance Draw. This is one of the most heavily roaded portions of the entire Grande Ronde Subbasin.

Cottonwood Creek is the lowest tributary system in the Joseph Creek drainage and contains Broady and Horse Creeks. The upper reaches are owned by the Forest Service and Lower Reaches are private with some small areas of BLM ownership.

The Joseph Creek Tributaries geographic area contains lower Peavine Creek, Cougar Creek and Sumac Creek. These are moderate gradient, relatively short tributaries that are almost entirely on Forest Service land.

The Main Grande Ronde geographic area is the lowest reach of the Grande Ronde River. The river here is in a relatively confined canyon with a road along most of the river and several isolated properties.

3.5.1.6 Wallowa River

The Wallowa River system supports summer steelhead, Wallowa-Lostine chinook, Deer Creek Bull Trout and the Lostine/ Bear Creek Bull Trout populations. The Minam River is within the Wallowa Watershed but because is supports distinct populations of chinook and bull trout and has unique ownership patterns it is considered separately.

Priority Attributes: Key Habitat Quantity (reduced wetted widths)
Habitat Diversity (reduced wood, riparian function)
Sediment
Temperature
Flows

Lower Wallowa River, Wallowa 1,2,3 is the stretch below the mouth of the Minam River, confined canyon with limited access and limited activity along river bottom. Road along mainstem for upper two miles and railroad along east side of river through entire reach. There are private timber and grazing lands on both sides of river. Sediment impacts identified by EDT are likely the result of upstream activities.

Lower Wallowa Tribs,– Howard Creek & Fisher Creek are almost entirely on private timberlands with a road going up the mainstem Howard Creek. Fisher Creek has fewer roads and is more isolated. Sediment input from these roads transport directly to the lower Wallowa. Identifying and minimizing sediment inputs from these roads should be a priority action.

The Mid Wallowa River watershed contains Wallowa reaches 4-10 to the mouth of the Lostine. There is a road on one side of the river and a railroad on the other along reaches 4-8. Above Reach 8 the valley opens up to the town of Wallowa right along river.

Deer Creek (Wallowa), Deer CR (Wallowa), and Sage Creek all flow through a relatively confined canyon with road up entire length – private timber and grazing lands on both sides in lower reaches. The upper reach is on Forest Service property with lots of roads.

The Mid Wallowa Tribs geographic area contains Fountain Canyon and Water Canyon which are relatively small moderate gradient creeks. Water Canyon has road along entire length. Identifying and minimizing sediment inputs from these roads should be a priority action.

The Rock Creek geographic area contains Rock Creek, Dry Creek, and Reagin Gulch. These creeks are in mostly private timber, ranching, and farming lands. There have been some creek modifications associated with the activities in the floodplain. Maintaining and enhancing riparian conditions to decrease sediment inputs, moderate temperatures and increase habitat diversity should be priority actions.

The Lower Bear Creek area contains Bear Cr 1& 2 which flow along the outskirts of the town of Wallowa above Wallowa there are some irrigation diversions, push up dams and ditches moving water out of the stream channel and altering the stream channel form.

Upper Bear Creek contains reaches Bear 3, 4,5, Little Bear, Doc Creek, and Goat Creek. These are private lands supporting ranching and grazing, the upper portions of the drainage is in Forest Service ownership and the headwaters are in wilderness.

The lower portion of Whiskey Creek is in a wide open valley. There is farming and grazing along creek, irrigation diversions and creek straightening. The upper portion of Wiskey Creek including Straight Whiskey Creek and the Forks flow through private timber and grazing lands with a high density of roads.

The Lower Lostine geographic area extends from the mouth of the Lostine to just above the town of Lostine. These reaches are low gradient in a relatively unconfined valley. Land use includes irrigated agriculture, ranching, grazing, and residential development within the valley and floodplain. There are several water diversions, push-up dams and ditches in the valley and on the hillsides, impacting channel form and summer low flows.

The Upper Lostine flows through a moderately confined valley which is mostly in Forest Service ownership, there is a road along the stream providing access to the wilderness headwaters.

Upper Wallowa River, Wallowa 11 – 19 (Wallowa Valley to Lake) is a moderatly confined low gradient reache with a road and railroad on the same side of the river. The largest scale impacts to riparian habitat have taken place in the Wallowa valley through a combination of water withdrawals and channel modification as a result of agriculture, road construction and flood control. The towns of Enterprise and Joseph are located in this area. There are also numerous irrigation diversions (some impassible near Joseph).

Wallowa Lake Dam and Upper Alder Slope Diversion are significant barriers to fish passage. The barrier presented by Wallowa Lake Dam precluded reestablishment of sockeye salmon after their extirpation from the system. Other passage barriers include seasonal thermal or flow barriers, and which restrict or limit movement of fish. Irrigation withdrawals can “dewater” sections of streams precluding passage and impairing water quality. Overland return flows from irrigation systems can warm streams, contribute to high levels of fecal coliform, and in some instances load them with silt.

Agricultural activities have drained and cleared many of the deciduous riparian areas which are bench wetlands which were historically abundant in areas such as Alder Slope near Enterprise, Oregon. Deciduous riparian areas perform a water storage function, allowing for slow release and dampening the affect of heavy rains and snow melt. This wetland type has been drained and cleared for agricultural use, primarily pasture.

Spring Creek and the Upper Wallowa Tribs including Parsnip Creek Trout Cr (Wallowa) and Little Hurricane Cr comprise two geographic areas. There is a road along Parsnip through a confined canyon with limited riparian vegetation. It is likely the riparian cover has been reduced as a result of agriculture (grain fields) and grazing, There is also a road along Trout Creek which has a moderately confined canyon. Little Hurricane Creek passes through an open floodplain with extensive farming and ranching on the outskirts of Enterprise. According to EDT these areas are relatively low priorities for restoration or protection.

Lower Hurricane Creek, contains reaches Hurricane Cr 1,2,3 and flows through a relatively unconfined valley with rural residential, farming, irrigation diversions.

Upper Hurricane Creek, contains reaches Hurricane Cr 4,5,6 there is a road along most of the creek onto FS property. The lower portion of the area has irrigation dams which may be fish passage barriers there is a waterfall barrier further up and the headwaters are in wilderness area.

Prairie Creek geographic area contains, Prairie Cr, Hayes Fork, OK Gulch Fork. This area is typical open-valley agriculture. Prairie Creek, Hayes Fork and OK Gulch Fork are areas of high groundwater input with a lot of springs which may be enhanced by irrigation. Hayes Fork is a hot spot for chinook spawning.

Prairie Creek has a high sediment load and a different flow regime from other areas. There are 300cfs of water from the Wallowa River water transferred to Prairie creek from ditches. Currently summer low flows in Prairie Creek carries are higher than historic. This has created eroded banks which coupled with local cattle feed operations creates high sediment and nutrients.

Wallowa Lake contains reaches (Wallowa 20, 21) and above Wallowa Lake is reach Wallowa 22 . Species present in Wallowa Lake and Wallowa River above lake include bull trout, brook trout (introduced), kokanee, lake trout (introduced), and whitefish.

Wallowa Lake is the only major water impoundment in the Grande Ronde River subbasin. Although it is a natural lake, a dam was constructed at the outlet in 1918 and enlarged between 1928 and 1929 to its present height. Located upstream of Joseph, Oregon, The principal use for water stored in Wallowa Lake is irrigation, although a small proportion is diverted for municipal use in Joseph. Due to reduced peak flows from dam operations there are increased fine sediment accumulations in the reaches of the Wallowa River below the dam.

3.5.1.7 Minam

The Minam River system supports summer steelhead, Minam chinook, Mianm Bull Trout and Little Minam resident bull trout populations. The Minam River is within the Wallowa Watershed but because is supports distinct populations of chinook and bull trout and has unique ownership patterns it is considered separately. The upper reaches of the Mianm is almost entirely in the Eagle Cap Wilderness and is mostly undisturbed. Only the lowest portion of the Minam is in private ownership where restoration activities are identified.

Priority Attributes: Key Habitat Quantity (reduced wetted widths)
Habitat Diversity (reduced wood, riparian function)

Lower Minam River (Minam reaches 1,2,3) are low gradient confined canyon reaches. A road goes along creek through mostly private timberlands. The lowest reach is impacted from historic splash damming, which cleared woody debris and simplified the channel.

The Lower Minam Tribs geographic area contains Squaw and Gunderson Creeks. Both creeks are on private timberlands with roads right up creek bottom. Sediment input from these roads would transport directly to the lower Minam and lower Wallowa. Identifying and minimizing sediment inputs from these roads should be a priority action.

The rest of the Minam watershed contains the following 5 geographic areas; 1) Mid Minam River (Minam 4,5,6), 2) Mid Minam Tribs (Cougar Creek, Trout (Minam), Murphy Cr), 3) Little Minam (Little Minam, Goulder Cr, Dobbin Cr) and, 5) Upper Minam River (Minam 7,8,9, Minam – N, Elk Cr). All of this area is in the Eagle Cap Wilderness with limited access, few impacts and limited opportunities for restoration.

3.5.1.8Lookingglass Creek

The Lookingglass Creek system supports summer steelhead, Lookingglass chinook, and, Lookingglass bull trout populations. The Lookingglass Creek watershed is one of the most pristine non-wilderness watersheds in the Grande Ronde River basin. Lookingglass Creek is the the site of Lookingglass Creek hatchery that is the production hub for four stocks of listed spring chinook salmon from the upper Grande Ronde, Lostine, and Imnaha rivers and Catherine Creek. Lookingglass Creek historically had a large endemic population of spring chinook salmon that was extirpated with the construction of Lookingglass Hatchery. Because the hatchery does not have an adequate well, it gets most of its water supply from the creek.

All reaches within the Lookingglass Creek watershed were identified as having similar priority for restoration by EDT. The lower Grande Ronde reaches 13-25 was identified as the highest priority for restoration to increase abundance of Lookingglass Creek chinook..

Priority Attributes: Key Habitat Quantity (reduced wetted widths)
Habitat Diversity (reduced wood, riparian function)
Sediment

Lower Lookingglass geographic area contains Lookingglass reaches 1-4 and Jarboe Creek. The land is mostly private timber. This reach above the hatchery and contains a large portion of the spawning and rearing habitat on the stream (Burck 1993). Past land use practices, logging of the hillsides and heavy grazing have lead to high silt loads at the hatchery.

The Little Lookingglass geographic area contains Little Lookingglass, Mottet, and Buzzard Creeks. The lower portion is on private timberlands and upper reaches are Forest Service. There are numerous roads.

Upper Lookingglass geographic area contains Lookingglass Creek reaches 5-7, Eagle Cr, and Summer Cr. The lower reaches are private timberlands and upper reaches Forest Service. Roads are along most of creek.

3.5.1.9 Catherine Creek/ Middle Grande Ronde

This portion of the Grande Ronde Subbasin supports the Catherine Creek chinook (which includes chinook using Indian Creek), Catherine Creek Bull Trout, Indian Creek Bull Trout and a portion of the Upper Grande Ronde Steelhead populations.

EDT rated the middle Catherine Creek geographic area as an overwhelming priority for restoration (with a predicted 5000+%) increase in chinook abundance. Mid-Catherine was also a high priority for steelhead. However the attributes identified as priorities for this area are similar tp other watersheds.

Priority Attributes: Key Habitat Quantity (reduced wetted widths)
Habitat Diversity (reduced wood, riparian function)
Sediment
Flow
Temperature

The Middle Grande Ronde 1 geographic area contains reaches Grande Ronde 26 – 27 (mouth of Wallowa to Lookingglass). This is a confined canyon with private timber in the north side. The Middle Grande Ronde 2, geographic area (Grande Ronde 28 – 33) is similar although near the upstream portion the valley becomes less confined with a road along river, the town of Elgin, and some agricultural activities.

The Middle Grande Ronde Tribs 1 contains Duncan Canyon and Rysdam Canyon. Middle Grande Ronde Tribs 2, contains Cabin Cr, Gordon CR, Medicine Cr. These are all relatively small drainages in mostly private ownership. There is some ranching and grazing, private timberlands, a fair number of creeks have roads along them. Some creeks have Forest Service lands in the upper portion of their drainages.

Phillips Creek contains Phillips, Little Phillips, Bailey, Pedro, and Clark Creeks. Land ownership is a mix of private ranching, timber, and some forest service in the headwaters. There are roads along most creeks.

Indian Creek consists of two geographic areas. Lower Indian Creek contains reaches Indian 1 & 2, Shaw Cr, and Little Indian Cr. Land use is mostly private farming and ranching. Indian Creek is listed by Oregon Water Resources Department (OWRD) as a flow restoration priority at the mouth. Upper Indian Creek contains reaches Indian 3- 6, Camp Cr, and Indian EF. The lower portion is private ranching, and upper reaches are on private timber lands. There are roads up most creeks.

The lower portion of Willow Creek is a low gradient open valley with private farming, ranching and some stream straightening. It is listed as an OWRD priority for restoration at mouth and above Mill Creek. Upper Willow Creek is mostly private farming and ranching lands.

Lower Catherine Creek, flows through a low gradient unconfined valley. This area has been highly modified. In the late 1800's the state ditch was constructed as a flood control cut-off channel. This portion of Catherine Creek has been diverted into the old main Grande Ronde channel. There is extensive agricultural use and water diversions. This reach is also listed as an OWRD flow restoration priority.

The Lower Catherine Tributaries of Mill Creek and Little Creek are unconfined low gradient valleys with extensive agriculture in the lower reaches. Upper portions of these creeks flow through private timber lands with roads along most creeks.

Middle Catherine (reaches Catherine 2-9) was identified by EDT as the biggest priority for restoration for Catherine Creek chinook and a high priority for Upper Grande Ronde Steelhead. Most of the impacts occur below the town of Union where there is extensive agriculture that has impacted the riparian area, reducing shade and confining the channel. In addition there are water withdrawals. Starting in June with flow reductions of about 25%, by mid July flow reduction is about 50%. By 3rd week in July through end of Sept flow reduction is 90-95%. A couple days into Oct, irrigation diversions stop and flow returns to near normal with about a 10-20% reduction of flow for stock water use.

Above the town of Union the road and houses constrain the creek. Allowing the stream to meander and reducing sediment inputs would improve stream habitat conditions.

The Middle Catherine Tribs, geographic area contains Ladd Creek, Pyles Canyon, Little Catherine, Milk and Scout Creeks. Pyles Canyon starts in Union in a low gradient unconfined valley then moves into confined canyon road on both sides. Little Catherine Creek and Milk Creek flow through private timber lands with roads along creek. Scout Creek flows through Forest Service lands with a road along the creek.

Ladd Creek is a unique part of this geographic area. It flows through a low gradient unconfined valley and the channel has been extensively modified, ditched and straightened. Historically this portion of the subbasin was wet meadows and emergent wetland. The historic Tule Lake, remnants of which can be found in the Ladd Marsh Wildlife Area, covered nearly 20,000 acres of the Grande Ronde Valley before it was drained for agricultural use. These wetland areas served an important function in the hydrology of the area by collecting and filtering water for slow release into the system. Beavers were an integral part of these wetland systems; beaver dams created a succession of wetland types from open water ponds to wet meadows. These wet meadows and emergent wetlands have been lost or degraded by conversion to agriculture, road building, livestock introduction and removal of beavers.

The SF Catherine Creek geographic area contains Catherine SF, Collins, and Sand Pass Creeks all headwater streams feeding Catherine Creek. There is a Forest Service road up south fork, tributaries are generally unroaded. There is an irrigation diversion which transfers water from the Catherine Creek drainage into the Powder River drainage.

The NF Catherine Creek geographic area contains NF Catherine, MF Catherine, and Buck Cr (Catherine). This area is entirely within Forest Service ownership. There is a road up the NF of Buck Creek and numerous roads within the drainage.

3.5.1.10 Upper Grande Ronde

This portion of the Grande Ronde Subbasin supports the Upper Grande Ronde chinook, Upper Grande Ronde Complex Bull Trout and a portion of the Upper Grande Ronde Steelhead populations.

EDT rated the Mid Grande Ronde 4 and Upper Grande Ronde 1 (from the upper end of the Grande Ronde Valley to Fly Creek) as priority areas for restoration for both chinook and steelhead populations. There was no single reach identified as a large priority. There are 45 stream segments in the upper Grande Ronde watershed identified by Oregon's 1998 303(d) List of Water Quality Limited Waterbodies as water quality limited including most of the larger tributaries to the upper Grande Ronde River above La Grande. Because, the Upper Grande Ronde has some clear patterns of widespread impacts the following discussion covers mainstem and tributaries as distinct groups instead of individually discussing geographic areas.

Priority Attributes: Sediment
Flow
Temperature
Key Habitat Quantity (reduced wetted widths)

MAINSTEM Upper Grande Ronde

The Middle Grande Ronde 3 (reaches GR-34A, to 36) geographic area encompasses the Grande Ronde Valley including the city of La Grande. The large river valley of the main Grande Ronde has low gradients and a high demand for water and land for human development. Water diversions for irrigation, stream channelization, loss of riparian vegetation and runoff from fields and roads are some of the most serious challenges to habitats in this area. Extensive channelization of portions of the Grande Ronde River and other streams for flood control and irrigation has resulted in losses of both riverine and associated wetland habitats throughout the subbasin. Channel modification included construction of the state ditch which has reduced the channel length by approximately 29 miles. This is likely an important salmonid winter rearing area. Although EDT did not identify this area as a priority, local ODFW biologists felt habitat conditions could be improved to increase winter survival (J. Zakel pers. comm.2004)

Middle Grande Ronde 4, (reaches GR-37 – 44) extends to the mouth of Meadow Creek. This area is mostly a confined steep canyon with a road along river. The terrain limits land use and restoration options are limited.

UPPER GRANDE RONDE TRIBUTARIES

Impacts of elevated temperature, sediment and habitat modification are widespread throughout the Upper Grande Ronde Watershed. Much of this is legacy of historic activities. Some of the broader scale impacts include, destruction of spawning habitat in portions of the upper Grande Ronde River above Starkey by gold dredging (McIntosh et al. 1994). Past splash damming in the upper Grande Ronde River and Meadow Creek also dramatically altered habitat (Farnell 1979). Streamside vegetation and rocks were removed to allow construction of splash dams and the intense scouring caused by their use removed preferred gravels and virtually all structural components in the stream.

Loss of floodplains and wetlands has eliminated rearing areas for juveniles. Riparian habitat degradation is the most serious problem in the subbasin (ODEQ 2000). Elevated water temperatures occur throughout the Upper Grande Ronde Subbasin with a 10 degree rise in temperatures through Vey Meadows (ODEQ 2000, J. Zakel ODFW pers. comm. 2004).

3.5.2. Description of Historic Factors Leading to Decline of Focal Species/Ecological Function-Process – Terrestrial

3.5.2.1 Key Factors Inhibiting Populations and Ecological Processes

The subbasin Terrestrial Technical Team identified 9 categories of factors limiting distribution and productivity of focal species: Habitat loss and/or degradation, habitat fragmentation, predation and/or competition by non-native species, disease transmission by non-native species, water quality, grazing, human activity/disturbance, reduced food base, potential for overharvest. These limiting factors are discussed in individual focal species accounts and are summarized here.

Habitat loss and or degradation is the most commonly noted factor limiting distribution and productivity of focal species in the subbasin and it applies to a number of habitat types or structural stages within habitat types.

- Wetlands: The Grande Ronde subbasin has seen substantial reductions in wetland habitats due to draining, diking and ditching for agricultural and residential development and flood control.
- Riparian – Large Trees: Large riparian trees, mostly cottonwood and willow, have been lost to agricultural development, road building and other activities. Further, where large trees remain to grow old and fall, grazing prevents their replacement from the understory.
- Riparian – sub-canopy: The sub-canopy layer of shrubs and young trees in riparian zones have often been lost along with large trees to agricultural development, grazing, road building and other activities.
- Ponderosa pine forest – especially late and old structure (LOS): Ponderosa pine stands have been reduced by a variety of means. Fire suppression and changes in fire regime have allowed encroachment of less fire resistant species such as Douglas-fir and conversion of stands to Interior Mixed Conifer. Timber harvest has reduced the amount of old-growth forest and associated large diameter trees and snags. In lower elevation areas, agricultural and residential development has contributed to loss and degradation of properly functioning ponderosa pine ecosystems.
- Mixed Conifer forest – early post-fire structural stage: Fire suppression has reduced availability of this successional stage and reduced habitat diversity in mixed conifer forests.
- Mixed conifer forest – late and old structure: Timber harvest and stand-replacement fires have reduced old growth and associated large trees and structural diversity.
- Shrub-steppe: Development for agricultural and residential use as well as road construction have contributed to degradation and fragmentation of this habitat. Range improvement programs change the species composition of the vegetation communities, often degrading habitat values.
- Native grasslands: This habitat type has declined in extent due to conversion to agricultural uses and changes in the historic fire regime. Remaining grasslands are often degraded by invasion of noxious weeds and annual grasses.

Predation and/or competition by non-native species can be an issue for many of the terrestrial species in the subbasin. Among the subbasin's focal species, this is exemplified by the Columbia spotted frog and the potential negative effects of non-native fishes and bullfrogs.

Disease transmission by non-native species is primarily a factor for Rocky Mountain bighorn sheep in areas grazed by domestic sheep.

Water quality is noted as a limiting factor for great blue herons and Columbia spotted frogs although water quality would presumably have an impact on virtually every species using a given body of water.

Quaking aspen and curlleaf mountain mahogany are both limited by lack of recruitment due to grazing by both domestic and wild ungulates.

Human activity can have a limiting effect on species when important sites such as nest and roost sites are disturbed (e.g., bald eagle and great blue heron) and when habitats are so restricted that animals have virtually nowhere to go to escape disturbance (e.g., Rocky Mountain goats).

Use of pesticides may reduce the food base of insect-eating species such as yellow warbler and olive-sided flycatcher.

While not currently identified as a problem in the subbasin, overharvest of managed species such as beaver and American marten could limit population growth. Carefully managed harvest seasons, low pelt prices and fewer trappers currently prevent overharvest.

3.5.2.2 Key Disturbance Factors inside the Subbasin Limiting Populations

Summarized above.

3.5.2.3 Key Disturbance Factors outside the Subbasin Limiting Populations

See Section 3.3 *Out of Subbasin Effects*

3.6. Synthesis/Interpretation

3.6.1. Subbasin-wide Working Hypothesis – Aquatic

AQUATIC SUBBASIN-WIDE HYPOTHESES AND ASSUMPTIONS

The purpose of this section of the assessment is to bring together the primary assumptions and working hypotheses that, collectively, makeup the aquatic assessment. In the broadest sense the working hypotheses consist of all of the data, professional judgments, assumptions, model relationships, and analytical results that are contained in the preceding sections. However, for the purpose of this summary we have focused on the most important limiting factors and estimated population performance. These hypotheses and assumptions set the framework for evaluating the inventory (i.e., it provides a gap analysis of what has and is being done to address the limiting factors) and developing the management plan, which contains strategies to address the identified gaps. The primary assumptions and working hypotheses are:

- The aquatic technical team has adequately interpreted and synthesized the known data regarding current and reference habitat conditions within the subbasin. We are moderately confident in this assumption, given the presence on the team of individuals with long experience in the subbasin, and considering the breadth of agency involvement. However the large size of the basin, large number of EDT reaches and limited time made it difficult to consistently assign attributes. In some cases interpretation of ratings varied among professionals and this was difficult to standardize.

- The Ecosystem Diagnosis and Treatment (EDT) model adequately represents the complex relationships between the focal species and their environments. The EDT is an expert system, and as such provides a structured and better-documented approach to evaluating limiting factors than expert opinion alone. In addition the Ecosystem Diagnosis and Treatment (EDT) model, allowed us to evaluate the validity of the outcome (i.e., estimates of population size are generated).
- The species-specific hypotheses are correct and adequately represent how focal species use the subbasin. As part of the EDT model we capture the aquatic technical teams understanding of how the focal species use the various reaches within the subbasin, and what habitat attributes are most important to the focal species under both current and reference conditions. Given the aquatic technical team's expertise within the subbasin we feel that these hypotheses are reasonable.
- Of the 45 habitat attributes considered in this analysis the following four factors are the most limiting, and adequately illustrate the concerns with respect to the focal species:
    - Sediment
    - Temperature
    - Flows
    - Channel Condition (Key Habitat Quantity & Diversity)

- In the big picture the other limiting factors (in addition to the ones described previously) can be mostly ignored. Additional habitat attributes are either dependent on the "big" factors identified above, or are of relatively local and/or minor concern.
- Prioritization of restoration and protection can be first approximated using EDT, but must consider additional factors. The EDT methodology produces a prioritization approach for reach-scale restoration and protection. However, this first cut must be tempered with additional considerations, such as the additional factors described below.
- Additional factors are not adequately addressed in EDT, and must be dealt with in a more qualitative fashion. Consequently, these must be highlighted in the management plan as areas of special concern. This includes evaluation of passage problems from culverts and road crossings.
- Static, "one size fits all" biological objectives are inadequate for outlining a restoration strategy and management plan for the Grande Ronde subbasin. As noted by the ISAB, biological objectives must be developed with consideration given to inherent variability both in space (among the reaches in various parts of the watershed, and within the reaches themselves), and over time in response to natural disturbance and channel evolutionary response. The biological objectives, particularly for channel and riparian condition, have been outlined with this in mind.
- Many, if not most, of the likely strategies derived from these biological objectives are already being implemented within the subbasin. The products from the aquatic assessment do not implicate a change in direction for the various land management agencies, individuals, or other entities (e.g., watershed council) within the subbasin. Rather, the products here will (hopefully) help direct and prioritize ths ongoing activities at the watershed scale.
- Population performance is the ultimate arbiter of habitat protection/restoration activities, and must be incorporated into monitoring and evaluation plans. The underlying assumption of the work presented here is that it is appropriate to focus on habitat, and the focal species response will follow (i.e., "if you build it they will come"). However, this assumption must be borne out by thorough and systematic monitoring programs, which should be developed as part of this planning process.

3.6.2. Terrestrial Assessment Synthesis

Wildlife Habitat Type: Combined Mid- to High-Elevation Conifer Forest
Focal Species: Olive-sided Flycatcher, American Marten

Habitat Status/Change:

Estimated Acres of Habitat	Current	Historic	Difference	% Change
	1,019,112	1,049,834	-30,722	-3

Current Protection Status:

Estimated Acres of Habitat	High Protection	Medium Protection	Low Protection	No Protection
	277,033	21,015	519,459	201,604
Percent Protected	27.2	2.1	51.0	19.8

Factors Affecting Habitats and Focal Species:

- Fire suppression has changed the structural condition and increased fuel load, causing lower frequency, higher intensity, often stand replacing fires.
- Fire suppression in lower elevation ponderosa pine forest has allowed encroachment of less fire-tolerant conifers into those habitats, thereby increasing the range of mixed conifer stands.
- Timber harvesting has focused on large, shade intolerant species in mid- to late-seral forests resulting in stands composed of smaller, shade tolerant trees.
- Fire suppression has reduced availability of early post-fire habitats and the mosaic of seral and edge habitat.
- Extensive logging and wildfires alter the structural composition of forests making them less suitable for martens and other species requiring large, old stand structure.
- Invasion of exotic plants has altered understory conditions and increased fuel loads.

Mid- to High-Elevation Conifer Forest Working Hypothesis:
Factors affecting this habitat type involve changes in structural and seral diversity due primarily to timber harvesting, fire suppression and wildfires. Overall, the quantity of this habitat type has changed little although the quality has deteriorated in local areas. Loss of diversity has resulted in relatively small, isolated pockets of habitat for specialist species which require specific structural or seral stages of conifer forest habitat.

Recommended Range of Management Conditions:
Late-successional mixed conifer forest: The American marten represents species that prefer/require late-successional conifer forest with complex physical structure near the ground and with large standing snags and stumps.
Early post-fire mixed conifer forest: Olive-sided flycatchers represent wildlife species that require forest openings and edge habitat, especially early post-fire habitats. Forest management practices, such as timber harvest, once thought to mimic natural disturbance may be detrimental to species such as the olive-sided flycatcher.

Management Strategies:

- Protect extant habitat in good condition through easements and acquisitions; protect poor quality habitat and/or lands with habitat potential adjacent to existing protected lands (avoid isolated parcels/wildlife population sinks).
- Fund and coordinate weed control efforts on both public and private lands.
- Coordinate with public and private land managers on the use of prescribed fire and stand management practices.
- Restore forest function by providing key environmental correlates through prescribed burns and silvicultural practices.
- Identify and protect wildlife habitat corridors/links.

Data Gaps and M&E Needs:

- Habitat quality data; assessment data bases do not address habitat quality.
- Finer resolution GIS habitat type maps that include structural component and KEC data.
- GIS soils products.
- Significant lack of local population/distribution data for American marten and olive-sided flycatcher
- Current mixed conifer and lodgepole pine structural condition/habitat data.

Wildlife Habitat Type: Ponderosa Pine Forest and Woodlands
Focal Species: White-headed Woodpecker

Habitat Status/Change:

Estimated Acres of Habitat	Current	Historic	Difference	% Change
	498,705	734,858	-236,153	-32

Current Protection Status:

Estimated Acres of Habitat	High Protection	Medium Protection	Low Protection	No Protection
	22,190	18,188	194,436	263,889
Percent Protected	4.4	3.6	39.0	52.9

Factors Affecting Habitats and Focal Species:

- Species and size-selective timber harvesting has reduced the amount of old growth and associated large diameter trees and snags.
- Residential and agricultural development has contributed to loss and degradation of properly functioning ecosystems.
- Fire suppression has contributed to habitat degradation, especially declines in understory shrubs and forbs due to increased density of small shade-tolerant trees. High risk of loss of remaining ponderosa pine overstories from stand-replacement fires due to high fuel loads in densely stocked understories.
- Invasion of exotic plants has altered understory conditions and increased fuel loads.
- Overgrazing has resulted in reduced recruitment of sapling trees, especially pines.
- Fragmentation of remaining tracts has had a negative effect on species with large area requirements.
- Hostile landscapes, particularly those in proximity to agricultural and residential areas, may have high density of nest parasites (brown-headed cowbird), exotic nest competitors (European starling), and domestic predators (cats), and may be subject to high levels of human disturbance.

Ponderosa Pine Forest and Woodland Working Hypothesis:
Factors affecting this habitat type are direct loss of habitat due primarily to timber harvest, suppression of low-intensity ground fires, wildfires, mixed conifer encroachment, development, reduction of habitat diversity and function resulting from invasion by exotic species and overgrazing. The principal habitat diversity stressor is the spread and proliferation of mixed forest conifer species within ponderosa pine communities due primarily to changes in the fire regime from high frequency, low intensity burns to low frequency, high intensity (stand replacing) fires. Habitat loss and fragmentation (including fragmentation resulting from extensive areas of undesirable vegetation), coupled with poor habitat quality of existing vegetation have resulted in extirpation and/or significant reductions in ponderosa pine habitat obligate wildlife.

Recommended Range of Management Conditions:
Mature ponderosa pine forest: The white-headed woodpecker represents species that require/prefer large patches(greater than 350 acres) of open, mature/old growth ponderosa pine

stands with canopy closure of 10-50 percent and snags and stumps for nesting (nesting stumps and snags greater than 31 inches DBH).

Management Strategies:

- Protect extant habitat in good condition through easements and acquisitions; protect poor quality habitat and/or lands with habitat potential adjacent to existing protected lands (avoid isolated parcels/wildlife population sinks).
- Coordinate with public and private land managers on the use of prescribed fire and stand management practices.
- Restore forest function by providing key environmental correlates through prescribed burns and silvicultural practices.
- Fund and coordinate weed control efforts on both public and private land.
- Identify and protect wildlife habitat corridors/links.

Data Gaps and M&E Needs:

- Habitat quality data; assessment data bases do not address habitat quality.
- Finer resolution GIS habitat type maps that include structural component and KEC data.
- GIS soils products.
- Significant lack of local population/distribution data for white-headed woodpeckers.
- Current ponderosa pine structural condition/habitat variable data.

Wildlife Habitat Type: Combined Rare or Unique Habitats
Focal Species: Quaking Aspen and Curlleaf Mountain Mahogany

Habitat Status/Change:

Estimated Acres of Habitat	Current	Historic	Difference	% Change
	740	329	+411	+125

Current Protection Status:

Estimated Acres of Habitat	High Protection	Medium Protection	Low Protection	No Protection
	0	0	718	21.2
Percent Protected	0	0	97.1	2.9

Factors Affecting Habitats and Focal Species:

- Fire suppression and changes in the fire regime have reduced both aspen and mountain mahogany regeneration.
- Heavy browsing by domestic livestock and wild ungulates can limit regeneration by aspen and mountain mahogany and have a negative effect on young trees that do survive.
- Fire suppression and the resultant increase in fire return interval has effectively eliminated aspen's competitive advantage and allowed invasion of aspen stands by more shade-tolerant conifers.
- Fire suppression has increased competition by conifers in mountain mahogany stands.
- Increases in exotic annuals such as cheatgrass has reduced mountain mahogany reproduction in many areas as the seeds seldom germinate in established plant communities.

Rare and Unique Habitats Working Hypothesis:
Both quaking aspen and curlleaf mountain mahogany stands have decreased in both size and distribution due primarily to fire suppression and grazing. Encroachment by conifers, largely a result of fire suppression, further restricts recruitment in both habitats. These somewhat rare habitats serve as an important part of a diverse forested ecosystem and may serve vital functions in the survival of species that use them.

Recommended Range of Management Conditions:
Quaking aspen: Self-regenerating aspen stands are dominated by quaking aspen although scattered individuals of ponderosa pine and Douglas-fir may be present. A relatively short fire return interval maintains the competitive advantage conferred by aspen's clonal reproduction and prevents dominance by conifers.
Curlleaf mountain mahogany: Mountain mahogany often occurs in pure stands but may co-dominate with other shrubs. The understory is relatively sparse, leaving bare mineral soil for mountain mahogany seed germination.

Management Strategies:

- Protect extant stands of aspen and mountain mahogany through fencing to exclude both big game and livestock and livestock management.
- Remove conifers from stands of aspen and mountain mahogany to allow recruitment of young trees to size classes beyond the reach of browsing wildlife.

- Promote use of low-intensity ground fires to regenerate aspen.

Data Gaps and M&E Needs:

- Finer resolution habitat maps which show location and extent of aspen and mountain mahogany stands.
- Lack of data regarding timing and type of use of these habitats by wildlife.
- Lack of data regarding the effect of altered water tables on aspen.
- Lack of data regarding the genetic relatedness of aspen clones.

Wildlife Habitat Type: Combined Alpine and Subalpine Habitats
Focal Species: Mountain Goat

Habitat Status/Change:

Estimated Acres of Habitat	Current	Historic	Difference	% Change
	68,061	26,180	+41,881*	+160*

* These habitats are underrepresented in the historic data; the trend should be stable or declining slightly.

Current Protection Status:

Estimated Acres of Habitat	High Protection	Medium Protection	Low Protection	No Protection
	65,019	141	2,142	758
Percent Protected	95.5	0.2	3.1	1.1

Factors Affecting Habitats and Focal Species:

- Fire suppression has allowed the encroachment of whitebark pine into areas previously dominated by grasslands increasing the coverage of subalpine parkland and decreasing alpine grasslands and shrublands.
- Human recreation is a major factor affecting alpine grassland and shrubland habitat through trampling and other types of disturbance.
- Recreational activities may disturb or displace mountain goats into marginal habitat with negative repercussions for reproduction and survival.

Alpine and Subalpine Habitats Working Hypothesis:
Alpine and subalpine habitats in the Grande Ronde subbasin are highly protected from development. Threats to these habitats are from recreational use and fire management that result in habitat degradation and changes in composition.

Recommended Range of Management Conditions:
Diverse alpine and subalpine habitats. Mountain goats represent species that prefer/require a mosaic of forested, open and rocky habitat elements for thermal cover, forage and security cover.

Management Strategies:

- Fire management to prevent continued encroachment of conifers into grassland habitats which reduces foraging habitat.
- Manage recreational access to minimize impacts to vegetation and disturbance to mountain goats, especially females with young.
- Public education to reduce goat/recreation conflicts in sensitive areas.

Data Gaps and M&E Needs:

- Identify habitat links and corridors for dispersing mountain goats.
- Higher resolution habitat maps which show location and extent of alpine and subalpine habitats.

Wildlife Habitat Type: Eastside Canyon Shrublands
Focal Species: Rocky Mountain Bighorn Sheep

Habitat Status/Change:

Estimated Acres of Habitat	Current	Historic	Difference	% Change
	35,696	15,292	+20,404*	+133*

- Habitat underrepresented in historic data; trend should be stable or declining slightly.

Current Protection Status:

Estimated Acres of Habitat	High Protection	Medium Protection	Low Protection	No Protection
	4,638	1,125	3,451	26,483
Percent Protected	13.0	3.2	9.7	74.2

Factors Affecting Habitats and Focal Species:

- Fire suppression and heavy grazing have depleted bunchgrass cover in some areas allowing expansion of this shrub habitat
- Talus movement alters shrub cover.
- Disease transmission from domestic sheep and goats is a key factor limiting success of bighorn sheep in the subbasin.
- Invasion of noxious weeds into core bighorn sheep habitat reduces quality forage.

Rare and Unique Habitats Working Hypothesis:
Although this habitat is similar in extent to historic times, the majority of this habitat type in the subbasin has no protection from development and/or changes in land management and is vulnerable to future losses.

Recommended Range of Management Conditions:
Canyon shrublands adjacent to grasslands. Rocky Mountain bighorn sheep represent species which utilize canyon shrublands in combination with grassland and other habitats based on seasonal and daily needs for forage and security and thermal cover.

Management Strategies:

- Protect extant areas of bighorn sheep habitat including canyon shrublands and other preferred habitats.
- Limit access by domestic sheep and goats to bighorn sheep range to minimize exposure to diseases.
- Fund and coordinate weed control efforts on both public and private land.

Data Gaps and M&E Needs:

- Finer resolution habitat maps which show location and extent of eastside canyon shrublands.

Wildlife Habitat Type: Eastside Grasslands
Focal Species: Western Meadowlark

Habitat Status/Change:

Estimated Acres of Habitat	Current	Historic	Difference	% Change
	486,002	641,553	-155,551	-24

Current Protection Status:

Estimated Acres of Habitat	High Protection	Medium Protection	Low Protection	No Protection
	19,625	23,882	60,888	381,608
Percent Protected	4.0	4.9	12.5	78.5

Factors Affecting Habitats and Focal Species:

- Extensive, permanent habitat conversion, primarily to cropland and pasture, resulting in fragmentation of remaining tracts.
- Degradation of habitat values from intensive grazing and invasion of exotic plant species.
- Fire management, either suppression or over-use and wildfires alters the vegetative communities.
- Loss and reduction of cryptogramic crusts, which help maintain the ecological integrity of grassland communities.
- Conversion of CRP lands back to cropland.
- Human disturbance during breeding and nesting season of grassland dependent species such as the meadowlark.

Eastside Grasslands Working Hypothesis:
The major factors affecting this habitat type are direct loss of habitat due primarily to conversion to agriculture, reduction of habitat diversity and function resulting from invasion of exotic vegetation and wildfires and overgrazing. The principal habitat diversity stressor is the spread and proliferation of annual grasses and noxious weeds such as cheatgrass and yellow-star thistle that either supplant and/or radically alter entire native bunchgrass communities significantly reducing wildlife habitat quality. Habitat loss and fragmentation (including fragmentation resulting from extensive areas of undesirable vegetation), coupled with poor habitat quality of existing vegetation have resulted in extirpation and/or significant reductions in grassland obligate wildlife species.

Recommended Range of Management Conditions:
The western meadowlark represents species that depend upon native grassland habitats dominated by native grasses such as bluebunch wheatgrass and Idaho fescue. The range of conditions recommended for eastside grassland habitat includes:

- Native bunchgrasses greater than 40 percent cover
- Native forbs 10-30 percent cover
- Herbaceous vegetation height greater than 10 inches
- Visual obstruction readings at least 6 inches
- Native, non-deciduous shrubs less than 10 percent cover
- Exotic vegetation/noxious weeds less than 10 percent cover

Management Strategies:

- Protect extant habitat in good condition through easements and acquisitions; protect poor quality habitat and/or lands with habitat potential adjacent to existing protected lands (avoid isolated parcels/wildlife population sinks).
- Fund and coordinate weed control efforts on both public and private lands.
- Restore grassland function by providing vegetation structural elements through reestablishment of native plant communities where practical and cost effective.
- Limit access by domestic livestock to bighorn sheep range to minimize exposure to diseases.
- Identify and protect wildlife habitat corridors/links.
- Promote research and development of bio-control agents for noxious weeds.
- Promote landowner education in identification and management of noxious weeds.

Data Gaps and M&E Needs:

- Habitat quality data. Assessment data bases do not address habitat quality.
- Higher resolution habitat maps which accurately show location and extent of grassland habitats.
- Refined habitat maps including CRP program/field delineations.
- GIS soils products including wetland delineations.
- Grassland-obligate species data.
- Efficacy of bio-control agents for noxious weeds.

Wildlife Habitat Type: Shrub-steppe
Focal Species: Sage Sparrow

Habitat Status/Change:

Estimated Acres of Habitat	Current	Historic	Difference	% Change
	27,211	16,301	+10,910*	+67*

* Magnitude of change is exaggerated; may be underrepresented in historic data or overrepresented in current data.

Current Protection Status:

Estimated Acres of Habitat	High Protection	Medium Protection	Low Protection	No Protection
	8,443	924	5,196	12,647
Percent Protected	31.0	3.4	19.1	46.5

Factors Affecting Habitats and Focal Species:

- Extensive, permanent habitat conversion resulting in fragmentation of remaining tracts.
- Degradation of habitat values from intensive grazing and invasion of exotic plant species.
- Fire management, either suppression or over-use and wildfires.
- Loss and reduction of cryptogramic crusts, which help maintain the ecological integrity of shrub-steppe communities.
- Conversion of CRP lands back to cropland.
- Loss of big sagebrush communities to brush control.
- Human disturbance during breeding and nesting season.
- Nest predation and/or parasitism.

Shrub-steppe Working Hypothesis:
The major factors affecting this habitat type are direct loss of habitat due primarily to conversion to agriculture, reduction of habitat diversity and function resulting from invasion of exotic vegetation and wildfires and livestock grazing. The principal habitat diversity stressor is the spread and proliferation of annual grasses and noxious weeds such as cheatgrass and yellow-star thistle that either supplant and/or radically alter entire native bunchgrass communities significantly reducing wildlife habitat quality. Habitat loss and fragmentation (including fragmentation resulting from extensive areas of undesirable vegetation), coupled with poor habitat quality of existing vegetation have resulted in extirpation and/or significant reductions in shrub-steppe obligate wildlife species.

Recommended Range of Management Conditions:

The sage sparrow represents shrub-steppe obligate species that require habitats dominated by big sagebrush within large tracts of shrub-steppe habitat. Suitable habitat includes semi-open habitats with shrubs 1-2 m high and free of exotic annuals; sage sparrows abandon former habitats once they have been invaded by cheatgrass.

Management Strategies:

- Protect extant habitat in good condition through easements and acquisitions; protect poor quality habitat and/or lands with habitat potential adjacent to existing protected lands (avoid isolated parcels/wildlife population sinks).
- Fund and coordinate weed control efforts on both public and private lands.

- Restore shrubland function by providing vegetation structural elements through reestablishment of native plant communities where practical and cost effective.
- Identify and protect wildlife habitat corridors/links.

Data Gaps and M&E Needs:

- Habitat quality data. Assessment data bases do not address habitat quality.
- Higher resolution habitat maps which accurately show location and extent of shrubland habitats.
- Refined habitat maps including CRP program/field delineations.
- GIS soils products including wetland delineations.
- Shrub-steppe obligate species data. Significant lack of local population/distribution data for sage sparrow.

Wildlife Habitat Type: Agriculture, Pasture and Mixed Environs
Focal Species: Rocky Mountain Elk

Habitat Status/Change:

Estimated Acres of Habitat	Current	Historic	Difference	% Change
	383,575	0	+383,575	N/A

Current Protection Status:

Estimated Acres of Habitat	High Protection	Medium Protection	Low Protection	No Protection
	250	2,684	1,384	379,257
Percent Protected	0.1	0.7	0.4	98.9

Factors Affecting Habitats and Focal Species:
- Conversion of wetland, grassland, shrub-steppe and forested habitats has created this habitat type.
- Conversion of former elk winter range to agriculture has resulted in conflict between elk and agricultural land managers.

Agriculture, Pasture and Mixed Environs Working Hypothesis:
The major factors affecting this habitat type are primarily anthropogenic and intentional and involve cultivating, planting, harvesting, mowing and application of chemical fertilizers and pesticides. Human-wildlife conflicts occur when animals such as elk consume and/or trample agricultural products with severe economic effects on the land owner/manager.

Recommended Range of Management Conditions:
The Rocky Mountain Elk represents species in conflict with humans due to their use of agricultural lands and products and the economic impacts of that use. This habitat type is unlikely to be managed for wildlife values.

Management Strategies:
- Protect unconverted winter range in good condition through easements and acquisitions.
- Implement winter range forage improvement activities to reduce elk/cropland conflicts.

Data Gaps and M&E Needs:
- Refined habitat maps including CRP program/field delineations.
- GIS soils products including wetland delineations.

Wildlife Habitat Type: Open Water – Lakes, Rivers and Streams.
Focal Species: Bald Eagle

Habitat Status/Change:

Estimated Acres of Habitat	Current	Historic	Difference	% Change
	7,045	9,486	-2,441	-26

Current Protection Status:

Estimated Acres of Habitat	High Protection	Medium Protection	Low Protection	No Protection
	1,037	706	485	4,817
Percent Protected	14.7	10.0	6.9	68.4

Factors Affecting Habitats and Focal Species:

- Irrigation withdrawal/over appropriation results in very low water levels in some lakes and streams affecting habitat values for aquatic species.
- Loss and/or degradation of riparian vegetation affects water temperature and availability of terrestrial invertebrates to aquatic ecosystems.
- Degradation of habitat values from invasion of exotic aquatic plant species.
- Degradation of habitat values, both aquatic and riparian, due to livestock grazing.
- Channelization.
- Human disturbance during breeding and nesting season.
- Loss of large riparian trees for nesting and roosting.

Open Water Habitats Working Hypothesis:
Open water habitats may have actually increased since European settlement due to impoundments and development for agriculture, livestock and human use although the quality of these habitats for wildlife may not equal their natural counterparts. The major factors affecting open water habitats in the subbasin are those that affect water quality (e.g., eutrophication, temperature, high sediment load) and riparian condition.

Recommended Range of Management Conditions:
The bald eagle represents species that live at the interface of aquatic and terrestrial habitats, requiring healthy areas of both to satisfy all their life history requirements. Quality habitat includes open water areas that support healthy populations of prey including fish and waterfowl and a healthy riparian zone with native vegetation and diverse structure including large trees.

Management Strategies:

- Protect extant habitat in good condition through easements and acquisitions; protect poor quality habitat and/or lands with habitat potential adjacent to existing protected lands (avoid isolated parcels/wildlife population sinks).
- Protect water quality through existing regulations and guidance.
- Fund and coordinate weed control efforts on both public and private lands.
- Restore riparian function by providing vegetation structural elements through reestablishment of native plant communities where practical and cost effective.
- Restore degraded and/or channelized streams to natural condition where practical and cost effective
- Identify and protect wildlife habitat corridors/links.

Data Gaps and M&E Needs:

- Habitat quality data. Assessment data bases do not address habitat quality.
- Higher resolution habitat maps which accurately show location and extent of open water and riparian habitats.
- Monitor restoration projects to assess relative success of various methods.
- Monitor bald eagle nests to record nest success and fledgling survival.

Wildlife Habitat Type: Wetlands
Focal Species: Columbia Spotted Frog, Great Blue Heron, Yellow Warbler, American Beaver.

Habitat Status/Change:

Estimated Acres of Habitat	Current	Historic	Difference	% Change
	91,033	131,758	-40,725	-31

Current Protection Status:

Estimated Acres of Habitat	High Protection	Medium Protection	Low Protection	No Protection
	44,487	947	21,331	24,268
Percent Protected	48.9	1.0	23.4	26.7

Factors Affecting Habitats and Focal Species:

- Extensive, permanent habitat conversion/draining.
- Habitat alteration from 1) hydrological diversions resulting in reduced stream flows and reduction in overall area of riparian habitat; loss of vertical stratification in riparian vegetation and lack of recruitment of young cottonwoods, willows, etc. and 2) stream bank stabilization which narrows stream channel, reduces the flood zone and reduces the extent of riparian vegetation.
- Habitat degradation from livestock grazing which can widen channels, raise water temperatures, reduce understory cover, etc.
- Habitat degradation from conversion of native wetland and riparian vegetation to invasive exotics such as reed canary grass, purple loosestrife, perennial pepperweed and Russian olive.
- Hostile landscapes, particularly those in proximity to agricultural and residential areas, may have high density of nest parasites (brown-headed cowbird), exotic nest competitors (European starling), and domestic predators (cats), and may be subject to high levels of human disturbance.
- Human disturbance during breeding and nesting season.
- Nest predation and/or parasitism.
- Chemical pollutants and other water quality issues may reduce productivity and/or survival of Columbia spotted frogs.

Wetlands Working Hypothesis:
The major factors affecting this habitat type are direct loss of habitat due primarily to urban/agricultural development, reduction of habitat diversity and function resulting from invasion of exotic vegetation, livestock overgrazing and fragmentation. The principal habitat diversity stressor is the spread and proliferation of invasive exotics. This, coupled with poor habitat quality of existing vegetation have resulted in extirpation and/or significant reductions in wetland- and riparian-obligate wildlife species.

Recommended Range of Management Conditions:
The Columbia spotted frog represents species that require shallow-water habitats with emergent vegetation and that are productive of invertebrate prey. The great blue heron represents species that live at the interface of aquatic and terrestrial habitats as it forages in either relatively shallow water for aquatic prey or in fields and pastures for terrestrial prey and nests and roosts in large

riparian trees. The yellow warbler represents species that utilize riparian scrub-shrub or riparian understory shrub habitats. The American beaver, like the great blue heron, represents species that require both aquatic and terrestrial elements of the ecosystem to satisfy all their life history needs. Further, beavers shape the environment by creating wetlands that often progress through successional stages of siltation and vegetation growth to become meadows and/or riparian areas.

Management Strategies:

- Protect extant habitat in good condition through easements and acquisitions; protect poor quality habitat and/or lands with habitat potential adjacent to existing protected lands (avoid isolated parcels/wildlife population sinks).
- Fund and coordinate weed control efforts on both public and private lands.
- Work with Conservation Districts, NRCS, Forest Service, landowners et al., to implement best management practices in wetland and riparian areas in conjunction with CRP, CREP, WHIP, WRP and other programs.
- Restore wetland function by providing vegetation structural elements through reestablishment of native plant communities where practical and cost effective.
- Restore riparian area function with enhancements, livestock exclusions, in-stream structures and bank modification if necessary, and stream channel restoration activities.
- Identify and protect wildlife habitat corridors/links.
- Develop a beaver management plan to promote the reestablishment/reintroduction of beaver into headwater and mid-elevation habitats.

Data Gaps and M&E Needs:

- Habitat quality data. Assessment data bases do not address habitat quality.
- Higher resolution habitat maps which accurately show location and extent of wetland and riparian habitats.
- Refined habitat maps including CREP program/field delineations.
- GIS soils products including wetland delineations.
- Wetland/riparian obligate species data. Significant lack of local population/distribution data for Columbia spotted frog, yellow warbler and beaver

3.6.3. Desired Future Conditions – Aquatic

Included in Biological Objectives in Management Plan

3.6.4. Desired Future Conditions – Terrestrial

Included in Synthesis Section 3.6.2.

3.6.5. Opportunities

See Section 3.5.1 and Table 46.

4. Inventory of Existing Activities (Private, Local, State, Federal)

The inventory section describes existing legal protection, plans, management programs and restoration projects followed by a gap assessment of effectiveness of these elements in protecting and conserving species and habitats in the Grande Ronde Subbasin.

4.1. Existing Legal Protection

The Land Management Protection Class map (Figure 62) illustrates the protection status of lands within the subbasin. The same protection class map is also seen as an overlay on the habitat maps in section 3.4.2. The protection status working definitions for the GAP analysis are as follows:

- High (Status 1): An area having permanent protection form conversion of natural land cover and a mandated management plan in operation to maintain a natural state within which disturbance events (of natural type, frequency, intensity and legacy) are allowed to proceed without interference or are mimicked through management.
- Medium (Status 2): An area having permanent protection form conversion of natural land cover and a mandated management plan in operation to maintain a primarily natural state, but which may receive uses or management practices that degrade the quality of existing natural communities, including suppression of natural disturbance.
- Low (Status 3): An area having permanent protection from conversion of natural land cover for the majority of the area, but subject to extractive uses of either a broad, low intensity type (e. g., logging) or localized intense type (e. g., mining). It also confers protection to federally listed endangered and threatened species throughout the area.
- None (Status 4): There are no known public or private institutional mandates or legally recognized easements or deed restrictions held by the managing entity to prevent conversion of natural habitat types to anthropogenic habitat types. The area generally allows conversion to unnatural land cover throughout.

Protected Areas: The following is a list, with brief descriptions, of the major protected areas within the subbasin.

U.S. Forest Service

- *Eagle Cap Wilderness Area.* The Eagle Cap Wilderness Area lies in the heart of the Wallowa Mountains on the Wallowa-Whitman National Forest and encompasses 361,446 acres. First established as a primitive area in 1930, the Eagle Cap Wilderness became a part of the National Wilderness Preservation System with the passage of the Wilderness Act of 1964. The Eagle Cap Wilderness Area includes most of the Minam, upper Wallowa and upper Lostine river drainages as well as Bear Creek and Hurricane Creek and a small portion of Catherine Creek.
- *Wenaha-Tucannon Wilderness Area.* The Wenaha-Tucannon Wilderness Area was created by the Endangered American Wilderness Act of 1978. Located in the northern Blue Mountains of southeastern Washington and northeastern Oregon, it encompasses 177,465 acres and includes most of the Wenaha River drainage.

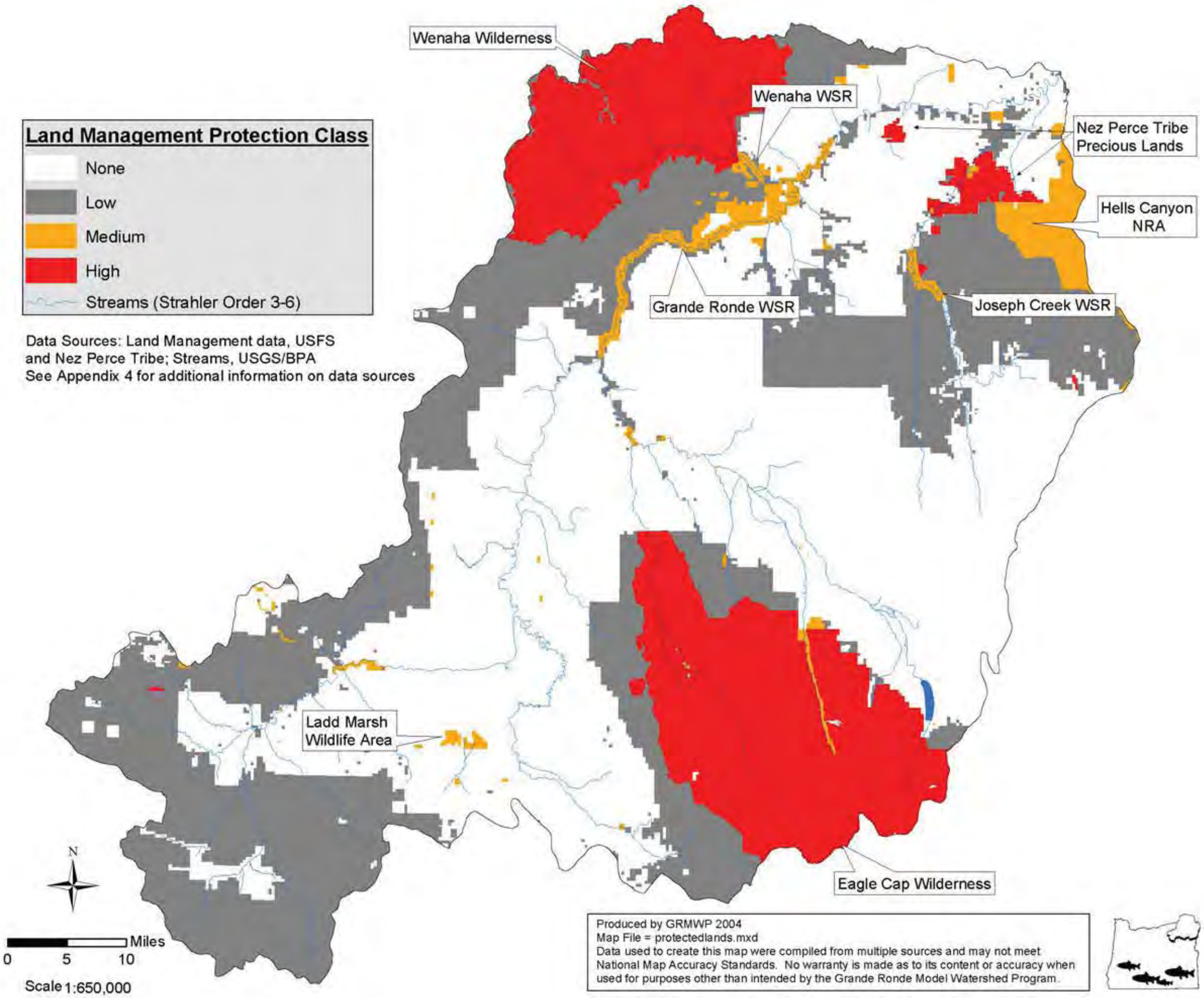


Figure 62. Land protection status and some protected areas in the Grande Ronde subbasin (NRA= National Recreation Area; WSR=Wild and Scenic River).

Oregon Department of Fish and Wildlife

- *Ladd Marsh Wildlife Area:* Ladd Marsh Wildlife Area is located about 5 miles southeast of La Grande, Oregon. It presently includes 4,051 acres of streams, ponds, wetlands and associated uplands, although negotiations to purchase neighboring tracts are ongoing. The Nature Conservancy and the Rocky Mountain Elk Foundation have purchased adjacent properties. These properties will be managed by ODFW as part of the Ladd Marsh Wildlife Area. Ladd Marsh is home to over 200 species of birds, 40 species of mammals and 10 species of reptiles and amphibians. Snake River spring Chinook salmon, Snake River summer steelhead and bull trout may all be found in Ladd Creek within the Wildlife Area at some times of the year.
- *Wenaha Wildlife Area:* The Wenaha Wildlife Area is located approximately 50 miles north of Enterprise, Oregon. The Wildlife Area encompasses 10,966 acres with an additional 1,370 acres currently managed as part of the Wildlife Area. The Wenaha Wildlife Area was established in 1953 to provide natural and subsistence food for mule deer, elk and bighorn sheep, to enhance habitat for native fish and wildlife species, and to provide wildlife-oriented recreational opportunities for the public. The Wenaha Wildlife Area is home to a variety of wildlife, both resident and migratory, including 29 species of mammals, 131 species of birds, and 7 species of reptiles and amphibians. Spring Chinook salmon, fall Chinook salmon, and summer steelhead may all be found in reaches of the Grande Ronde and Wenaha Rivers where they pass through the Wildlife Area.
- *Enterprise Wildlife Area:* Located in Wallowa County near Enterprise, Oregon, the Enterprise Wildlife Area consists of 32 acres of riparian and juniper habitat managed for a variety of wildlife species.
- *Lostine Wildlife Area:* The Lostine Wildlife Area is located in the Lostine River drainage of Wallowa County, Oregon about 6 mi. south of Lostine. The wildlife area encompasses 969 acres of grassland habitat managed primarily for Rocky Mountain bighorn sheep.
- *Rhinehart Wildlife Area:* This 1-acre tract adjacent to the Grande Ronde River near Elgin, Oregon is managed for its value as riparian habitat for passerine birds and other wildlife.
- *Saw-whet Wildlife Area:* This 7-acre wildlife area, in Union County, Oregon consists of pond and riparian habitat and is managed for a variety of wildlife associated with these habitats.
- *Wallowa Wildlife Area:* The Wallowa Wildlife Area is 22 acres of wetland and riparian areas. This area is managed to benefit wintering birds and a variety of other wildlife.
- *Minam River Public Access:* Located near the confluence of the Minam and Wallowa rivers, this public access area consists of 338 acres of mostly riparian habitat. The area is managed primarily for large mammals and other wildlife while offering an access point for recreation in the Minam River drainage.
- *Morgan Lake Public Access:* Morgan Lake is a 65-acre lake located southwest of La Grande, Oregon. The area serves as habitat for waterfowl and other wildlife as well as offering recreational opportunities for anglers, paddlers, birdwatchers, and others.

Washington Department of Fish and Wildlife

- *Chief Joseph Wildlife Area.* The Chief Joseph Wildlife Area complex consists of 3 parcels, with a total of 13,425 acres, located on the lower Grande Ronde River. The area is in Asotin County, Washington, approximately 30 miles south of the town of Asotin. The largest parcel in the complex, 9,735 acres, was purchased in 1974. The other two parcels, with a combined area of 3,680 acres, were added in the 1990's through Snake River dam mitigation for wildlife programs. The Chief Joseph Wildlife Area is managed for Rocky Mountain bighorn sheep, mule deer, upland birds and a variety of non-game wildlife. Over 115 species of birds have been identified in the Area. Peregrine falcons have been reared in the wildlife area and it is a popular wintering area for bald eagles. Through its management of the wildlife area, WDFW owns or manages 11.5 miles of anadromous fish streams in, or bordering the area.

Nez Perce Tribe

- *Precious Lands.* The Precious Lands area, purchased with Snake River dam wildlife mitigation funds, lies approximately 40 miles north of Enterprise, Oregon and encompasses parts of Cottonwood, Broady, Tamarack, Joseph, and Buford Creeks. The area, with a total of 15,325 acres, contains primarily grassland plant communities dominated by bluebunch wheatgrass. North facing slopes also support dense shrub fields and/or mixed conifer stands of Douglas-fir and ponderosa pine. Riparian areas largely consist of a black cottonwood or white alder overstory with multi-layered shrub understory, or dense black hawthorn thickets with an occasional conifer. The area supports a wide range of wildlife species and is a critical big game wintering area for the Chesnimnus Unit elk herd. Survey work has identified 87 bird species, 29 mammals, and 11 reptiles and amphibians that inhabit the project area. Joseph and Cottonwood Creeks also support steelhead populations that benefit from the current management of the property.

Wild and Scenic Rivers

The lower Grande Ronde River in Oregon and all or portions of four tributaries are designated as federal Wild and Scenic under the Omnibus Oregon Wild and Scenic Rivers Act and are sub-classified as wild, scenic or recreational. These river segments are the Grande Ronde from its confluence with the Wallowa River (RM 82) to the Washington border, a distance of about 44 miles (wild, scenic, recreational); Joseph Creek from 6.5 miles below the Crow Creek/Chesnimnus Creek confluence to the Forest Service Boundary, about 9 miles (wild); The Lostine River from the headwaters to the Forest Service boundary, about 16 miles (wild, recreational); the Minam river from the headwaters to the Wilderness boundary, about 39 miles (wild); and the Wenaha River from the confluence of the North and South Forks (Wenaha Forks, RM 22) to the mouth, about 21 miles (wild, scenic, recreational). Outstandingly Remarkable Values (ORV) of the Wild and Scenic River designation include scenery, recreational opportunities and fisheries. Wild and Scenic rivers within the National Forests in the subbasin are managed by the Forest Service; those outside the National Forests are managed by the Bureau of Land Management.

Three river segments in the subbasin are also designated as Scenic Waterways under the Oregon State Scenic Waterways System. These are the entire Minam River; the Wallowa River from Minam to the confluence with the Grande Ronde; and the Grande Ronde from the Wallowa River to the Washington border. The criteria for state Scenic Waterways are similar to those for federal designation.

4.2. Existing Plans

➲ *US Forest Service and Bureau of Land Management*

The U.S. Forest Service is required to manage habitat to maintain viable populations of anadromous fish and other native and desirable non-native vertebrate species. **Land and Resource Management Plans (Forest Plans)** were developed for the Wallowa-Whitman National Forest (USDA 1990), and the Umatilla National Forest (USDA 1990). These Forest Plans guide all natural resource management activities, establish forest-wide multiple-use goals and objectives, and establish management standards and guidelines for the National Forests.

The Bureau of Land Management, in accordance with the Federal Land Policy and Management Act of 1976, is required to manage public lands to protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values. Both the USFS and BLM are required by the Clean Water Act to ensure that activities on administered lands comply with requirements concerning the discharge or run-off of pollutants.

In the Columbia River Basin, the Forest Service and the Bureau of Land Management manage salmonid habitat under the direction of **PACFISH** (USDA and USDI 1994) and **INFISH** (Inland Native Fish Strategy; USDA 1995). These interim management strategies aim to protect areas that contribute to salmonid recovery and improve riparian habitat and water quality throughout the Basin, including the Grande Ronde subbasin. These strategies have also facilitated the ability of the federal land managers to meet requirements of the ESA and avoid jeopardy. PACFISH guidelines are used in areas east of the Cascade Crest for anadromous fish. INFISH is for the protection of habitat and populations of resident fishes outside anadromous fish habitat.

The **Interior Columbia Basin Ecosystem Management Project** (ICBEMP) is a regional-scale land-use plan that covers 63 million acres of federal lands in Oregon, Washington, Idaho, and Montana http://www.icbemp.gov/.

The Bureau of Land Management is developing the **Northeastern Oregon Assembled Land Exchange (NOALE) and Resource Management Plan (RMP)** for the retention, exchange, and disposal of public land (USDI 1998). The goal of the exchange is to enable the BLM to more effectively meet ecosystem management objectives, to consolidate BLM managed lands for more effective and efficient resource protection, enhancement, and use; and to ensure that retained lands have sufficient public benefit to merit the costs of management (Land Exchange Act).

➲ *US Fish and Wildlife Service*

The U.S. Fish and Wildlife Service administers the Endangered Species Act (ESA) for resident fish and wildlife. This act provides for the development of **Recovery Plans** and directs enforcement of federal protection laws. Relevant recovery plans in the subbasin include:

- Bald Eagle Recovery Plan
- Canada Lynx Recovery Plan
- Bull Trout Draft Recovery Plan
- Howell's Spectacular Thelypody Recovery Plan
- MacFarlane's Four-O'Clock Recovery Plan
- Greenmann's Lomatium Conservation Agreement
- Spalding's Catchfly Conservation Strategy

The USFWS also administers the **Lower Snake River Fish and Wildlife Compensation Plan (LSRCP)** authorized by the Water Resources Development Act of 1976 (Public Law 94-587). The goal of the LSRCP is to mitigate and compensate for fish and wildlife resource losses caused by construction and operation of the four lower Snake River dams and navigation lock projects (FWS 1998).

➲ *NOAA Fisheries*

The National Oceanic and Atmospheric Administration administers the **ESA** as it pertains to anadromous fish only. NOAA Fisheries has jurisdiction over actions pertaining to Snake River spring and fall Chinook salmon and Snake River Basin Steelhead where they occur in the subbasin.

The ODFW has prepared **Hatchery and Genetics Management Plans (HGMP**) for artificial production programs in the subbasin at the direction of NOAA Fisheries.

➲ *Environmental Protection Agency*

The U.S. Environmental Protection Agency is responsible for implementing and administering the **Clean Water Act** (CWA). Accelerated and strengthened efforts to achieve clean water and aquatic habitats was the intent of the Clean Water Initiative (1998), the core of which is the **Clean Water Action Plan (CWAP)**, a federal partnership to promote and enhance locally based watershed improvements (the Unified Federal Policy for Ensuring a Watershed Approach to

Federal Land and Resource Management). Restoration strategies called **Total Maximum Daily Loads (TMDL)** are being developed for the Columbia River mainstem and tributaries (including the Grande Ronde subbasin), based on court orders and negotiated agreements through CWA litigation. EPA serves an oversight and advisory role in development of TMDLs.

➲ *Confederated Tribes of the Umatilla Indian Reservation*

The CTUIR is responsible for protecting and enhancing treaty fish and wildlife resources and habitats for present and future generations. Members of the CTUIR have federal reserved treaty fishing and hunting rights pursuant to the 1855 Treaty with the United States government. CTUIR co-manages fisheries resources with ODFW and individually and/or jointly implements restoration and mitigation activities throughout the areas of interest and influence in northeast Oregon and southeast Washington. CTUIR policies and plans applicable to subbasin management include the **CTUIR Columbia Basin Policy** (1996), **Wy-Kan-Ush-Mi Wa-Kish-Wit: Spirit of the Salmon** (CRITFC 1995).

➲ *Nez Perce Tribe*

The Nez Perce Tribe is responsible for managing, protecting, and enhancing treaty fish and wildlife resources and habitats for present and future generations in the Grande Ronde River subbasin. The Nez Perce Tribe individually and/or jointly implements restoration and mitigation activities throughout their areas of interest and influence. Nez Perce Tribal policies and plans applicable to subbasin management include **Nez Perce Tribal Executive Committee Resolutions**, the **Wallowa County/Nez Perce Tribe Salmon Habitat Recovery Plan and Multi-Species Strategy** (Wallow County and Nez Perce Tribe, 1993), the **Wy-Kan-Ush-Mi Wa-Kish-Wit: Spirit of the Salmon** (CRITFC 1995), the **Nez Perce Fish and Wildlife Code**, and Reports to General Council.

➲ *Blue Mountains Elk Initiative*

The **Blue Mountains Elk Initiative** is a federal, private, state and tribal Partnership to manage elk in the Blue Mountains of Oregon and Washington. The mission of the Initiative is to more effectively manage elk and elk habitat in the Blue Mountains with an emphasis on working closely with landowners to alleviate damage, using more than 90 percent of funding for on-the-ground projects and obtaining consensus on elk management from all partners and interested groups.

➲ *Senate Bill 1010*

Senate Bill 1010 allows the Oregon Department of Agriculture (ODA) to develop Water Quality Management plans for agricultural lands where such actions are required by state or federal law, such as TMDL requirements. The **Water Quality Management Plan** should be crafted in such a way that landowners in the local area can prevent and control water pollution resulting from agricultural activities.

➲ *Oregon Plan*

Passed into law in 1997 by Executive Order, the **Oregon Plan for Salmon and Watersheds** (http://www.oregon-plan.org/) and the **Steelhead Supplement to the Oregon Plan** outlines a statewide approach to ESA concerns based on watershed restoration and ecosystem management to protect and improve salmon and steelhead habitat in Oregon.

➲ *Oregon Department of Fish and Wildlife*

Oregon Department of Fish and Wildlife is responsible for protecting and enhancing Oregon fish and wildlife and their habitats for present and future generations. ODFW co-manages fishery resources with the NPT, CTUIR and Washington Department of Fish and Wildlife (WDFW). Management of the fish and wildlife and their habitats in and along the Grande Ronde Subbasin is guided by ODFW policies, collaborative efforts with affected tribes, and federal and state legislation. Direction for ODFW fish and wildlife management and habitat protection is based on the amendments and statutes passed by the Oregon Legislature. For example, **Oregon Administrative Rule (OAR) 635 Division 07 – Fish Management and Hatchery Operation** sets forth policies on general fish management goals, the **Natural Production Policy**, the **Wild**

Fish Management Policy, and other fish management policies and **OAR 635 Division 008 – Department of Wildlife Lands** sets forth management goals for each State Wildlife Area. Another pertinent ODFW policy is the **Oregon Guidelines for Timing of In-Water Work** to **Protect Fish and Wildlife Resources** (ODFW 1997b). In addition to the OAR's, ODFW has developed a variety of species-specific management plans. http://www.dfw.state.or.us/

- Mule Deer Management Plan (2003)
- Elk Management Plan (2003)
- Bighorn Sheep and Rocky Mountain Goat Management Plan (2003)
- Cougar Management Plan (1993)
- Black Bear Management Plan (1987)
- Migratory Game Bird Program Strategic Management Plan (1993)
- Oregon Wildlife Diversity Plan (1999)
- Oregon's Trout Plan
- Warmwater Fish Plan
- Comprehensive Plan for Production and Management of Oregon's Anadromous Salmon and Trout, Part III: Steelhead Plan
- Native Fish Conservation Policy

➲ *Oregon Department of Agriculture*

The Department of Agriculture oversees several programs in the Natural Resource Division that address soil, water, and plant conservation in the Grande Ronde subbasin. Soil and Water Conservation Districts, Watershed Councils, the Environmental Quality Incentives Program (EQIP), and Coordinated Resource Management Planning (CRMP) are under the jurisdiction of the Department of Agriculture as is the **Oregon Noxious Weed Strategic Plan**.

➲ *Oregon Department of Forestry*

The Oregon Department of Forestry enforces the **Oregon Forest Practices Act** (OAR 629-Division 600 to 680 and ORS 527) regulating commercial timber production and harvest on state and private lands. The OFPA contains guidelines to protect fish bearing streams during logging and other forest management activities, which address stream buffers, riparian management, and road maintenance.

➲ *Washington Department of Fish and Wildlife*

The WDFW is responsible for preserving, protecting, and perpetuating populations of fish and wildlife. Washington State laws, policies or guidance that WDFW uses to carry out its responsibilities include:

Hydraulic Code (RCW 75.20.100-160): This law requires that any person, organization, or government agency that conducts any construction activity in or near state waters must comply with the terms of a Hydraulic Project Approval permit issued by WDFW.

Strategy to Recover Salmon (part of *Extinction is not an Option*): The strategy is intended to be a guide, and it articulates the mission, goals, and objectives for salmon recovery.

The **Bull Trout and Dolly Varden Management Plan**: Describes the goal, objectives, and strategies to restore and maintain the health and diversity of self-sustaining bull trout and Dolly Varden stock and their habitats.

The **Wild Salmonid Policy for Washington**: Describes the direction the WDFW will take to protect and enhance native salmonid fish. The document includes proposed changes in hatchery management, general fish management, habitat management, and regulation/enforcement.

The **Draft Steelhead Management Plan:** Describes the goals, objectives, policies, and guidelines to be used to manage the steelhead resource.

Washington Priority Habitats and Species (PHS): A guide to management of fish and wildlife "critical areas" habitat on all State and private lands as they relate to the Growth

Management Act of 1990. The recommendations address upland as well as riparian habitat and place emphasis on managing for the most critical species and its habitat.

Specific wildlife species management or recovery plans, (e.g., **Blue Mt. Elk Herd Management Plan 2000, Statewide Elk Management Plan, Bighorn Sheep Herd and Statewide Management Plan, Black Bear, State Ferruginous Hawk Recovery Plan, Bald Eagle Recovery Plan**).

The **Draft Snake River Wild Steelhead Recovery Plan**: This plan is an assessment of problems associated with the continuing decline in natural steelhead populations within the Snake River basin and includes recommendations to reverse the decline.

The WDFW **Snake River Fishery Management and Evaluation Plan (FMEP)**: A plan required by NOAA Fisheries for all fisheries in the Snake River and its tributaries in Washington. The plan is an assessment of fisheries effects on listed anadromous salmonids.

➲ *County Governments*

County Commissioners have established **Comprehensive Plans** for land use within each county in Oregon.

Asotin County Shorelines Master Program (1994) is responsible for protecting the classified Shorelines of Statewide Significance.

➲ *Grande Ronde Water Quality Committee*

The Grande Ronde Water Quality Committee is a group of representatives from interest groups affected by water quality issues and regulations. They developed the **Upper Grande Ronde Water Quality Management Plan** (ODEQ 1999). Similar plans for the lower Grande Ronde and Wallowa watersheds are in development. These WQMPs provide a framework for achieving the load allocations in the TMDL

➲ *Asotin County Conservation District*

The ACCD is Asotin County's designated lead agency for watershed planning and implementation. The ACCD is responsible for the implementation of the **Asotin Creek Model Watershed Plan** and the Washington State Salmon Recovery Act within Asotin County.

➲ *Columbia River Basin Forum*

Formerly called The Three Sovereigns, the Columbia River Basin Forum is designed to improve management of fish and wildlife resources in the Columbia River Basin. The Forum is included as a vehicle for implementation of the **Coordinated Federal Strategy for the Recovery of the Columbia-Snake River Basin Salmon**.

4.3. Existing Management Programs

➲ *Bonneville Power Administration*

The Bonneville Power Administration has mitigation responsibility for fish and wildlife restoration under the **Fish and Wildlife Program** of the Northwest Power and Conservation Council as related to hydropower development. It is also accountable and responsible for mitigation related to federal Biological Opinions and Assessments for recovery of threatened, endangered, and sensitive species. The recently released FCRPS Biological Opinion calls for the BPA to expand habitat protection measures on non-federal lands. BPA plans to rely on the Council's program as its primary implementation tool for the FCRPS BiOp off-site mitigation requirements.

➲ *U.S.D.A. Natural Resources Conservation Service*

Within the U.S. Department of Agriculture (USDA), the **Natural Resources Conservation Service (NRCS)** oversees the implementation of conservation programs to help solve natural resource concerns. The **Environmental Quality Incentives Program (EQIP)**, established in the 1996 Farm Bill, provides a voluntary conservation program for farmers and ranchers who face serious threats to soil, water, and related natural resources. The **Conservation**

Reserve Program (CRP) puts sensitive croplands under permanent vegetative cover. The **Conservation Reserve Enhancement Program (CREP)** helps to establish forested riparian buffers. The NRCS assists landowners to develop farm conservation plans and provides engineering and other support for habitat protection and restoration (PL 566). Other NRCS programs include river **Basin Studies**, **Forestry Incentive Program**, **Wildlife Habitat Improvement Program** and **Wetlands Reserve Program (WRP).**

➲ *Oregon State Police*

The Fish and Wildlife Division of the Oregon State Police (OSP) is responsible for enforcement of fish and wildlife regulations in the State of Oregon. **The Coordinated Enforcement Program (CEP)** ensures effective enforcement by coordinating enforcement priorities and plans by and between OSP officers and ODFW biologists.

➲ *Grande Ronde Model Watershed Program*

The **Grande Ronde Model Watershed Program (GRMWP**) was selected in 1992 by the Northwest Power Planning Council as the model watershed project in Oregon. The GRMWP has a Board of Directors, composed of local representatives, tribes and natural resource management agencies, to coordinate policy of the program. For the last twelve years the GRMWP has served as an example of a watershed management partnership among local residents, agency staffs and public interest groups. The Program coordinates the implementation, maintenance and monitoring of habitat restoration projects. To date the Program has facilitated the implementation of nearly 300 restoration projects. Activities are guided by the Grande Ronde Model Watershed Operations Action Plan (1994).

➲ *Asotin County Noxious Weed Board*

The primary function of the **Asotin County Noxious Weed Control Program** is to provide technical assistance to the citizens of the county in developing effective control strategy's in dealing with their noxious weed problems and encourage people to be good land stewards.

4.4. Existing Restoration and Conservation Projects

This section and Appendices will summarize restoration project activities and accomplishments in the Grande Ronde Subbasin. The accomplishments are mostly aquatics related although there are certainly projects such as wetlands restoration that benefit many wildlife species. Summary narrative and tables are included in the body of the document, complete project listings are found in the appendix. Accomplishments are listed by geographic areas corresponding to unique steelhead and Chinook population units identified by the Interior Columbia Technical Team (TRT 2003). Figure 63 shows the TRT defined population units. Table 59 displays ownership acreages by population units. Figure 64 is a map of project points for work done between 1994 and present.

The Grande Ronde Model Watershed Program has been using BPA fish and wildlife mitigation funds to implement watershed restoration projects since 1994. GRMWP staff, in response to BPA, agency and stakeholder requests about restoration accomplishments, began development of a database in 1996 to track restoration activities. The database currently contains approximately 610 projects, 400 of which are listed in Appendix 4, Grande Ronde Subbasin Project Inventory by Salmonid Population Units. Projects located in the Imnaha subbasin, those that occurred prior to 1994, and those that are not on-the-ground restoration activities were excluded from the list.

The database includes most aquatic habitat and restoration work by agencies, tribes, and private landowners. Emphasis was placed on obtaining data on riparian/stream/fish habitat improvement projects. However upland projects intended to improve watershed condition or fish habitat were also included. Projects conducted under the FSA/NRCS programs such as CCRP, CRP, EQIP, and WHIP programs; and completed before 2001, were also included in the database. In 2001 access to FSA/NRCS project information was restricted so only FSA/NRCS projects funded through BPA/GRMWP are included after2001. All ODFW/BPA stream/riparian projects and some wildlife projects are also included.

A short narrative and project accomplishment summary table is included below for each population. Information in the table is listed by restoration category and tasks. Where applicable, work is reported by: # of task items, miles accomplished, stream miles affected, acres treated, acres benefited and stream miles made accessible to anadromous fish. Appendix 5, listing projects by name for each of the population units, includes the lead organization, work description, tasks, funding sources, project objectives and monitoring.

Restoration work in the Grande Ronde Subbasin has been the cooperative effort of many agencies, two tribes, schools, two county governments and many individual landowners. Funding partners are shown in the project listing in Appendix 5. Table 47 summarizes total funding contributions for projects accomplished from 1994 to present.

Table 47. Sources of funding for restoration projects located in the Grande Ronde subbasin from 1994 to present.*

Funding Source	**Funding****
Bonneville Power Administration	$8,216,270
Bureau of Land Management	$25,925
Bureau of Reclamation	$970,159
Environmental Protection Agency	$92,225
Farm Services Administration	$1,221,322
Federal Emergency Management Agency	$44,750
Federal Hwy Administration	$62,148
National Marine Fisheries Service	$97,200
Natural Resource Conservation Service	$930,828
Northwest Power Planning Council	$5,000
U.S. Army Corps of Engineers	$217,000
US Fish & Wildlife Service	$107,700
US Forest Service	$5,342,324
Oregon Dept. of Agriculture	$76,164
Oregon Dept. of Environmental Quality	$254,687
Oregon Dept. of Fish and Wildlife	$977,828
Oregon Dept. of Forestry	$120,351
Oregon Dept. of Geology and Mineral Industries	$54,146
Oregon Dept. of Transportation	$104,562
Oregon Parks & Recreation Department	$52,337
Oregon Water Resources Dept.	$55,820

Oregon Watershed Enhancement Board (includes OWHP & GWEB)	$6,306,604
Soil and Water Conservation Districts	$117,926
County/City/Schools	$1,329,904
Misc. State Agencies/Universities	$120,154
Tribes	$679,017
Private Landowners	$4,389,084
Other/Unknown	$288,765
Total	**$32,260,199**

*This summary was derived from the GRMWP project database and corresponds with the projects listed in Appendix X and tables CC through CCC.
**includes inkind services and materials

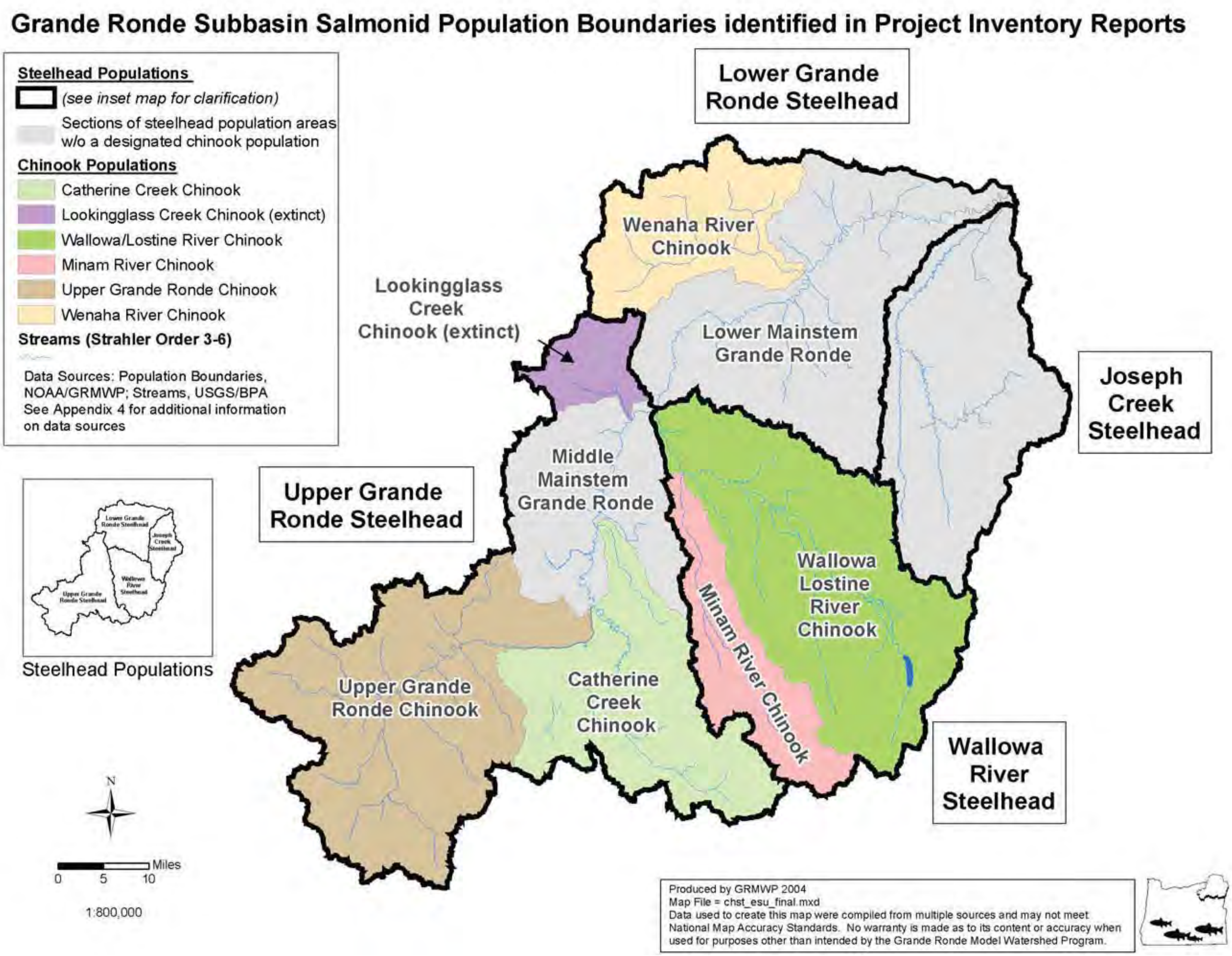


Figure 63. Grande Ronde Subbasin Salmonid Population areas identified in the EDT analysis and in project inventory tables.

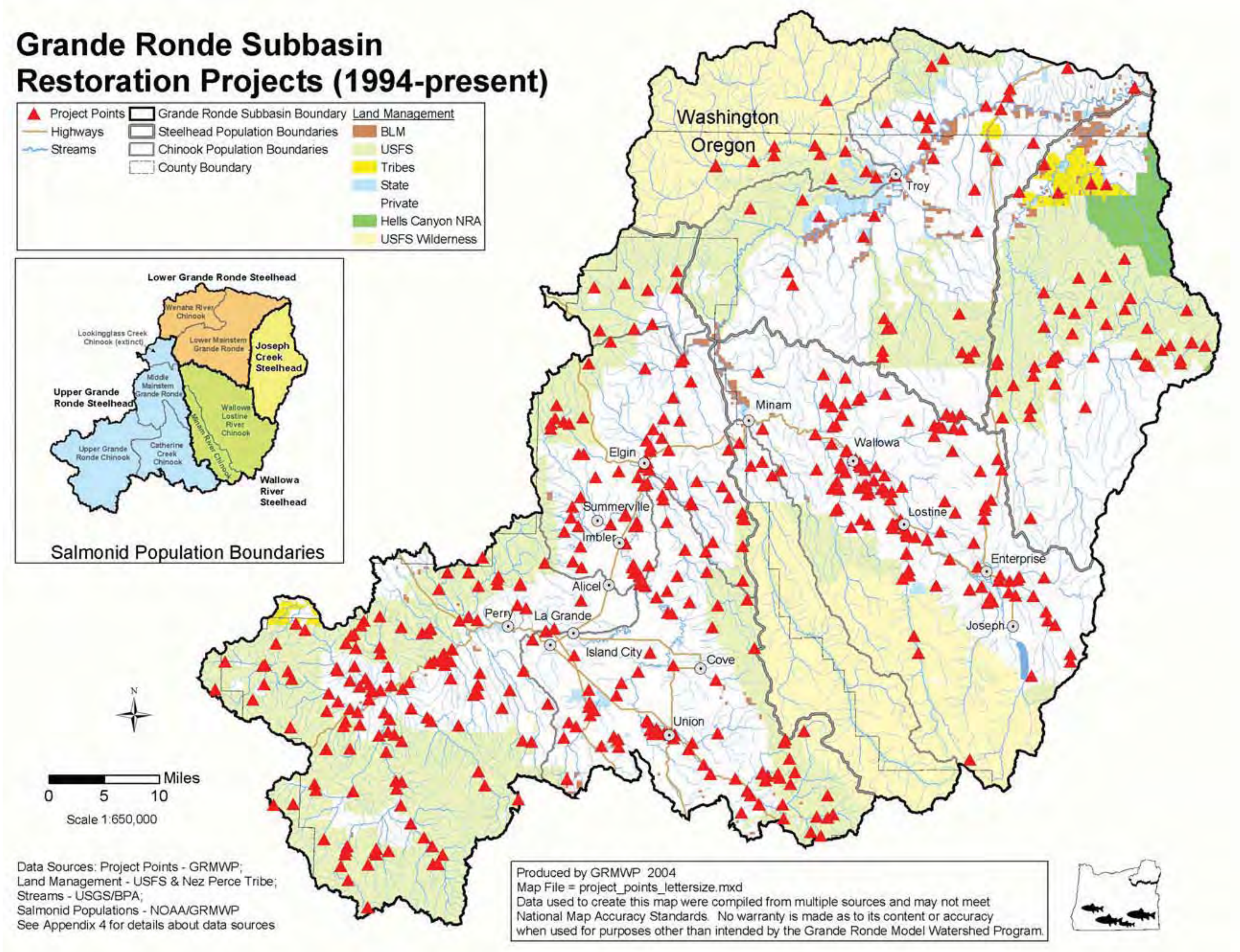


Figure 64. Restoration Projects 1994-present. Points represent central location of project activities.

Table 48. Restoration Inventory Project Task Objectives, Benefits, Descriptions.

Restoration Category	Task	# Projects*	Objectives**; benefits; description of specific techniques	BPA WMP EIS Management Technique Codes***
In Stream Enhancements	placement of boulders	13	ISD, WQS; Provide localized scour pools and resting areas, can provide additional cover or direct streamflow to preferred channel areas, enhances existing habitat, encourages upstream migration through higher velocity reaches	1.7
	placement of large woody material	62	ISD, SBS, WQS; Provides hydraulic and structural diversity, mimics natural processes, provides additional cover, slow, long-term decay of wood can provide transitional return to natural conditions; e.g. wood pieces, whole logs, logs with rootwads, can be hand/machine/helicopter placed, in a few cases used to keep livestock out of stream	1.6
	restore historic channel	8	ISD, SBS, WQS; Restores naturally operating processes necessary to sustaining channel structure and fish habitat, maintains a greater quality and quantity of fish and riparian habitat	1.3
	concrete structure(s)	1	WHI, WQN, WQT; in this one case designed as water control structures for ground water recharge for wetland	2.3
	log structure(s)	11	FPA, ISD, SBS, WQN, WQS; see benefits for placement of boulders and large woody material, directs flow to minimize bank erosion and/or improve fish passage, creates pool habitat, captures sediment, and cools water, when constructed as control structures an additional objective is to raise the water table; e.g. log weirs, water control structures, drop structures	1.6, 1.7, 2.3
	rock structure(s)	22	FPA, ISD, SBS, WQN, WQS; see benefits for placement of boulders, directs flow to minimize bank erosion and/or improve fish passage, creates pool habitat, captures sediment, and cools water, when constructed as control structures an additional objective is to raise the water table, objectives similar to log structures but used even more so to modify flow and protect banks and to help stabilize diversion sites; e.g. rock weir, grade control, check dam, drop structure,	1.7, 2.3
	misc. channel work	14	See objectives and benefits described for restoring historic channel; e.g. pool excavation, gravel bar removal, create meanders, reconfigure channel,	1.3
Dam-Diversion	fish passage ladder(s) @ diversion	5	FPA; Facilitates increased fish migration, provides access to unused or under utilized habitat	1.15
	fish passage weir(s) @ diversion	2	FPA, SBS, WQS; See benefits for fish passage ladder(s) @ diversion, also used to direct flow to minimize streambank erosion and collect sediment	1.15
	irrigation diversion(s)	12	FPA, SBS, WQN, WQS; Improves conditions for fish passage and eliminates pushup dams or replaces poorly designed or failing diversion to minimize streambank erosion and sediment, when headgate installed water use and rate applied can be controlled and monitored	4.2, 4.22, 4.25
	irrigation diversion(s) modified	7	See objectives and benefits for irrigation diversion(s); e.g. majority of projects involved installing/replacing headgates	4.2, 4.22, 4.25
	fish passage ladder(s) @ dam	1	See objectives and benefits for fish passage ladder(s) @ diversion	4.2, 4.22, 4.25
Side Channel-Pool Habitat	construction of side channel(s)/pool(s)	3	ISD, increase or improve available rearing habitat, potential to increase rearing success	1.17
	place large woody material in side channel(s)/pool(s)	3	See objectives and benefits for instream placement of large woody material	1.6, 1.17
	misc. modifications to side channel(s)/pool(s)	2	See objectives and benefits for construction of side channel(s)/pool(s); e.g. excavate pool to increase size, passage structure to provide access	

*Number of projects in the Grande Ronde Subbasin

**Objectives and benefits listed may not apply to all applications of the associated task; Objective Code Definitions: EDU – Education; FPA – Fish Passage Improvement; ISD – Improve Instream Habitat Diversity; RIC – Improve Overall Riparian Condition; SBS – Stabilize Streambanks; SHP – Protect Spawning Habitat; UHI - Improve Upland Habitat; WHI – Wildlife Habitat Improvement; WQC – Improve Water Chemistry; WQN – Improve Water Quantity; WQS – Reduce Water Sediment; WQT – Improve Water Temperature

*** IDs are from BPA Watershed Management Program - Final EIS – 0265 Appendix A Available Management Techniques

Restoration Category	Task	# Projects*	Objectives**; benefits; description of specific techniques	BPA WMP EIS Management Technique Codes***
Streambank Enhancements	streambank rock treatment	11	SBS, WQS; protect streambanks from erosion, useful in highly disturbed areas or where high quality habitat and high value property require immediate protection; e.g. rip rap,	1.10
	streambank log structure(s)	13	ISD, SBS, WQS; absorb or redirect flow to reduce streambank erosion, mimics natural process of large woody debris recruitment , gradual decay provides transition to naturally stable banks, provides bank cover and scour pools for fish; e.g. revetment, jetty	1.9 & 1.10
	streambank rock structure(s)	36	ISD, SBS, WQS; absorb or redirect flow to reduce streambank erosion, provides bank cover and scour pools for fish; e.g. Barbs, jetties, j-vanes often with wood tied into structure	1.9 & 1.10
	streambank planting	29	SBS, WQS, WQT; Stabilizes banks, promotes natural processes, shades stream to maintain cool water temperatures, reduces sediments reaching streams nutrients taken up by vegetation; e.g. often includes bioengineering, planting in or between rock/wood streambank structures	1.8, 2.1, 2.4
	streambank seeding	4	SBS, WQS; Stabilizes banks, promotes natural processes, reduces sediments reaching streams nutrients taken up by vegetation; e.g. often used following project completion to protect disturbed ground, majority of USFS projects use native seed mixes	1.8, 2.4
	log/rootwad streambank treatment(s)	3	SBS, WQS; see benefits for streambank log structure(s); e.g. Juniper rip rap	1.9 & 1.10
	misc. streambank treatment(s)	7	SBS, WQS, WQT; Stabilizes banks, promotes natural processes, provides bank cover and scour pools for fish; shades stream to maintain cool water temperatures, reduces sediments reaching streams nutrients taken up by vegetation; e.g. bioengineering	1.8 – 1.10
Riparian Zone Habitat Enhancement	floodplain restoration	13	ISD, SBS, WQN, WQS, WQT, Restores naturally operating processes necessary to the sustaining of channel structure and fish habitat, maintains a greater quality and quantity of fish and riparian habitat, water slowly replenishes ground water and helps to sustain low flows later in summer; e.g. remove or relocate man made structures (dikes, railroad grade) that restricted interaction of river with floodplain	1.3 2.3
	place large woody material in riparian zone	5	SBS, WQS, WQT; reduces livestock access to riparian zone and streams, reduces erosion of streambank and sediment input, improved growth of riparian vegetation should provide shade and cool stream; e.g. used to restrict livestock access to streambanks and stream	2.1
	riparian planting	89	ISD, SBS, WQC, WQS, WQT; shades steam to maintain cool water temperatures, filters sediment, nutrients and other pollutants from upland sources, retains sediment, nutrients and other pollutants deposited from overbank flow events, preserves off-channel habitats, provides recruitment of large woody debris, provides detritus and primary food production, if conifers are planted provides thermal cover to sensitive stream reaches prone to ice development, moderates riparian temperatures which can reduce freezing of fish eggs and overwintering fry and juvenile fish, reduced bank and riparian damage from ice floes	2.1, 2.2, 2.14, 3.15, 4.12
	riparian seeding	15	See objectives and benefits for streambank seeding	1.8, 2.4
	noxious weed control	6	SBS, WQS, WQT; e.g. herbicide and/or hand pulling	2.7, 2.11
	thin riparian vegetation	2	RIC; benefits understory vegetation, primary aquatic food production, larger trees for large woody debris recruitment, wildlife habitat, reduces soil erosion due to increased understory	2.14, 8.13
	misc, riparian enhancement(s)	3	RIC	2.1

*Number of projects in the Grande Ronde Subbasin

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Restoration Category	Task	# Projects*	Objectives**; benefits; description of specific techniques	BPA WMP EIS Management Technique Codes***
Wet Meadow Habitat Enhancement	restore wet meadow	4	WQN, WQS, WQT; improves water quantity by storing ground water for release in late season (ground water recharge), captures/stores sediment; e.g. use structures to raise water table, close access to protect	2.3
	wet meadow prescribed burn	1	RIC; maintain early seral stage, increase vegetative diversity and wildlife communities; e.g. burn to prevent conifer encroachment	2.12
	wet meadow planting	1	WQS, WQT; Stabilizes soils, promotes natural processes, shade to maintain cool water temperatures, filters sediment, nutrients and other pollutants from upland sources	1.8, 2.1
	wet meadow seeding	1	WQS; Stabilizes soils, promotes natural processes, filters sediment, nutrients and other pollutants from upland sources	1.8
Wetland Habitat Enhancement	restore wetland	1	WQN, WQT late season ground water recharge	2.3
	wetland planting	3	See objectives and benefits for wet meadow planting	1.8, 2.1
Road Work	road(s) closed	17	WQS; removal of potential (and often active) sediment sources to reduce sediment yields to streams and fish habitat; e.g. berms or gates to prevent access	7.18
	road(s) built	6	WQS; avoid unstable slopes, provide adequate drainage, reduce sediment input to streams; e.g. roads built in less detrimental location to replace closed or obliterated roads	7.1
	road(s) improved	52	SHP, WQS; removal of potential (and often active) sediment sources to reduce sediment yields to streams and fish habitat; e.g. drainage structures (culverts, ditches, water bars, rolling dips, sediment traps), re-surface or seal, re-align or reposition grade, stabilize slopes	7.6, 7.7, 7.8, 7.10, 7.13, 7.14, 7.16, 7.19
	road(s) obliterated	26	SHP, WQS; removal of potential (and often active) sediment sources to reduce sediment yields to streams and fish habitat, return land to natural production; e.g. remove road, re-contour and plant slope, close access	7.6, 7.7, 7.8, 7.10, 7.13, 7.14, 7.16, 7.19
	road(s) relocated	7	See objectives and benefits for road improvement; road relocated away from stream or to a location that reduces sediment runoff	7.21
Stream Crossings	stream crossing structure(s)	37	FPA, SBS, WQSS; restore fish migration, reduces in-channel erosion and sedimentation, reduces pool filling; e.g. culvert, bridge, occasionally hardened ford, replace structures that produce sediment or impede fish passage	1.12 & 5.11, 1.13, 1.14
	stream crossing structure(s) modified	6	See objectives and benefits for stream crossing structure(s)	1.12 & 5.11, 1.13, 1.14
	stream crossing structure(s) obliterated	3	See objectives and benefits for stream crossing structure(s)	1.12 & 5.11, 1.13, 1.14
Agric. Practices-Erosion Control	modify irrigation methods	14	EDU, WQC, WQN, WQS; conserve water, minimize soil and nutrient runoff; e.g., convert from flood to sprinkler, gated pipe, demonstrate use of method	4.1, 4.6, 4.7
	misc. upland treatment(s)	4	WQS, reduces wind shear on soil surface thus reducing soil removed by wind and deposition of sediment to surface waters; e.g. windbreaks	2.5
	modify agriculture practice(s)	4	EDU, WQC, WQS; reduce erosion, reduced pollutant runoff, demonstrate use of method; e.g. terracing, direct seeding, convert to perennial crop/pasture	3.1,3.3, 3.12
	control erosion	4	WQS; remove sediment and debris; e.g. sediment traps/ponds	3.17
Irrigation Modification	ditch/canal work	6	WQN, WQS, reduce water loss and erosion; e.g. line ditch, convert from ditch to pipe conveyance	4.9, 4.10, 4.22

*Number of projects in the Grande Ronde Subbasin

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Restoration Category	Task	# Projects*	Objectives**; benefits; description of specific techniques	BPA WMP EIS Management Technique Codes***
Livestock Mgmt & Animal Facilities	CREP	10	ISD, SBS, WQC, WQS, WQT; see benefits from riparian exclosure fencing and planting; FSA/NRCS program to protect (fence) and plant riparian zone	2.1, 2.2, 2.14, 3.15, 4.12, 6.10
	relocate feedlot	4	WQC, WQS; reduced erosion and runoff of soluble nutrients; e.g. relocate away from riparian zone, redirect runoff away from riparian zone	6.18
	improve feedlot	4	WQC, WQS; reduced erosion and runoff of soluble nutrients; e.g. redirect runoff away from riparian zone	5.1 & 6.18
	grazing system modification	2	RIC, UHI; increase or sustain quantity and quality of vegetation, reduce sediment and nutrient in runoff; e.g. rotation grazing	6.1, 6.2, 6.3
	misc. modifications to livestock management	1	RIC; e.g. Construct livestock trail to aid moving cattle away from riparian area	2.1, 6.3
Water Developments	pond water development(s)	21	SBS, WQC, WQN, WQS, WQT; reduce sediment and direct contact of animal waste, when used to replace or supplement livestock access to stream for water helps protect streambank and riparian conditions, better distribution of livestock grazing improves habitat and reduces erosion, can be used to store water for late season flows, some provide wildlife habitat; e.g. most are fenced and piped to troughs to protect the water source	5.13, 6.5, 6.6 & 6.7
	spring water development(s)	21	SBS, WQC, WQN, WQS, WQT; reduce sediment and direct contact of animal waste, when used to replace or supplement livestock access to stream for water helps protect streambank and riparian conditions, better distribution of livestock grazing improves habitat and reduces erosion; e.g. most are fenced and piped to troughs to protect the water source	5.13, 6.5, 6.7 & 6.9
	well water development(s)	23	See objectives and benefits for spring water developments; e.g. typically wells already exist and the project work involves improvements and installation of piping and troughs	5.13, 6.5, 6.7 & 6.8
	water development(s) with ditch or stream as source	6	See objectives and benefits for spring water developments	5.13, 6.5, 6.7

*Number of projects in the Grande Ronde Subbasin

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Restoration Category	Task	# Projects*	Objectives**; benefits; description of specific techniques	BPA WMP EIS Management Technique Codes***
Fencing	riparian cross fence	9	SBS ,WQS, WQT; increase or sustain quantity and quality of vegetation, reduce sediment and nutrient in runoff , used to reduce livestock access or modify timing of access to riparian zone and streams, better distribution of livestock grazing improves habitat and reduces erosion; usually part of a rotational grazing plan	2.1, 6.1, 6.2, 6.10
	riparian exclusion fence	107	ISD, SBS, SHP, WQC, WQN, WQS, WQT; reduce sediment and direct contact of animal waste, protect streambank, increase or sustain quantity and quality of vegetation, improve/increase spawning habitat; eliminates livestock access to riparian zone and streams or springs, reduces erosion of streambank and sediment input, improved growth of riparian vegetation should provide shade and cool stream temperatures and in some cases provide woody material input	1.16, 2.1, 6.10
	riparian/upland cross fence	12	See objectives and benefits for riparian cross fence	2.1, 6.1, 6.2, 6.10
	upland cross fence	35	SBS, SHP, WQS, WQT; reduce sediment and direct contact of animal waste, protect streambank , increase or sustain quantity and quality of vegetation, improve/increase spawning habitat; reduces livestock access to riparian zone and streams or springs, reduces erosion of streambank and sediment input, improved growth of riparian vegetation should provide shade and cool stream temperatures and in some cases provide woody material input; e.g. used as part of rotational grazing plan to control when and how long livestock have access to the riparian zone, USFS has used to protect spawning habitat, also used to improve distribution in the uplands.	2.1, 6.1, 6.2, 6.10
	ditch cross fence	1	WQS; reduce sediment and direct contact of animal waste; e.g. used as part of rotational grazing plan to control when and how long livestock have access to ditch	6.10
	ditch exclusion fence	9	WQC, WQS, WQT; eliminates livestock access to ditch, reduces sediment input and direct contact of animal waste, improved growth of riparian vegetation should provide shade and cool water temperatures.	6.10
	pond exclusion fence	2	WHI; reduce sediment and direct contact of animal waste, increase or sustain quantity and quality of vegetation; e.g. this is fencing that is not associated with a water development	6.10
	riparian/upland exclusion fence	10	ISD, SBS, SHP, WQS, WQT; reduce sediment and direct contact of animal waste, protect streambank, increase or sustain quantity and quality of vegetation, improve/increase spawning habitat; eliminates livestock access to riparian and upland, reduces erosion of streambank and sediment input, improved growth of riparian vegetation should provide shade and cool stream temperatures and in some cases provide woody material input, eliminates livestock access to upland, riparian zone and streams	1.16 5.13, 6.10
	spring exclosure fence	1	WQS; reduce sediment and direct contact of animal waste; e.g. this is fencing that is not associated with a water development	6.10
	upland exclosure fence	2	RIC; e.g. one project is a watershed division fence, the other is an exclosure below feedlot to filter runoff	5.2
	wet meadow cross fence	1	WQT; e.g. low fence to prevent livestock while permitting wildlife access	6.1, 6.2, 6.3, 6.10
	wet meadow exclosure fence	2	RIC	6.1, 6.2, 6.3, 6.10
	wetland exclosure fence	4	RIC	6.1, 6.2, 6.3, 6.10
Upland Vegetation Management & Erosion Control	upland noxious weed control	5	WQS, UHI; e.g. spray, hand pull, plant perennial plants	2.7. 2.11
	upland planting	9	SHP, UHI, WQN, WQS; stabilize soils and reduce sediment runoff, increased ground water to support summer base flows; e.g. reforestation	8.14, 8.15
	upland seeding	8	SHP, UHI, WQS; stabilize soils and reduce sediment runoff	8.24
	thinning	4	UHI, WQN, WQS; increase understory vegetation, fire control, primary aquatic food production, size of trees available for large woody debris recruitment, reduce erosion, increased ground water to support summer base flows	8.13, 8.15, 8.26

*Number of projects in the Grande Ronde Subbasin

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Restoration Category	Task	# Projects*	Objectives**; benefits; description of specific techniques	BPA WMP EIS Management Technique Codes***
	misc upland vegetation management	1	UHI, WHI; increased quantity and quality of vegetative cover ; e.g. fence Aspen stands to protect from browsing	8.22
Combined Riparian/Upland Vegetation Management	riparian/upland thinning	5	RIC, WQN, WQS, WQT; increase understory vegetation, primary aquatic food production, size of trees available for large woody debris recruitment, reduce erosion, increased ground water to support summer base flows	8.13, 8.15, 8.26 2.14
	riparian/upland planting	3	See riparian and upland planting	2.1, 2.2, 2.14, 3.15, 4.12, 8.24
	riparian/upland seeding	1	See riparian and upland seeding	1.8, 2.4, 8.24
Recreation	close campground(s)/park	2	EDU, SBS, SHP, WQS, WQT; e.g. close access, usually rehabilitate area (subsoil, plant), some include placing interpretive signs to explain the reason for the closure (habitat protection)	10.1, 10.5, 10.9
	obliterate campground(s)/park	2	EDU, SBS, SHP, WQC, WQS, WQT; e.g. close access, remove all campground improvements (toilets, tables, fences, fire rings, fences, etc), rehabilitate area (subsoil, plant), some include placing interpretive signs to explain the reason for the campground/park removal (habitat protection)	10.1, 10.5, 10.7
	improve trails	6	WQS, SBS move trails away from streams and/or improve drainage to reduce runoff	10.1, 7.13, 7.19
	improve campground(s)/park	3	EDU, SHP SBS, WQS, WQT, relocate sites or modify to reduce impact on riparian zone and streams; e.g. (1 case protects spawning habitat), close or modify access routes to direct use away from riparian areas, some include planting and placing interpretive signs to explain the reason for the modifications (habitat protection)	10.3, 10.4, 10.5
Mining	mine/dredge work	2	SHP, WQS; e.g. recontour, improve drainage and stabilize slope of abandoned mine to minimize runoff to salmonid spawning stream	11.2
Misc. Habitat	construct/improve pond (not water development)	1	WHI, WQC; e.g. construct settling pond below feedlot to collect runoff and filter pollutants also developed for wildlife habitat	
Facilities	wastewater facility	1	WQC, WHI replaced old system to improve treatment and use of municipal wastewater effluent for irrigation and use for wildlife habitat and wetlands.	9.4

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Table 49. Summary of Restoration/Conservation Projects located in the Grande Ronde Subbasin, from 1994 to present. See **Table 48** for information about each task.

Restoration Category	Task	# task Items	mi. of task	stream mi. treated	stream mi. benefited	ac. treated	ac. benefited	stream mi. made accessible to fish
In Stream Enhancements	placement of boulders			12.75				
	placement of large woody material			208.16				
	restore historic channel			4.44				
	concrete structure(s)	5		3.70				
	log structure(s)	236		15.73				
	rock structure(s)	163		18.58				
	misc. channel work			9.26				
Dam-Diversion	fish passage ladder(s) @ diversion	7						1.50
	fish passage weir(s) @ diversion	4						
	irrigation diversion(s)	14						
	irrigation diversion(s) modified	8						1.50
	fish passage ladder(s) @ dam	1						14.00
Side Channel-Pool Habitat	construction of side channel(s)/pool(s)			0.10				
	place large woody material in side channel(s)/pool(s)			0.01				
	misc. modifications to side channel(s)/pool(s)			0.01		3.00		
Streambank Enhancements	streambank rock treatment			0.75				
	streambank log structure(s)	96		3.67				
	streambank rock structure(s)	230		11.45				
	streambank planting			8.33		11.00		
	streambank seeding			0.08				
	log/rootwad streambank treatment(s)			0.14				
	misc. streambank treatment(s)			4.33				
Riparian Zone Habitat Enhancement	floodplain restoration		1.05	4.80		159.04		
	place large woody material in riparian zone			2.37		3.00		
	riparian planting			89.91		1,230.81		
	riparian seeding			20.39		159.16		
	noxious weed control			15.15		246.00		
	thin riparian vegetation			1.25		25.00		
	misc. riparian enhancement(s)					20.00		
Wet Meadow Habitat Enhancement	restore wet meadow			2.50		152.00		
	wet meadow prescribed burn					60.00		
	wet meadow planting			1.50		50.00		
	wet meadow seeding					45.00		
Wetland Habitat Enhancement	restore wetland					300.00		
	wetland planting			0.30		12.50		
Road Work	road(s) closed		171.12					
	road(s) built		5.72					
	road(s) improved		214.74					
	road(s) obliterated		267.59					
	road(s) relocated		2.10					
Stream Crossings	stream crossing structure(s)	65						38.25
	stream crossing structure(s) modified	6						
	stream crossing structure(s) obliterated	5						
Agriculture Practices-Erosion Control	modify irrigation methods				1.10		643.80	
	misc. upland treatment(s)				2.63	4.75		
	modify agriculture practice(s)				4.40	2,512.70		
	control erosion				0.10		100.00	
Irrigation Modification	ditch/canal work		1.09					

Restoration Category	Task	# task Items	mi. of task	stream mi. treated	stream mi. benefited	ac. treated	ac. benefited	stream mi. made accessible to fish
Livestock Management & Animal Facilities	CREP			18.32		663.20		
	relocate feedlot	4		0.01		0.10		
	improve feedlot	1				12.00		
	grazing system modification				2.00		4,390.00	
	misc. modifications to livestock management				1.00		12.00	
Water Developments	pond water development(s)	241						
	spring water development(s)	248						
	well water development(s)	25						
	water development(s) with ditch or stream as source	9						
Fencing	riparian cross fence		24.49		18.12		11,341.50	
	riparian exclusion fence		177.46	109.25		2,369.06		
	riparian/upland cross fence		24.54		26.35		8,147.00	
	upland cross fence		171.09		265.44		219,008.00	
	ditch cross fence		0.50					
	ditch exclusion fence		4.61			9.59		
	pond exclusion fence		2.26			8.25		
	riparian/upland exclusion fence		24.90	30.17		16,202.00		
	spring exclosure fence		0.30			3.00		
	upland exclosure fence		3.60		14.20			
	wet meadow cross fence		3.50		1.50		100.00	
	wet meadow exclosure fence		0.50	3.25		303.00		
	wetland exclosure fence		1.86			40.50		
Upland Vegetation Management & Erosion Control	upland noxious weed control				4.75	8,637.00		
	upland planting				22.30	2,979.00		
	upland seeding				11.50	2,973.00		
	thinning				2.15	441.00		
	misc upland vegetation management					2.00		
Combined Riparian/Upland Vegetation Management	riparian/upland thinning			22.87		2,192.00		
	riparian/upland planting			0.50		76.00		
	riparian/upland seeding			3.00		34.00		
Facilities	wastewater facility	1						
Recreation	close campground(s)/park					7.90		
	obliterate campground(s)/park	18				20.00		
	improve trails		38.71					
	improve campground(s)/park					7.10		
Mining	mine/dredge work					10.00		
Miscellaneous Habitat Treatments	construct/improve pond (not water development)	1						

Steelhead – Upper Grande Ronde Population

Includes: Upper Grande Ronde Chinook Population
Catherine Creek Chinook Population
Lookingglass Chinook Population (extinct)
Middle Mainstem Grande Ronde area (not a Chinook population)

Upper Grande Ronde Chinook Population

This area has been a high priority restoration area for the GRMWP for some time as a result of prior assessments. National Forest lands comprise 64% of the land area. The La Grande Ranger District has completed over 50 individual restoration projects since 1995. Additionally there have been more than 40 projects done on private lands.

Restoration activities in the Upper Grande Ronde that have been emphasized large wood placement, riparian planting, road closure and obliteration, and riparian livestock exclusion fencing. Table 50 summarizes accomplishments by restoration categories and tasks.

Table 50. Summary of Restoration/Conservation Projects located in the Upper Grande Ronde River Chinook Population Area, from 1994 to present. See Table 48 for information about each task.

Restoration Category	Task	# Task Items	mi. of Task	stream mi. treated	stream mi. benefited	ac. Treated	ac. Benefited	stream mi. made accessible to fish
In Stream Enhancements	placement of boulders			9.07				
	placement of large woody material			61.13				
	restore historic channel			3.09				
	log structure(s)	110		6.40				
	rock structure(s)	30		7.23				
	misc. channel work			3.50				
Dam-Diversion	irrigation diversion(s)	2						
	fish passage ladder(s) @ dam	1						14.00
Streambank Enhancements	streambank rock treatment			0.02				
	streambank log structure(s)	68		2.15				
	streambank rock structure(s)	54		3.20				
	streambank planting			3.43		3.00		
	misc. streambank treatment(s)			3.73				
Riparian Zone Habitat Enhancement	floodplain restoration			0.78		2.04		
	place large woody material in riparian zone			1.92				
	riparian planting			22.51		363.15		
	riparian seeding			12.02		132.00		
	noxious weed control			5.90		193.00		
	thin riparian vegetation			1.25		25.00		
Wet Meadow Habitat Enhancement	restore wet meadow			2.00		52.00		
Road Work	road(s) closed		56.85					
	road(s) built		0.85					
	road(s) improved		15.28					
	road(s) obliterated		67.24					
	road(s) relocated		1.11					
Stream Crossings	stream crossing structure(s)	11						24.50
	stream crossing structure(s) modified	4						
Irrigation Modification	ditch/canal work		0.06					
Livestock Management & Animal Facilities	CREP			3.21		216.00		
	grazing system modification						2,290.00	
	misc. modifications to livestock management				1.00		12.00	
Water Developments	pond water development(s)	33						
	spring water development(s)	60						
	well water development(s)	1						
Fencing	riparian cross fence		7.00		3.50		6,080.00	
	riparian exclusion fence		68.47	44.68		1,243.10		
	riparian/upland cross fence		8.13		8.97		2,757.00	
	upland cross fence		13.44		21.10		9,102.00	
	ditch cross fence		0.50					
	riparian/upland exclusion fence		21.08	21.92		12,942.00		
	upland exclosure fence		3.00		14.00			
	wet meadow exclosure fence			3.00		300.00		
Upland Vegetation Management & Erosion Control	upland noxious weed control				0.25	10.00		
	upland planting				7.25	188.00		
	upland seeding				6.00	5.00		
	thinning				1.60	156.00		
Combined Riparian/Upland Vegetation Management	riparian/upland thinning			14.87		1,455.00		
	riparian/upland planting					71.00		
	riparian/upland seeding			3.00		34.00		
Recreation	obliterate campground(s)/park					20.00		
Mining	mine/dredge work					10.00		

Catherine Creek Chinook Population

Catherine Creek has been another emphasis restoration area for both public and private land managers. National forest lands comprise 26% of the land area with most of this being in the headwater stream reaches. Private forest lands comprise the mid elevation areas with the Grande Ronde Valley agricultural lands occurring at the lowest elevations. Forty projects have been accomplished on private lands with another twenty on national forest lands.

Projects of note in Catherine Creek include several hundred acres of wetland restoration in the Ladd Marsh Wildlife Management Area using treated municipal effluent and several dike setback/wetland restoration projects on private lands along the lower reaches of Catherine Creek. The Ladd Marsh projects have restored historic wetlands at the south end of the Grande Ronde Valley. Additionally, 140 miles of sediment-producing roads have been closed or obliterated, mostly in headwater areas adjacent to Chinook or steelhead spawning stream reaches. Table 51 summarizes accomplishments by restoration categories and tasks.

Table 51. Summary of Restoration/Conservation Projects located in the Catherine Creek Chinook Population Area, from 1994 to present. See **Table 48** for information about each task.

Restoration Category	Task	# Task Items	mi. of Task	stream mi. treated	stream mi. benefited	ac. Treated	ac. Benefited	stream mi. made accessible to fish
In Stream Enhancements	placement of boulders			3.43				
	placement of large woody material			11.16				
	restore historic channel			1.12				
	concrete structure(s)	5		3.70				
	log structure(s)	45		2.75				
	rock structure(s)	5		0.54				
	misc. channel work			3.71				
Dam-Diversion	fish passage ladder(s) @ diversion	6						1.50
	fish passage weir(s) @ diversion	4						
	irrigation diversion(s)	5						
	irrigation diversion(s) modified	5						1.50
Side Channel-Pool Habitat	construction of side channel(s)/pool(s)			0.04				
Streambank Enhancements	streambank rock treatment			0.04				
	streambank log structure(s)	1		0.09				
	streambank rock structure(s)	42		0.43				
	streambank planting			1.32		1.50		
	streambank seeding			0.02				
Riparian Zone Habitat Enhancement	floodplain restoration			0.58		18.00		
	place large woody material in riparian zone			0.20		3.00		
	riparian planting			13.55		99.56		
	riparian seeding			4.53		11.66		
Wet Meadow Habitat Enhancement	restore wet meadow			0.50				
Wetland Habitat Enhancement	restore wetland					300.00		
	wetland planting			0.30		2.00		
Road Work	road(s) closed		86.25					
	road(s) built		3.23					
	road(s) improved		39.95					
	road(s) obliterated		53.25					
	road(s) relocated		0.55					
Stream Crossings	stream crossing structure(s)	16						3.00
Agriculture Practices-Erosion Control	modify irrigation methods						21.00	
	misc. upland treatment(s)				0.13	0.75		
Irrigation Modification	ditch/canal work		0.63					

Restoration Category	Task	# Task Items	mi. of Task	stream mi. treated	stream mi. benefited	ac. Treated	ac. Benefited	stream mi. made accessible to fish
Livestock Management & Animal Facilities	CREP			0.28		3.00		
Water Developments	pond water development(s)	14						
	spring water development(s)	50						
	well water development(s)	3						
Fencing	riparian cross fence		1.13		1.00			
	riparian exclusion fence		16.09	10.48		138.91		
	riparian/upland cross fence		6.01		7.63		2,470.00	
	upland cross fence		43.30		112.59		82,926.00	
Upland Vegetation Management & Erosion Control	upland noxious weed control				4.00	8,587.00		
	upland planting				13.55	2,654.00		
	upland seeding				4.50	1,398.00		
Combined Riparian/Upland Vegetation Management	riparian/upland thinning			8.00		737.00		
Facilities	wastewater facility	1						

Lookingglass Chinook Population (extinct)

Lookingglass is a small, but distinct Chinook population extirpated during the early years of Lookingglass Hatchery operations as a result of adult fish collection. The drainage is about 80% National Forest lands. Overall current habitat and water quality is quite good. Little restoration work has been done. About 40 miles of forest roads have been closed or obliterated, and 60 acres of wetlands have been enhanced. Table 52 summarizes accomplishments by restoration categories and tasks.

Table 52. Summary of Restoration/Conservation Projects located in the Lookingglass Creek Chinook Extinct Population Area, from 1994 to present. See **Table 48** for information about each task.

Restoration Category	Task	# Task Items	mi. of Task	stream mi. treated	ac. Treated
In Stream Enhancements	log structure(s)	1		0.01	
	misc. channel work			0.01	
Streambank Enhancements	streambank rock structure(s)	6		0.20	
Wet Meadow Habitat Enhancement	wet meadow prescribed burn				60.00
Road Work	road(s) closed		4.40		
	road(s) improved		5.22		
	road(s) obliterated		34.20		
Stream Crossings	stream crossing structure(s) obliterated	3			
Upland Vegetation Management & Erosion Control	misc upland vegetation management				2.00

Middle Mainstem Grande Ronde (not a Chinook population)

The Middle Mainstem Grande Ronde is the Grande Ronde River portion of the Upper Grande Ronde Steelhead Population area that is not in a Chinook population area. It is 78% private lands. The south approximate one third of the area is the north end of the Grande Ronde Valley. Over 40 individual farm and ranch projects have been accomplished with only about 10 projects on public lands. Riparian planting and streambank stabilization work in both the Grande Ronde Valley and forested streams zones, along with road closures, improvement or obliteration has been done in many areas to reduce sediment input to streams. Riparian exclusion fencing and noxious weed treatments were also done on several projects. Table XX summarizes accomplishments by restoration categories and tasks.

Table 53. Summary of Restoration/Conservation Projects located in the Middle Mainstem Grande Ronde Sub Area, from 1994 to present. See Table 48 for information about each task.

Restoration Category	Task	# Task Items	mi. of Task	stream mi. treated	stream mi. benefited	ac. Treated	ac. Benefited	stream mi. made accessible to fish
In Stream Enhancements	placement of large woody material			6.63				
	restore historic channel			0.23				
	misc. channel work			1.75				
Dam-Diversion	fish passage ladder(s) @ diversion	1						
	irrigation diversion(s)	1						
	irrigation diversion(s) modified	2						
Streambank Enhancements	streambank rock treatment			0.38				
	streambank log structure(s)	13		0.10				
	streambank rock structure(s)	65		3.51				
	streambank planting			0.52		1.50		
	streambank seeding			0.05				
	misc. streambank treatment(s)			0.10				
Riparian Zone Habitat Enhancement	floodplain restoration		1.05	3.44		139.00		
	place large woody material in riparian zone			0.25				
	riparian planting			10.44		150.65		
	riparian seeding			1.55		14.50		
Wetland Habitat Enhancement	wetland planting					10.00		
Road Work	road(s) closed		9.00					
	road(s) improved		19.64					
	road(s) obliterated		58.50					
	road(s) relocated		0.41					
Stream Crossings	stream crossing structure(s)	11						3.25
	stream crossing structure(s) modified	1						
	stream crossing structure(s) obliterated	1						
Agriculture Practices-Erosion Control	misc. upland treatment(s)				1.50			
	modify agriculture practice(s)				0.40	200.00		
	control erosion				0.10		100.00	
Livestock Management & Animal Facilities	CREP			3.41		36.00		
	relocate feedlot	2		0.01		0.10		
	grazing system modification				2.00		2,100.00	
Water Developments	spring water development(s)	13						
	well water development(s)	1						
	water development(s) with ditch or stream as source	2						
Fencing	riparian exclusion fence		12.22	8.46		84.15		
	upland cross fence		7.79		27.00		26,080.00	
	upland exclosure fence		0.60		0.20			
	wet meadow exclosure fence		0.50	0.25		3.00		
	wetland exclosure fence		0.50			10.00		
Upland	upland noxious weed control					6,500.00		

Vegetation Management & Erosion Control	upland planting				0.50	25.00		
	upland seeding					750.00		
	thinning				0.55	55.00		
Miscellaneous Habitat Treatments	construct/improve pond (not water development)	1						

Steelhead – Wallowa River

Includes: Wallowa - Lostine Chinook Population
Minam Creek Chinook Population

Wallowa - Lostine Chinook Population

This unit is one of the largest population areas and naturally productive Chinook populations. Geography is very diverse ranging from the Wallowa Mountains in the Eagle Cap Wilderness, to Wallowa Valley agricultural lands, to rolling grasslands. Just over 30% is National Forest Lands, most of which is in the Eagle Cap Wilderness.

Over 100 projects have been accomplished in this unit, with all but a handful occurring on private lands. Most of the projects were accomplished through cooperative efforts of the Wallowa Soil and Water Conservation District, the Natural Resource Conservation District and the Bureau of Reclamation working with individual landowners and irrigation districts. Emphasis areas were irrigation diversion replacement or upgrades to address fish passage, livestock management activities to improve riparian condition, irrigation efficiency projects to address stream flow and streambank stabilization work to address sediment. Table 54 summarizes accomplishments by restoration categories and tasks.

Table 54. Summary of Restoration/Conservation Projects located in the Wallowa/Lostine River Chinook Population Area, from 1994 to present. See Table 48 for information about each task.

Restoration Category	Task	# Task Items	mi. of Task	stream mi. treated	stream mi. benefited	ac. Treated	ac. Benefited	stream mi. made accessible to fish
In Stream Enhancements	placement of boulders			0.25				
	placement of large woody material			1.18				
	log structure(s)			0.57				
	rock structure(s)	108		9.27				
	misc. channel work			0.20				
Dam-Diversion	irrigation diversion(s)	6						
	irrigation diversion(s) modified	1						
Side Channel-Pool Habitat	construction of side channel(s)/pool(s)			0.06				
	place large woody material in side channel(s)/pool(s)			0.01				
	misc. modifications to side channel(s)/pool(s)			0.01		3.00		
Streambank Enhancements	streambank rock treatment			0.09				
	streambank log structure(s)	10		1.30				
	streambank rock structure(s)	45		1.01				
	streambank planting			2.68		4.00		
	log/rootwad streambank treatment(s)			0.14				
	misc. streambank treatment(s)			0.50				
Riparian Zone Habitat Enhancement	riparian planting			17.33		223.25		
	noxious weed control			2.25		13.00		
	misc. riparian enhancement(s)					20.00		
Wet Meadow Habitat Enhancement	wet meadow seeding					45.00		
Wetland Habitat Enhancement	wetland planting					0.50		

Restoration Category	Task	# Task Items	mi. of Task	stream mi. treated	stream mi. benefited	ac. Treated	ac. Benefited	stream mi. made accessible to fish
Road Work	road(s) closed		6.42					
	road(s) built		1.64					
	road(s) improved		84.36					
	road(s) relocated		0.03					
Stream Crossings	stream crossing structure(s)	21						1.00
Agriculture Practices-Erosion Control	modify irrigation methods				1.10		622.80	
	misc. upland treatment(s)				1.00	4.00		
	modify agriculture practice(s)					1,410.00		
Irrigation Modification	ditch/canal work		0.40					
Livestock Management & Animal Facilities	CREP			5.26		138.80		
	relocate feedlot	2						
	improve feedlot	1				12.00		
Water Developments	pond water development(s)	118						
	spring water development(s)	62						
	well water development(s)	20						
	water development(s) with ditch or stream as source	7						
Fencing	riparian cross fence		1.41		1.22		11.50	
	riparian exclusion fence		36.81	23.87		436.50		
	riparian/upland cross fence		7.40		5.00		820.00	
	upland cross fence		87.75		86.75		90,140.00	
	ditch exclusion fence		4.61			9.59		
	pond exclusion fence		2.26			8.25		
	riparian/upland exclusion fence		0.44	1.00		200.00		
	wetland exclosure fence		1.36			30.50		
Upland Vegetation Management & Erosion Control	upland planting					13.00		
	thinning					135.00		
Combined Riparian/Upland Vegetation Management	riparian/upland planting			0.50		5.00		
Recreation	close campground(s)/park					7.90		
	obliterate campground(s)/park	18						
	improve trails		3.75					
	improve campground(s)/park					7.10		

Minam River Chinook Population

The Minam population unit is a relatively small area compared to other Chinook populations but is important to the overall Grande Ronde Chinook population because of the current quality of the habitat and numbers of returning fish. Ninety percent of the unit is national forest land with all of that being in the Eagle Cap Wilderness area. The wilderness habitat is near pristine except for the lower fifteen miles which were splash-dam logged in the early 1900's.

There have been a few projects on private lands consisting of livestock management activities to reduce grazing impacts in riparian areas and some road work to reduce sediment input to streams. Table XX summarizes accomplishments by restoration categories and tasks.

Table 55. Summary of Restoration/Conservation Projects located in the Minam River Population Area, from 1994 to present. See Table 48for information about each task.

Restoration Category	Task	# Task Items	mi. of Task	stream mi. benefited	ac. Benefited
Road Work	road(s) closed		5.50		
	road(s) improved		58.00		

Water Developments	pond water development(s)	21			
	spring water development(s)	6			
Fencing	upland cross fence		8.40	24.00	15,000.00

Steelhead – Lower Grande Ronde

Includes: Wenaha River Chinook Population
Lower Mainstem Grande Ronde area (not a Chinook population)

Wenaha River Chinook Population

The Wenaha Chinook population is similar to the Minam population in terms of size and condition. The area is 97 percent national forest land with most of that being in the Wenaha-Tucannon Wilderness Area. This unit however has not had splash-dam logging. There is a small portion of the watershed that is outside of the wilderness area where forest management activities and grazing occur.

Habitat condition is nearly pristine, little restoration work has been necessary. The Forest Service has closed several miles of forest roads outside of the wilderness. Within the wilderness the most notable project has been noxious weed control work on the lower reach of the Wenaha River. Table 56 summarizes accomplishments by restoration categories and tasks.

Table 56. Summary of Restoration/Conservation Projects located in the Wenaha River Population Area, from 1994 to present. See **Table 48** for information about each task.

Restoration Category	Task	mi. of Task	stream mi. treated	ac. Treated
Riparian Zone Habitat Enhancement	riparian planting		2.00	
	riparian seeding		2.00	
	noxious weed control		7.00	40.00
Road Work	road(s) improved	3.00		
	road(s) obliterated	12.00		
Upland Vegetation Management & Erosion Control	upland seeding			550.00
Recreation	improve trails	23.27		

Lower Mainstem Grande Ronde area (not a Chinook population)

The Lower Mainstem Grande Ronde is the Grande Ronde River portion of the Lower Grande Ronde Steelhead Population area that is not in a Chinook population area. There are numerous small steelhead producing tributaries. Chinook production/use is mostly limited to rearing and migration in the Grande Ronde mainstem. The Grande Ronde River through this reach is a Wild and Scenic river managed by the Bureau of Land Management. Over 60 percent is in private ownership with the remainder National Forest and Bureau of Land Management lands.

About 30 projects have been accomplished in this unit. A mix of activities has occurred with emphasis on livestock control fencing to improve riparian zone condition, in-channel large wood placement, and road work to reduce sediment. Table 57 summarizes accomplishments by restoration categories and tasks.

Table 57. Summary of Restoration/Conservation Projects located in the Lower Mainstem Grande Ronde Sub Area, from 1994 to present. See Table 48 for information about each task.

Restoration Category	Task	# Task Items	mi. of Task	stream mi. treated	stream mi. benefited	ac. Treated	ac. Benefited	stream mi. made accessible to fish
In Stream Enhancements	placement of large woody material			31.75				
	rock structure(s)	20		1.54				

Riparian Zone Habitat Enhancement	riparian planting			10.24		242.90		
	riparian seeding			0.29		1.00		
Wet Meadow Habitat Enhancement	restore wet meadow					100.00		
	wet meadow planting			1.50		50.00		
Road Work	road(s) closed		2.70					
	road(s) improved		30.18					
	road(s) obliterated		40.80					
Stream Crossings	stream crossing structure(s)	5						6.50
Agriculture Practices-Erosion Control	modify agriculture practice(s)				4.00	902.70		
Livestock Management & Animal Facilities	CREP			4.97		204.60		
Water Developments	pond water development(s)	55						
	spring water development(s)	33						
Fencing	riparian cross fence		3.50		5.00		5,000.00	
	riparian exclusion fence		17.08	10.38		249.90		
	riparian/upland cross fence		1.75		1.75		100.00	
	upland cross fence		21.81		36.00		33,800.00	
	spring exclosure fence		0.30			3.00		
	wet meadow cross fence		3.50		1.50		100.00	
Upland Vegetation Management & Erosion Control	upland planting				1.00	99.00		
	upland seeding				1.00	710.00		
	thinning					95.00		
Recreation	improve trails		11.69					

Steelhead – Joseph Creek

The Joseph Creek watershed is not a Chinook population unit. Joseph Creek is a lower elevation, canyon-land type watershed not suited to Chinook salmon production. Ownership is nearly evenly split between national forest and private lands. Joseph Creek has not been a particularly high priority for habitat restoration work mostly due to the absence of Chinook. Approximately 20 projects have been done on National Forest lands. Only a handful have been done on private lands. Restoration emphasis has been the placement of large woody material, riparian planting and livestock management activities, e.g. riparian fencing and off-channel water developments. Table XX summarizes accomplishments by restoration categories and tasks.

Table 58. Summary of Restoration/Conservation Projects located in the Joseph Creek Steelhead Population Area, from 1994 to present. See **Table 48** for information about each task.

Restoration Category	Task	# task items	mi. of task	stream mi. treated	stream mi. benefited	ac. treated	ac. benefited
In Stream Enhancements	placement of large woody material			96.31			
	log structure(s)	80		6.00			
	misc. channel work			0.09			
Streambank Enhancements	streambank rock treatment			0.22			
	streambank log structure(s)	4		0.03			
	streambank rock structure(s)	18		3.10			
	streambank planting			0.38		1.00	
	streambank seeding			0.01			

Riparian Zone Habitat Enhancement	riparian planting			13.84		151.30	
Road Work	road(s) improved		1.61				
	road(s) obliterated		1.60				
Stream Crossings	stream crossing structure(s)	1					
	stream crossing structure(s) modified	1					
	stream crossing structure(s) obliterated	1					
Livestock Management & Animal Facilities	CREP			1.19		64.80	
Water Developments	pond water development(s)	5					
	spring water development(s)	24					
Fencing	riparian cross fence		11.45		7.40		250.00
	riparian exclusion fence		26.79	11.38		216.50	
	riparian/upland cross fence		1.25		3.00		2,000.00
	riparian/upland exclusion fence		3.38	7.25		3,060.00	
Upland Vegetation Management & Erosion Control	upland noxious weed control				0.50	40.00	
	upland seeding					750.00	

Miscellaneous Existing Projects

There are a number of entities accomplishing program-level surveys and work, or relatively small-scale projects for which we had difficulty obtaining accurate accomplishment information. The most significant ones are listed here.

Noxious weeds - there have been several noxious weed projects that are included in the inventory database. In addition to those projects there are several program-level work activities. Both Wallowa and Union Counties, the U. S. Forest Service and Wallowa Resources (non-profit organization) have noxious weed programs. Work includes landowner educational programs, survey and inventory, and control activities as funding allows.

Wildlife - The Oregon Department of Fish and Wildlife manages four wildlife habitat enhancement programs that have been utilized in the Grande Ronde Subbasin. These programs are aimed at improving habitats or deterring big game damage.

The Green Forage (G.F.) program helps fund weed control, seeding, prescribed burning, fertilization and water development projects. The goal of these projects is to draw big game away from areas where they damage agricultural crops.

The Deer Enhancement and Rehabilitation (DEAR) program supports the same type of projects as those associated the G.F. program, but is directed at improving mule deer habitat. Over the past decade both the G.F. and DEAR programs have implemented 10 to 30 projects per year in Union County. Annual treated area varies from 500 to several thousand acres.

The Upland Bird program has funded tree and shrub distributions, seeding, fertilization, access and other projects primarily aimed at improving upland bird habitat. Our tree and shrub distributions in the past have amounted to about 3000 plants annually on several hundred acres. These plants were used primarily on upland projects, with some going to riparian areas.

Wildlife damage funds are used to implement projects similar to those under the G.F. and DEAR program. Most of that budget pays for fencing supplies and personnel or supplies associated with hazing/detouring big game from areas where damage is occurring.

The La Grande Ranger District implements several activities each year at a program level. The District uses prescribed fire for big game forage enhancement on 500 to 1,000 acres per year. The District is working on over 100 acres of mountain mahogany restoration and three aspen regeneration sites. Maintenance is done most years. The District manages over 60,000 acres as limited vehicle access to reduce big game disturbance.

Riparian easements - the Farm Services Administration and Natural Resource Conservation Service has been very active promoting the Conservation Reserve Enhancement Program (CREP) and Continuous Conservation Reserve

Program in the Grande Ronde Subbasin. In addition to individual projects listed in the project inventory prior to 2001, since 2001 there have been approximately 2800 acres put into riparian buffers.

Table 59. Grande Ronde Subbasin Fish Population Areas, Acreage and Ownership.

Steelhead Population	Chinook Population/Sub area	Total Acres	Private		USFS		State		BLM		Tribal Lands	
Upper Grande Ronde Steelhead		1,046,784	557,078	53%	476,703	46%	5,268	1%	4,331	0%	3,404	0%
	Upper Grande Ronde Chinook	469,064	159,829	34%	302,448	64%	2,201	0%	1,183	0%	3,404	1%
	Catherine Creek Chinook	296,748	213,815	72%	78,124	26%	2,759	1%	2,050	1%		
	Middle Mainstem Grande Ronde	220,199	170,672	78%	48,119	22%	308	0%	1,099	0%		
	Lookingglass Creek Chinook (extinct)	60,773	12,761	21%	48,012	79%						
Wallowa River Steelhead		609,955	323,121	53%	282,307	46%	1,878	0%	2,649	0%		
	Wallowa/Lostine River Chinook	457,238	307,326	67%	145,484	32%	1,818	0%	2,610	1%		
	Minam River Chinook	152,717	15,795	10%	136,822	90%	60	0%	40	0%		
Lower Grande Ronde Steelhead		618,271	274,761	44%	313,134	51%	13,205	2%	15,556	3%	1,614	0%
	Lower Mainstem Grande Ronde	429,176	272,244	63%	130,385	30%	9,965	2%	14,967	3%	1,614	0%
	Wenaha River Chinook	189,095	2,517	1%	182,749	97%	3,241	2%	589	0%		
Joseph Creek Steelhead		352,497	170,136	48%	173,387	49%	1,460	0%	7,514	2%		

4.5. Gap Assessment of Existing Protections, Plans, Programs and Projects

The gap assessment will briefly address some of the more pertinent plans or policies but will primarily focus on existing programs, projects and strategies.

Protection and Plans

There are many plans, policies and regulations governing management actions on both public and private lands in the Grande Ronde Subbasin. There are also many, federal and state laws regulating land use, ESA species and water quality. There are land use designations that offer various levels of protective status such as wilderness, wild and scenic rivers and wildlife management areas. Additionally there are a multitude of fish and wildlife management plans, hatchery and genetics plans, and water quality plans. These are listed in sections 4.1 and 4.2., and in Appendix 5, GRSBP Planning Source Documents. It appears there are ample laws, regulations, plans and policies to provide the structure and incentive for both public and private land managers to protect or restore fish and wildlife populations and their habitat in the Grande Ronde Subbasin.

National forest and BLM lands are managed under Land and Resource Management Plans (LRMP). The Wallowa-Whitman and Umatilla National Forest Plans were approved in 1990. The BLM Baker Resource Area Resource Management Plan was approved in 1989. Public land management plans go through an extensive public involvement process when they are developed and are intended to provide a balanced approach to the management of natural resources.

Amendments to the LRMP's in the mid-1990's provided additional protection for riparian areas and wildlife habitat on federal lands. These were PACFISH, INFISH and the Regional Forester's Eastside Forest Plan Amendment #2 (known as "SCREENS"). PACFISH AND INFISH applied to all federal lands, SCREENS applied only to national forest lands.

PACFISH (anadromous fish habitat) and INFISH (non-anadromous) established riparian goals, Riparian Management Objectives (RMO's) and Riparian Habitat Conservation Areas (RHCA's) adjacent to all stream courses. RHCA widths range from 50 feet on intermittent streams to 300 feet on fish bearing streams. Standards and Guidelines were developed for the RHCA's modifying timber harvest, grazing, recreation and other activities.

The Regional Forester's Eastside Forest Plan Amendment #2 (known as "SCREENS") established ecosystem standards (SCREEN 2) and wildlife standards (SCREEN 3) to manage forest stands toward the Historic Range of Variability (HRV). SCREENS required HRV analysis before most timber harvest to begin processes to reestablish historic species composition and older structural stages. SCREEN #3 required the maintenance of specific levels of snags, snag replacements and down logs.

PACFISH, INFISH and SCREENS provided increased protection for fish and wildlife resources on federal lands. They are management direction until LRMP's are revised. The revision process is currently underway for the national forest plans and is scheduled to be completed in four years. The BLM revision is scheduled to begin in 2006.

Fish production and hatchery management plans (see Section 4.2 and Appendix 5) developed by the subbasin's co-managers are in place. These plans are periodically revised as knowledge of the species and management techniques change.

Programs

The GRMWP was designated in 1992 by the NPPC to be the model watershed for Oregon to coordinate restoration work in the Grande Ronde Subbasin. The GRMWP was entrusted by BPA to oversee the planning and implementation of new projects using BPA funds. GRMWP oversight has provided consistency in project implementation in the Grande Ronde Subbasin.

FSA and NRCS administer many farm programs which have been used extensively in the subbasin to reduce agricultural impacts to riparian areas and water quality. CRP, Continuous CRP, CREP and WRP are the programs most used.

Projects

Over 400 on-the-ground restoration projects were accomplished in the Grande Ronde Subbasin in the last decade. Many of these were implemented through the GRMWP using BPA fish and wildlife mitigation funds. Others were done by agencies without the assistance of BPA. Table 49 summarizes work accomplishment for the entire Grande Ronde Subbasin from 1994 to present.

Examination of Section 4.4 (page 231) reveals several emphasis work areas. There have been over 200 stream miles of large wood placement in response to prior assessments identifying wood deficiencies. Over 30 projects have addressed fish passage at irrigation diversions, a common problem at many older diversion structures or at gravel push-up dams (Clearwater Biostudies 1993). Over 2000 acres of riparian zone enhancement activities, including planting, seeding and weed control have been implemented to address degraded riparian conditions. Approximately 650 miles of road work; closures, obliteration and improvement have been accomplished to address sediment issues, another limiting factor reinforced by the current EDT assessment. Livestock management activities, primarily fencing and water developments, have been done on several thousand acres to address riparian degradation.

The previously established “focus” areas, and corresponding limiting factors, are not substantially different than limiting factors identified by the current EDT analysis. Both are based on available data, prior assessments and professional expertise. Prior assessments have identified in-channel habitat diversity, large wood, sediment, temperature and riparian condition as being problems to varying degrees in most of the subbasin’s watersheds. The difference, providing the EDT can be calibrated to correctly reflect actual conditions, is that the EDT can now more precisely identify habitat impacts by stream reach to fish life stages.

Strategies

Project selection and implementation in the Grande Ronde Subbasin for the last ten years, using BPA funds, has been coordinated through the GRMWP. The process followed a protocol established by the GRMWP Board of Directors. The GRMWP appointed a Technical Committee, composed of agency and tribal biologists and others, to annually review and prioritize prospective projects for BPA funding. Early in this process the Technical Committee established “focus” areas based on various habitat assessments and the initial prototype EDT Assessment (Mobrand 1996). Limiting factors were identified for the focus areas along with “candidate restoration actions”. The Technical Committee established project review criteria that considered the location of proposed work, technical merit, degree of benefit, species benefited, educational value and cost.

Each year the GRMWP solicited project applications from agencies, SWCD’s and tribes. The Technical Committee reviewed, prioritized and made recommendations to the Board of Directors for funding.

This process resulted in the accomplishment of many beneficial projects, responding to identified habitat needs. Project prioritization was the result of the Technical Committee’s comparison of the proposed activities, the evaluation criteria and how well the committee felt the project addressed the location’s limiting factors. The process relied on the Technical

Committee's subjective assessment of the project in terms of benefits to habitat. Most biologists felt this process adequately screened and prioritized prospective projects. However there was no methodology to quantitatively compare fish production benefits from project to project.

Project accomplishment on private land has been "opportunistic", meaning when we have had willing landowners we have tried to take advantage of the opportunity. Private landowners have participated in habitat restoration for a variety of reasons; a desire to improve habitat, fear of future regulation, testimonials from other participating landowners, cost share opportunity, etc. All have played a part in an individual's decision to implement a project. The GRMWP has had a long standing policy of considering all proposals from willing landowners, provided the proposed work addressed identified habitat needs. Although there may have been higher priority actions, or higher priority reaches in which to pursue conservation and/or restoration, this has not always been possible due to the absence of willing landowners. This process may not have resulted in the highest priority work being done in terms of fish benefits, but it has resulted in accomplishing many beneficial projects.

Project applications from public lands have generally reflected the agency's priorities for work on a particular area, e.g. USFS Ranger District. These are often more total resource oriented as opposed to strictly fish production. As with private lands, the GRMWP process considered these projects in terms of benefits to watersheds and fish habitat.

Summary

We believe there are sufficient protective mechanisms, laws, management plans and programs to provide the framework for habitat protection and restoration in the Grande Ronde Subbasin. Additionally projects over the last decade have been targeting the same limiting factors as have been identified in this assessment. The EDT model, if calibrated, refined and validated; may assist subbasin planners to more precisely target restoration work to stream reaches, watersheds and fish populations where the work will be the most beneficial to fish recovery.

5. Management Plan

The Grande Ronde Subbasin Planning vision describes the desired future condition in terms of a common goal for the subbasin. The subbasin-level vision is qualitative and reflects the **policies, legal requirements, local conditions, values and priorities of the subbasin** in a manner consistent with the Northwest Power and Conservation Council's overall fish and wildlife program vision which is:

- Sustain an abundant, productive and diverse community of fish and wildlife;
- Mitigate across the basin for the adverse effects to fish and wildlife caused by the development and operation of the hydro-system;
- Provide the benefits from fish and wildlife valued by the people of the region;
- Recognize the abundant opportunities in the ecosystem for tribal trust and treaty right harvest and for non-tribal harvest and the conditions that allow for the recovery of the fish and wildlife affected by the operation of the hydro-system and listed under the Endangered Species Act;
- Protect and restore the natural ecological functions, habitats, and biological diversity of the Columbia River Basin, wherever feasible. Where not feasible, other methods that are compatible with naturally reproducing fish and wildlife populations will be used;

- Where impacts have irrevocably changed the ecosystem, the program will protect and enhance the habitat and species assemblages compatible with an altered ecosystem;
- Actions taken under this program must be cost-effective and consistent with an adequate, efficient, economical and reliable electric power supply.

5.1. Vision for the Subbasin

Vision Statement

Create a healthy ecosystem with abundant, productive, and diverse populations of aquatic and terrestrial species, which will support sustainable resource-based activities that contribute to the social, cultural, and economic well-being of the communities within the subbasin and the Pacific Northwest.

5.2 Aquatic Species and Habitats

5.2.1 Habitats

5.2.1.1 Goals

- Protect high quality habitat, restore degraded habitats, and provide connectivity between functioning habitats.
- Manage for healthy ecosystems to support aquatic resources and native species.

5.2.1.2 Habitat Objectives and Strategies

The aquatic assessment sets the stage for development of the aquatic biological objectives. The summary of limiting factors identifies primary habitat attributes that limit the abundance of the three focal species in the Subbasin, and also identifies the primary management related activities that result in these limitations. The attributes are listed by watershed in Table 60. The purpose of this current section is to outline the overall biological objectives for each of these limiting factors.

Table 60. Summary of priority attributes identified by EDT for each watershed in the Grande Ronde Subbasin.

Watershed	Priority Attributes
Wenaha	none
Lower Grande Ronde	Habitat Diversity (primary pools, glides, spawning gravels) Key Habitat Quantity (wood, hydromodifications to channel) Sediment
Joseph Creek	Sediment Temperature Key Habitat Quantity (reduced wetted widths)
Wallowa River	Key Habitat Quantity (reduced wetted widths) Habitat Diversity (reduced wood, riparian function) Sediment Temperature Flows
Minam	Key Habitat Quantity (reduced wetted widths) Habitat Diversity (reduced wood, riparian function) Sediment
Lookingglass Creek	Key Habitat Quantity (reduced wetted widths) Habitat Diversity (reduced wood, riparian function)

	Sediment
Catherine Creek	Key Habitat Quantity (reduced wetted widths) Habitat Diversity (reduced wood, riparian function) Sediment Flow Temperature
Upper Grande Ronde	Sediment Flow Temperature Key Habitat Quantity (reduced wetted widths)

There are some clear patterns that emerge in the Subbasin. Sediment levels are elevated above template conditions and reducing productivity everywhere but in wilderness area watersheds. There has been a reduction in Key Habitat Quantity basin-wide. Temperature levels are elevated in all but Lookingglass, Minam and Wenaha.

One of the difficulties in interpreting EDT results are the attributes of Key Habitat Quantity and Habitat Diversity. These are defined differently for different species and life history stages and multiple factors play into the definition. For example, the habitat diversity for Steelhead and Chinook at the Age 0 inactive life history stage is defined by a combination of factors including; gradient, confinement, hydro modification, riparian function and wood levels. Flow can also be complicated – the primary environmental correlate can be either changes in low flow or high flow depending on life history stage. In addition, if there is no change in the primary correlate EDT may still identify flow as a priority attribute if enough of the modifying correlates change – hence in some cases there were changes in hydromodification, riparian function and habitat types but no changes in flow and EDT still identified flow as a priority attribute.

In order to focus our objective development on key measurable factors we have made the following generalizations:

- The habitat quantity and habitat diversity attributes are a function of channel condition, and

- Temperature is a largely function of riparian condition and/or low flows.

Therefore we recommend setting objectives for the following attributes;

1- Channel Condition

2- Sediment Reduction

3- Riparian Function

4- Low Flows

In assembling these biological objectives we have been mindful of the need to steer clear of the pitfall of developing static habitat target values, or “one size fits all” solutions. The Independent Science Advisory Board (ISAB, Bilby et al. 2003) recognizes the need to take a spatially variable and temporally dynamic approach to setting biological objective by noting that:

> *“In many cases the application of environmental standards and performance thresholds will divert attention from the real issue – managing watersheds in such a way that ecological processes supporting aquatic productivity and diversity are restored and conserved. Habitat standards have often failed….because they are taken as fixed and do not focus on dynamic processes that create and maintain ecologically complex and resilient watersheds…”*

The ISAB goes on to note that:

"This approach [of setting fixed standards] *is inappropriate because the general trend is to homogenize habitat rather than maintain the complexity of conditions that support biological diversity at multiple scales"*

In outlining our biological objectives for the Grande Ronde subbasin we have tried to incorporate these guidelines. The result is a road map of how to arrive at the "dynamically stable" future condition that will support the full spectrum of aquatic species. The detailed and spatially explicit information needed to implement these objectives (e.g., the current and potential distribution of channel types, and the appropriate range of channel conditions that should be represented within those channel types) constitute and important data gap that should be a high priority for evaluation.

Channel Conditions

Simply stated, the biological objective for future channel condition is:

> To have both a 1) distribution of channel types (e.g., Rosgen (1996) channel types[1]), as well as 2) a distribution of habitat conditions within those channel types, that are as close as possible to the historic distribution of these two variables within the subbasin.

By "as close as possible" we are recognizing that there are human institutions, and infrastructure that supports those institutions that may result in a difference between the historic and potential future condition.

In the EDT model we assigned gradient and confinement categories to describe the current and historic channel types based on a simple channel gradient and valley confinement approach. This channel classification is too coarse to provide the resolution that required at the reach or finer scales to implement these objectives. Consequently, a more detailed analysis (e.g., OWEB, 1999) will be needed to identify the current, historic, and potential future distribution of channel types. This approach must also incorporate the concepts of the evolutionary stages of channel adjustment outlined by Rosgen (1996) that channels will proceed through as they adjust to natural disturbances (e.g., wildfire and flooding).

Once the distribution of channel types is known we can then evaluate the appropriate habitat characteristics (e.g., width/depth ratios, entrenchment, pool frequency, etc.) within these channel types. Again, it is important not to think of these as static values within a given channel type, but also to consider the range of values and how that would be distributed across the landscape. Generic reference values (and ranges of values) could be used (e.g., those found in Rosgen 1996), however, it would be more appropriate to use information from the local management agencies (BLM, USFS, etc.) in developing a set of conditions appropriate to the local area.

Strategies (not prioritized):

- Improve the density, condition and species composition of riparian vegetation through planting, seeding, grazing management and improved forest management practices.
- Reconstruct channelized stream reaches to historic or near-historic form and location where appropriate and feasible.
- Remove or relocate channel confinement structures such as draw-bottom roads and dikes where appropriate and feasible.
- Maintain existing LWD by promoting BMP's for forestry practices.

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[1] The Rosgen classification system is used in this discussion, given it's ubiquity and usefulness in the interior west, however, other classification systems may be equally appropriate

- Add LWD where deficient and appropriate to meet identified short term deficiencies.
- Reconnect channels with floodplain or historic channels where appropriate and feasible.
- Remove or relocate channel confinement structures such as draw-bottom roads and dikes where appropriate and feasible.
- Install in-channel structures (LWD, bolders, rock structures) as appropriate to improve habitat complexity in the short term.

<u>Sediment Conditions</u>

The biological objective for future stream channel sediment conditions follows a similar line of reasoning as for channel conditions:

> To have a distribution of sediment type and size structure that is appropriate for the channel type, geology and ecoregion, recognizing that the distribution will also vary in time in response to natural disturbance factors.

The recognition that channel sediment conditions vary with varying channel conditions ties this biological objective to the previous. For example, particle size in a low gradient meandering meadow will be different from a moderate gradient channel.

The recognition that natural disturbance factors (e.g., wildfire, flooding, etc.) will influence the potential channel condition (different portions of the subbasin will be more or less susceptible to these disturbances) and time (disturbance has a probability and distribution associated with it) requires us to think of restoration not in terms of fixed target conditions, but as an improving trend in conditions, a trend that may at times experience set backs, across a broader landscape.

Strategies (not prioritized):

- Identify sediment sources
- Close, obliterate or relocate sediment producing roads.
- Improve drainage, install culverts, surface, on open sediment producing roads.
- Manage grazing in riparian areas following grazing plans designed to improve riparian condition; could include exclusion, partial season use, development of off-site water, herding.
- Reestablish riparian vegetation by planting trees, shrubs, sedges (native species preferred)
- Stabilize active erosion sites, where appropriate, through integrated use of wood structures (limited use of rock if necessary) and vegetation reestablishment.
- Where appropriate and feasible, relocate channelized stream reaches to historic locations.
- Promote interaction of stream channels and floodplains by removing, where feasible and appropriate) channel confinement structures (roads, dikes).
- Encourage landowner participation in riparian management incentive programs, e.g. CREP, WRP, EQIP.
- Promote/implement minimum tillage practices.
- Promote/implement development of grazing plans to improve upland vegetative condition.
- Implement an integrated noxious weed management program including survey, prevention practices, education, treatment and revegetation.
- Create/construct wetlands and filter strips for livestock feedlots and irrigation return flows.

<u>Riparian Conditions</u>

The biological objective for future riparian conditions follows a similar line of reasoning as for channel conditions:

> To have a distribution of riparian communities having 1) a species composition, 2) size, and 3) structure that is appropriate for the channel type and ecoregion, recognizing that the distribution will also vary in time in response to natural disturbance factors.

The recognition that the potential riparian communities will vary with varying channel conditions ties this biological objective to the previous. For example, restoration of a stream that presently flows through a channelized former-wet meadow will require not only restoration of the plant community, but restoration of the channel to restore the hydrology and soil conditions under which the potential plant community can develop.

The recognition that certain human institutions, and infrastructure that supports those institutions, exists that may result in a difference between the historic and potential future riparian condition is implicit, given the between the potential riparian community and the potential channel type.

The recognition that natural disturbance factors (e.g., wildfire, flooding, etc.) will influence the potential community both in space (different portions of the subbasin will be more or less susceptible to these disturbances) and time (disturbance has a probability and distribution associated with it) requires us to think of restoration not in terms of fixed target conditions, but as an improving trend in conditions, a trend that may at times experience set backs, across a broader landscape.

Strategies (not prioritized):

- Improve the density, condition and species composition of riparian vegetation through planting, seeding, improved grazing and forest management practices.
- Reconnect channels with floodplain or historic channels where appropriate and feasible.
- Remove or relocate channel confinement structures such as draw-bottom roads and dikes where appropriate and feasible.
- Encourage/promote participation in agriculture and farm programs to enhance riparian vegetative condition and function (CREP, WRP, EQIP)
- Relocate developed recreational facilities, where appropriate, from riparian areas to upland sites.

Low Flow Conditions

Unlike the previous two biological objectives, which can (in our opinion) be achieved while sustaining the economic concerns of the human community, the limiting factors that result from low-flow related impacts is a much less tractable problem. Human use of water in the arid west comes at the direct cost to aquatic species, and any attempt to retain more water instream will come at the expense of existing water-dependent practices (i.e., irrigated farming). However, this reality not withstanding, there are activities that can occur that soften the blow to either the human or the aquatic communities. These include things such as the more efficient use of water, or the voluntary (and fully compensated) transfer of water rights to instream uses, such as is done under the auspices of the Oregon Water Trust (http://www.owt.org).

Fortunately, from the perspective of restoring the health of the focal species in the Grande Ronde subbasin, low flows are the primary limiting factor among only a few of the assessment reaches. Consequently, moderate improvements in the existing low flow situation (through technological advances as well as voluntary reductions in use), coupled with improvements in channel and riparian conditions, will result in substantial benefits to the aquatic community. In light of this we propose the following biological objective with respect to low flows in the Grande Ronde subbasin:

To enhance low flow conditions such that they mimic the natural hydrograph to the extent possible, given the limitations posed by agriculturally dependent water use in the region.

The practical implication of this objective is that we will seek to reduce irrigation impacts to the extent possible, through both technological innovation and voluntary reductions in water use, however our focus will be on the non-consumptive factors that also affect low flows such as 1) lower <u>effective</u> summertime flows due to poor channel conditions that result in flow going sub-surface, 2) dam operations and irrigation infrastructure changes that can keep more water in the stream at the times and in the places that it is needed, and 3) restoration of natural storage pathways within the subbasin such as beaver dam/meadow complexes, and channel/floodplain connectivity.

Strategies (not prioritized):

- Identify flow deficient stream reaches caused by irrigation withdrawals.
- Improve riparian function and water storage where feasible by reconnecting floodplains through removal of confinement structures (roads, dikes), enhancing riparian vegetation, reestablishing beaver populations.
- Re-establish historic wet meadow complexes where feasible.
- Improve hydrologic function of forested watersheds through manipulation of tree species and density toward historic conditions.
- Explore feasibility of water storage facilities (above or below ground) to enhance late season stream flow.
- Reduce irrigation withdrawals through an integrated program of irrigation efficiency improvements, diversion point consolidations, water right leasing and water right purchase, where applicable with willing landowners.
- Promote education and technical training in the efficient use of irrigation water.
- Facilitate research and development of less water-intensive agricultural crops.
- Reduce water withdrawals through measurement to valid water rights quantities

<u>Other Attributes</u>

As discussed above, the primary limiting factors among the streams in the Grande Ronde subbasin are the habitat attributes described above. Furthermore, the additional habitat attributes can be considered as being either dependent on these "big four" factors, and therefore remedied by the objectives discussed above, or of relatively local and/or minor concern. However, for the sake of completeness, we will explicitly state the biological objectives for these other attributes here:

- <u>Habitat diversity</u> shall be restored as near as possible to historic conditions, as a result of restoring channel conditions and riparian conditions,

- <u>High and low water temperatures</u> and <u>dissolved oxygen</u> conditions shall be restored as near as possible to historic conditions, as a result of restoring channel conditions, reducing sediment loads, improving riparian conditions, and improving low flow conditions,

- Localized impacts due to Pollutants are expected to be reduced as ongoing best management practices are implemented that will reduce inputs of pollutants across the landscape.

5.2.2 Fish Production/Population Strategies

Fish production goals are discussed in Section 3.2.3.4.2 (page 86).

Some additional population objectives are included below:

Achieve escapement objectives shown in Table X within 24 years (represents 4-5 generations; timeline is consistent with the NPCC's Fish and Wildlife Program). Criteria will involve both a time element (persistence) and an abundance element, both of which are currently under review. Achieving these objectives would restore and maintain in-basin escapement for natural production, broodstock needs, treaty-reserved tribal harvest, and recreational fisheries (Table X).

Table 61. Anadromous adult return objectives for the Grande Ronde Subbasin.

Species		Adult Escapement	Natural Spawning Component	Hatchery Component (Broodstock Need)	Harvest Component
Spring/ Summer Chinook	Future Goal	? [8]	?	?	?
	Historic Condition	5,000-12,200[2]	5,000-12,000	0	200-800[3]
	Existing Condition	250-3,000[4]	250-3,000	up to 720	0
Fall Chinook	Future	? [8]	?	?	?
	Historic Condition	?	?	?	?
	Existing Condition	up to 500	up to 500	?	?
Wild Summer Steelhead	Future	>5,000	>5,000	0	>1,000
	Historic Condition	3,500-16,000[1]	3,500-16,000	0	1,100-3,000[2]
	Existing Condition	1,100-8,500[5]	1,100-8,500	0	0
Hatchery Summer Steelhead	Future	?	?	?	?
	Historic Condition	0	0	0	0
	Existing Condition	1,000-10,000	0[6]	500	200-7,000

[2] Historic escapement for spring/summer Chinook and summer steelhead based on LSRCP method of partitioning run over McNary Dam 1954-1963 (first ten years of McNary data).

[3] Punch card estimates for 1959 (first year of data) through 1963.

[4] Estimate based on expanding total redd count by three fish per redd for most recent 10 years (1994-2003).

[5] Estimate using 14.9% of Lower Granite Dam wild count from 1993-94 through 2002-2003 run years (LSRCP method).

[6] No intentional release of hatchery summer steelhead for natural spawning in recent years.

Sockeye	Future	? [7]	?	?	?
	Historic Condition	up to 15,000[7]	up to 15,000	0	up to 15,000
	Existing Condition	extirpated	-	-	-
Coho	Future	? [7]	?	?	?
	Historic Condition	up to 5,000 or more[6]	up to 5,000 or more	0	?
	Existing Condition	extirpated	-	-	-

[1] Historic escapement for spring/summer Chinook and summer steelhead based on LSRCP method of partitioning run over McNary Dam 1954-1963 (first ten years of McNary data).
[2] Punch card estimates for 1959 (first year of data) through 1963.
[3] Estimate based on expanding total redd count by three fish per redd for most recent 10 years (1994-2003).
[4] Estimate using 14.9% of Lower Granite Dam wild count from 1993-94 through 2002-2003 run years (LSRCP method).
[5] No intentional release of hatchery summer steelhead for natural spawning in recent years.
[6] Cramer, S.P. and K.L. Witty. 1997. The feasibility of reintroducing sockeye and coho salmon in the Grande Ronde basin. S.P. Cramer and Associates, Gresham, OR, USA.
[7] NPT proposed reintroduction, numbers not agreed to by co-managers.
[8] Numbers not agreed to by co-managers.

[7] Cramer, S.P. and K.L. Witty. 1997. The feasibility of reintroducing sockeye and coho salmon in the Grande Ronde basin. S.P. Cramer and Associates, Gresham, OR, USA.

[7] NPT proposed reintroduction, numbers not agreed to by co-managers.

[8] Numbers not agreed to by co-managers.

Table 62. Comparison of anadromous fish objectives from various plans pertaining to the Grande Ronde Subbasin

CRITFC=Spirit of the Salmon; 1990 Plan= 1990 Snake Subbasin Salmon and Steelhead Production Plan; NMFS 2002=NMFS Draft Interim Abundance Goals; CRFMP=Columbia River Fish Management Plan

Species	Long-term Objective	Natural Spawning	Hatchery Spawning	Total Spawning	Harvest Component	Overall Goal/Notes
			Spring Chinook			
CRITFC	16,000	----	----	----	----	
1990 Subbasin Plan	16,000	----	----	12,000	4,000	Parkhurst 1950
NMFS 2002		2,000	----	----	----	Interim delisting Abundance
LSRCP	12,200	----	-----	----	----	Snake R. above L. Granite
US v. Or						
			Fall Chinook			
CRITFC	10,000	----	----	----	----	
1990 Subbasin Plan	10,000	----	----	----	2,500	
US v.Or		----	----	----	----	
			Summer Steelhead			
CRITFC	27,500	----	----	----	----	
1990 Subbasin Plan	27,500	----	----	18,450	9,050	Thompson et al. 1958
NMFS 2002	10,000	----	----	----	----	Interim Abundance Goal
LSRCP	15,900	----	-----	----	----	Snake R. above L. Granite
US v. Or						
			Sockeye			
CRITFC	2,500	**----**	**-----**	**----**	**----**	
1990 Subbasin Plan	2,500			**-**	**625**	
NMFS 2002						
US v. Or.						
			Coho			
CRITFC	3,500					
1990 Subbasin Plan	3,500	**1,000**	**2,200**	**3,200**	**300**	
US v. OR						

[1] CRFMP, which has expired (US v. Oregon), establishes interim mgmt goals for fish passing over the Lower Granite Dam; Snake River specific goals are not defined.
[2] Represents interim abundance goal for Snake River ESU
[3] CRFMP, which has expired (US v. Oregon), establishes interim management goals for fish passing over the Lower Granite Dam; Snake River specific goals are not defined.

5.3. Terrestrial Species and Habitats

The following terrestrial goals were established by the terrestrial technical group and approved by the management and policy group.

- Maintain the subbasin's wildlife diversity by protecting and enhancing populations and habitats of native wildlife at self-sustaining levels throughout their natural geographic ranges.
- Restore and maintain self-sustaining populations of non-game species extirpated from the state or regions within the state, consistent with habitat availability, public acceptance, and other uses of the lands and waters of the state.

Objectives

The terrestrial team did not establish quantifiable habitat objectives because accurate acreage for both current and historic habitat types is not available. The terrestrial wildlife team spent considerable time reviewing IBIS and ONHIC data and determined that there were significant inaccuracies in both. Better data needs to be developed before future analysis. The team however does feel that the available data does adequately portray trend and approximate magnitude of change from historic to present.

Ponderosa Pine Forest and Woodlands

Acreage in this his habitat type has been reduced approximately one third from historic primarily due to selective timber harvest, fire suppression and agricultural development. Timber harvest has also significantly reduced tree size and snags habitat. Reversing this trend will be a very long term process.

Objective: Establish an increasing trend in acreage and tree size for the type.

Strategies (not prioritized:

- Protect extant habitat in good condition through easements and acquisitions.
- Identify ponderosa pine types that have converted to mixed conifer stands and promote the conversion back to ponderosa pine.
- Coordinate with public and private land managers on the use of prescribed fire and stand management practices.
- Restore forest function through the use of prescribed fire and silvicultural treatments.
- Fund and coordinate weed control efforts on both public and private land.
- Identify and protect wildlife habitat corridors/links.

Quaking Aspen and Curleaf Mountain Mahogany

The data showed an increase in acreage from historic to current. However the terrestrial team doubted this is the case based on professional experience and personal communications. Indications are overall acreage is somewhat less, but the extent of the decline is unknown. Browsing by both domestic and wild ungulates, fire suppression and invasion of exotic plants have combined to reduce the occurrence of these habitats.

Objective: Increase size and vigor of aspen and mahogany stands.

Strategies (not prioritized):

- Conduct inventories to locate and map existing, isolated aspen and mahogany stands.
- Protect extant stands of aspen and mountain mahogany through fencing to exclude both big game and livestock.
- Remove conifers from stands of aspen and mountain mahogany to allow recruitment of young trees to size classes beyond the reach of browsing wildlife.
- Promote use of low-intensity ground fires to regenerate aspen.

Eastside Grasslands

Eastside grasslands have been substantially reduced by conversion to cropland and pasture, and shrub invasion in the absence of frequent low intensity fires. Additionally the quality of existing grasslands has been degraded by overgrazing and invasion of exotic plants.

Objective: Increase the occurrence and condition of native grasslands.

Strategies (not prioritized):

- Fund and coordinate weed control efforts on both public and private lands.
- Restore grassland function through reestablishment of native plant communities where practical and cost effective.
- Identify and protect wildlife habitat corridors/links.
- Promote research and development of bio-control agents for noxious weeds.
- Promote landowner education in identification and management of noxious weeds

Wetlands

Extensive stream channelization and ditching, dike construction, road construction, overgrazing, beaver elimination and invasion of exotic species have substantially reduced wetland acreage throughout the subbasin. The terrestrial team felt that the acreage reduction may be even more pronounced than indicated due to the scale of mapping. Small wet meadow complexes likely were under represented historically.

Objective: Protect existing wetlands and reestablish wetland and wet meadow complexes where feasible.

Strategies (not prioritized):

- Protect extant habitat in good condition through easements and acquisitions.
- Fund and coordinate weed control efforts on both public and private lands.
- Work with soil and water conservation districts, NRCS, FSA, landowners et al., to implement best management practices in wetland and riparian areas.
- Promote and fund CRP, CREP, WHIP, WRP and other programs.
- Restore wetland function through reestablishment of native plant communities where practical and cost effective.
- Restore riparian area function through livestock management, in-channel improvements, vegetative enhancement and removal of channel confinement structures.
- Identify and protect wildlife habitat corridors/links.

- Develop a beaver management plan to promote the reestablishment/reintroduction of beaver into suitable habitats.
- Restore historic or near-historic stream channels where feasible.

Mid- to High-Elevation Conifer Forest

Overall, the quantity of this habitat type has changed little although the quality has deteriorated. Structural and seral diversity has changed due primarily to selective timber harvest, fire suppression and wildfires. Heavy fuel conditions have predisposed vast acreages to high intensity stand replacement wildfire.

Objective: Increase acreage occupied by vigorous stands, reduce acreage of heavy fuel loading.

Strategies (not prioritized):

- Restore forest function and improve stand vigor through the use of prescribed fire and silvicultural practices.
- Identify and protect wildlife habitat corridors/links.

Agriculture, Pasture and Mixed Environs

This habitat type has been created by conversion of native grasslands, wetlands, shrub-steppe and ponderosa pine habitat type to crop land and pasture. The focal species representing this type is the Rocky Mountain elk. Elk were designated a focal species due to the social and economic importance of the species to the local area, and due to conflicts with agriculture as a result of loss of winter range.

Objective: Reduce elk/agriculture conflicts.

Strategies (not prioritized):

- Protect unconverted winter range in good condition through easements and acquisitions.
- Implement winter range forage improvement activities.
- Take actions necessary to prevent the establishment of year-around resident valley elk herds.

5.4 Consistency with ESA/CWA Requirements

As discussed throughout the document, the Grande Ronde Subbasin Plan is consistent with the Endangered Species Act, the Clean Water Act and other relevant laws and regulations.

5.5 Research, Monitoring and Evaluation

5.5.1 Aquatic Research, Monitoring, and Evaluation

Aquatic research, monitoring and evaluation (RM&E) needs have been identified for the Grande Ronde subbasin through input from the EDT results and from a wide range of stakeholders and professionals who are most familiar with the logistical needs in their areas.

The information provided in the aquatics RM&E section considers taking both a 'bottom-up' and 'top-down' approach. The bottom-up approach is in accordance with the initiative provided two years ago in the *Technical Guidance for Subbasin Planners* (NPPC 2001), and specifically treats M&E at the project scale, for example, in support of individual habitat projects. The top-down approach is recognized to be a critical component of RM&E efforts at the regional or programmatic level, as it examines monitoring questions now being asked at large-scale landscape and ecosystem levels and has been called for in the Federal Salmon Recovery Strategy and the Implementation Plan of the Action Agencies addressing the NOAA-Fisheries Biological Opinion (Biological Opinion) on the Federal Columbia River Power System (FCRPS). (Note: the Action Agencies are Bonneville Power Administration, the Army Corps of Engineers, and the Bureau of Reclamation).

The aquatics RM&E section follows guidelines provided in the Pacific Northwest Aquatic Monitoring Partnership (PNAMP 2004). The PNAMP represents a group whose mission is to coordinate between project-specific and regional RM&E efforts to establish the most effective system design and application needed to accomplish objectives at both levels. Several assumptions are built into the guidance document, which are also applicable to the Grande Ronde RM&E section (PNAMP 2004)

1. Monitoring and evaluation coordination and implementation will be an ongoing activity at the reach, subbasin, and regional levels.

2. Monitoring that is proposed will be more effective if it fits within a broader programmatic network of status monitoring programs and intensively monitored watersheds.

3. It is assumed that local, bottom-up approaches developed within the Grande Ronde will have higher likelihood for successful funding and meaningful results if they reflect the approaches being developed within the comprehensive state, tribal initiatives, and federal pilot projects (Wenatchee, John Day, and Upper Salmon), and the top-down framework and considerations being developed by PNAMP.

Using a checklist developed for the Council's Independent Scientific Advisory Board (ISAB) and the Independent Scientific Review Panel (ISRP) review of subbasin plans, the PNAMP (2004) suggests planners consider the inclusion of 1) Monitoring Objectives, 2) Monitoring Indicators, 3) Data and Information Archive, 4) Coordination and Implementation, and 5) Evaluation and Adaptive Management in the RM&E component.

Monitoring and Evaluation Objectives and Indicators

The Grande Ronde subbasin planning team used the subbasin assessment, information provided in Section 5.1.2 of this document for guidance. But largely structured the following section using information provided in the Monitoring and Evaluation Plan For Northeast Oregon Hatchery Imnaha and Grande Ronde Subbasin Spring Chinook Salmon (Hesse et al. 2004), and information provided in Monitoring and Evaluation Framework for Northeast Oregon Hatchery Grande Ronde and Grande Ronde Subbasin Steelhead (Hesse et al. 2004 *in review*) to develop a list of measurable objectives and indicators to address subbasin-level questions about factors defining the condition of the watersheds and associated salmon and steelhead populations.

Hesse et al. (2004) and Hesse et al. (*in review*) was used extensively in the development of the Grande Ronde aquatic M&E objectives and indicators since the work provides a format that (1) is specific to the Grande Ronde, (2) coordinates an array of monitoring and evaluation activities, (3) fits within a regional framework, and (4) results in information with broad applicability. Hesse et al. (2004) and Hesse et al. (*in review*) also draws from federal, state, tribal, academic and independent sources for monitoring and evaluation recommendations and statistical council.

Limitations of structuring the M&E section by using Hesse et al. (2004) and Hesse et al. (*in review*) include the omission of RM&E specific to other focal species. Also, because Hesse et al. (2004) and Hesse et al. (*in review*) were developed as a part of The Northeast Oregon Hatchery (NEOH) program, their primary intent is to guide evaluation of the NEOH program, give empirical evidence of effects and fill knowledge gaps regarding supplementation and its uncertainty as an enhancement tool.

Despite their focus on only two of the aquatic focal species, the spring/summer chinook and steelhead M&E plans developed by Hesse et al. (2004) and Hesse et al. (*in review*) provide a solid, statistically-based foundation from which additional M&E plans can be derived, and represent an M&E effort that is regionally applicable.

The information presented below represents only a portion of that which is provided in the NEOH M&E plans, but includes that which is pertinent to all five focal species (i.e. fall chinook, bull trout, and Pacific lamprey) and to M&E needs identified in the assessment and Section 5.1.2 of this document.

<u>Monitoring Questions:</u>
As suggested in the PNAMP (2004) guidance document, management goals and the measurable monitoring objectives are based on a series of monitoring questions that define specific M&E problems. The monitoring questions address six key variables, including 1) Abundance, 2) Survival/Productivity, 3) Distribution, 4) Genetics, 5) Life History, and 6) Habitat.

1. How is the annual abundance and distribution of Grande Ronde spring chinook summer and bull trout populations and associated life history stages changing over time within the subbasin?

2. How is freshwater productivity (e.g., smolt/female) and survival (e.g., SAR) of focal fish populations affected by hatchery practices?

3. What is the fraction of potential natural spawners that are of hatchery origin?

4. What is the age-structure of chinook salmon, steelhead bull trout populations?

5. How does habitat condition affect productivity of various life history stages of focal populations?

6. What are the overall impacts of human related activities on freshwater habitat and landscape processes within the subbasin?

<u>Management Objectives and Assumptions:</u>
The following management objectives/assumptions are based on the previous questions, and address the same key variables. For each <u>Management Objective</u> determining whether the <u>assumptions</u> are met (valid) requires expression of the assumption in quantifiable terms.

MANAGEMENT OBJECTIVE 1: UNDERSTAND THE CURRENT STATUS, TRENDS, AND DISTRIBUTION OF FOCAL SPECIES IN THE GRANDE RONDE

Assumptions:

A. In-basin habitat is stable and suitable for focal species production
B. We can describe juvenile production in relationship to available habitat in each population and throughout the subbasin.
C. We can describe annual (and 8-year geometric mean) abundance of natural-origin adults relative to management thresholds (minimum spawner abundance and ESA delisting criteria) within prescribed precision targets.
D. Adults utilize all available spawning habitat in each population and throughout the subbasin.
E. The relationships between life history diversity, life stage survival, abundance and habitat are understood.

MANAGEMENT OBJECTIVE 2: ASSESS, MAINTAIN, AND ENHANCE NATURAL PRODUCTION AND SURVIVAL OF FOCAL SALMONID POPULATIONS IN SUPPLEMENTED STREAMS WITHIN THE GRANDE RONDE

Assumptions:

A. Progeny-to-parent ratios for hatchery-produced fish significantly exceeds those of natural-origin fish.
B. Natural reproductive success of endemic hatchery-origin fish must be similar to that of natural-origin fish.
C. Spatial distribution of endemic hatchery-origin spawners in nature is similar to that of natural-origin fish.
D. Abundance and spatial distribution of non-endemic hatchery-origin spawners in nature is limited.
E. Productivity of supplemented populations is similar to productivity of populations if they had not been supplemented.
F. Life stage-specific survival is similar between hatchery and natural-origin population components.

MANAGEMENT OBJECTIVE 3: ASSESS LIFE HISTORY CHARACTERISTICS AND MAINTAIN GENETIC DIVERSITY IN SUPPLEMENTED AND UNSUPPLEMENTED FOCAL POPULATIONS IN THE GRANDE RONDE

Assumptions:

A. Adult life history characteristics in supplemented populations remains similar to pre-supplementation population characteristics.
B. Temporal variability of life history characteristics in supplemented populations remains similar to unsupplemented populations (assumes robust wild population dynamics).
C. Juvenile life history characteristics in supplemented populations remains similar to pre-supplemented population characteristics.
D. Genetic characteristics of the supplemented population remain similar (or improved) to the unsupplemented populations.

MANAGEMENT OBJECTIVE 4: UNDERSTAND THE CURRENT STATUS AND TRENDS OF HABITAT CONDITIONS AS THEY RELATE TO FOCAL SPECIES STATUS IN THE GRANDE RONDE

Assumptions:

A. The relationships between focal species use and habitat are understood
B. In-basin habitat is stable and suitable for focal species production
C. We can describe juvenile production in relationship to available habitat in each population and throughout the subbasin

MANAGEMENT OBJECTIVE 5. ASSESS THE EFFECTIVENESS OF RESTORATION ACTIVITIES AND OTHER HUMAN RELATED ACTIVITIES ON FOCAL SPECIES HABITAT CONDITION

Assumptions:

A. Habitat conditions in wilderness reaches (*e.g.,* Eagle Cap) are representative of an unmanaged system and can be used comparatively between streams sharing similar physical characteristics
B. Determination of restoration activity effectiveness and/or human-related disturbance on aquatic habitats are indicative of biological production potential of a given focal species

Monitoring and Evaluation Objectives:

The management assumptions form the basis of the Monitoring and Evaluation Objectives. Testable hypotheses or descriptive measures are then identified. Key and associated performance measure(s) to be quantified are then described. The KPMs and associated spatial scale, required/desired precision, and sampling frequency/duration are presented in Table 63. To maximize incorporation of the five subbasin focal species, verbiage presented in Hesse et al. (2004) and Hesse et al. (*in review*) has been selectively incorporated, and/or revised.

Table 63. Summary of key performance measures in relation to spatial scale, required precision, frequency of sampling, and linkage to monitoring objectives and objectives/strategies defined in Section 5.2.1.

	Performance Measure	Spatial Scale	Required Precision[1] (CV)	Desired Precision[1] (+/- 95% CI)	Frequency/ Duration	Monitoring Objective Link
Abundance	Adult Escapement to Snake Basin	Subbasin-wide			Annual	
	Fish per Redd	Primary Aggregates			Annual – ongoing	1b, 2a, 2b
	Adult Spawner Abundance	Primary Aggregates			Annual – ongoing	2a
	Index of Spawner Abundance (redd counts)	Subbasin-wide and Primary Aggregates			Annual – ongoing	1b, 2a
	Hatchery Fraction	Primary Aggregates			Annual – ongoing	2a, 2b
	Harvest	Key Areas			Annual	2a

	Performance Measure	Spatial Scale	Required Precision[1] (CV)	Desired Precision[1] (+/- 95% CI)	Frequency/ Duration	Monitoring Objective Link
	Index of Juvenile Abundance (Density)	Subbasin-wide			Annual	1a
	Juvenile Emigrant Abundance	Primary Aggregates			Annual	1a, 2c
	Hatchery Production Abundance	Key Areas			Annual	2a
	Smolt Equivalents	Primary Aggregates			Annual	2a, 2c
	Run Prediction	Key Areas			Annual, ongoing	
Survival-Productivity	Smolt-to-Adult Return Rate	Subbasin-wide and Key Areas			Annual	2c
	Parent Progeny Ratio (lambda, adult-to-adult)	Subbasin-wide and Key Areas			Annual for at least 10 years intervals	2a
	Recruit/spawner (smolt per female or redd)	Primary Aggregates			Annual	2a
	Pre-spawn Mortality	Key Areas			Annual	2a
	Juvenile Survival to Lower Granite Dam	Primary Aggregates			Annual	2c
	Juvenile Survival to Mainstem (McNary and Bonneville) Dams	Subbasin-wide			Annual	
	In-hatchery Life Stage Survival	Key Areas			Annual	
	Post-release Survival	Key Areas			Annual	2c
Distribution	Adult Spawner Spatial Distribution	Subbasin-wide			3-5 year cycle	1c
	Stray Rate	Key Areas			Annual	
	Juvenile Rearing Distribution	Subbasin-wide			Annual (5 year cycle)	1a
	Disease Frequency	Primary Aggregates			Annual, Event Triggered	
Genetic	Genetic Diversity	Subbasin-wide and Key Areas			Small-scale Study (5 years)	3a
	Reproductive Success (Parentage)	Key Area			Small-scale Study (5 years)	2c
	Gene Conservation (Cryopreservation)	Primary Aggregates			Annual (5 + year cycle)	
Life	Age–at–Return	Primary Aggregates			Annual - ongoing	2a, 3b
	Age–at-Emigration	Primary Aggregates			Annual	3c

	Performance Measure	Spatial Scale	Required Precision[1] (CV)	Desired Precision[1] (+/- 95% CI)	Frequency/ Duration	Monitoring Objective Link
	Size-at-Return	Primary Aggregates			Annual	3b
	Size-at-Emigration	Primary Aggregates			Annual	3c
	Condition of Juveniles at Emigration	Primary Aggregates			Annual – ongoing	3c
	Adult Spawner Sex Ratio	Primary Aggregates			Annual - ongoing	2a, 2b, 3b
	Fecundity	Key Areas			Annual	2b, 3b
	Adult Run-timing	Key Areas			Annual	3b
	Spawn-timing	Key Areas			Annual	2b
	Juvenile Emigration Timing	Primary Aggregates			Annual	3c
	Mainstem Arrival Timing (Lower Granite)	Subbasin-wide			Annual	3c
Habitat	Physical Habitat	Subbasin-wide and Key Areas			Every three years	4a
	Stream Network	Subbasin-wide			10yrs	
	Passage Barriers/Diversions	Subbasin-wide			5 yrs	
	Instream Flow	Subbasin-wide and Key Areas			Continual (5 plus year cycle)	4a
	Water Temperature	Subbasin-wide and Key Areas			Continual (5 year cycles), Event Triggered	4a
	Chemical Water Quality	Subbasin-wide			Continual, 3 years	
	Macroinvertebrate Assemblage	Subbasin-wide			5 years	
	Fish and Amphibian Assemblage	Subbasin-wide			5 year	

[1] Prescription of the required/desired precision is being developed as part of the final M&E plan Step 3 submittal based on observed annual variability, five year evaluation cycles, and number of replicates associated with each performance measure needed to detect biologically/management significant change. Currently used recommendations generally identify CV's of 15 and 25% (Jordan et al. 2002). However these have been established through EMAP type projects on the bases of the number feasible sample size/replication (i.e. 50 sample site). Required precision is related to ability to detect change, whereas desired precision compares population status with management thresholds.

The following section is structured as follows:

Monitoring Question
MANAGEMENT OBJECTIVE
Monitoring and Evaluation Objective
    Hypotheses or Descriptive Monitoring Attributes
        Performance Measures Required
        Statistical Tests Applied
        Duration/frequency
        Spatial Scale of Application

MANAGEMENT OBJECTIVE 1: UNDERSTAND THE CURRENT STATUS, TRENDS, AND DISTRIBUTION OF NATURAL FOCAL SPECIES POPULATIONS IN THE GRANDE RONDE.

Monitoring and Evaluation Objective 1a. Describe status and trends in juvenile abundance at the population and subbasin scales in the Grande Ronde Subbasin

H_1 - Descriptive: Characterize parr densities over time for the Grande Ronde subbasin.

H_2 - Descriptive: Characterize smolt production over time in index production areas.

Key performance measures:

- parr densities
- juvenile emigrant abundance

Statistical Tests Applied: Data analysis will involve calculating the percentage of survey sites that contain at least one juvenile fish for each focal species and the percentage of pools per site that contain juvenile fish for each focal species to quantify changes in the relative distribution inter-annually. We will quantify the number of juveniles observed per square meter for use in population trend analysis within and among individual subbasins. Confidence limits for summary estimates will be developed based on quantifying the measurement error in the survey data and site-to-site variability based on a variance estimator developed by the EPA Environmental Monitoring and Assessment Program (EMAP) for this application (*refer to* http://www.epa.gov/nheerl/arm/).

Duration/Frequency: Monitoring of juvenile emigration will occur continually over time by emigrant trapping in key production streams.

Spatial Scale: Subbasin-wide

Monitoring and Evaluation Objective 1b. Describe status and trends in adult abundance and productivity for all focal populations in the Grande Ronde subbasin

H_1 - Descriptive: Trend in adult abundance over time.

H_2 - Descriptive: Monitor survival rates and abundance relative to management and conservation thresholds.

Key performance measures:

- adult abundance (weir, mark- recapture, and redd count combinations)
- derived measures of productivity (Lamda; based on annual and 8-year geometric means of minimum spawner escapement thresholds and ESA recovery criteria)

Statistical Tests Applied: We will apply data of time series abundance to the Diffusion Approximation Model (also called a Wiener-Drift process model) to evaluate population viability. The DA model has been recommended for use when analyzing time series data regarding abundance (Dennis et al. 1991, Holmes 2001, Holmes and Fagan 2002).

Frequency/Duration: Annually – ongoing

Spatial Scale: Subbasin-wide and primary aggregates

Monitoring and Evaluation Objective 1c. Monitor focal species spawning distributions in the Grande Ronde subbasin

H_1 - Descriptive: Spatial distribution of adult spawners over time.

Key performance measure:

- redd distribution

Statistical Tests Applied: The development of an EMAP- type probabilistic sampling scheme for redd counts will complement current survey efforts. Twenty-five random sites outside the traditional survey areas will be selected. Each site will be 1 km in length. Survey style will be based on protocols and methods used during traditional surveys employed in the subbasin.

Frequency/Duration: 3-5 year cycle

Spatial Scale: Subbasin-wide

MANAGEMENT OBJECTIVE 2: ASSESS, MAINTAIN, AND ENHANCE NATURAL PRODUCTION AND SURVIVAL OF FOCAL SALMONID POPULATIONS IN SUPPLEMENTED STREAMS WITHIN THE GRANDE RONDE

Monitoring and Evaluation Objective 2a: Determine and compare the productivity of hatchery-origin fish and natural-origin fish in Grande Ronde

Ho_1: Progeny-per-parent ratio of hatchery-origin fish over time is equal to that of natural-origin fish for each stream.

Ha_1: Progeny-per-parent ratio of hatchery-origin fish over time is greater than that of natural-origin fish for each stream.

Ho_2: Progeny-per-parent ratio is equal between streams (or the levels of supplementation intensity) regardless of fish type (hatchery vs. natural-origin fish).

Ha_2: Progeny-per-parent ratio is significantly different between streams (or the levels of supplementation intensity) regardless of fish type (hatchery vs. natural-origin fish).

Ho_3: Progeny-per-parent ratio of hatchery-origin fish is the equal to that of natural-origin fish across streams (or the levels of supplementation intensity).

Ha_3: Progeny-per-parent ratio of hatchery-origin fish is significantly different from that of natural-origin fish across streams (or the levels of supplementation intensity).

Key performance measures:

- progeny-per-parent ratio (P:P). Calculation of P:P relies on annual run reconstructions and requires quantification of adult abundance to tributary (escapement), index of spawner of abundance (redd counts), spawner abundance (spawner), fish per redd, hatchery fraction, age class structure, age-at-return, adult spawner sex ratio, prespawning mortality, and in-tributary harvest. Progeny are quantified through run-reconstruction. Natural fish P:P use two variants of parents; estimated escapement and spawners. Hatchery P:P are generated from the number of parents collected for broodstock by brood year and resulting hatchery returns to the parent stream. P:P ratio will be calculated for total adult contribution (adult-to-adult) and by female contribution (female-to-female).

Statistical Tests Applied: Testing of results for significantly greater rate by hatchery-origin fish applies a pair-wise one-tail t-test comparison of hatchery P:P to natural P:P by brood year (cohort) within each tributary over time. Time (year) plays a role of 'pair'. Characterization of result variability over time within each stream utilizes replication over 5 years periods.

We also desire to test across streams (or the levels of supplementation intensity). In this case, we are interested in testing additional null hypotheses. In testing these hypotheses, we check the main effect of stream, whereas in testing the second hypotheses, we first check the interaction term between stream and fish type. Graphically, the second null hypothesis says that P:P ratio of hatchery fish over streams is parallel to that of naturally produced fish. Years are replicates. To test these hypotheses at the same time, two-factor analysis of variance (ANOVA) is appropriate, where two factors are fish type (hatchery fish vs. naturally produced fish), and stream (or the level of supplementation intensity).

We will test at 5% Type I error (i.e. $\alpha = 0.05$), and show the p-value of test statistic. If the p-value is less than the level of Type I error, we will reject null hypothesis.

Frequency/Duration: Annual – ongoing. Monitoring of P:P ratios is a long-term process which should continue until the program achieves equal or stable performance for two complete generations (assumption of consistent program operations). Changes in hatchery program operations must be accompanied by monitoring of P:P ratios.

Spatial Scale: Primary Aggregates

<u>Monitoring and Evaluation Objective 2b:</u> Determine and compare relative reproductive success of hatchery and naturally produced focal species

Ho_1: Reproductive success of naturally spawning hatchery fish is equal to that of naturally produced fish.
Ha_1: Reproductive success of naturally spawning hatchery fish is significantly different than that of naturally produced fish.

Ho_2: Mate choice is random with respect to parentage of individual fish (i.e., wild, conventional and captive brood stock).
Ha_2: Mate choice with respect to parentage of individual fish is selective and is significantly different.

Ho_3: Selection gradients are the same in the hatchery and the wild and do not differ between sexes nor between hatchery- and naturally-produced fish.
Ha_3: Selection gradients are significantly different for hatchery and natural origin fish between sexes.

Ho_4: Interfamily variance in reproductive success is so great that it is not possible to make meaningful conclusions about specific selective factors and the quantitative genetic interactions between hatchery and wild components of these supplemented populations. Preliminary results indicate that although variance is large, effect sizes can also be large.
Ha_4: Interfamily variance can be accounted for relative to effect size.

<u>Key performance measures</u>:

- The relative proportion of offspring produced per parent by origin.
- Supporting performance measures include adult abundance to tributary, hatchery fraction, age-at-return, adult spawner sex ratio, fecundity (by age and size), and spawn-timing (by origin).

<u>Statistical Tests Applied:</u> Probabilistic approaches that explore the likelihood of each possible parentage assignment and establish statistical criteria for accepting the true parent (*e.g.,* Cervus 2.0, Marshall et al. 1998).

<u>Frequency/Duration:</u> Annual – ongoing. Performance should be monitored for at least two complete generations and replicated annually three to five year.

<u>Spatial Scale:</u> Primary aggregates.

<u>Monitoring and Evaluation Objective 2c:</u> Determine and compare life-stage specific survival rates for hatchery and natural fish in the Grande Ronde

Ho_1: There is no difference in survival rate of smolts from the tributary to Lower Granite Dam between hatchery produced fish and naturally produced fish over time for each stream.

Ha_1: There is a significant difference in survival rate of smolts from the tributary to Lower Granite Dam between hatchery produced fish and naturally produced fish over time for each stream.

Ho_2: There is no difference in smolt-to-adult return rate between hatchery fish and naturally produced fish over time for each stream.

Ha_2: There is a significant difference in smolt-to-adult return rate between hatchery fish and naturally produced fish over time for each stream.

Descriptive: Base line monitoring of life stage specific survival for trends over time.

Key performance measures:

- juvenile emigrant survival to Lower Granite Dam
- smolt-to-adult return rate (SAR) for natural-origin fish and hatchery produced fish within each tributary.

Statistical Tests Applied: Testing of results for significant differences in survival rates between hatchery and natural production within streams/subbasin annually and over five year periods. Juvenile survival estimates generated by the SURPH.2 model include a point estimate and associated variance. SAR estimates will be point estimates with no associated variance descriptor. When we compare two samples by year, the paired t-test is appropriate.

A χ^2 contingency table analysis is performed to test the null hypothesis that detection rates are the same for all populations (Zar 1984, equation 6.1). If detection rates differ, a Tukey-type multiple comparison on transformed proportions is used to determine which populations differ (Zar 1984, equation 22.13). Survival probabilities are compared between populations using the modeling and hypothesis testing capabilities of SURPH 2.1. Candidate models are compared by the likelihood ratio test, and Akaike's information Criterion (AIC).

We will test at 5% Type I error (i.e. $\alpha = 0.05$), and show p-value of test statistic. If the p-value is less than the level of Type I error, we will reject null hypothesis.

Frequency/Duration: Annual

Spatial Scale: Primary Aggregates

MANAGEMENT OBJECTIVE 3: ASSESS LIFE HISTORY CHARACTERISTICS AND GENETIC DIVERSITY IN SUPPLEMENTED AND UNSUPPLEMENTED FOCAL POPULATIONS IN THE GRANDE RONDE

Monitoring and Evaluation Objective 3a. Determine and compare genetic characteristics of hatchery and natural fish in the Grande Ronde subbasin

Ho_1: There are no genetic differences between hatchery populations and natural populations they were derived from.
Ha_1: Significant genetic differences exist between hatchery and natural population segments they were derived from.

Ho_2: Populations that have been supplemented show the same magnitude of genetic change over time as unsupplemented populations.

Ha_2: The magnitude of genetic change over time has been altered in supplemented populations.

Ho_3: The relationship between N_e and N is the same in hatchery and natural populations.
Ha_3: The relationship between N_e and N is significantly reduced for hatchery and natural populations.

Ho_4: Non-target wild populations have not been genetically affected by hatchery strays.
Ha_4: Non-target wild populations have been genetically altered by hatchery strays.

Key performance measures:

- Measure levels of genetic variability in each population: Genetic variability within populations will be evaluated in a number of different ways. Comparisons of variability in hatchery, natural, and wild populations will be made and changes in levels of variability will be evaluated through time. Observed variability will also be compared.
- Estimate effective population size (N_e) and the ratio N_e/N for each population--Fixation indices and gametic disequilibrium will be used to estimate and evaluate the relationship between effective population size and census size (N) estimated from redd counts, spawner surveys, and population enumeration.
- Evaluate population genetic structure of natural and wild populations--Fixation indices and hierarchical gene diversity analyses will be used to partition genetic variation into spatial and temporal components. These relationships will be used to estimate levels of gene flow among populations.
- Document selective forces and genetic effects of supplementation on target and non-target populations--Indices of genetic differentiation will be calculated between hatchery and natural, and hatchery and wild populations. Patterns of genetic change will be examined through time in the three classes of populations.

Statistical Tests Applied: Electrophoretic phenotypes visualized on starch gels are interpreted as genotypes according to guidelines discussed by Utter et al. (1987). A chi-square test is used to compare genotypic frequencies at each variable locus in each population with frequencies expected under Hardy-Weinberg equilibrium. This test can be useful in detecting artifactual (nongenetic) variation. The method of Waples (1988) is used to evaluate genotypes and estimate allele frequencies at isoloci (duplicated gene loci). A variety of standard statistical analyses are routinely applied to the data (e.g., computing heterozygosity, gene diversity, number of alleles per locus, genetic distances, and F-statistics; testing for heterogeneity of allele frequencies among populations).

In addition to these analyses, a number of more specialized analyses are used to estimate effective population size. As the primary goal of this project is to study genetic changes over time in natural and wild populations resulting from supplementation, it is necessary to consider factors other than hatchery-wild genetic interactions that can lead to genetic change. Because supplementation is typically considered only when natural abundance is low, the effects of random genetic drift due to finite population size must be considered in evaluating observed genetic changes. Our methods for estimating effective population size include the following:

Quantifying allele frequency change. The statistic used to measure the magnitude of genetic change is $\hat{F} = (P_1 - P_2)^2 / [(\overline{P}(1-\overline{P})]$, where P_1 and P_2 are allele frequencies in samples taken at two different times and is the mean of P_1 and P_2. $\hat{F}$ is computed for each gene locus surveyed, and a mean $\hat{F}$ over all loci in a comparison of temporally spaced samples is also computed.

Testing for selection. Although there is a body of evidence suggesting that the enzymatic gene loci sampled by electrophoresis in general are largely unaffected by natural selection, it is important to evaluate this assumption because strong selection would complicate the interpretation of changes within populations and interactions between populations. If the loci used are effectively neutral, they all should be affected by genetic drift to approximately the same degree. The method of Lewontin and Krakauer (1973) will be used to test the hypothesis that the variance of single locus values is no larger than expected from random sampling error. DNA sequence data will be subjected to additional tests of neutrality, including non-synonymous to synonymous substitution rates and others (reviewed by Ford 2002b).

Measuring gametic disequilibrium. The statistic r^2, the squared correlation of alleles at different gene loci, are computed for each pair of loci in each sample. The overall mean r^2 value is a measure of gametic disequilibrium, or non-random associations across loci.

Estimating N_b. After omitting any loci identified by the test for selection, the mean value (computed as in #1) is used to estimate N_b, the effective number of breeders each year. The procedure follows the "temporal method" for estimating effective population size (Krimbas and Tsakas 1971; Nei and Tajima 1981; Waples 1989), as modified specifically for Pacific salmon (Waples 1990).

Because $\hat{F}$ is known to be distributed approximately as chi-square, confidence limits can be placed on the estimate of N_b. The mean value of r^2 provides an independent method for estimating N_b, based on the method developed by Hill (1981), and confidence limits can also be placed on this estimate.

Frequency/Duration: Annual (5-year cycle)

Spatial Scale: Primary aggregates; Subbasin-wide; Key areas

Monitoring and Evaluation Objective 3b. Determine and compare adult life history characteristics between hatchery and natural fish in the Grande Ronde subbasin

Ho_1: There is no difference in adult age-at-return structure over time between hatchery and natural fish within each supplemented population.

Ha_1: There is a significant difference over time in adult age-at-return structure between hatchery and natural fish within each supplemented population.

Ho_2: There is no difference in adult size-at-age over time between hatchery and natural fish within each supplemented population.

Ha_2: There is a significant difference over time in adult size-at-return between hatchery and natural fish within each supplemented population.

Ho_3: There is no difference in adult spawner sex ratio over time between hatchery and natural fish within each supplemented population.

Ha_3: There is a significant difference over time in adult spawner sex ratio between hatchery and natural fish within each supplemented population.

Ho_4: There is no difference in adult run-timing over time between hatchery and natural fish within each supplemented population.

Ha_4: There is a significant difference over time in adult run-timing between hatchery and natural fish within each supplemented population.

Ho_5: There is no difference in fecundity over time between hatchery and natural fish within each supplemented population.

Ha_5: There is a significant difference over time fecundity between hatchery and natural fish within each supplemented population.

Ho_6: There is no difference in egg size over time between hatchery and natural fish within each supplemented population.

Ha_6: There is a significant difference over time in egg size between hatchery and natural fish within each supplemented population.

Key performance measures:

- age-at-return structure (with out jacks)
- size-at-return
- sex ratios
- fecundity
- adult run-timing

Statistical Tests Applied: A simple t-test is appropriate because we compare two population segments (hatchery origin and natural-origin) directly for each adult life history characteristics over time. Years are replicates.

We determine whether migration timing (frequency distributions) differs between populations using a Kruskal-Wallis one-way analysis of variance on ranked dates of detection, expressed as day of the year, of expanded fish numbers. When significant differences are found, we use

Dunn's pair-wise multiple-comparison procedure ($\alpha = 0.05$) to further analyze the data (SPSS Inc. 1992–1997).

ANOVA analysis can also be used to characterization of trends (population description) over time by considering time (year) as an explanatory variable not as replicates.

We will test at 5% Type I error (i.e. $\alpha = 0.05$), and show p-value of test statistic. If the p-value is less than the level of Type I error, we will reject null hypothesis.

Frequency/Duration: Annually. Monitoring of adult life history characteristics will occur annually for the duration of the program operations. Testing for change will occur in 5-year intervals.

Spatial Scale: Primary Aggregates and other key areas.

Monitoring and Evaluation Objective 3c. Determine and compare smolt migration characteristics between natural and hatchery smolts in the Grande Ronde

Ho_1: There is no difference in juvenile age-at-emigration over time between hatchery and natural fish within each supplemented population.

Ha_1: There is a significant difference over time in juvenile age-at-emigration between hatchery and natural fish within each supplemented population.

Ho_2: There is no difference in size-at-emigration over time between hatchery and natural fish within each supplemented population.

Ha_2: There is a significant difference over time in size-at-emigration between hatchery and natural fish within each supplemented population.

Ho_3: There is no difference in juvenile emigration-timing over time between hatchery and natural fish within each supplemented population.

Ha_3: There is a significant difference over time in juvenile emigration-timing between hatchery and natural fish within each supplemented population.

Key performance measures:

- age-at-emigration
- size-at-emigration
- emigration timing

Statistical Tests Applied: A simple t-test is appropriate because we compare two population segments (hatchery origin and natural-origin) directly for each juvenile life history characteristics over time. Years are replicates.

We determine whether migration timing (frequency distributions) differs between populations using a Kruskal-Wallis one-way analysis of variance on ranked dates of detection, expressed as day of the year, of expanded fish numbers. When significant differences are found, we use Dunn's pair-wise multiple-comparison procedure (α = 0.05) to further analyze the data (SPSS Inc. 1992–1997).

ANOVA analysis can also be used to characterization of trends (population description) over time by considering time (year) as an explanatory variable not as replicates.

We will test at 5% Type I error (i.e. $\alpha = 0.05$), and show p-value of test statistic. If the p-value is less than the level of Type I error, we will reject null hypothesis.

Frequency/Duration: Annual. Monitoring of juvenile life history characteristics will occur annually for the duration of the program operations. Testing for change will occur in 5-year intervals.

Spatial Scale: Primary aggregates; subbasin-wide

MANAGEMENT OBJECTIVE 4: UNDERSTAND THE CURRENT STATUS AND TRENDS OF HABITAT CONDITIONS AS THEY RELATE TO FOCAL SPECIES STATUS IN THE GRANDE RONDE

Monitoring and Evaluation Objective 4a. Determine status and trends of focal species habitat in the Grande Ronde

H_1 - Descriptive: Characterization of physical habitat condition throughout each subbasin and trend over time.

H_2 - Descriptive: Characterization of water temperature profiles for each watershed and key areas within each treatment and reference stream (including in-hatchery temperatures).

H_3 - Descriptive: Characterization of stream flow profiles for each subbasin and key areas within each treatment and reference stream (including stream reaches impacted by hatchery facilities).

Key performance measures: N/A

Statistical Tests Applied: We will implement the Environmental Monitoring and Assessment Program (EMAP) sampling framework, a statistically based and spatially explicit sampling design to quantify status and trends in stream and riparian habitats.

Frequency/Duration: Annually (late June through September).

Spatial Scale: Fifty spatially balanced, randomly selected reaches will be sampled for juvenile salmonids and stream and riparian condition in the Grande Ronde subbasin.

MANAGEMENT OBJECTIVE 5. ASSESS THE EFFECTIVENESS OF RESTORATION ACTIVITIES AND OTHER HUMAN RELATED ACTIVITIES ON FOCAL SPECIES HABITAT CONDITION

Stock status and performance can be evaluated only with respect to the properties of the natural environment in which the population is found. We will characterize abiotic features of stream habitat and its use by focal species. Habitat features influence the distribution and productivity of populations and sometimes serve as limiting factors. The sampling conducted under this objective will help quantifying the type and availability of habitat features that juvenile and adult salmonids use. Temperature, flow, and substrate are environmental variables that are known to influence aquatic organisms. They will be used in analyses of cause-effect relationships. Understanding habitat use and influence will allow co-managers to make recommendations regarding specific habitat protection and restoration measures.

Monitoring and Evaluation Objective 5a. Determine status and trends of habitat in the Imnaha and Grande Ronde subbasins.

Descriptive: Characterization of physical habitat condition throughout each subbasin and trend over time.

Descriptive: Characterization of water temperature profiles for each subbasin and key areas within each treatment and reference stream .

Descriptive: Characterization of stream flow profiles for each subbasin and key areas within each treatment and reference stream (including stream reaches impacted by hatchery facilities).

We will implement the Environmental Monitoring and Assessment Program (EMAP) sampling framework, a statistically based and spatially explicit sampling design to quantify status and trends in stream and riparian habitats. Fifty spatially balanced, randomly selected reaches will be sampled for juvenile salmonids and stream and riparian condition in the Imnaha and Grande Ronde subbasins from late June through September annually.

Sampling domains and site selection: In each subbasin, we will refine the sampling universe for habitat and juvenile surveys based on current distribution maps. The sampling domain will be defined at the upper ends of watersheds by perennial streams and at the lower end by the capability of field crews to snorkel the sample reach. Juvenile salmonids will be inventoried at all sites within the summer rearing distribution of juvenile *O. mykiss* and spring chinook in snorkelable streams below known barriers to upstream migration. Sample sites will be derived from the 1:100k EPA River Reach file. To balance the needs of status (more random sites) and trend (more repeat sites) monitoring, we will implement a rotating panel design in the Columbia Plateau based on recommendations from the EPA EMAP Design Group. The 50 sites drawn on an annual basis for each subbasin will be assigned to the rotating panel design as follows:

- 3 panels with different repeat intervals
- 17 of the sites will be sampled every year
- 16 sites will be allocated to a 4 year rotating panel (sites visited once every 4 years on a staggered basis)
- 17 sites will be new sites each year

With this sampling strategy, 50 sites will be drawn the first year and 33 new sites will be drawn in subsequent years because 17 of the originally drawn sites will be repeated each year. There is nothing "magical" about 50 as precision increases gradually with increase in sample size. For the most part, we want a good estimate of the variance of our target population. Small sample sizes give poor estimates of the variance, and with small samples, random draws can be quite a bit off from the actual population's characteristics (mean, variance, median...). Fifty is a rule of thumb to get a reasonably good picture. Another reasonably good rule of thumb is that doubling precision requires a four-fold increase in sample size. So if you get a particular precision at 50 samples, you'd need 200 samples to double precision. Over the first 3 years of the study, co-managers will evaluate the influence of sample size on meeting/not-meeting/exceeding our target precision levels and make recommendations for adjusting the sample size accordingly. Without the data this survey will provide it is extremely difficult to conduct the appropriate power analysis. Our experience on coastal watersheds has demonstrated that a target sample size of 50 sites will meet out precision targets for habitat and juvenile sampling.

Once annual sample sites are drawn, the site is assigned to the river reach file based on site coordinates. A Geographic Information System (GIS) incorporating a 1:100,000 digital stream network is used to insure an unbiased and spatially balanced selection of sample sites across each subbasin. The GIS site selection process provides the geographic coordinates (i.e. latitude and longitude) of each of the candidate sites. We then produce topographic maps showing the location of each sample point. Field crews use a handheld Geographic Positioning System to find the approximate location of the EMAP selected sample point, and then establish 1 km long survey reaches that encompass the sample point.

Methods

Habitat and Riparian Survey Methodology: Channel habitat and riparian surveys will be conducted as described by Moore et al. (1997) with some modifications. Modifications include: survey lengths of 500-1000 m and measurement of all habitat unit lengths and widths (as opposed to estimation). Survey teams will collect field data based on stream, reach, and channel unit characteristics. Each field crew is comprised of two people with each member responsible for specific tasks. The "Estimator" will focus on the identification of channel unit characteristics. The "Numerator" will focus on the counts and relative distribution of several unit attributes and will verify the length and width estimates for a subset of units. The "Estimator" and "Numerator" share the responsibility for describing reach characteristics, riparian conditions, identifying habitat unit types, and for quantifying the amount of large woody debris.

To quantify within-season habitat variation and differences in estimates between survey crews, ten percent of the sites will be resampled with a separate two-person crew. Repeat surveys will be a randomly selected sub-sample from each subbasin and each survey crew. Variation in survey location was assumed minimal because survey starting and ending points were marked in the field. The precision of individual metrics will be calculated using the mean variance of the resurveyed streams “Noise” and the overall variance encountered in the habitat surveys “Signal”. Three measures of precision are calculated, the standard deviation of the repeat surveys SDrep, the coefficient of variation of the repeat surveys (CVrep), and the signal to noise ratio (S:N). S:N ratios of < 2 can lead to distorted estimates of distributions and limit regression and correlation analysis. S:N ratios > 10 have insignificant error caused by field measurements and short term habitat fluctuations (Kauffman et al. 1999).

Habitat conditions in each subbasin will be described using a series of cumulative distributions of frequency (CDF). The variables described are indicators of habitat structure, sediment supply and quality, riparian forest connectivity and health, and in-stream habitat complexity. The specific attributes include but are not constrained to:

Density of woody debris pieces (> 3 m length, >0.15 m diameter)
Density of woody debris volume (> 3 m length, >0.15 m diameter)
Density of key woody debris pieces (>10 m length, >0.6 m diameter)
Density of wood jams (groupings of more than 4 wood pieces)
Density of deep pools (pools >1 m in depth)
Percent pool area
Density of riparian conifers (>0.5 m DBH) within 30 m of the stream channel
Percent of channel shading (percent of 180 degrees)
Percent of substrate area with fine sediments (<2 mm) in riffle units
Percent of substrate area with gravel (2-64 mm) in riffle units

While these attributes do not describe all of the conditions necessary for high quality salmonid habitat, they do describe important attributes of habitat structure within and adjacent to the stream channel. The attributes are also indicative of streamside and upland processes. The median and first and third quartiles will be used to describe the range and central tendencies of the frequency distributions of the key habitat attributes used in the analysis of current habitat conditions (Zar 1984). Frequency distributions will be tested to determine if significant differences ($p<0.05$) exist between subbasins for each habitat attribute (Thom et al. 2000).

3. Data Information Archive

The ability for all resource managers to access monitoring and evaluation information is paramount in their ability to report recovery success. This depends upon consistent data management standards. The PNAMP data management goal is to: develop or adopt fish and habitat data collection protocols, sampling protocols, and analytical methods, and to ensure that data arising from these protocols can be managed, shared, and used.

To facilitate the PNAMP data management goal, data management systems will follow a consistent methodology that breaks the tasks into distinct steps (from PNAMP 2004):

1. Assessing needs and gathering requirements. Understanding the necessary data products, the people who are involved, and when products are needed.
2. Developing a detailed Data Management Coordination Project Plan following forthcoming guidance from PNAMP. Set out the time frame for deliverables, who will do what and when and cost and cost share.
3. Analyzing the requirements. The requirements need to be described in data management terms.
4. To the degree possible, utilize existing database projects and systems.
5. Designing, developing and testing solutions.
6. Transition and training.
7. Deployment.
8. Maintenance.
9. Independent validation and verification.

Coordination of data management will be most successful if standard RM&E protocols are adhered to by planners. Examples of data definitions (*e.g.,* definitions of KPMs) are provided in Appendix X.

4. Coordination and Implementation

As previously discussed, the mission of the PNAMP is to coordinate between project-specific and regional RM&E efforts to establish the most effective system design and application needed to accomplish objectives at both levels. The Grande Ronde subbasin planning team welcomes this assistance, as well as that provided through the Council in order to establish a meaningful and replicable M&E program.

5. RME Logic Path (Evaluation and Adaptive Management)

The Grande Ronde aquatics RM&E program is predicated upon achieving the desired future condition of the subbasin (Biological Vision Statement – Section 5.1 of this document). The vision statement provides guidance for implementing actions in the future and frames the biological objectives and strategies for the subbasin. Direct ties between the proposed RM&E program and the guiding principles used to implement the vision statement are illustrated in **Error! Reference source not found.**.

Table 64. Ties between the proposed Grande Ronde RM&E program and the guiding principles of the Grande Ronde vision statement (linkage is shown with an 'X').

<table>
<tr><th>RM&E Program</th><th>Process Principles</th><th>Outcome Principles</th></tr>
<tr><td></td><td>Respect, recognize, and honor the legal authority, jurisdiction, treaty-reserved rights, and legal rights of all parties</td><td rowspan="2">Provide ridgetop-to-ridgetop stewardship of natural resources, recognizing all components of the ecosystem, including the human component</td></tr>
<tr><td>X</td><td>Coordinate efforts to implement the Pacific Northwest Electric Power Planning and Conservation Act; the Endangered Species Act; the Clean Water Act; tribal treaties; and other local, state, federal, and tribal programs, obligations, and authorities</td></tr>
<tr><td>X</td><td>Promote and enhance local participation in, and contribution to, natural resource problem solving and subbasinwide conservation efforts</td><td rowspan="2">Provide opportunities for natural resource-based economies to recover in concert with aquatic and terrestrial species</td></tr>
<tr><td>X</td><td>Develop a scientific foundation that incorporates local knowledge for prioritizing projects and for monitoring and evaluation</td></tr>
<tr><td>X</td><td>Promote understanding and appreciation of the need to maintain, protect, enhance, and/or restore a healthy and properly functioning ecosystem</td><td>Maintain, enhance, and/or restore habitats to sustain and recover aquatic and terrestrial species diversity</td></tr>
</table>

The Grande Ronde aquatics RM&E program is also designed to fit within 'top down' regional RM&E efforts, such as those currently being coordinated by the PNAMP and the CSMEP, both of which draw from the federal Action Agencies and NOAA Fisheries in their "Draft Research, Monitoring and Evaluation Plan for the NOAA-Fisheries 2000 Federal

Columbia River Power System Biological Opinion" (The Research, Monitoring and Evaluation Plan, http://www.efw.bpa.gov/cgi-bin/FW/welcome.cgi).

Because of the M&E efforts already underway in the Grande Ronde (e.g., NPT NEOH M&E program and CSMEP), a template for cataloging data, similar to that currently being used in the other federal pilot programs (e.g.,Wenatchee, John Day, and Upper Salmon), is available for application (Appendix 9). The template includes consideration of Tier 1, 2, and 3 variables, which are consistent with the FCRPS BiOp

5.5.2 Terrestrial Research Monitoring and Evaluation

The Grande Ronde Subbasin Terrestrial Team found preparation of the terrestrial assessment very challenging. Initial screening of IBIS and ONHIC data found both to be of questionable accuracy. Consequently the team spent much time analyzing the data for accuracy and validity. There is little if any local species population data for many of the selected focal species so changes in habitat from historic to current were the basis of the assessment. Data gaps and research needs are also addressed for each habitat type in the Synthesis section beginning on page 206.

Suggestions for monitoring and evaluation are:

- Determine population status in the Grande Ronde Subbasin of the American marten, olive-sided flycatcher, white-headed woodpecker, sage sparrow, Columbia spotted frog and yellow warbler. Data on these species is a prerequisite to meaningful discussions on the changes to habitats.
- Inventory and assess condition of aspen and mountain mahogany habitat types. Access USFS data, although these are limited, for baseline information.
- Conduct literature search and/or initiate studies to determine timing and type of use of these habitats by wildlife in the Grande Ronde Subbasin.
- Access USFS data and inventory priority habitats to determine habitat quality with reference to dependent focal species.
- Identify key wildlife habitat corridors/links.
- Identify and protect wildlife habitat corridors/links

Develop higher resolution habitat maps which accurately show location and extent of priority habitats (e.g., stringer wetlands).

6. Appendices

6.1 Appendix 1: References

Achord, S., J.R. Harmaon, D.M. Marsh, B.P. Sandford, K.W. McIntyre, K. L. Thomas, N.N. Paasch, and G.W. Matthews. 1992. Research related to transportation of juvenile salmonids on the Columbia and Snake rivers, 1991. National Marine Fisheries Science, Seattle, Washington.