

Aquatic/riparian¹⁰

Seven key salmonids were selected for detailed analysis. These are bull trout, westslope cutthroat trout, Yellowstone cutthroat trout, and redband trout; steelhead; and ocean-type and stream-type chinook salmon. Less area within the basin is currently occupied by three or more key salmonids (fig. 17) than existed historically (fig. 18). Figure 19 shows the distribution of subwatersheds with by one or more key salmonid species stronghold. Key salmonid strongholds are subbasins that support strong populations based on the consideration of life history forms, trends in population numbers and relative abundance of individuals. Strong populations (fig. 20) are associated with higher-elevation forested lands, and the proportion declines with increasing road densities (fig. 21). The largest areas of contiguous watersheds supporting strong populations of key salmonids are associated with the Central Idaho Mountains, the Snake Headwaters, and the Northern Cascades ERUs. Important but more restricted areas are found in the Blue Mountains, Upper Clark Fork, and the Northern Glaciated Mountains ERUs. Strongholds varied between 32 percent of the occupied range for Yellowstone cutthroat trout and less than 1 percent for stream-type chinook/salmon (table 12).

Many of the aquatic strongholds occur in areas of low road density (the definitions of road density categories are in figure 16). The higher the road density, the lower the proportion of subwatersheds that support strong populations of key salmonids (fig. 21). There is an apparent difference in the response of aquatic systems between FS-administered lands and all other lands at very low road densities. Strongholds within the “all lands” category decline more quickly as road density increases. Strongholds on FS-administered lands remain stable or slightly increase. At higher road densities FS-administered lands provide a greater proportion of strongholds. For the Basin, 56 percent of the unroaded area is in key

salmonid strongholds but the proportion varies from a high of 76 percent in the Snake headwaters to none in the Upper Klamath (table 13).

Designated wilderness and potentially unroaded areas are important anchors for strongholds throughout the Basin. More than 19 million acres (8 million ha) (27%) of FS- and BLM-administered lands in the Basin contain strongholds (40% FS and 4% BLM). These stronghold subwatersheds contain large areas of unroaded land (about 11.6 million acres/4.7 million ha), averaging 58 percent of the area of an individual subwatershed.

The use of intensive forest management to re-establish more natural landscape patterns and disturbance regimes has variable risks and benefits across the landscape. However, the consequences of large fires are dependent on habitat conditions and the inherent resiliency of local populations. Damage to aquatic ecosystems from fire may be most severe when they have been seriously degraded and fragmented. Intensive management of watersheds that support healthy populations may pose greater risk for disruption of watershed processes and degradation of habitats than does fire.

Rehabilitation of depressed populations of anadromous salmonids cannot rely on habitat improvement alone but requires a concerted effort to address causes of mortality in all life stages. These include freshwater spawning and rearing, juvenile migration, ocean survival, and adult migration. Thus, to realize the benefits of improved migration and ocean survival, there must be maintenance of good-quality freshwater habitats and healthy populations as well as increases in the distribution of high-quality spawning and early rearing habitats. Federal land management plays a key role in spawning and rearing habitats.

Analysis of the extensive stream inventory data reveals that major decreases in pool habitat, both frequency of pools and deep pools, have occurred over the last 40 to 60 years. These are attributable to losses in riparian vegetation, road and highway construction, timber harvest, grazing, farming,

¹⁰Details on historical trends and current status of the Basin's aquatic/riparian ecosystem are in the *Component Assessment--Aquatic* chapter (Lee and others 1996).

Figure 17—Current number of key salmonid species present within the Basin.

Figure 18—Historic number of key salmonid species present within the Basin

Figure 19—Number of key salmonid species within strongholds.

Figure 20—The location of aquatic strongholds in relation to areas of very low road densities.

and other disturbances. The losses appear to be greatest in low-gradient, biologically-productive areas. In-stream wood and fine sediment were also found to be influenced by management activities.

The composition, distribution, and status of fish within the Basin are different than they were historically. The overall changes are extensive, and in many cases irreversible. Even with no further habitat loss, the apparent fragmentation and isolation may place remaining populations of key salmonid species at risk. Much of the native ecosystem has been altered, but core areas remain for rebuilding and maintaining functioning native aquatic systems. The system of dams in the Basin has altered water flows in the larger water systems resulting in changes in water temperatures, timing and level of peak flows, barriers to fish migration,

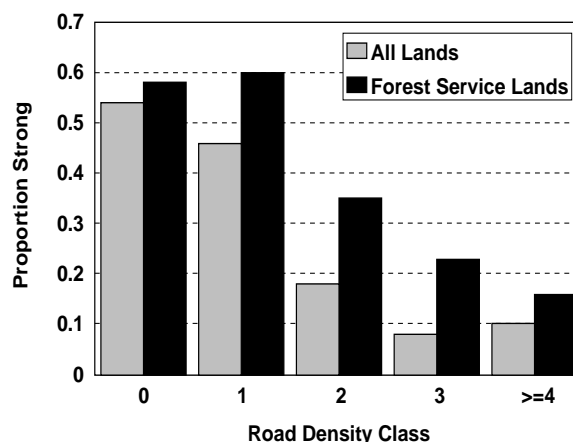


Figure 21—Proportion of subwatersheds supporting strong populations of key salmonids by road density class and land ownership.

Table 12—Historical and occupied range and habitat status for key salmonids within the Basin Assessment area.¹

Species	Historical range occupied	Occupied range classed as strong	Strongholds in wilderness	Strongholds on FS/BLM	Depressed on FS/BLM	Sensitive to FS/BLM uses
----- percent -----						
Bulltrout	45	13	55	95	82	yes
Westslope cutthroat	85	25	44	94	65	yes
Yellowstone cutthroat	66	35	19	70	46	yes
Redband	69	22	8	56	58	yes
Steelhead	46	1	9	70	61	yes
Stream-type chinook	28	<1	50	88	77	yes
Ocean-type chinook	30	15	0	20	25	minor influence

¹For detailed explanation see Lee and others (1996).

Table 13—Percent of predicted unroaded (<0.1km/km²) area in subwatersheds (~8,000 ha in size) with key salmonid species strongholds.

Ecological reporting unit	Unroaded area in strongholds
	-----percent-----
Northern Cascades	45
Southern Cascades	13
Upper Klamath	0
Northern Great Basin	21
Columbia Plateau	30
Blue Mountains	45
Northern Glac. Mtns	54
Lower Clark Fork	33
Upper Clark Fork	49
Owyhee Uplands	42
Upper Snake	2
Snake Headwaters	76
Central Idaho Mtns	72
Basin Average	56

reductions in riparian areas, and changes in other physical attributes. Consequently, the aquatic ecosystem no longer supports the same species of fish, macroinvertebrates, and aquatic plants.

A variety of species such as kokanee salmon, chinook salmon, lake trout, brown trout, Atlantic salmon, coho salmon, black bass and other centrachids, and ictalurids were introduced in these systems to diversify angling opportunities, create trophy fisheries, and to provide forage for potential trophy species. Many ephemeral lakes in the Great Basin have been stocked with crappie, bass, bullheads, and other centrarchids and ictalurids. Cultured strains of rainbow trout have been widely used to sustain put-and-take fisheries in lakes and rivers where angler harvest or habitat degradation were too excessive to rely on natural reproduction. These introductions have provided

increased fishing opportunities and socioeconomic benefits.

Terrestrial⁷

Over 43,000 species of macroorganisms are estimated to occur in the assessment area and 17,186 species are known to occur (table 9). Microorganisms, critical to ecosystem health and function, probably tally at least several hundred thousand species. This biodiversity results from the wide variety of habitats, topographic conditions, and prehistoric events in the Basin. The terrestrial ecology staff evaluated 14,028 species of

⁷Detailed information on historical trends and current status of terrestrial ecosystems is in the *Component Assessment*-Terrestrial chapter (Marcot and others 1996).

macroorganisms and explicitly included 1,339 individual species and 143 species groups in a database on species-environment relations. There were 296 species (excluding fish) of particular interest to American Indian tribes identified.⁸ In terms of current status, the assessment produced: lists of habitats and associated species with greatest declines in area or distribution since historic times, and species-environment relations (SER) databases listing species by habitats and ecological functions, for use in determining potential effects of ecosystem management activities and crafting the activities to emphasize or restore specific habitats or functions. It also contains or cites 538 Geographic Information Systems (GIS) maps of species distribution and maps of biodiversity hot spots; and descriptions of key ecological roles of fungi, lichens, bryophytes, and invertebrates for maintaining ecosystem health and long-term productivity and sustainable use of resources.

Overall, there is a limited scientific understanding of the current status of most individual species and their specific ecology within the Basin. Numerous species may play key ecological functions in maintaining ecosystem diversity, productivity, and sustainability. At present, there are many species of plants (including fungi and lichens) and animals (including invertebrates and vertebrates) that might be in jeopardy of population declines or local extirpation because of changes in their native habitats and environments. Federally designated threatened, endangered, and candidate species of all taxonomic groups occur in the Basin.

Some 264 taxa (species, subspecies, or fish stocks) have federal listing status. Among non-fish taxa, these include 184 category 2 candidate, 31 category 1 candidate, 11 endangered, and 6 threatened taxa,

⁸Personal communication. 1996. Ralph Perkins, U.S. Forest Service, Interior Columbia Basin Ecosystem Management Project. On file with: U.S. Department of Agriculture, Forest Service, U.S. Department of Interior, Bureau of Land Management, Interior Columbia Basin Ecosystem Management Project, 112 E. Poplar, Walla Walla, WA 99362.

and 1 Federally proposed as endangered taxon. The FS and BLM list 538 species (excluding fish) as sensitive; some of the threatened and endangered species and many of the additional species of potential conservation concern are dependent on environmental or habitat components that were not evaluated at the broad scale. Table 10 indicates threatened and endangered species tallies; it does not project species viability or extinctions. By comparison, there are an estimated 43,684 species in the Basin: 18,946 plants and allies; 24,270 invertebrates; and 468 vertebrates (tally includes only macroorganisms; bacteria, protozoa, rotifers, nematodes, microfungi and fish are excluded) (*Component Assessment--Terrestrial*).

We mapped the locations of relatively high levels of both plant and animal biodiversity or species rarity and endemism (fig. 22). These centers of biodiversity were locations that either had unusually high numbers of species rarity and endemism, or were locations with unusually high numbers of species of all abundance classes. Locations with three or more centers of concentration of the two types mentioned defined smaller "hot spots" for plants and animals combined (fig. 23). We identified 12 hot spots of species rarity and endemism and seven hot spots of high biodiversity. Additional hot spots are likely to occur in Southern Idaho and could also be identified at finer levels of geographic resolution than were used in the *Component Assessment*. Hot spots included areas in southwestern Oregon, the Snake River, the Columbia River Gorge, and in the desert steppes of central and southern Washington. Natural areas on Federal lands total approximately 29 million acres (11.72 million ha) in 26 land allocation categories.

To determine how well natural areas might support vertebrates in the Basin, we compared the distribution of sizes of existing natural areas to the home range sizes of vertebrate species. Existing natural areas might be suitable for supporting small populations of at least 70 percent of vertebrate species. No estimates were made concerning

The Component Assessment—Terrestrial chapter reports on analyses conducted through October 1995. Since that time, USDI Fish and Wildlife Service has published a change in their species status program, (Federal Register, February 28, 1996) essentially replacing the three candidate species categories with a single category of candidates for listing with a one-year review period of this program change (U.S. Government 1996). In this change, most of the species that were classified as Category 2 or 3, and 303 taxa that were Category 1 candidates, are no longer included in the list of candidate species. A number of plant and animal species addressed in this assessment were denoted as Candidate Category 1 or 2 when the data were gathered. Of those 131 Category 1 or 2 plants, four became Candidates in the Federal Register notice: *Castilleja christii*, *Erigeron basalticus*, *Sidalcea oregana* var. *Calva*, and *Thelypodium howellii* spp. *Spectabilis*. Of those 34 Category 2 animals (none had been designated Category 1 in the assessment area), only mountain plover (*Charadrius montanus*) and spotted frog (*Rana luteiventris*) were still designed as Candidates. All other plants and animals were dropped from the list of Candidates. The assessment retains the listings for two reasons: (1) their analyses and data collection preceded the ruling change; and, (2) their charge was to address species' ecologies and conservation status, and the C2 status in particular still helps to denote species of potential conservation concern deserving attention.

suitability of natural areas to support other types of animal, plant, and other life.

We also identified a number of taxa worthy of additional attention. These include 394 fungal species; 40 functional groups of lichen species; at least 400 apparently rare bryophyte species; 280 vascular plant species and 82 rare plant communities; 144 rare and endemic invertebrates (gastropods and insects); and additionally, various vertebrates and microbiotic crusts. Among the vertebrates are the aquatic-dwelling amphibians, reptiles susceptible to ground-disturbing management activities, and birds and mammals associated with habitats that are now scarce, declining, or increasingly fragmented including native grasslands, sagebrush, and old low- and mid-elevation forests.

Economics¹³

Overall, the economies of the four states making up the bulk of the Basin (Idaho, Montana, Oregon, and Washington) are doing well. In 1990

¹³Detailed information on historic trends and current economic status of the Basin is in the *Component Assessment-Economics* chapter.

their economies comprised 3.6 percent of the U.S. economy with the economy of Washington being larger than the sum of the other three (U.S. Department of Commerce 1993). Of the four states, Washington is the only one with higher per capita income than the U.S. average, but in all four states, per capita income is growing faster than the U.S. rate (table 14). Similarly, earnings per job is increasing in Montana, Oregon, and Washington faster than in the United States; only Idaho has a smaller percentage change. Except in Montana the poverty rate is lower

than the U.S. average. Unemployment rates in Idaho and Montana are lower than the U.S. average and decreasing at a faster rate. In Oregon and Washington the reverse is true: unemployment rates are higher than the national average and falling at a slower rate.

In the Basin, the six metropolitan counties (see fig. 24) have been the center of economic growth, with higher rates of growth in total employment, total personal income, non-farm labor income, and a greater ability to weather national recessions than other counties. They tend to have lower per capita incomes than their counterparts throughout the United States; this gap has been widening since 1980. Some economists believe this indicates that amenities are attracting surplus labor, as has been found elsewhere (Power 1996, Treyz 1993); alternatively, these smaller metropolitan areas may lack the highest paying jobs. Earnings per job in metropolitan areas of Idaho (primarily Boise) are increasing at a faster rate than the national average. Poverty rates in Washington's metropolitan counties are increasing at a faster rate than the national rate, though the levels are still lower than the national average.

Table 14— Current economic indicators for the United States, Idaho, Montana, Oregon, and Washington; totals, metropolitan and non-metropolitan counties, current and percent change since previous year or decade.

Category	United States		Idaho		Montana		Oregon		Washington	
	Data	Percent change	Data	Percent change	Data	Percent change	Data	Percent change	Data	Percent change
Total:										
Per capita income ¹	\$20,105	4.9	\$17,512	5.0	\$17,376	6.2	\$18,605	5.0	\$21,289	6.0
Earnings per job	\$26,531	5.6	\$23,216	5.4	\$20,700	7.5	\$23,916	5.7	\$26,910	7.3
Poverty rate ²	13.8%	11.3	13.3%	5.1	16.1%	30.8	12.4%	16.6	10.9%	11.0
Unemployment rate ³	6.8%	-8.1	5.6%	-9.7	5.0%	-18.0	7.2%	-2.7	7.5%	1.4
Metro Counties:										
Per capita income	\$21,247	4.7	\$20,114	5.3	\$19,154	4.7	\$19,619	5.0	\$22,084	6.0
Earnings per job	\$27,944	5.7	\$25,379	6.1	\$22,561	5.8	\$25,113	5.7	\$27,844	7.4
Poverty rate	12.1%	6.1	10.7%	5.1	12.7%	30.8	11.3%	16.6	10.0%	11.0
Unemployment rate	6.7%	-6.9	4.3%	-10.4	4.3%	-18.9	6.5%	-4.4	7.0%	0.0
Non-Metro Counties:										
Per capita income	\$15,682	6.2	\$16,377	4.7	\$16,817	6.8	\$16,236	5.1	\$17,400	5.7
Earnings per job	\$20,085	5.5	\$22,087	4.9	\$20,058	8.3	\$20,690	5.7	\$21,431	6.6
Poverty rate	17.1%	8.2	14.3%	5.1	17.1%	30.8	15.0%	16.6	15.6%	11.0
Unemployment rate	7.4%	-7.5	6.2%	-10.1	5.3%	-15.9	8.9%	-1.1	10.3%	3.0

Source: USDA Economic Research Service, August 1, 1995 AUTOFAX State Fact Sheets.

¹ Income and earnings figures are 1992 with change 1991-92, for U.S., Oregon, Washington; Idaho and Montana are 1993 figures with change 1992-93.

² Poverty rates for all are 1990 data, with change 1980-90.

³ Unemployment figures are 1993, with change 1992-93, for U.S., Oregon, Washington; Idaho and Montana are 1994 figures, with change 1993-94.

Figure 22—Location of centers of endemism and rarity and of centers of biodiversity (for plants and animals).

Figure 23—Location of hotspots for rarity/endemism and biodiversity.

Figure 24—Recreation opportunities and metropolitan areas account for higher rates of population growth by county.

Table 15—Employment in economic sectors of United States, the Basin, and Bureau of Economic Analysis (BEA) regions for 1995; asterisks indicate values above the national average.

Industry	Nation	Basin							Idaho				Redmond-	
		average	Tri-Cities	Spokane	Missoula	Falls	Twin Falls	Boise	Pendleton	Bend ¹	Butte			
Agriculture services	1.1	2.6*	4.4*	1.1	1.9*	2.7*	4.7*	2.5*	2.6*	2.1*	0.9			
Mining	0.7	0.5	0.2	0.6	0.6	0.8*	0.3	0.4	0.0	0.0	1.5*			
Construction	5.2	4.7	4.2	4.6	5.4*	5.4*	5.4*	5.1	3.5	4.6	3.5			
Manufacturing	14.1	11.7	11.3	11.2	11.5	9.6	11.7	12.6	15.0*	16.0*	4.4			
SIC 24 ²	0.6	2.5*	1.0*	2.8*	5.0*	0.5	0.5	2.3*	2.7*	5.5*	2.4*			
Transportation	4.8	4.3	3.3	4.3	5.7*	3.7	4.7	4.9*	4.5	3.8	6.0*			
Trade	21.5	21.1	21.1	22.1*	21.4	21.9*	21.1	20.4	19.0	20.7	20.3			
FIRE ³	7.5	6.0	4.6	6.7	6.2	5.5	5.6	7.7*	4.5	5.5	6.8			
Services	28.4	25.0	23.2	26.8	27.4	27.2	21.4	24.2	20.9	23.7	31.7*			
Government (all)	14.6	16.4*	14.6	18.8*	15.0*	15.8*	11.0	16.3*	17.8*	15.1*	23.1*			
State & local	10.4	12.2*	11.9	14.0	10.5	11.8	9.0	10.3	13.4	11.1	18.5*			
Federal	4.1	4.2*	2.7	4.7*	4.5*	4.0	2.0	6.0*	4.4*	4.1	4.6*			
Farm employment	2.2	7.8*	13.0*	3.9*	4.9*	7.3*	14.2*	6.0*	12.2*	8.5*	1.8			

Note: Farm employment is calculated as the difference between total employment and covered employment. Because it is calculated as a difference it includes rounding errors.

¹Redmond-Bend is the portion of the Portland-Salem BEA region that is in the Basin.

²Timber and wood products.

³Financial, insurance, and real estate industries.

The non-metropolitan counties in the Basin have even better economic indicators than metropolitan counties. Per capita income is higher than the national average in all four states, although, except for Montana, growth rate is lower than the national average. Earnings per job in non-metropolitan counties are higher than the national average in the three Basin states, excluding Montana.

The Basin's economy is small relative to the United States, accounting for only one percent of U.S. employment in 1995. The economic strengths of the Basin were characterized by identifying those economic activities within it that have a higher percentage of employment than the benchmark economy of the United States. Data for the percentage of employment in various economic sectors and areas (see table 15) suggest that the traditional notion that manufacturing is the driving sector of the Northwest economy, is too narrow (for example see Beuter 1995). The economic strengths of the Basin include agriculture and agricultural services. Mining and manufacturing, are less important to economies in the Basin than for the nation. Basin-wide, including both public and private lands, timber and wood products account for 2.5 percent of the jobs, cattle grazing accounts for 1.0 percent of the jobs, and mining accounts for 0.5 percent of the jobs. The percentage of jobs attributable to recreation is not shown here because the Bureau of Economic Analysis (BEA) does not define it as an industry. In the discussion of recreation below, we calculate that 14.6 percent of jobs in the Basin are attributable to recreation.

A more complex story emerges by looking at individual economic areas (called BEA regions; fig. 25) within the Basin. Agriculture is an economic strength in every region except the Butte BEA region. Mining in the Butte BEA region is double that of the national average, and it is important in the Idaho Falls BEA region as well. Manufacturing is a strong activity only in the Pendleton and Redmond-Bend BEA regions, and forest products and food

processing are important components of both. The importance of trade in each BEA region (except the Pendleton region) mirrors the United States. The same can be said about the service sector except there is more variability around the Basin. In the Boise BEA region, finance, insurance, and real estate are important activities. In several BEA regions construction and transportation are strong parts of the economy. The percentage of jobs supported by recreation is highest in the Idaho Falls (30%), Missoula (31%) and Redmond-Bend (25%) BEA regions.

The past two decades have seen rapid population growth, and the evolution of what was a mature, resource-based, economy into a diverse economy oriented toward technology-based, transportation, and service sectors, with manufacturing, agriculture, and government sectors expected to decline over the next 50 years. Changes in current FS and BLM activities have little effect on the economy of the Basin. FS and BLM activities may have greater affect in specific communities, however. This study found there are 29 out of 539 census-recognized places that may be sensitive to levels of public timber harvest¹⁴ (fig. 26).

People hold both existence values and use values for ecosystem goods, functions, and conditions. Of the value provided society by the FS- and BLM-administered lands in the Basin now and by 2045, the existence of unroaded areas provides 47 and 41 percent; recreation provides 41 and 53 percent; timber provides 11 and 5 percent; and range provides less than 1 percent at both times. Market basket values per acre of FS- and BLM-administrated lands in the Basin are shown by ERU in figure 27. This market basket is only a subset of the measurable values of FS- and BLM-administered ecosystem goods, functions, and conditions: existence value of unroaded areas, recreation, timber, and range. This is the subset of ecosystem values (goods, function, and conditions)

¹⁴The *Component Assessment*-Economic chapter defined isolated timber-dependent communities as those communities located more than 50 miles from another incorporated area with more than 10,000 people, and not located in either recreation or metropolitan counties.