Middle Snake Subbasins Assessment

May 2004

by
Ecovista
and
Idaho Department of Fish and Game

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1 Introduction

The *Middle Snake Subbasins Assessment* (see

Figure 1 for location map of subbasins) is the first of three volumes of the *Middle Snake Subbasins Plan*. The *Middle Snake Subbasins Plan* was produced as part of the Northwest Power and Conservation Council's (NPCC) Columbia River Basin Fish and Wildlife Program. Subbasin plans are intended to direct Bonneville Power Administration's (BPA) funding of projects that mitigate for damage to fish and wildlife caused by the development and operations of the Columbia River's hydropower system. The *Middle Snake Subbasins Plan* was developed in an open public process that included the participation of a wide range of state, federal, local, and tribal governments local managers; landowners and other stakeholders—a process that the NPCC hoped would ensure support of the final plan and provide a means to better direct funding to fish and wildlife projects that will do the most good.

An adopted subbasin plan is intended to be a living document that increases analytical, predictive, and prescriptive ability to restore fish and wildlife. This *Middle Snake Subbasins Plan* will be updated every three to five years to include new information that will guide revision of the biological objectives, strategies, and the implementation plan. The NPCC views plan development as an ongoing process of evaluation and refinement of the region's efforts through adaptive management, research, and evaluation. More information about subbasin planning can be found at http://www.nwcouncil.org.

The Middle Snake subbasins were originally two of 62 subbasins in the region. Discrepancies between maps, textual descriptions, and work plans for the subbasins on the NPCC's website (NPCC 2003) resulted in confusion and eventually changes in the boundaries of the subbasins. The boundaries used here—from Shoshone Falls to Hells Canyon Dam, including the Wood River drainage—are consistent with those used in the subbasin summaries. They also provide for ecological continuity to the historic upstream distribution (Shoshone Falls) of anadromous fish stocks. The tributaries to the Lower Middle Snake subbasin on the Oregon side from Succor Creek to Hells Canyon Dam are not covered in this plan. The decision was made early in the process to cover these tributaries in the *Burnt, Powder, Brownlee Subbasin Plan* and no further efforts occurred to incorporate these areas into Middle Snake subbasins planning process.(L. Youngbar, NPCC, personal communication, January 9, 2004).

The *Middle Snake Subbasins Plan* includes three interrelated volumes that describe the characteristics, management, and vision for the future of the Middle Snake subbasins: the assessment, inventory and plan.

Assessment (Volume 1)—The assessment analyzes the biological potential of the Middle Snake subbasins to support key habitats and species and the factors limiting this potential. These potential limiting factors provide opportunity for restoration. The assessment describes existing and historic resources and conditions within the subbasins, focal species and their habitats, environmental conditions, impacts outside the subbasins, ecological relationships, potential limiting factors, and a final synthesis and interpretation.

Inventory (Volume 2)—The inventory summarizes fish and wildlife protection, restoration, and artificial production activities and programs within the Middle Snake subbasins that have occurred over the last five years or are about to be implemented. The information includes programs and projects, as well as locally developed regulations and ordinances that provide fish, wildlife, and habitat protections.

Management Plan (Volume 3)—The management plan defines a vision for the future of the subbasin, including biological goals and strategies for the next 10 to 15 years. The management plan includes a research, monitoring, and evaluation plan to ensure that implemented strategies succeed in addressing potential limiting factors and to reduce uncertainties and data gaps. This management plan also includes information about the relationship between proposed activities and the Endangered Species Act (ESA) and Clean Water Act (CWA).

The completed plan was submitted to the NPCC by the Shoshone-Paiute Tribes on May 28, 2004. The following sections detail the entities contractually involved in developing the subbasin plan for the Middle Snake subbasins and describe the planning process.

1.1 Contract Entities and Planning Participants

Multiple agencies and entities are involved in managing and protecting fish and wildlife populations and their habitats in the Middle Snake subbasins. Federal, state, and local regulations, plans, policies, initiatives, and guidelines are part of this effort and share co-management authority over the fisheries resource. Federal involvement in this arena stems from ESA responsibilities and management responsibilities for federal lands. Numerous federal, state, and local land managers are responsible for multipurpose land- and water-use management, including protecting and restoring fish and wildlife habitat. The contract entities and plan participants involved in development of the *Middle Snake Subbasins Plan* are outlined below.

1.1.1 Shoshone-Paiute Tribes of Duck Valley Indian Reservation

The Shoshone-Paiute Tribes (SPT) served as lead entity for subbasin planning for the Middle Snake subbasins. The tribes contracted with the NPCC to deliver the *Middle Snake Subbasins Plan*. They provided an opportunity for participation in the process by fish and wildlife managers, local interests, and other key stakeholders, including tribal and local governments.

The Shoshone-Paiute Tribes are responsible for managing, protecting, and enhancing fish and wildlife resources and habitats on the Duck Valley Indian Reservation (which encompasses portions of the Owyhee and Bruneau subbasins) as well as surrounding areas in the Lower Middle Snake Province where the tribes held aboriginal title. They are a self-governance tribe, as prescribed under Public Law 103-414. A seven-member Tribal Business Council is charged with making decisions on behalf of 1,818 tribal members.

The Wildlife and Parks Department, with direction from the Tribal Business Council, is responsible for fish and wildlife species monitoring and management, recovery efforts, mitigation, research, management of the tribal fisheries, and enforcement of fishing and hunting regulations. The department implements fish and wildlife restoration and mitigation activities toward the goal of restoring properly functioning ecosystems and species assemblages for present and future generations to enjoy.

1.1.2 Northwest Power Conservation Council

The NPCC has the responsibility to develop and periodically revise the Fish and Wildlife Program for the Columbia Basin. In the 2000 revision, the NPCC proposed that 62 locally developed subbasin plans, as well as plans for the mainstem Columbia and Snake rivers, be adopted into its Fish and Wildlife Program. The NPCC will administer subbasin planning contracts pursuant to requirements in its master contract with the BPA (NPCC 2000). The NPCC will be responsible for reviewing and adopting each subbasin plan, ensuring that it is consistent with the vision, biological objectives, and strategies adopted at the Columbia Basin and province levels.

1.1.3 Bonneville Power Administration

The BPA is a federal agency established to market power produced by the federal dams in the Columbia River basin. As a result of the Northwest Power Act of 1980, BPA is required to allocate a portion of power revenues to mitigate the damages caused to fish and wildlife populations and habitat from federal hydropower construction and operation. These funds are provided and administered through the Lower Snake River Compensation Plan (LSRCP).

1.1.4 Project Team

In addition to its own staff, the Shoshone-Paiute Tribes hired two contractors to help with the planning process and help write plan documents: Ecovista to work on the assessment, inventory, and plan and the Idaho Council on Industry and the Environment (ICIE) to organize and carry out the public involvement and public relations tasks for the Middle Snake subbasins. Under a separate contract, the Idaho Department of Fish and Game (IDFG) helped develop the assessment and inventory for the subbasins. Staff from these contractors served on the Project Team (see section 1.1.4 of the management plan for additional information on Project Team members.)

1.1.5 Planning Team

The Planning Team for the Middle Snake subbasins included representatives from government agencies with jurisdictional authority in the subbasin, the Shoshone-Paiute Tribes, fish and wildlife managers, county and industry representatives, and private landowners. The Planning guided the public involvement process, developed the vision statement, reviewed the biological objectives, and participate in prioritizing subbasin strategies. Regular communication and input among team members occurred throughout the planning process. The Planning Team met monthly although not all members were able to participate consistently. For additional information about the Planning Team see section 1.1.5 of the management plan.

1.1.6 Technical Teams

The Aquatic and Terrestrial Technical Teams for the Middle Snake subbasins included scientific experts who participated in developing the subbasin assessment, inventory and plan. The Technical Teams guided and participated in developing the assessment, and the biological objectives, strategies, research, monitoring, and evaluation sections of the management plan. The Technical Teams met monthly throughout the process, participated in workshops that were one or more days long, and focused on inputting professional judgment to fill data gaps. Not all members were able to participate consistently. See section 1.1.6 for additional information on the technical teams.

1.2 Public Outreach and Government Involvement

As the *Middle Snake Subbasins Plan* was developed, four methods of outreach and public and governmental participation were used in the Middle Snake subbasins: Technical Team meetings, Planning Team meetings, public meetings, and a website.

1.2.1 Technical Team Participation

The Technical Teams were composed of members with technical expertise in fish, wildlife, and habitat resources in the Middle Snake subbasins. The meetings were held mornings of the third Wednesday of every month in Boise at the IDFG state office and were open to the public. Meeting agendas and minutes were posted on the Ecovista website (2003) and provided at public meetings. The Technical Teams reviewed and gave input on the technical aspects of the subbasin plan; this input is documented in the subbasin assessment.

1.2.2 Planning Team Participation

The Planning Team was composed of members that have expertise and knowledge of the management of natural resources and socioeconomic issues in the Middle Snake subbasins. The meetings were held afternoons of the third Wednesday of every month in Boise at the IDFG state office and were open to the public. Meeting agendas and minutes were posted on the Ecovista website (2003) and provided at public meetings. The Planning Team reviewed and gave input on the subbasin plan; this input is in large part documented in the subbasin management plan.

1.2.3 Public Meeting Outreach

Three public meetings were held to introduce the subbasin planning process to local people and resource managers and provide an opportunity for input. Pat Barclay of the ICIE coordinated public meeting announcements and logistics for the Middle Snake subbasins. Public meeting outreach is summarized in Appendix A of the management plan.

1.2.4 Ecovista Website Information

As the *Middle Snake Subbasins Plan* was developed, draft documents and information on meetings, the subbasin, and subbasin planning were posted on Ecovista's website (2003) at www.ecovista.ws.

1.3 Review Process

The *Middle Snake Subbasins Assessment, Inventory* and *Management Plan* were available for review through e-mail notification lists compiled by the Project Team and during Technical and Planning Team meetings. The drafts were posted on the Ecovista website starting in December of 2003 and updated drafts were posted regularly throughout the process. For more information about the review process see section 1.3 of the management plan.

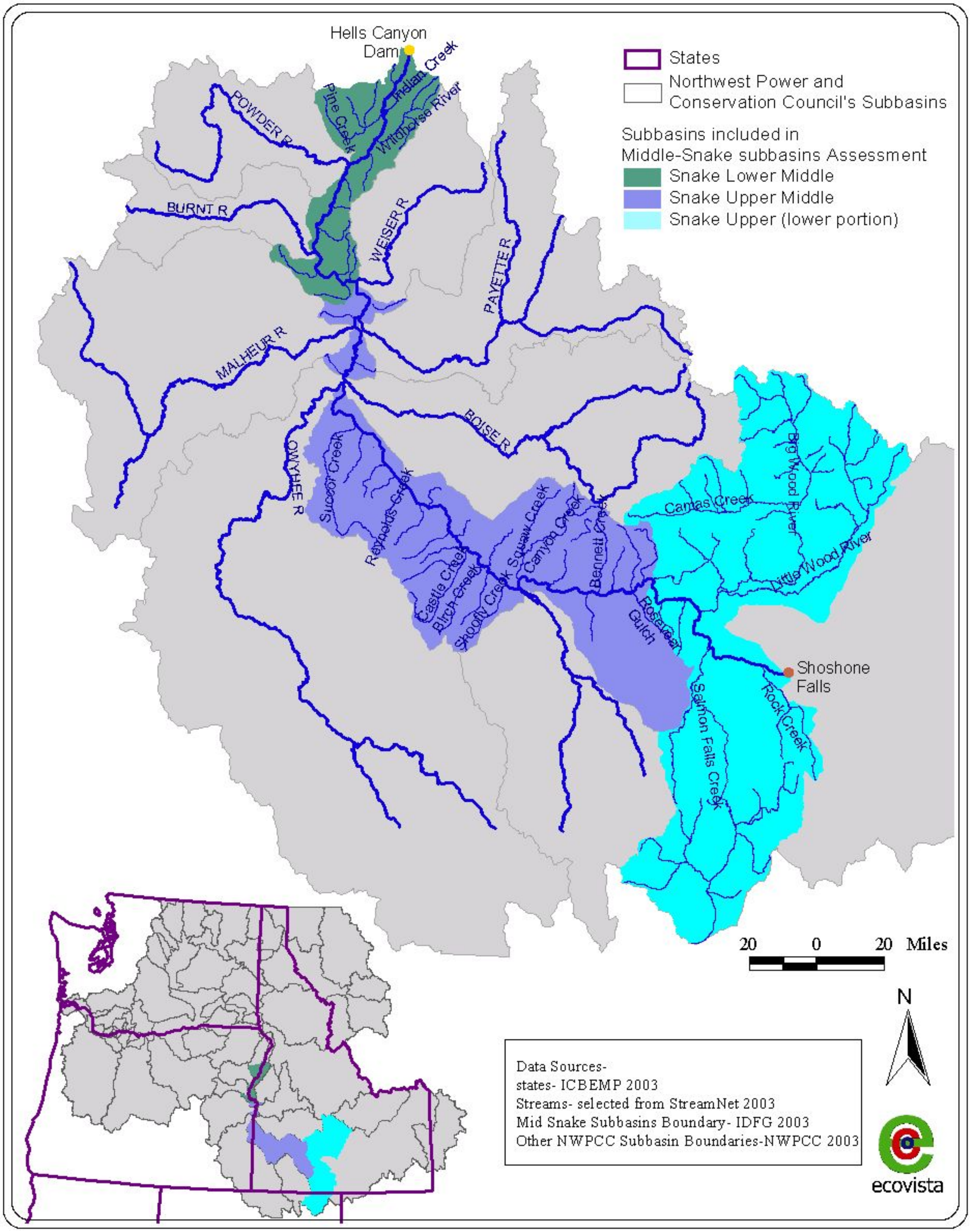


Figure 1. The Middle Snake subbasins within the Columbia River basin.

2 Subbasin Description

2.1 Subbasin Location and Size

The Middle Snake subbasins encompass the Snake River, and the lands that drain into it, from Shoshone Falls to Hells Canyon Dam. Separate subbasin assessments and plans will be completed for the major tributaries (Malheur, Owyhee, Boise, Payette, Weiser, Powder, Burnt, and Bruneau rivers) to the lower portion of the Middle Snake subbasins. The Middle Snake subbasins cover approximately 8.3 million acres and include 367 miles of the mainstem Snake River and numerous small tributaries. The subbasins encompass nine 4th field hydrologic unit code (HUCs) watersheds: Brownlee Reservoir, Middle Snake–Payette rivers, Middle Snake River–Succor Creek, C.J. Strike Reservoir, Camas Creek, Big Wood River, Little Wood River, Salmon Falls Creek, and Upper Middle Snake River–Rock Creek (Figure 2). These 4th order HUCs were used in some sections of this assessment to stratify the subbasins. In addition, this assessment refers to the Big Wood Drainage (the Big Wood River, Little Wood River, and Camas Creek 4th field HUCs) and the Owyhee Face Drainage (area of the middle Snake River–Succor Creek south of the Snake River) (Figure 2).

The majority of the Middle Snake subbasins are located in southern Idaho (82%), with small areas in eastern Oregon and northeastern Nevada (

Figure 1). The downstream half of the Snake River in the subbasins forms the border of Oregon and Idaho. The subbasins encompass portions of Ada, Adams, Blaine, Camas, Cassia, Canyon, Elmore, Gooding, Jerome, Lincoln, Owyhee, Payette, Twin Falls, and Washington counties in Idaho; Baker, Malheur, and Wallowa counties in Oregon; and Elko County in Nevada (

Figure 3). Major cities and towns within the subbasins include Glenns Ferry, Hailey, Homedale, Mountain Home, Payette, Sun Valley, Twin Falls, and Weiser in Idaho and Ontario in Oregon.

2.2 Climate

The Middle Snake subbasins encompass a broad climatic gradient, from a prevalent Pacific maritime-influenced climatic regime in mountainous regions of the subbasin to a Continental regime in lower-elevation valleys and plains. The subbasins generally have a semiarid climate, with limited areas of moderate to high precipitation in the northernmost portions of the subbasin. Summers in the canyons tend to be hot (mean temperatures of 80 to 90 °F, with maximums often > l00 °F), and winters mild (mean temperatures > 30 °F). At mid elevations and on the upper plateau, temperatures are cooler, with winters moderately severe and summers warm (Hurley et al. 2002, Saul et al. 2002).

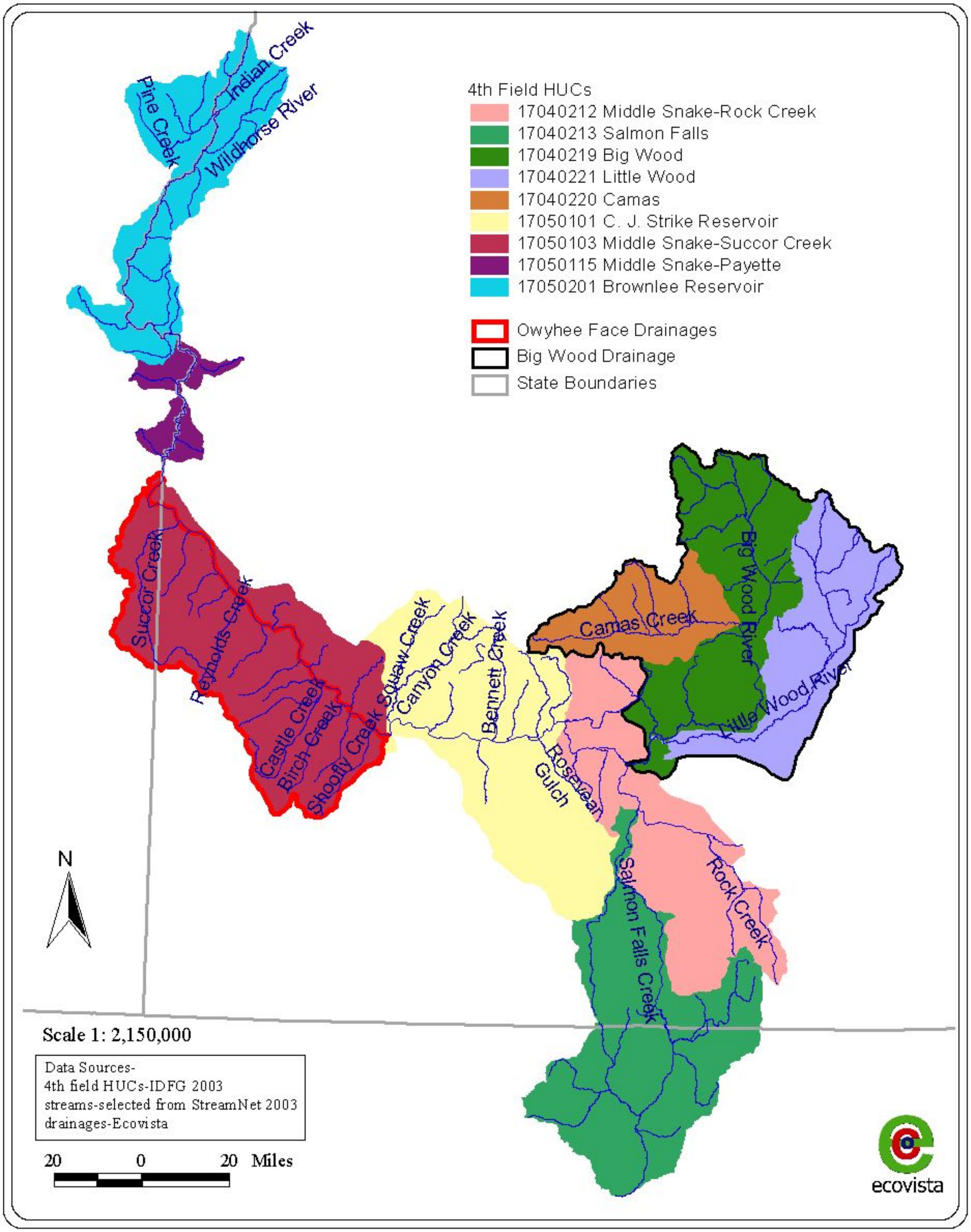


Figure 2. The 4th field HUCs and drainage areas of the Middle Snake subbasins.

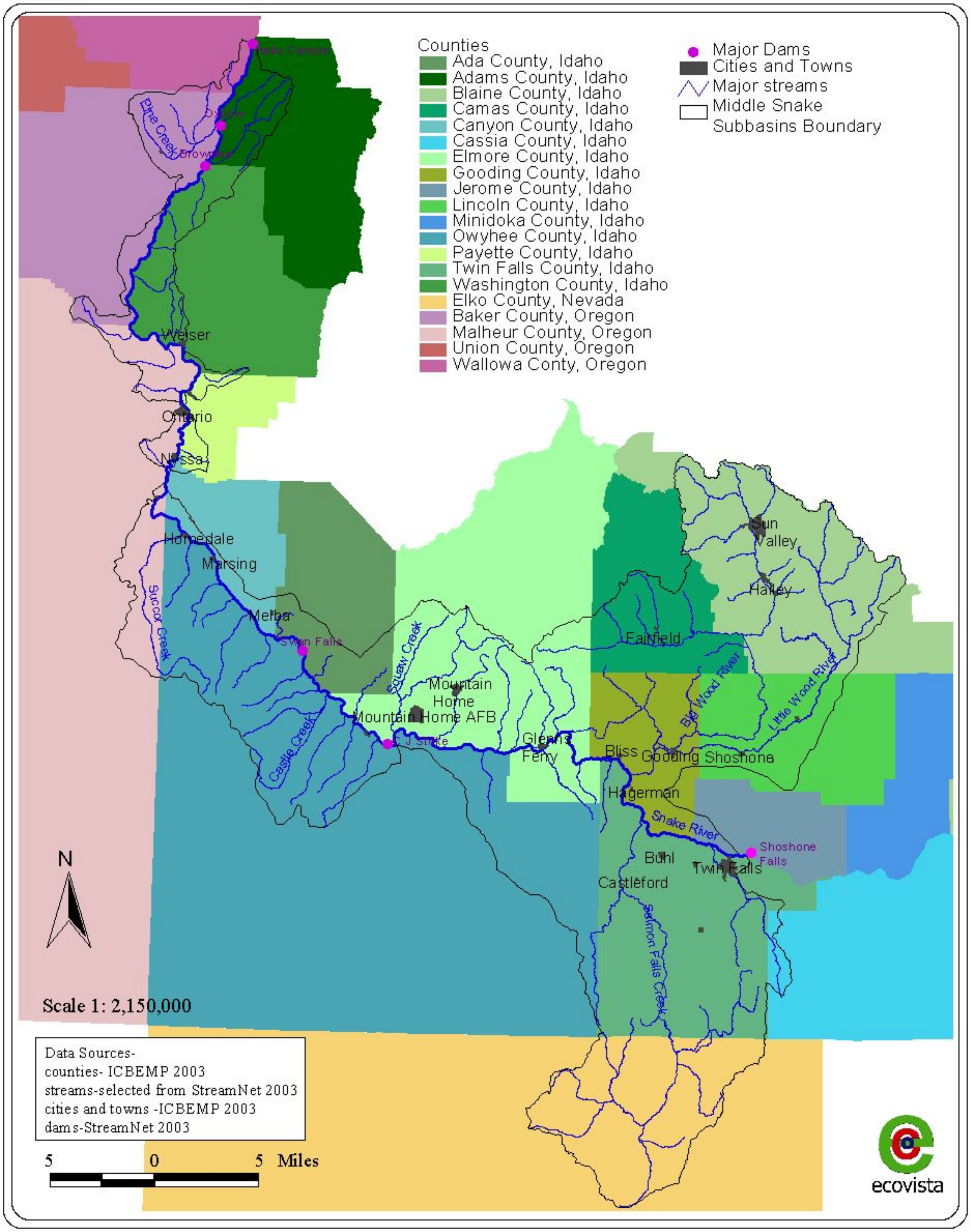


Figure 3. Counties, dams, and cities in the Middle Snake subbasins.

Annual precipitation follows similar patterns across the subbasin, although the amount of precipitation increases downstream (Figure 4). Precipitation comes in the form of short, intense summer storms and longer, milder winter storms (IDEQ and ODEQ 2003). Precipitation is strongly seasonal, with the majority falling as snow in winter. The average annual precipitation in the subbasins is 15 inches. The area surrounding the Snake River from Shoshone Falls downstream to the confluence of the Boise River receives an average annual precipitation of 7 to10 inches. Annual precipitation along the Snake River increases below the Boise River and is strongly influenced by elevation. The areas of highest precipitation (average annual precipitation of 45 to 71 inches) in the subbasins occur in the headwaters of Pine Creek in the Wallowa Mountains, Stevens and Bear Creeks in the Seven Devils, and the 1st order tributaries of the Big Wood River in the Boulder Mountains (Figure 4).

2.3 Topography

The Middle Snake subbasins lie in the Snake River Plain and are surrounded by high mountains. The Jarbidge and Owyhee mountains are southwest of the subbasins, while the Boulder Mountains lie in the northeast, the Sawtooth Range is to the west-northwest of those mountains, and the Seven Devils and Wallowa mountains surround the northwestern areas of the subbasins (

Figure 5). The highest elevation in the subbasin, 11,817 feet, occurs in the Boulder Mountains in the headwaters of the Big Wood River. The lowest elevation in the subbasin is 1,568 feet at Hells Canyon Reservoir.

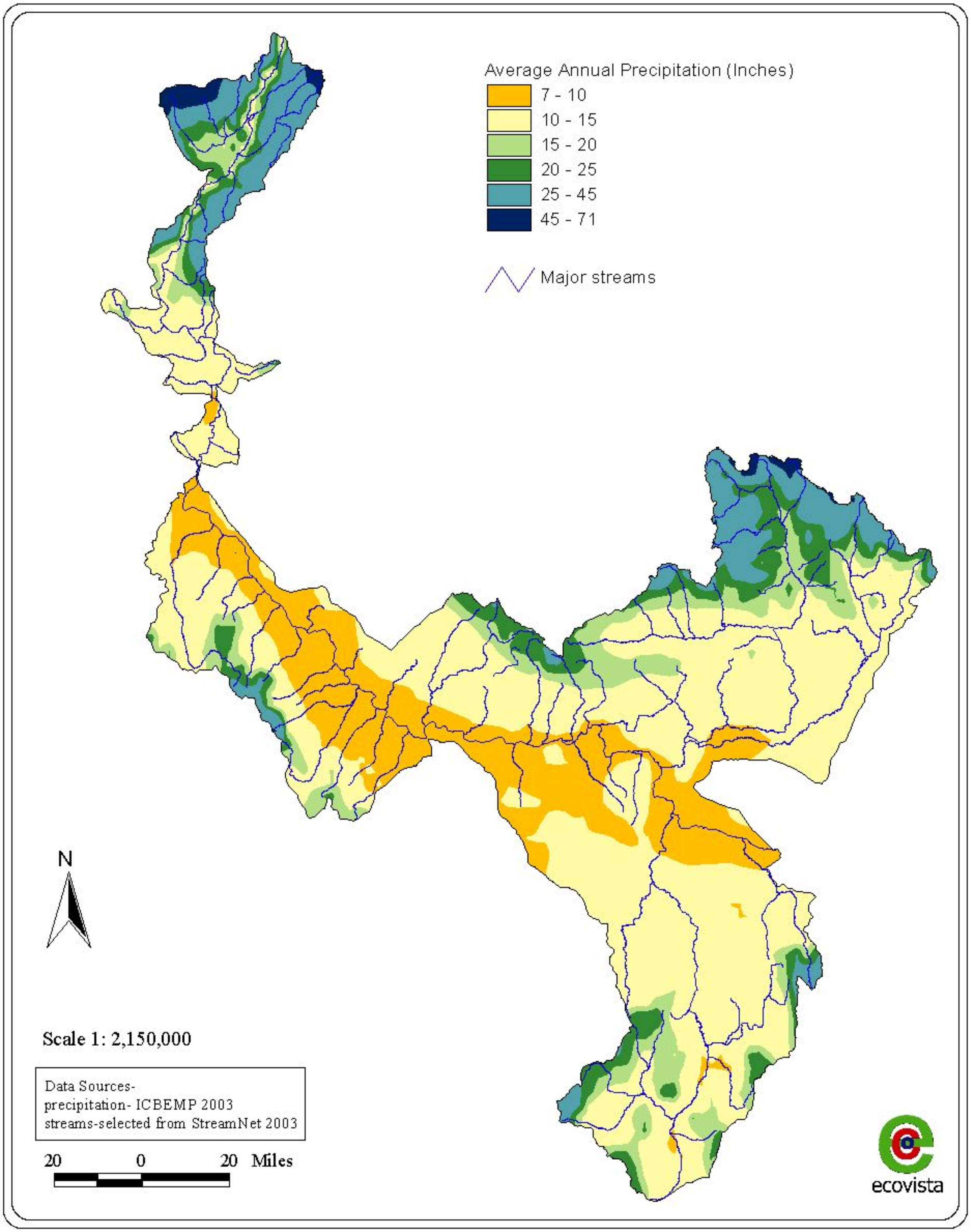


Figure 4. Average annual precipitation in the Middle Snake subbasins.

2.4 Geology and Geomorphology

The Snake River Plain and associated aquifer are the prominent geomorphic features within the subbasin. The Snake River Plain is divided near King Hill into the eastern Snake River Plain and western Snake River Plain (Ross and Savage 1967). The Snake River flows through a major hydrologic and topographic transition between the eastern and western Snake River Plains (Whitehead 1992). Groundwater permeability and transmissivity are very high in the eastern Snake River Plain, but fairly low in the western Snake River Plain. The western plain is 30 to 43 miles wide and trends northwest. It is a fault-bounded basin, with both the land surface and the rock layers dipping towards the axis of the plain. The western plain is far lower in elevation than the eastern plain is. The western plain, which primarily occupies the C.J. Strike Reservoir watershed down to the town of Payette, is filled with sedimentary deposits (lacustrine and fluviatile sediments) that are interbedded with basalt.

About 13 million years ago, lava flows dammed the Snake River at the narrows of Hells Canyon (on the Oregon–Idaho border) backing up the Snake River to approximately Twin Falls and forming Lake Idaho. About 1.5 million years ago, Lake Idaho cut through what is now Hells Canyon, connecting the Snake River Plain to the Columbia River basin. Once these areas were connected, the Snake River and its tributaries began to cut their current valleys (Orr and Orr 1996).

The lithology of the Middle Snake subbasins is diverse. Mafic volcanic flow types are dominant, forming the parent material on approximately 3.0 million acres of the subbasins. The remnants of Lake Idaho above Hells Canyon Dam are evident in the lake sediment and playa lithologies. Alluvium deposits are common around many stream channels in the subbasin and form approximately 1.6 million acres of fertile soils. Felsic pyroclastic lithology formed as a result of volcanic activity on nearly 1.5 million acres of the subbasin (Figure 6).

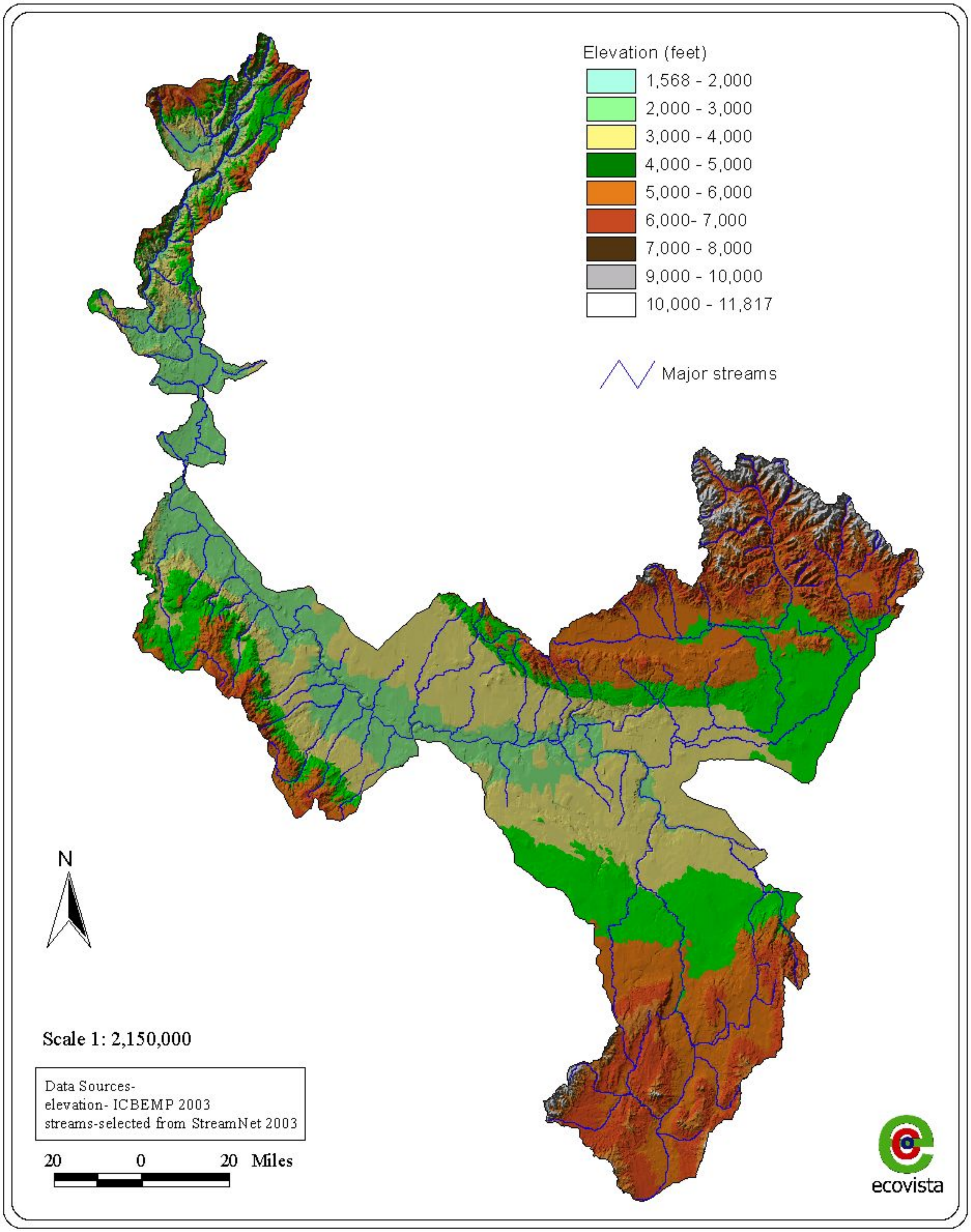


Figure 5. Elevation and topography of the Middle Snake subbasins.

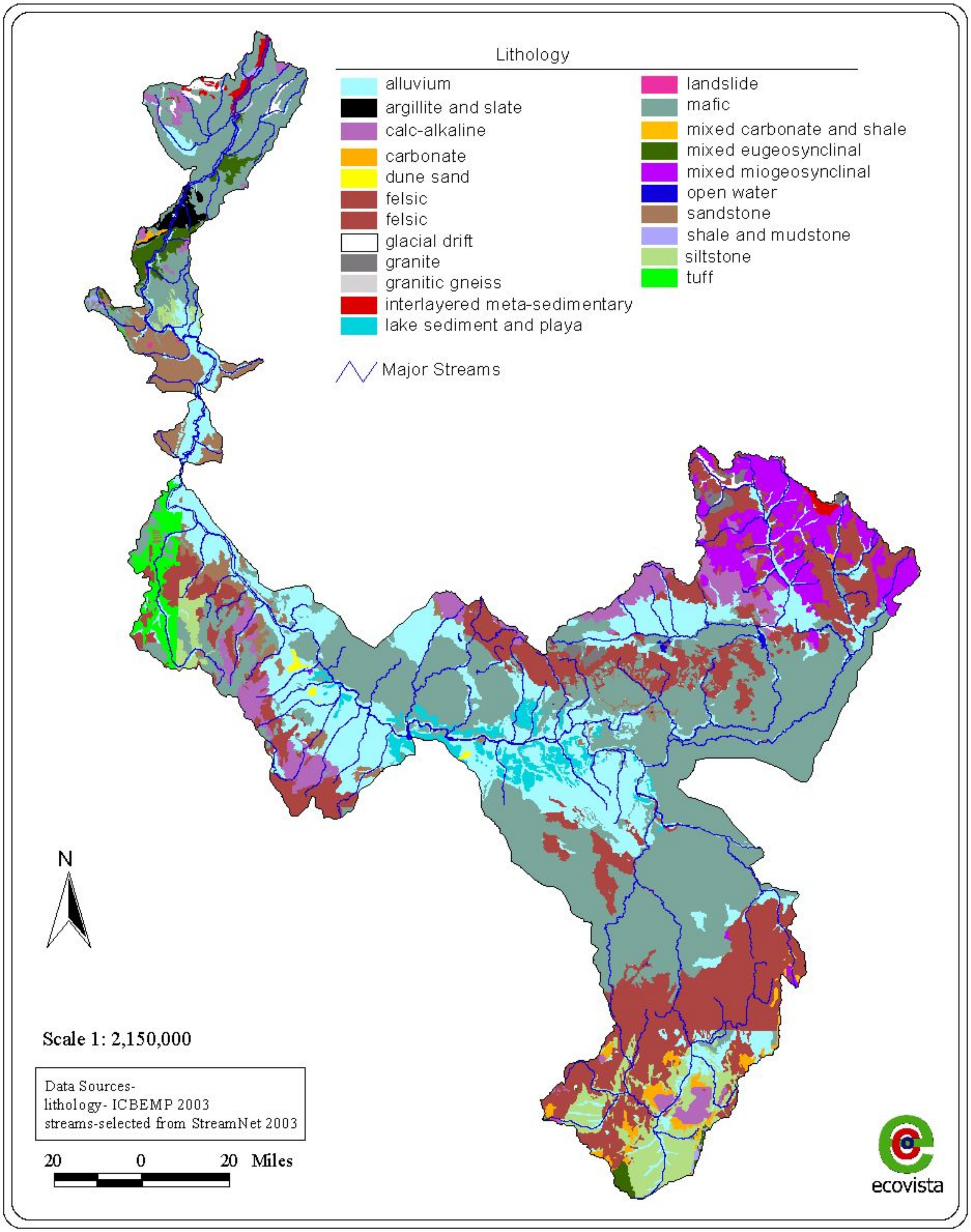


Figure 6. Lithology of the Middle Snake subbasins.

2.5 Vegetation

This section is a general introduction to the vegetative communities in the subbasins and their distribution. A more detailed discussion of the vegetative communities considered to be of particular importance to the wildlife species of the subbasins is provided in 3.5.1. Sagebrush is the characteristic vegetation of the subbasin and dominates the shrub-steppe habitats found in the lower and middle elevations of the subbasins (Table 1 and Figure 7). Eight different types of sagebrush dominate these areas and contribute to the great diversity of vegetative composition, structure, and condition in shrub-steppe areas in the subbasin (see 3.5.1 for details). Good condition shrub-steppe habitats frequently have a grassland component that is commonly dominated by bluebunch wheatgrass (*Pseudoroegneria spicata*, formerly called *Agropyron spicatum*) or Idaho fescue (*Festuca idahoensis*). Shrub-steppe habitats in the subbasins also contain numerous shrub species, including antelope bitterbrush (*Purshia tridentata*) and rabbitbrush (*Chrysothamnus viscidiflorus*). Although sagebrush-dominated habitats continue to cover the majority of the Middle Snake subbasins, their extent has decreased through conversion to agriculture and the introduction of exotic species, particularly cheatgrass (*Bromus tectorum*). Western juniper (*Juniperus occidentalis*) is prominent in only the Owyhee Face portion of the subbasins (Figure 7) but covers more than 76,000 acres of the subbasins (Table 1). Junipers in this area are spreading into lower elevations as a result of decreased fire frequencies caused by historic grazing practices (IDEQ 2002).

Riparian vegetation is patchy in the subbasins (Figure 7). Along many of the subbasins streams, riparian vegetation is sparse to nonexistent, while in other areas, it is dense and well developed. Common woody vegetation types include cottonwood (*Populus* spp.) trees and numerous shrubs such as sagebrush (*Artemisia* spp.), greasewood (*Sarcobatus* spp.), willows (*Salix* spp.), wild rose (*Rosa* spp.), and dogwood (*Cornus* spp.). The introduced Russian olive (*Elaeagnus angustifolia*) and salt cedar (*Tamarisk* spp.) tree species are common in many of the riparian areas of the subbasins.

Forest vegetation is rare in the subbasins and occurs primarily in the upper-elevation areas of the lower Brownlee Reservoir and the upper Big Wood Drainage (Table 1 and Figure 7). Communities in the Brownlee Reservoir area tend to be more xeric and contain more ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*), while communities in the Big Wood Drainage tend to be more mesic and contain subalpine fir (*Abies lasiocarpa*), and mixed mesic communities are more prominent.

Table 1. Acreages in major vegetative groups of the Middle Snake subbasins (groups created by combining Sagemap 2003 vegetative classes).

Vegetation Group	Acres in Middle Snake Subbasins
Sagebrush	3,653,025
Grass and forbland	1,634,943
Agriculture	1,298,189
Shrub	772,959
Forest (primarily coniferous)	582,736

Vegetation Group	Acres in Middle Snake Subbasins
Riparian and wetland	91,318
Rock, burn, snow	82,944
Juniper	76,042
Deciduous trees	73,388
Water	57,591
Urban	31,175

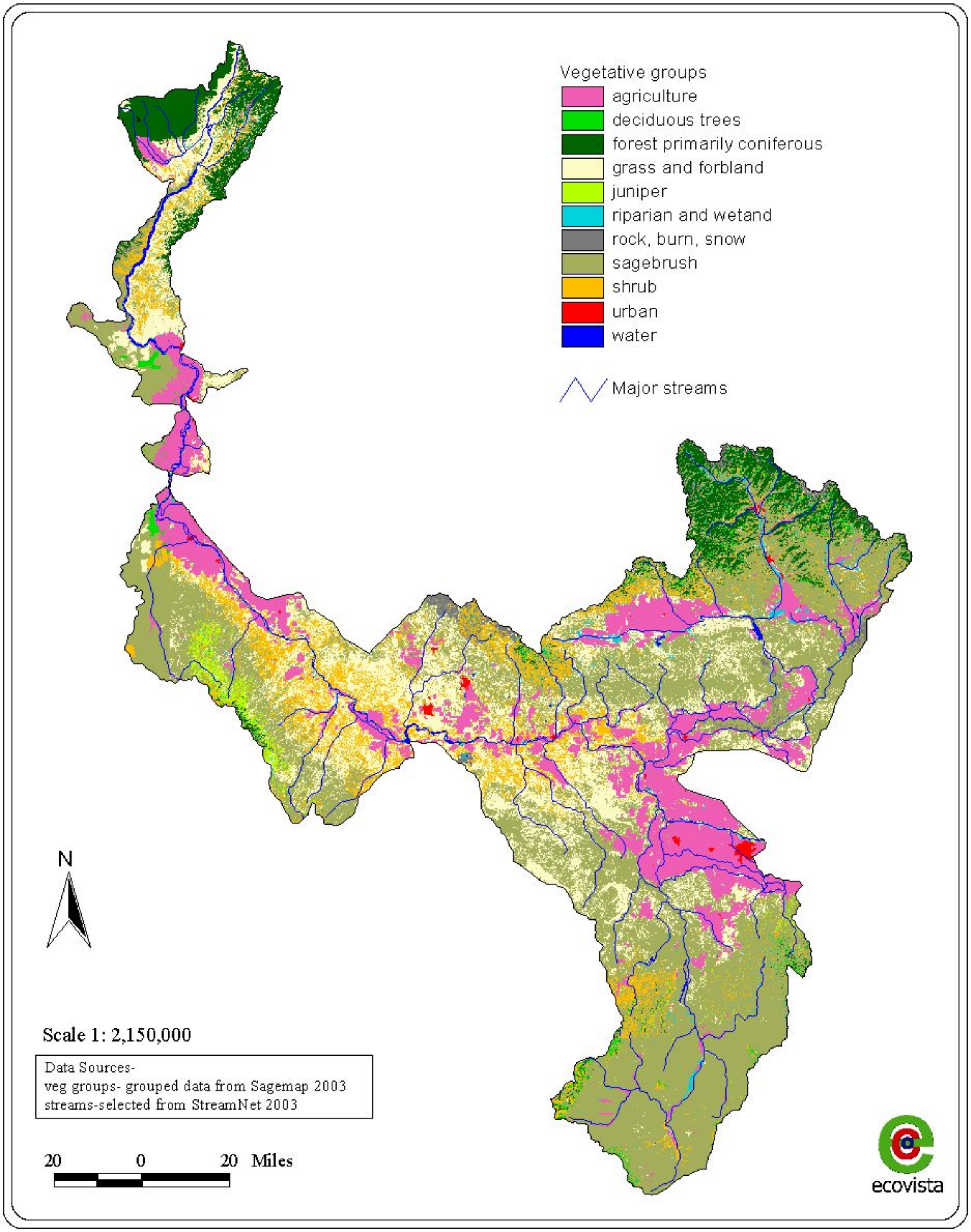


Figure 7. Distribution of major vegetative groups of the Middle Snake subbasins (groups created by combining Sagemap [2003] vegetative classes).

2.6 Hydrology

The hydrology of the Middle Snake subbasins is varied and complex. Spring and early summer streamflow in the Snake River driven by snowmelt and runoff from areas where precipitation falls mostly as snow (IDEQ and ODEQ 2003). Groundwater and spring systems have a profound impact on the hydrology of these subbasins and, in some areas and seasons, groundwater discharge is a substantial source of flow to the Snake River. The hydrology of both the mainstem and tributary systems has been substantially altered through irrigation diversions and hydropower development.

2.6.1 Mainstem Snake River

The Snake River is the major hydrologic feature of the subbasins, and all surface water and groundwater drain into the Snake River from the surrounding Snake River Plain and Columbia Plateau. The Snake River is fed on the surface largely by tributaries flowing from the mountains on the south and east side of the plain and plateau. A few major tributaries from the northern valleys flow directly into the Snake River, but many disappear through seepage into the permeable Snake River Plain basalts and recharge the aquifer (Johnson et al. 1998).

Annual streamflow is also highly variable. Between 1928 and 1996, the annual streamflow of the Snake River at Weiser, Idaho varied between a high flow of 24.5 million acre-feet and a low flow of 6.4 million acre feet (USBR 1998). Mean high flows generally range from 60,000 to 80,000 cfs; and mean low flows, from 7,000 to 10,000 cfs.

Mainstem flow in the Snake River is heavily influenced by dams and other water-control structures on both the mainstem and tributaries. The capacity for river regulation and water storage are substantial, as reservoirs upstream of Brownlee Dam have the cumulative capacity to store 75% of the average annual runoff (Columbia River Basin System Operation Review 1991). Less than 20% of the total inflow into the Snake River reaches the river without passing through a reservoir or other control structure (USBR 1998). Such management of flows affects both the magnitude and timing of flow variations within the mainstem Snake River. Although the overall volume may not have changed substantially, flows are now more evenly distributed over the year (USBR 1998; USGS 1996, cited in IDEQ and ODEQ 2003).

Minimum flows in the mainstem Snake River, from C.J. Strike Dam to Brownlee Dam, have been identified for protecting aquatic, wildlife, and vegetation resources (Table 2 and Table 3). These minimum flows are often not met during the irrigation season (USBR 1998). In addition to concerns about low flows, episodic high flows are necessary to maintain riparian and wetland vegetation dependant on periodic flooding. Maintaining islands in the Snake River also requires periodic sediment deposition from large episodic flood events (USBR 1998). Episodic flood events are needed every 10 to 15 years to maintain viable cottonwood communities.

Table 2. Minimum flows for aquatic resources in mainstem habitats, from C.J. Strike Reservoir to Brownlee Dam in cfs (USBR 1998).

Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
16,000					15,000	12,000	9,000	—	12,500		—

Table 3. Minimum flows for wildlife and vegetation resources in mainstem habitat, from C.J. Strike Reservoir to Brownlee Dam (from USBR 1998).

Reach	Gauge	Parameter Level	Parameter (cfs)				
			Spring[a]	Summer[b]	Fall[c]	Winter[d]	Episodic[e]
C.J. Strike Reservoir to Swan Falls Dam	River below dam near Grand View	optimum	11,200		9,700		41,300
		beneficial	10,300		9,600		34,400
		neutral	9,300		9,400		27,500
		adverse	<9,300 and >11,200		<8,300		2,670
Swan Falls Dam to Brownlee Reservoir	Near Murphy	optimum	13,400		11,800		no data
		beneficial	13,000		11,500		no data
		neutral	11,100		10,800		no data
		adverse	<11,100 and >13,400		<8,500		no data
	At Nyssa	optimum	21,000		14,900		no data
		beneficial	19,700		14,100		no data
		neutral	15,200		13,000		no data
		adverse	<15,200 and >21,000		<10,500		no data
	At Weiser	optimum	28,300		18,600		no data
		beneficial	27,600		16,300		no data
		neutral	21,000		15,200		no data
		adverse	<21,000 and >28,300		<11,500		no data
Brownlee Reservoir		optimum	maintain at or near 2,078.5 ft spring through fall, fluctuate in winter				
		beneficial	maintain at or near 2,077.5 ft spring through fall, fluctuate in winter				
		neutral	maintain at or near 2,077 ft spring through fall, fluctuate in winter				
		adverse	maintain at or near 1,975 ft spring through fall, fluctuate in winter				

[a] April, May, and March
[b] July and August
[c] September, October, and November
[d] December, January, February, and March
[e] Every 10 to 15 years

2.6.2 Tributaries

The Wood River/Malad River is the largest tributary included in the subbasins (larger tributary systems exist, but are defined as separate subbasins) and drains the high-elevation mountains of the Rocky Mountain Ecosystem complex from the north. The Wood River goes seasonally dry where it enters the Snake River Plain, partly from evaporation and percolation of surface water into the aquifer and partly from diversion of surface water. However, the Malad River, which is the river below the confluence of the Big and Little Wood rivers, has high surface flows from irrigation return flows and spring groundwater as the Malad River cuts a deep canyon into the basalts of the aquifer (Hurley et al. 2002).

Tributary hydrology in agricultural areass of the subbasins is complex, with water diverted into fields, discharged back into the tributaries through irrigation drains and subsurface flows, and rediverted onto additional lands downstream (IDEQ and ODEQ 2003). Most small tributaries in the low-elevation, arid portions of the subbasin are ephemeral or intermittent, with flow present only seasonally or during high precipitation events. Flow is highly variable in the perennial tributaries and is often composed of irrigation return flow and/or groundwater discharge (IWRB 1993). Many creeks remain perennial in the headwaters, but flow subsurface in the lower reaches (BLM 1996 1999). Underground tributary valley flow is a major component of groundwater input into the aquifer. Nine tributary stream reaches have minimum stream flow requirements filed with the Idaho Department of Water Resources (IDWR 2003; Table 4). The limited data available regarding tributary runoff patterns and volume do not indicate any long-term trends (BLM 1999).

Table 4. Minimum stream flow requirements filed for tributary reaches in Idaho and the Middle Snake subbasins (IDWR 2003).

File Number	Source	Miles	Flow (cfs)
37-7727	Silver Creek	11	99
37-7728	Silver Creek	10	74
37-7849	Silver Creek	13	74
37-7734	Bancroft Springs	0.1	17
37-7739	Little Wood River	14	39
37-7919	Big Wood River	18	70
37-8258	Big Wood River	9	150–200
37-8307	Big Wood River	NA	119
37-7920	Malad River	1	39

2.6.3 Irrigation Diversions

Surface diversions for irrigation greatly impact the flow through the lower Middle Snake subbasins. The Hells Canyon Complex of dams (Brownlee, Oxbow, and Hells Canyon) provides irrigation storage for more than 3.5 million acres of land, with a total estimated annual consumptive use of 6 to 8 million acre-feet (IDEQ and ODEQ 2003). Of the 3 million acres of irrigated land in the Snake River basin above Hells Canyon Dam, about 2 million acres are supplied by surface water, mostly by gravity diversions (USBR 1998). About 16.5 million acre-feet of surface water are diverted annually and conveyed by more than 3,000 miles of canals and laterals to irrigate agricultural fields (USBR 1998). Of the 20 million acre-feet of total combined surface water and groundwater used for irrigation, most returns to a stream or aquifer, with about 6 million acre-feet lost to consumptive use (USBR 1998). In low water years, pumping and diversions can remove more water from the Snake River than is contributed by its inflowing tributaries. Irrigation recharge during periods of low tributary input represents a significant source of in-river flow (as much as 52%) (IDEQ and ODEQ 2003).

In southwest portions of the subbasins, surface waters and irrigation flow do not percolate readily into the ground. Where areas of low permeability exist, soils became waterlogged from irrigation. Extensive drainage systems comprising drainage tunnels and tile drains connecting to relief wells were constructed in agricultural areas to dispense of irrigation waters (IWRB 1993). Many of these drainage systems discharge directly into the Snake River and contribute to sediment loading of the river.

2.6.4 Springs

The eastern Snake River Plain aquifer naturally discharges substantial amounts of water into the Snake River through major springs, primarily along two reaches: 1) near American Falls Reservoir, in which spring discharges total about 2,600 cfs, and 2) in the Kimberly to King Hill reach of the Snake River (Thousand Springs reach), where the collective discharge is about 5,200 cfs (Johnson et al. 1998). The springs are a significant and dominant part of the river flow, landscape, and economy of the area (Hurley et al. 2002). Of the 65 class one springs (greater than 100 cubic feet per second [cfs] discharge) found nationwide, 15 are in the Snake River basin. These springs support fish hatcheries that produce the majority of the nation's commercial trout and juvenile fish for planting in lakes and streams (Johnson et al. 1998). These springs also support a diverse, and often endemic, assemblage of unique flora and fauna.

2.6.5 Groundwater

The Snake River Plain Aquifer system is one of the largest groundwater systems in the United States and provides significant amounts of flow to the Snake River. Containing about 250 million acre-feet of water in its top 500 feet (USBR 1998), this aquifer is divided into an eastern and western aquifer; The aquifer of the eastern Snake River Plain is one of the highest water-producing aquifers in the nation. The boundary of the eastern and western portions of the Snake River Plain aquifer system roughly coincide with the boundary between the Upper and Lower Middle Snake subbasins. Groundwater quality in the Snake River Plains Aquifer is generally good (IDEQ and ODEQ 2003) and exceeds national drinking water standards (USBR 1998). While such quality is generally the case, a study in the Bruneau–Grand View area indicated that water quality in that area is marginal for domestic, industrial, and agricultural uses because of moderate to high concentrations of sodium and excessive amounts of fluoride (USFS 1999). In some areas, the Snake River channel is above the regional water table and recharges the underlying aquifer (IDEQ and ODEQ 2003).

Groundwater discharge into the Snake River from the Milner Dam to King Hill (middle Snake River reach) contributes a large percentage of the nitrate transported from the upper Snake River basin at King Hill. The highest concentrations of nitrate in groundwater are found in areas of urban and irrigated agricultural land use and where the water table is relatively shallow (USGS 2000).

2.7 Land Management

Land ownership within the Middle Snake subbasins follows patterns commonly found across the Intermountain West. Private lands are often the most arable, near water sources such as the Camas Creek and Middle Snake River–Rock Creek watersheds. The two largest public land managers are the federal Bureau of Land Management (BLM), which manages rangelands, and U.S. Forest Service (USFS), which manages public forestlands (

Figure 8). Nearly 50% of the land in the subbasin is administered by the BLM (Table 5). The USFS manages nearly 1 million acres in the subbasin; the largest portion of this amount is in the Sawtooth National Forest (578,998), followed by the Payette National Forest (169,532 acres) and Wallowa Whitman National Forest (134,717 acres). The majority of the privately owned land (over 2.6 million acres) is located at the lower elevations near the Snake River and used for agricultural purposes.

Table 5. Land managers or owners in the Middle Snake subbasins.

Manager or Owner	District or Forest	Acres in Subunit	Total Acres in Subbasin	Percentage (%) of Subbasin
Bureau of Land Management	Elko District	605,721	4,150,392	49.7
	Burley District	241,504		
	Boise District	2,037,378		
	Vale District	285,977		
	Shoshone District	979,366		
	Salmon District	309		
	Idaho Falls District	136		
U.S. Forest Service	Humboldt National Forest	71,326	960,979	11.5
	Wallowa-Whitman National Forest	134,717		
	Payette National Forest	169,532		
	Challis National Forest	3,252		
	Sawtooth National Forest	578,998		
	Boise National Forest	3,154		
Bureau of Reclamation			161,314	1.9
Department of Defense			85,453	1.0
State Land			342,863	4.1
U.S. Fish and Wildlife Service			356	0.0
Private			2,603,487	31.2
Water			41,021	0.5

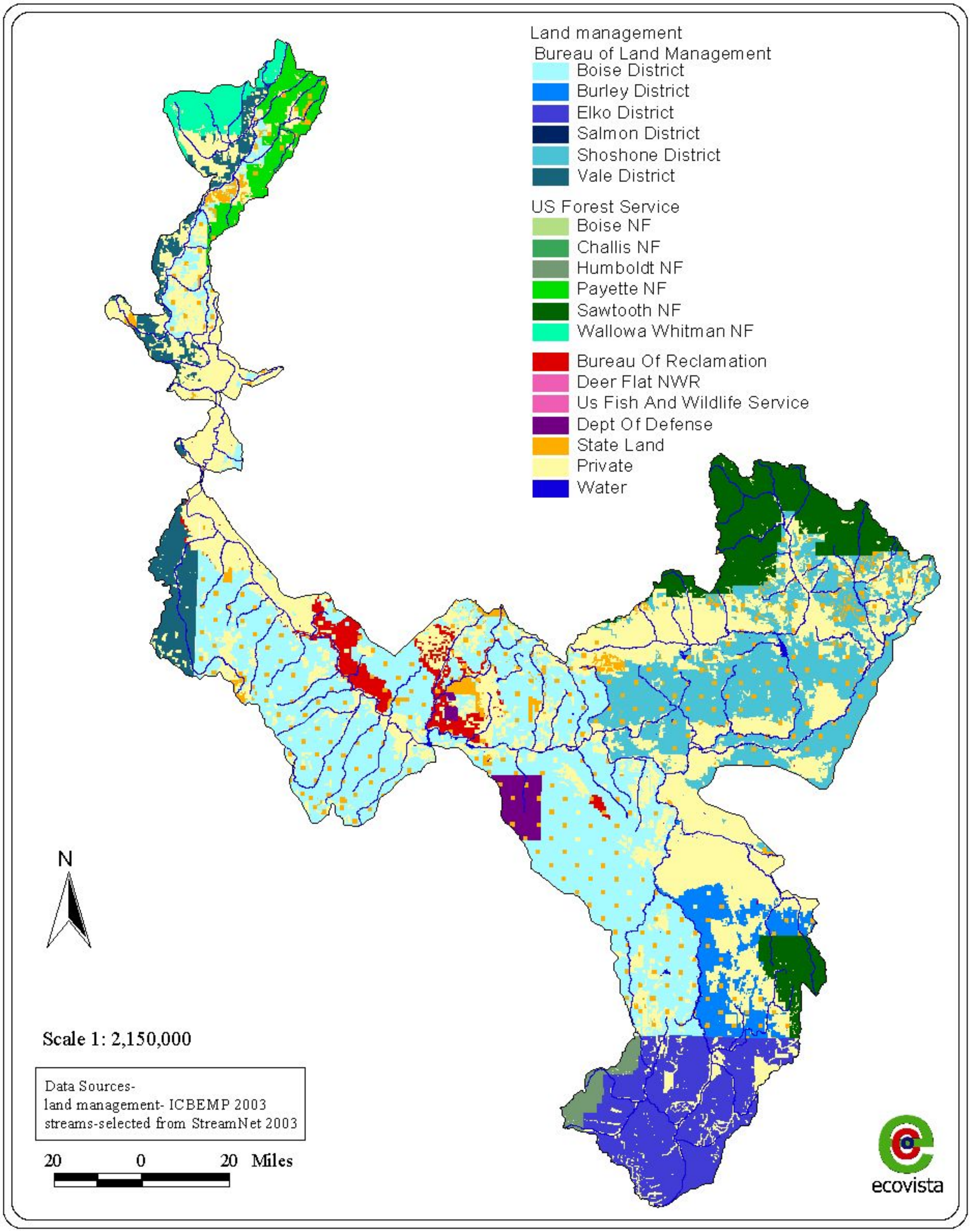


Figure 8. Land management in the Middle Snake subbasins.

2.8 Land Use

2.8.1 Pre-European Settlement

Prior to European settlement, the Northern Shoshone, Northern Paiute, and Bannock (a Northern Paiute subgroup) tribes occupied a territory that extended across most of southern Idaho into western Wyoming and south Utah and Nevada, a portion of which is today referred to as the Middle and Upper Snake provinces of the Columbia Basin. Evidence of human habitation in the Middle Snake subbasins dates back at least 2,000 years. Remnants of buffalo jumps have been found in the drainage divide between the middle Snake and Owyhee rivers (Agenbroad 1976, cited in IDEQ 2002).

The tribes moved with the seasons. The annual subsistence cycle began in the spring when some bands moved into the mountains to hunt large game and collect roots. Other bands moved to fishing locations on the Snake and Columbia rivers. During summer, large groups traveled to Wyoming and western Montana to hunt bison.

The summer months were a time of intertribal gatherings. Tribes met along the Snake River to trade, hunt, fish, and collect seeds, nuts, and berries. Late fall was a time of intensive preparation for winter. Meats and various plant foods were cached for later use, and winter residences along the Snake River were readied (Idaho Army National Guard 2000 *cited in* Saul et al. 2002).

The tribes utilized fish and wildlife resources across the region. Using implements such as spears, harpoons, dip nets, seines, and weirs, they fished for chinook salmon, steelhead trout (*Oncorhynchus mykiss*), Pacific lamprey (*Entosphenus tridentatus*), white sturgeon (*Acipenser transmontanus*), cutthroat trout (*Oncorhynchus clarki*), and mountain whitefish (*Coregonus williamsoni*). They hunted antelope, deer, elk, bighorn sheep, rabbits, bears, and certain types of waterfowl (Idaho Army National Guard 2000 *cited in* Saul et al. 2002).

Anglo-European beaver trappers first came to the area in the 1700s, but their use of the area was transient and the watershed remained primarily the home of Native Americans. The establishment of the South Alternate Route of the Oregon Trail represented the next significant migration of people, but these were also transient populations. The greatest use of the route occurred in the late 1840s through the 1860s. Although the South Alternate Route was shorter than the main trail, it was harder to travel and taking that route proved to be a more arduous journey. Irrigated agriculture in the Snake River basin dates back to the 1860s, and long-term settlement of the area increased as canals and diversions were completed (IDEQ 2002).

2.8.2 Current Land Use

Land use is closely tied to land ownership, with the private lands being more developed than public lands. Road density is often used as an indicator of intensity of land use, since development of land involves building roads. The most intensive development and greatest density of roads in the subbasin occur along the Boise side of the middle portion of the subbasin, and pockets of high road density also surround the towns of Hailey and Twin Falls in the upper subbasin (

Figure 9). Least developed areas in the subbasin tend to be higher-elevation areas, including portions of the Owyhee Face and the upper Big Wood and Salmon Falls Creek drainages. An exception to this pattern is the most downstream portion of the subbasins, where areas of low road density extend to the river corridor (

Figure 9). In addition to development, there are a variety of other major land uses in the subbasin. Most land use activities in the subbasins involve the use of natural resources—activities such as agriculture, farming, ranching, timber harvest, and mining.

Agriculture and Ranching

Approximately 15%, or 1,298,189 acres, of the subbasin is used for agricultural purposes (Table 1). Agriculture use in the subbasins is concentrated in areas of flat terrain adjacent to the Snake River, with irrigation water coming from the Snake River or its tributaries. Agricultural activities are common along the Snake River between Scott and Rabbit creeks and spotty between Birch and Clover creeks, and agriculture is the dominant land use activity along the Snake River from Clover Creek to Shoshone Falls. The lower reaches of the Big Wood River, Little Wood River, Rock Creek, and Salmon Falls Creek are surrounded by large areas of agriculture. The Camas Creek drainage supports pasture/hay lands and small grain crops. There are small areas under cultivation in the Patton Creek and Pine Creek drainages (Figure 7).

Rainfall is insufficient in most areas of the Snake River Plain to support commercial levels of agriculture without irrigation, requiring substantial diversions from surface and groundwater systems. Farmed crops include alfalfa hay, grass hay, sugar beets, potatoes, onions, corn, pasture, and mixed grain (IDEQ 2002). Most of the famous “Idaho potatoes” are grown in the irrigated portions of the Snake River Plain (Johnson et al. 1998).

Most of the subbasin that is not farmed is grazed. BLM’s Shoshone Field Office has 198 livestock grazing allotments utilizing a total 1,134,000 acres of public land. Cattle, sheep, horses, or a combination of these animals graze the allotments. The number of dairy cattle in the subbasins has doubled in the last decade, and Idaho is ranked 11th in the nation in milk production. The highest numbers of dairy cattle in the state occur in Twin Falls, Jerome, and Gooding counties, which also have some of the highest densities of dairy cows in the nation (Maupin 1996, cited in Hurley et al. 2002). Jerome and Gooding counties have the highest dairy production in the state.

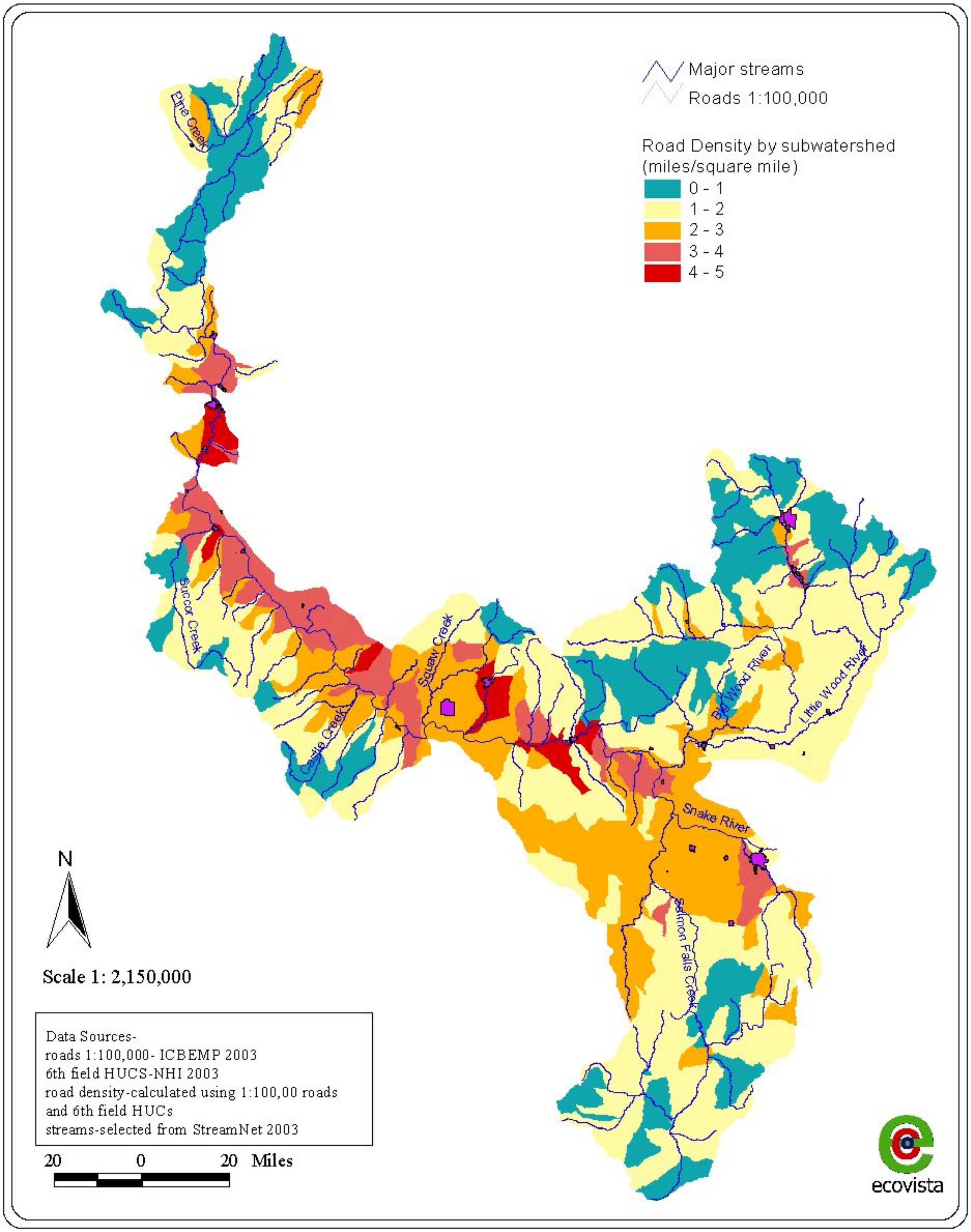


Figure 9. Density and distribution of roads in the Middle Snake subbasins.

Timber Harvest

Timber harvest in the Middle Snake subbasins is not a primary land use due to the paucity of marketable trees. Some timber harvest has occurred in the Pine Creek watershed (USFS 1999). Woodcutting of juniper occurs in the Owyhee Mountains. Forest ecosystems in the Big Wood and Middle Snake River–Rock Creek watersheds have been modified, in part, by harvest activities (Hurley et al. 2002).

Mining

Mining activity in the subbasins predates the discovery of gold at Pierce in 1860, which started Idaho's gold rush. Soldiers placer mined at Fort Boise in 1854, and similar activity was scattered all along the Snake River. Gold particles are abundant in the Snake River, but deposits are so fine that mining them has never proved economically viable (ISHS 1996). After the discovery of gold at Pierce, gold fever really took hold; prospectors worked their way south through the Clearwater and Salmon river subbasins in search of gold. Prospecting in the subbasin dramatically accelerated after the beginning of the Boise Basin mining boom in 1862. The 1863 discovery of gold in the Owyhee subbasin also had implications for the Middle Snake subbasins, and numerous gold mining operations were developed in the Owyhee Face Drainage (

Figure 10). The Owyhee area proved to be one of the most lucrative areas for mining in Idaho, eventually producing 90,000,000 worth of metals (ISHS 1985). The discovery of gold in the Pine Creek drainage helped Baker County produce two-thirds of the gold ever found in Oregon (Oregon Gold 2004). Gold was discovered in the Camas Creek area in 1885, but development of the area was slow until the end of the Bannock War in 1878. Although the value of gold removed from the Camas Creek area eventually totaled about $1 million, production in this area was eclipsed by the silver boom that occurred in the adjacent Big Wood River drainage (ISHS 1981).

The increasing profitability of lead and silver mining increased interest in the area, and by 1880, thousands of fortune hunters had rushed to the Wood River. This influx resulted in the formation of the towns of Ketchum, Hailey, and numerous smaller communities in the area. Transportation improvements—particularly construction of the Oregon Short Line to Hailey (May 7, 1883) and on to Ketchum (August 19, 1884) allowed the early Wood River mines to reach their maximum production. Mining in the area boomed until 1892 when falling silver prices initiated a decline (ISHS 1985). However, some mining activities continued; for example, the Minnie Moore mine (near Bellevue) extracted more than $1,000,000 worth of material between 1902 and1906, and the Triumph mine produced more than $28,000,000 between 1936 and 1957. Rising silver prices in 1967 led to revival of some of the old lead–silver–zinc properties around Bellevue, with production of $1,574,000 in 1967 and nearly $2,000,000 in 1968 (ISHS1981). The value of materials extracted from the Wood River region over its history makes it Idaho's third most profitable mining region, after the Coeur d'Alene and Owyhee regions (ISHS 1985).

After gold, silver, and lead, copper is the fourth most widely produced metal in the Middle Snake subbasins. Copper mining operations in the subbasins are also mostly historic, with concentrations in upper Salmon Falls, Indian, and King Hill creeks. The current, most prominent mining activity in the subbasins is the extraction of sand and gravel. This activity is focused in the area surrounding the town of Ontario, but sand and gravel operations are scattered throughout the subbasin. Other active mining operations in the subbasins extract clay (

Figure 10), gypsum, and zeolite.

Impacts of mining activity to natural resources are variable and depend on mine size and location, mining methods, products mined, and a number of other factors. Some species (e.g., bats) may benefit from the creation of mines, but most are adversely affected. The most common influences of mining activities on aquatic resources result from production of acidic wastes, toxic metals, and sediment (Nelson et al. 1991). Historic use of mercury in mining operations has resulted in increased mercury concentrations in river systems. Owyhee and Brownlee reservoirs have experienced elevated mercury levels in fish tissue samples (Walt VanDyke, Oregon Department of Fish and Wildlife, personal communication, October 12, 2001). The Triumph Mine is currently listed by the U.S. Environmental Protection Agency (USEPA) as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) project. The mine is currently undergoing remediation of its mine tailings and physical hazards, as well as hazardous materials removal. The Minnie Moore mine site was recently recommended to the USEPA for initiation of the preliminary assessment/site investigation phase of the CERCLA process (Buhidar 2002).

Aquaculture

Aquaculture is a major commercial enterprise in the subbasins that uses the constant temperature and flows of the springs in the subbasins. Aquaculture is the third largest animal-producing industry in Idaho and produces over 70% of the nation's commercial trout (Goodell 1988, cited in Hurley et al. 2002). Rainbow trout are the main species cultured, with over 40 million pounds produced in 1991. Coho salmon and cutthroat trout are also cultured, as are catfish, tilapia species, and alligator from warmer water sources (IDWR 1993b cited in Hurley et al. 2002). In 1991, there were 98 permits through the Idaho Department of Fish and Game (IDFG) for commercial production and 224 permits on file with the Idaho Department of Water Resources (IDWR) for diversion of surface water (IDWR 1993b cited in Hurley et al. 2002). About 80 to 90% of spring flow in the Snake River area of the upper subbasins is used for aquaculture. In 1980, 27 commercial trout farms in Twin, Jerome, and Gooding counties used 1,653,000 acre-feet of water (IDWR 1993b cited in Hurley et al. 2002).

Hydropower

Eleven dams and two power plants in the subbasins are operated by Idaho Power Company (IPC) for hydropower production. Nine of the dams are located on the mainstem snake; the other two, on the Malad River. Both the Thousand Springs and Clear Lake power plants are located on the walls of the Snake River Canyon near Hagerman.

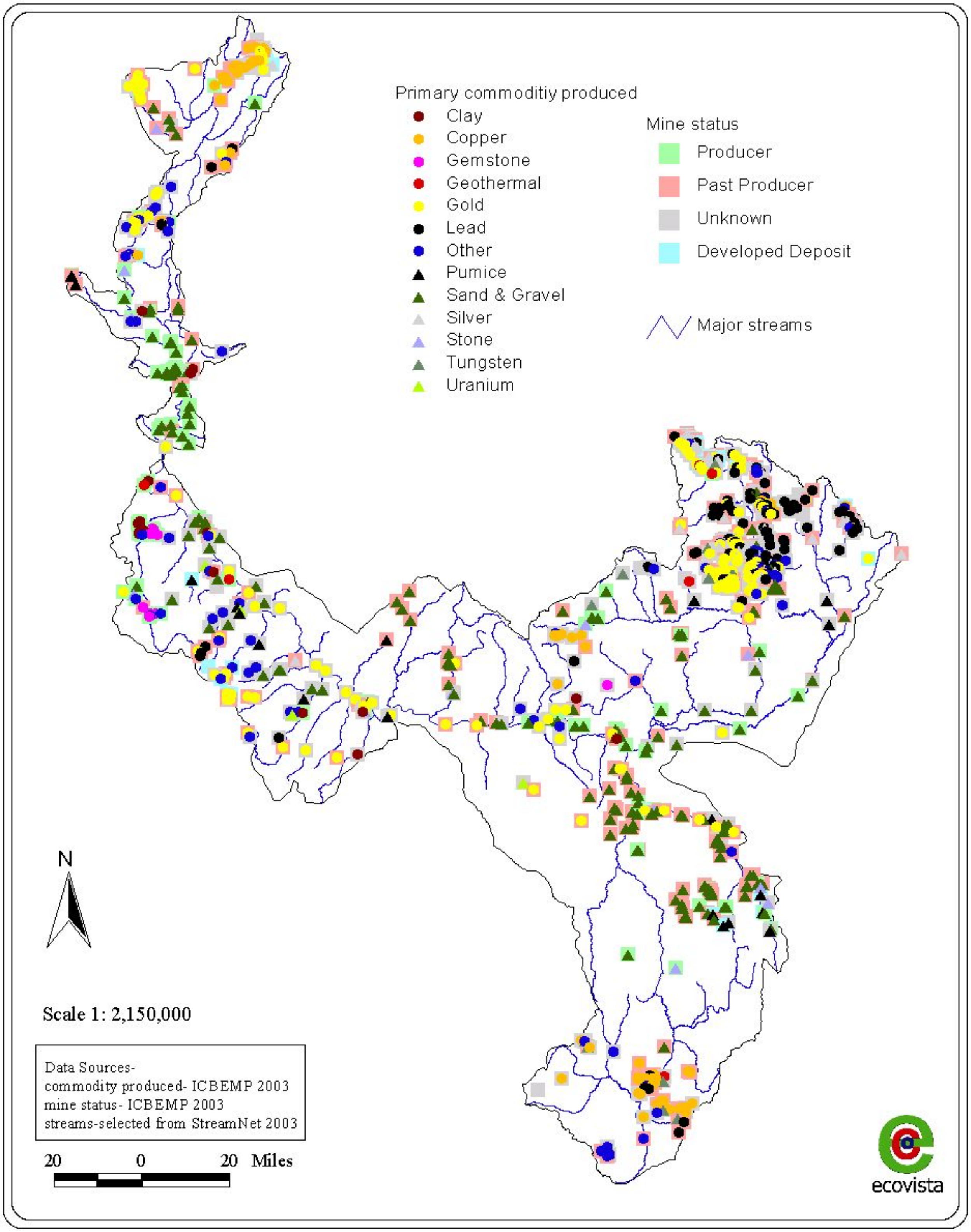


Figure 10. Current and historic mining activities in the Middle Snake subbasins.

The dams have very different hydroelectric capacities. Brownlee Dam has the highest capacity, at 585,400 kilowatts, which is over 47 times that of Shoshone Falls Dam (12,500 kilowatts) (

Figure 11). All the dams and immediate surrounding areas provide recreation activities to the residents of the subbasins, including fishing, upland game bird and waterfowl hunting, rafting, mountain biking, and boating. The dams operate under licenses issued by the Federal Energy Regulatory Commission (FERC). IPC is currently involved in the FERC relicensing process for all of its dams in the subbasins (IPC 2003). This section provides a description of the location, construction dates, and operation of those dams.

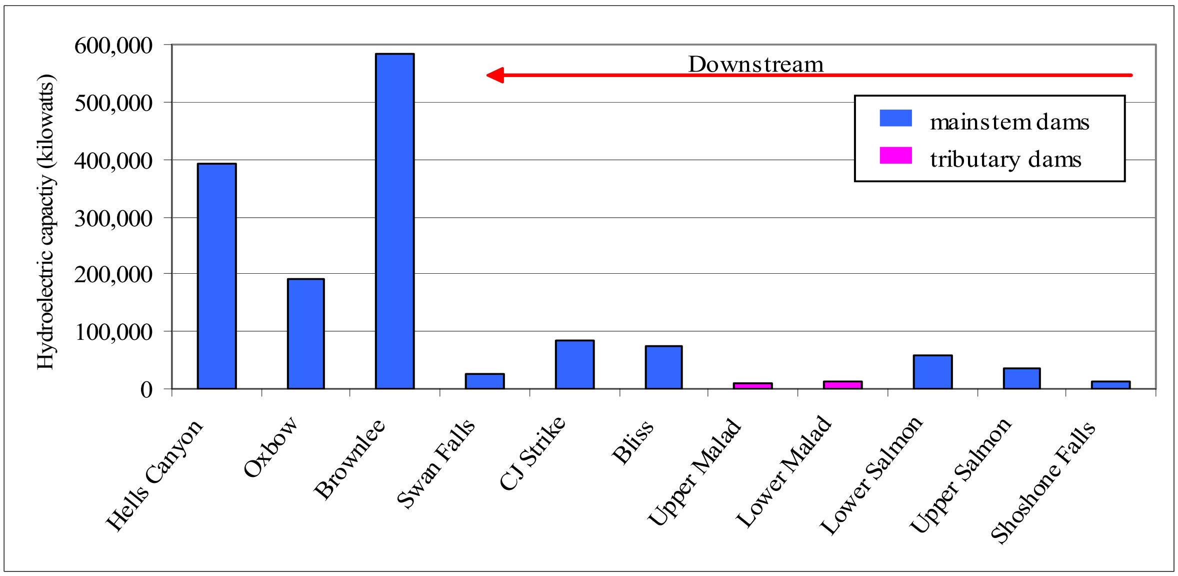


Figure 11. Hydroelectric capacity of the dams in the Middle Snake subbasins.

Shoshone Falls

The Shoshone Falls Dam is located on the Snake River about 3 miles northeast of Twin Falls in southern Idaho. It is constructed near the Shoshone Falls waterfall, one of southern Idaho's most celebrated landscape features. Construction on the project began in 1906, and energy was first produced in August 1907 as part of the Greater Shoshone and Twin Falls Water Power Company. New units were added in 1909, 1921, and 1936. IPC took ownership of the project in 1916. Shoshone Falls Dam is operated as a run-of-river facility (IPC 2003).

Mid-Snake Projects

The Upper Salmon Falls, Lower Salmon Falls, and Bliss dams, are known collectively as the Mid-Snake Projects. These projects are located on the 25-mile stretch of the Snake River between the towns of Hagerman and Bliss. IPC can operate Lower Salmon Falls and Bliss projects in a limited, load-following capacity when the load is high. Otherwise, the projects are operated as a run-of-river facility (IPC 2003). Between the dams and their associated reservoirs is a free-flowing stretch of the Snake River known as the Wiley Reach (IPC 2003).

The Upper Salmon Falls Project was begun as early as 1911, before IPC existed. Around 1931, IPC began constructing the existing diversion and canal system. The remainder of the Upper Salmon Falls Project was constructed during two phases, in 1937 and 1947. In 1909, the Greater Shoshone and Twin Falls Water Power Company began its small project, the Lower Salmon Falls Dam. In 1919 and 1935, IPC upgraded this project. Then during 1948 and 1949, the project was completed. In addition, the Bliss Project was constructed between 1948 and 1950 (IPC 2003).

Malad Project

The Malad Project, consisting of two dams (termed upper and lower) and two associated power plants, is located on the Malad River (Big Wood River below its confluence with the Little Wood River). The project first became operational in 1949. The two dams and associated structures are for diversion only. The water diverted by the dams is supplied almost entirely by springs that lie within the walls of the canyon through which the Malad River flows. The water is carried to each of the power plants through concrete flumes. Because these dams have no active storage, they are called run-of-river facilities (IPC 2003).

C.J. Strike Dam/Reservoir

C.J. Strike Dam is an earth fill dam that is located on the Snake River southwest of Mountain Home, at RM 494. The reservoir above the plant covers 7,500 surface acres and has a storage capacity of 247,000 acre-feet (IPC 2003).

Swan Falls Dam/Reservoir

Located between Kuna and Murphy, Idaho, at RM 457.7, Swan Falls Dam was the first dam on the Snake River. It was built in 1901 by the Trade Dollar Mining Company to supply electricity to the Trade Dollar mine, and excess power was distributed to the mining town of Silver City, as well as to other mines (IDEQ 2002). IPC recently constructed a new power plant and decommissioned the old plant (which will remain as a historical landmark). The reservoir behind the dam covers 1,525 surface acres and has a storage capacity of 7,425 acre-feet (IPC 2001).

Hells Canyon Complex

The Hells Canyon Complex is made up of three projects with dams and reservoirs: Brownlee, Oxbow, and Hells Canyon. Located on the Snake River between Idaho and Oregon, these three projects comprise two-thirds of IPC's total hydroelectric generating capacity (IPC 2001). The Federal Power Commission (now the FERC) authorized the complex in 1955.

Brownlee Project

Brownlee Dam was completed in 1959 and is the most upstream (RM 285) of the three dams in the Hells Canyon Complex. The rock-filled dam formed a reservoir 58 miles long (with 190 miles of shoreline)—the longest on the Snake River. The reservoir is 2,077 feet above sea level and has a total storage capacity of 975,000 acre-feet (total reservoir volume is 1,420,000 acre-feet). Full pool surface area covers 14,000 acres (IDEQ and ODEQ 2003). Average residence time (reservoir volume/average daily inflow volume) is 35 days, based on data from 1961 through 2000, with a range of 15 to 70 days (Nurnberg et al. 2001).

Brownlee Reservoir was constructed for power production, but the U.S. Army Corps of Engineers (USACE) also operates it for flood control. IPC prefers keeping Brownlee Reservoir at or near full pool because that level provides the best conditions for power generation. However, withdrawals, seasonal weather fluctuations, and the need for flood control all affect the ability to constantly keep the reservoir at maximum pool. The lowest reservoir elevation is typically in late April, while near-full status is reached by late May. In most years, that level has been maintained from Memorial Day weekend through July Fourth weekend, which coincides with the majority of the spawning season for crappie and bass (water level fluctuations during spawning season may negatively impact spawning success).

From early July through mid-August, IPC releases water to help anadromous fish migrate downstream. Brownlee Reservoir then partially refills, but soon after Labor Day another salmon-related drawdown begins and typically lasts through mid-October. This drawdown creates room in Brownlee Reservoir to store excess inflows between mid-October and mid-December, while outflows from Hells Canyon Dam are held stable to protect spawning fall chinook downstream.

These operations originally were characterized as voluntary participation, but have become mandatory with the creation of federal endangered species laws. Protecting recreational access has become more difficult as a result, since many boat ramps are dewatered during drawdown conditions.

Oxbow Project

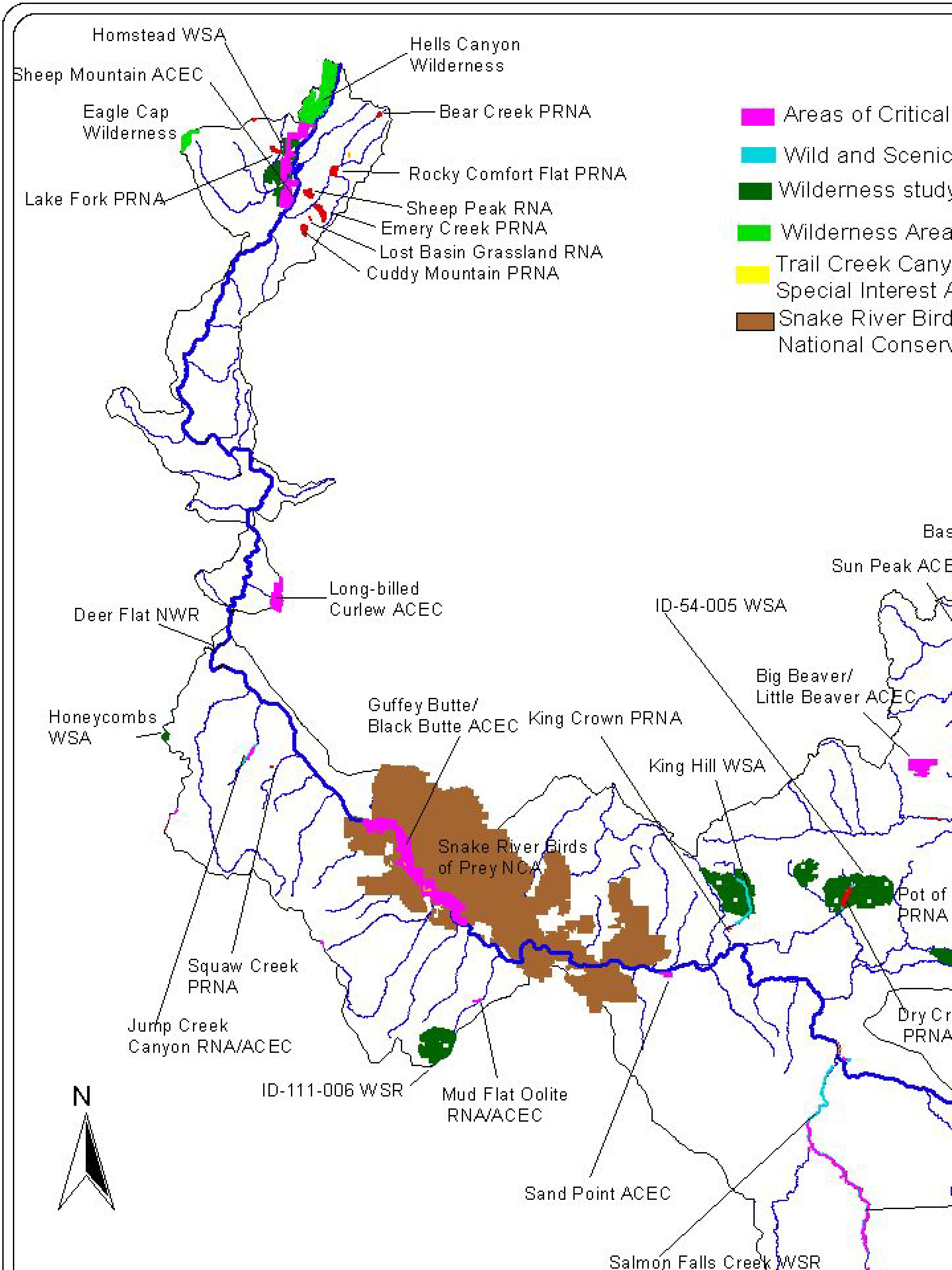
The Oxbow Project takes its name from a 3-mile bend in the Snake River at RM 273 that early settlers said resembled the U-shaped collar around an ox's neck. Oxbow Dam was the second dam of the Hells Canyon Complex, completed in 1961. The rock fill dam contains a powerhouse with 4 generating units having a total nameplate generating capacity of 190 megawatts (IPC 2001). Operating strategies and restrictions throughout the Hells Canyon Complex, including Oxbow Dam, are generally similar to those described above for Brownlee Dam.

Hells Canyon Project

At RM 247.6, Hells Canyon Dam, the third and last dam of the Hells Canyon Complex, began generating electricity in 1967. Hells Canyon is the deepest canyon on the North American Continent. The concrete gravity dam contains a powerhouse with 3 generating units having a total nameplate generating capacity of 391 megawatts (IPC 2001). Operating strategies and restrictions throughout the Hells Canyon Complex, including Hells Canyon Dam, are generally similar to those described above for Brownlee Dam.

2.8.3 Protected Areas

Numerous areas within the subbasin have been provide special protection usually to preserve the unique geological, hydrologic vegetative, feature or features the area contains and/or to preserve rare fish, wildlife or plant species the area possesses. Protection for important areas in the subbasin is provided at the Federal, State and Private levels.



Homstead WSA
Hells Canyon
Wilderness
Sheep Mountain ACEC
Eagle Cap
Wilderness
Bear Creek PRNA
Rocky Comfort Flat PRNA
Lake Fork PRNA
Sheep Peak RNA
Emery Creek PRNA
Lost Basin Grassland RNA
Cuddy Mountain PRNA
Areas of Critical
Wild and Scenic
Wilderness study
Wilderness Area
Trail Creek Cany
Special Interest A
Snake River Bird
National Conserv
Long-billed
Curlew ACEC
Deer Flat NWR
ID-54-005 WSA
Sun Peak ACE
Big Beaver/
Little Beaver ACEC
Honeycombs
WSA
Guffey Butte/
Black Butte ACEC
King Crown PRNA
King Hill WSA
Snake River Birds
of Prey NCA
Pot of
PRNA
Squaw Creek
PRNA
Dry Cr
PRNA
Jump Creek
Canyon RNA/ACEC
ID-111-006 WSR
Mud Flat Oolite
RNA/ACEC
Sand Point ACEC
Salmon Falls Creek WSR
N

Figure 12 presents an overview of select, relatively small scale, protected areas within the subbasins. Larger scale protected areas and those for which map data was not readily available are described textually in the following overviews:

Wilderness and Wilderness Study Areas

Portions of three Wilderness Areas managed by the USFS occur in the Middle Snake subbasins. A small portion of the Jarbidge wilderness area extends into the headwaters of Salmon Falls Creek and is managed by the Humboldt National Forest. Portions of the Hells Canyon, and Eagle Cap Wilderness areas are located in the Oregon side of the lower subbasin, these areas are managed by the Wallowa-Whitman National Forest. Wilderness Areas are protected by the Wilderness Act of 1964, and are managed to preserve their wild character. Numerous Wilderness Study Areas (WSAs), managed by the Bureau of Land Management, are located throughout the Middle Snake subbasins

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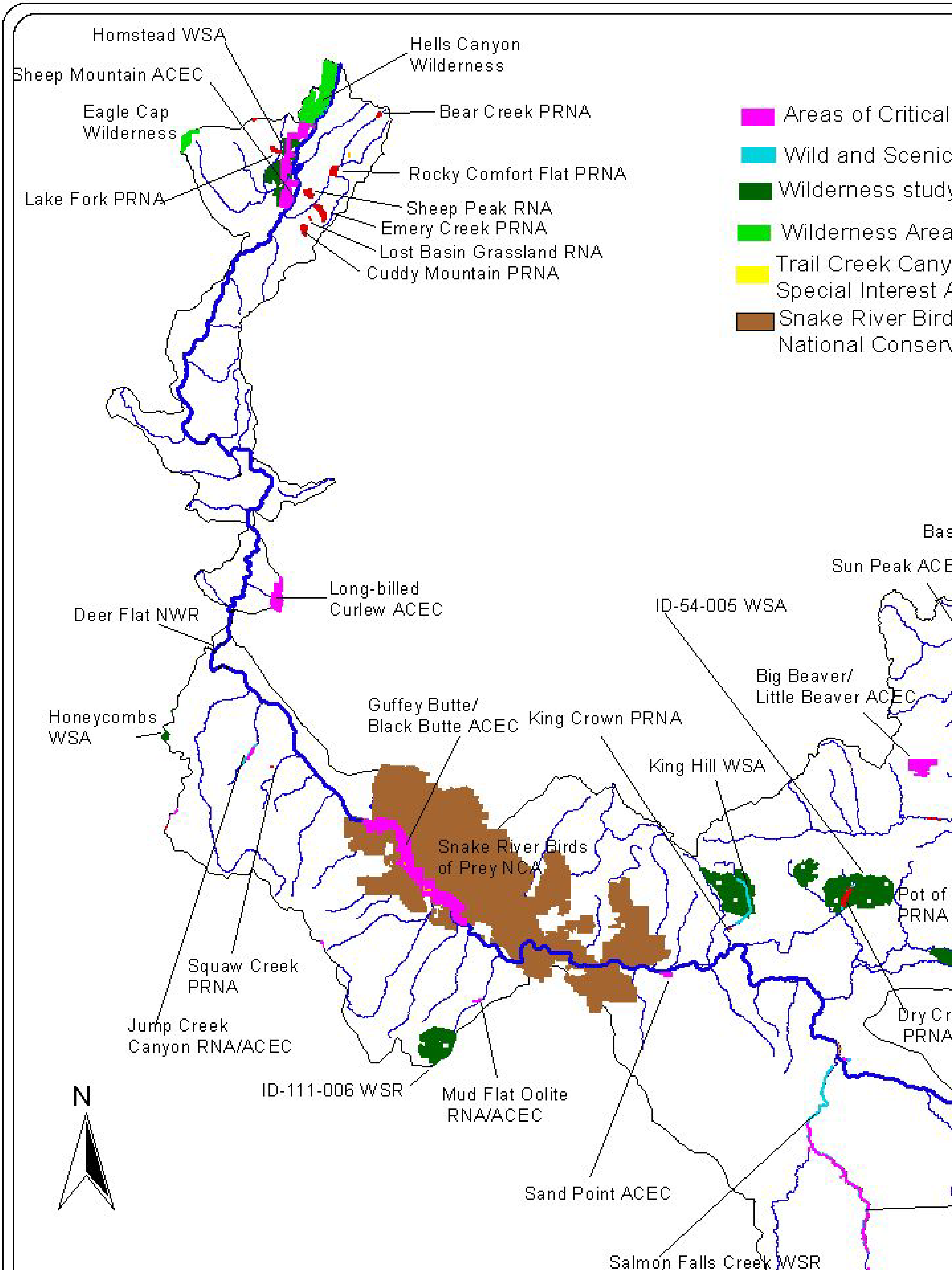

Homstead WSA
Hells Canyon Wilderness
Sheep Mountain ACEC
Bear Creek PRNA
Eagle Cap Wilderness
Rocky Comfort Flat PRNA
Lake Fork PRNA
Sheep Peak RNA
Emery Creek PRNA
Lost Basin Grassland RNA
Cuddy Mountain PRNA
Areas of Critical
Wild and Scenic
Wilderness study
Wilderness Area
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Snake River Bird
National Conserv
Long-billed Curlew ACEC
Deer Flat NWR
ID-54-005 WSA
Sun Peak ACE
Big Beaver/ Little Beaver ACEC
Honeycombs WSA
Guffey Butte/ Black Butte ACEC
King Crown PRNA
King Hill WSA
Snake River Birds of Prey NCA
Pot of PRNA
Squaw Creek PRNA
Jump Creek Canyon RNA/ACEC
Dry Cr PRNA
ID-111-006 WSR
Mud Flat Oolite RNA/ACEC
N
Sand Point ACEC
Salmon Falls Creek WSR

Figure 12). Wilderness study areas are managed to maintain wilderness character and potential for inclusion in the wilderness system, but are not designated wilderness areas.

Roadless Areas

Approx 825 square miles of inventoried roadless areas exist on USFS managed lands throughout the Middle Snake subbasins. The roadless areas, confined to the USFS lands on which they exist, are not uniformly distributed throughout the subbasin (refer to

Figure 8), and occur in the peaks of the Smokey and Pioneer mountains, foothill slopes of Rock Creek in the South Hills, in the Jarbidge Mountains of Nevada, and in northern most portions of the subbasins surrounding Hells Canyon Dam and Reservoir.

Research Natural Areas

Research natural areas, established through the USFS, are natural ecosystems that provide benchmarks for comparison with areas influenced by humans. Areas consider for selection as a RNA are high quality examples of widespread ecosystems, areas containing unique ecosystems or ecological features, or areas supporting rare or sensitive species of plants and animals. RNAs are permanently protected and maintained in natural conditions, for the purposes of conserving biological diversity, conducting non-manipulative research and monitoring, and fostering education. Seventeen areas are designated or are proposed for designation as Research Natural Areas in the Middle Snake subbasins

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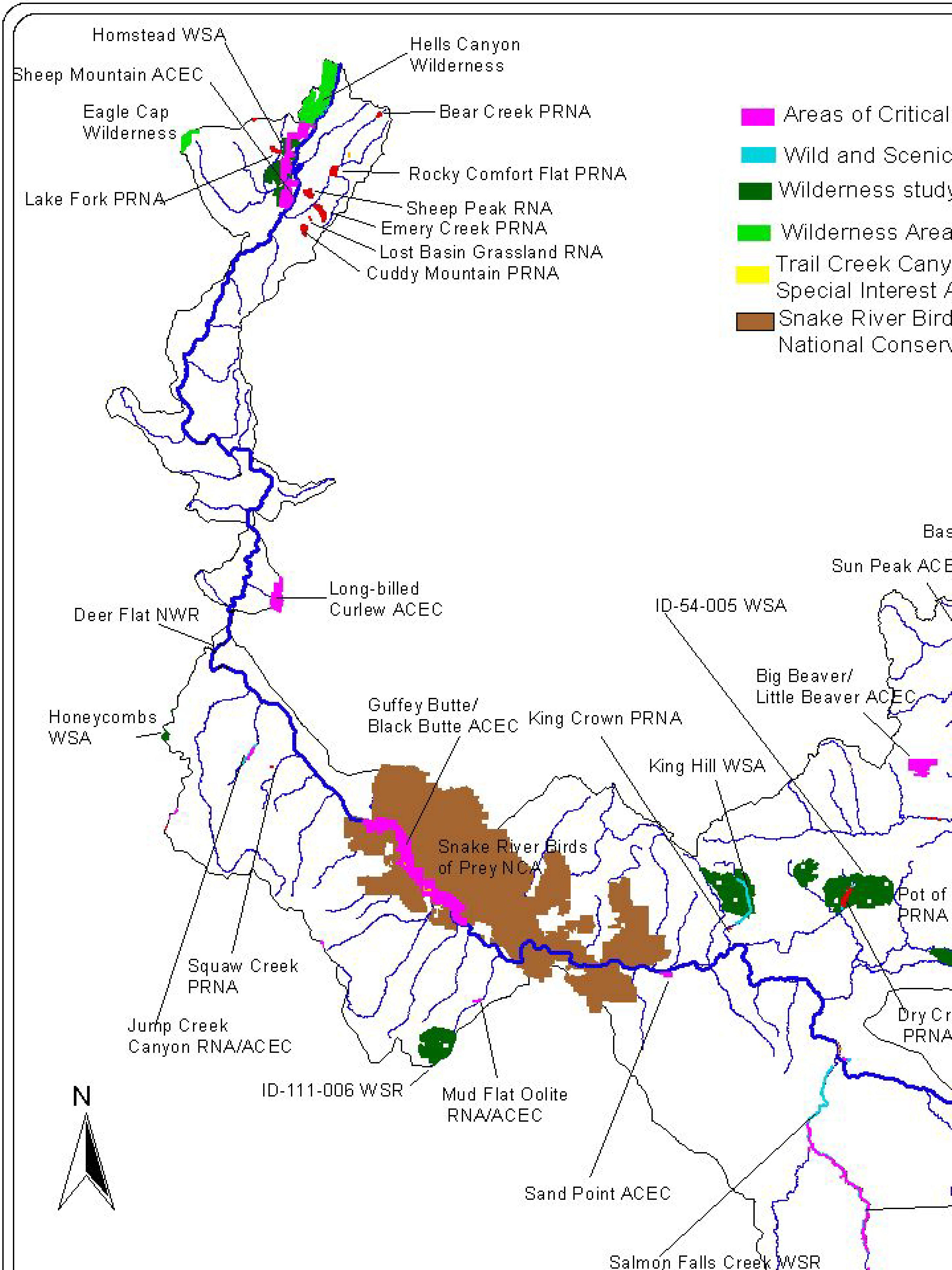

Homstead WSA
Hells Canyon Wilderness
Sheep Mountain ACEC
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Guffey Butte/ Black Butte ACEC
King Crown PRNA
King Hill WSA
Snake River Birds of Prey NCA
Pot of
PRNA
Squaw Creek PRNA
Jump Creek Canyon RNA/ACEC
Dry Cr
PRNA
ID-111-006 WSR
Mud Flat Oolite RNA/ACEC
Sand Point ACEC
Salmon Falls Creek WSR
N

Figure 12). Partially due to the distribution of Forest Service managed land, RNAs in the subbasin are most concentrated in the area just above Hells Canyon Dam and in the Big Wood drainage.

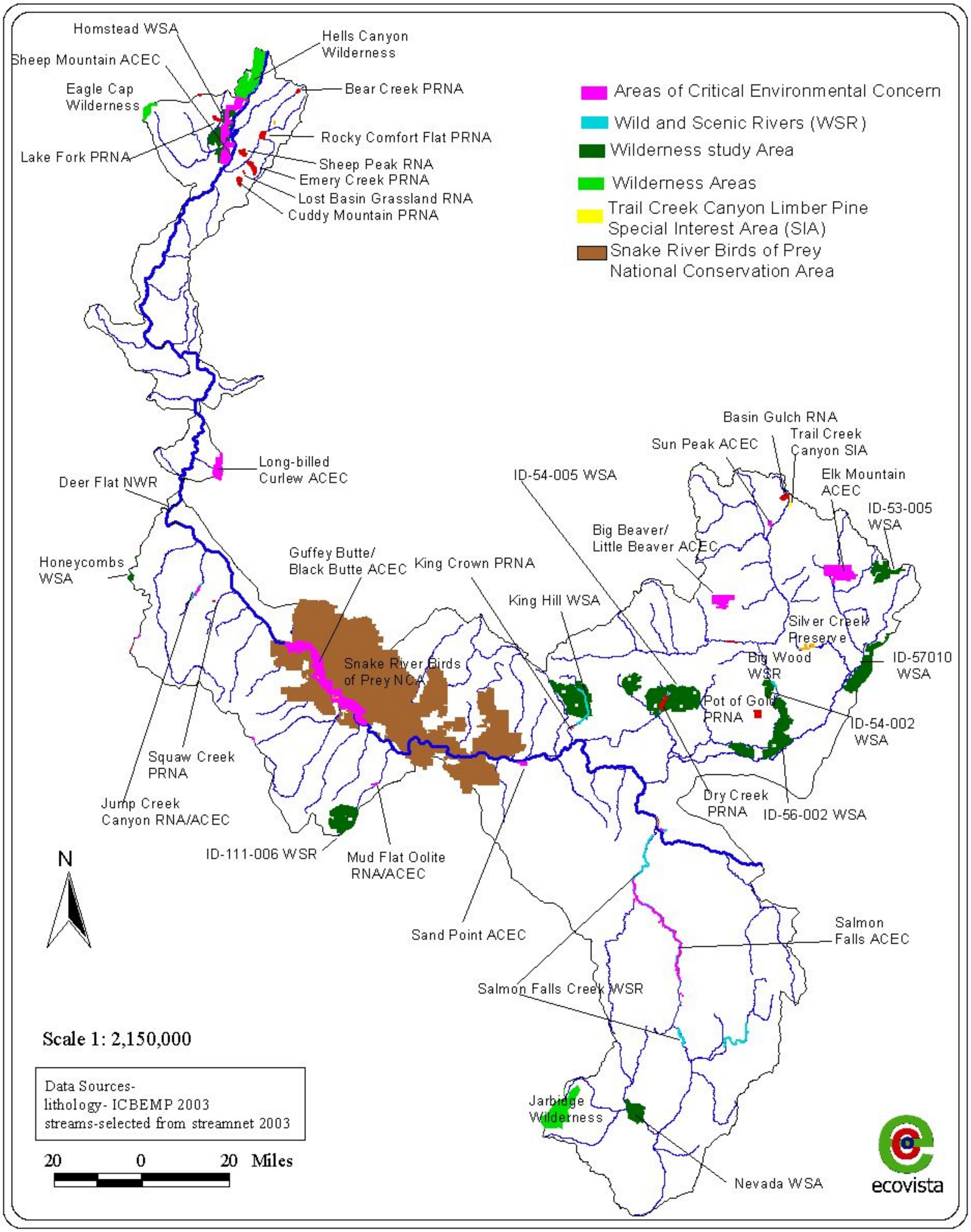

Figure 12. Protected areas in the Middle Snake subbasin.

Hells Canyon National Recreation Area

Established in 1975, Hells Canyon National Recreation Area (HCNRA) encompasses 652,488 acres, of which 194,132 acres are designated as wilderness and 33,000 are privately owned (USFS 1999). A fraction of the HCNRA is located in the Middle Snake subbasins near Hells Canyon Dam and reservoir (). HRNCA is administered as part of the Wallowa-Whitman National Forest.

Snake River Birds of Prey National Conservation Area

The 484,873-acre Snake River Birds of Prey National Conservation Area was established in 1993 to provide for the protection and enhancement of raptor populations and habitats (BLM 1995). Within this, 64,865 acres of essential nesting habitat were withdrawn from the operation of general mining laws, but not mineral lease laws. In addition, approximately 417,775 acres were withdrawn from agricultural operation. The area provides excellent habitat for falcons, eagles, and hawk, supporting the largest concentration of nesting raptors in North America. Eighty-seven percent of the Snake River Birds of Prey National Conservation Area occurs within the subbasin.

Deer Flat National Wildlife Refuge-Snake River Sector

The Snake River Sector of the Deer Flat National Wildlife Refuge is composed of 94 islands distributed along 113 miles of the Snake River in southwest Idaho and eastern Oregon. Twenty-two of these islands occur in the Middle Snake subbasins. The islands were acquired by various methods starting with 36 islands set aside by Executive Order, by President Franklin Roosevelt in 1937. Public Land Orders, purchases, donations and mitigation gains brought the refuge to the present 94 islands totaling approximately 800 acres. The Deer Flat National Wildlife Refuge is managed by the U.S. Fish and Wildlife service with the goal of preservation and maintenance of habitat for all species of native wildlife. The islands are especially important to migratory birds (USFWS 2001).

BLM Areas of Critical Environmental Concern

Areas of Critical Environmental Concern (ACECs) are places that receive special recognition because of the quality, uniqueness and significance of their natural and cultural resources. This designation illustrates that the BLM recognizes that an area has significant values and has established special management measures to protect those values. The Middle Snake subbasins encompass all or portions of at least ten ACECs administered by the BLM (Figure 12).

Idaho State Parks

The Idaho Department of Parks and Recreation (IDPR) manages six state parks within the subbasin. The 110 acre Niagara Springs Park is located along the Snake River southwest of Wendell, Idaho, is part of the Thousand Springs complex, and provides habitat for rainbow trout and waterfowl. Malad Gorge is a 652 acre park which protects a portion of the Malad River approximately 2.5 miles upstream of the mouth. Three Island Crossing, a 513 acre park, is located on the Snake River near Glenns Ferry, Idaho which provides habitat for the Idaho springsnail, the California floater, white sturgeon, long-billed curlew, bald eagle, trumpeter swans, burrowing owls, and the western toad. The 4,800 acre Bruneau Dunes Park is located south of Mountain Home, Idaho near the Snake River and contains the largest single-structured sand dune in North America and has lake, marsh, desert, and sagebrush habitats.

Box Canyon Park is jointly managed by The Nature Conservancy and IDPR. This 350 acre park is located 20 miles northwest of Twin Falls Idaho. Box Canyon Spring is the 11th largest spring in North America, flowing at approximately 400 cfs. The park provides habitat for the Shoshone sculpin, Bliss Rapids snail, Utah valvata, and the Banbury Springs limpet.

Billingsley Creek Park encompasses 287 acres near the town of Hagerman, Idaho. Billingsley Creek is exclusively spring-fed. It flows for over eight miles through the largest expanse of herbaceous wetland in the Magic Valley. The park was purchased to protect wildlife and aquatic habitat and to improve water quality in the creek as well as the Snake River.

Idaho Fish and Game Wildlife Management Areas (WMAs)

The IDFG owns and manages seven wildlife management areas (WMAs) in the Middle Snake subbasins for the benefit of fish and wildlife and associated recreation. Cecil D. Andrus Wildlife Management Area is located in northern Washington County, Idaho, and managed by the Idaho Department of Fish and Game.

The 976 acre Niagara Springs Wildlife Management Areas (NSWMA) is located 6.5 mi. south of Wendell, Idaho, and lies along the north bank of the Snake River. NSWMA was purchased to provide hunting and fishing opportunity, access to the Snake River, and provide habitat to support a variety of wildlife. The area extends from the canyon rim down 212 feet to the Snake River. The islands have increased in size since they were purchased due to sediment deposition on the downstream parts of the islands. No threatened or endangered species are known to reside on NSWMA. A wild rainbow trout fishery exists on NSWMA and they spawn in the irrigation canal fed by Niagara Springs.

Billingsley Creek Wildlife Management Area (BCWMA) encompasses 275 acres near the town of Hagerman. The area is traversed by Billingsley Creek, a spring fed stream. Several springs originate along the basaltic rim rock and feed a wetland before entering Billingsley Creek. Florence Spring, the largest spring within BCWMA, provides gravel spawning habitat for wild trout. Brown and rainbow trout inhabit the stream. IDFG stocks approximately 8,000 brown trout in Billingsley Creek annually. Hatchery fish escape from the commercial fish hatcheries located upstream from BCWMA. The area supports wildlife habitat for upland game, waterfowl and mule deer. Duck hunting is the dominant use when nearby waters freeze.

The 880 acre Hagerman Wildlife Management Area (HWMA) is located 2 mi. south of Hagerman, Idaho. State Highway 30 divides a portion of the management area. HWMA is situated on a gentle south-facing slope between the Snake River canyon wall and the river. Sixteen ponds are located at HWMA. The water supply for the ponds is Brailsford Ditch (Len Lewis Spring), Big Bend Ditch (Tucker Springs), and Riley Creek (approximately 17 springs flowing from the escarpment above the Hagerman National Fish Hatchery). An IDFG trout hatchery (Hagerman State Fish Hatchery) occupies 35 ac. in the middle of HWMA. The HWMA is an important wintering area for waterfowl. During the winter, HWMA is occupied by approximately 50,000 ducks and 3,000 Canada geese. The aquatic habitat is suitable for both coldwater and warmwater fish species depending on spring inflow and distance from spring heads.

Carey Lake Wildlife Management Area (CLWMA) is located near Carey, Idaho. The CLWMA encompasses approximately 750 acres, and provides aquatic and upland habitats for migrating, nesting and feeding waterfowl and shorebirds. Fish that inhabit Carey Lake include large mouthed bass, bluegill, yellow perch, brown bullhead and channel catfish (Hurley et al. 2002). Several sensitive, threatened, and endangered flora and fauna have been observed on or adjacent to CLWMA. Documented bird species include the black tern, great egret, white-faced ibis, bald eagle, long-billed curlew, and trumpeter swan. Mammals that have been observed are the long-legged and western small footed myotis. The western toad, an amphibian, has been seen in the area.

Centennial Marsh, a seasonally flooded wetland, is located in the Camas Prairie Centennial Marsh Wildlife Management Area 14 miles west of Fairfield, Idaho. It covers just over 3,100 acres, providing aquatic and upland habitats for breeding, nesting and feeding waterfowl and shorebirds. Typically from mid-April to mid-July 70% of the management area is covered by 1 ft., or less, of water and covered predominantly by sedges and juncus. The remainder of the management area is dominated by silver sagebrush or agricultural uses. Several sensitive, threatened, and endangered flora and fauna have been observed on or adjacent to Centennial Marsh. Documented bird species include the black tern, great egret, white-faced ibis, bald eagle, peregrine falcon, western burrowing owl, long-billed curlew, trumpeter swan, loggerhead shrike. The western toad and spotted frog, both amphibians, have been seen in the area. Sensitive plant species in the area are cinquefoil tansy, fringed water plantain, and bugleg goldenweed.

The C.J. Strike Wildlife Management Area encompasses 20,725 acres of C.J. Strike Reservoir, adjacent marshes, ponds and wildlife food plots, extending 26 miles up the Snake River and 12 miles up the Bruneau River between the towns of Grand View and Bruneau, Idaho. Idaho Power Company, Idaho Department of Fish and Game, and the Bureau of Land Management own the land. Existing agreements gave IDFG primary management authority and responsibility for the area. The management emphasis for the area focuses on waterfowl and upland game bird production, and much of the area is closed to the public from February 1 through July 31. Mink, mule deer, coyotes, chukars, wilson snipe, and mourning doves are also found on the CJSWMA in varying numbers. Game fish in the reservoir are dominated by warmwater species. The primary coldwater game species found in the reservoir is rainbow trout of hatchery origin. No wild or naturally produced rainbow trout have been found in recent surveys. Mountain whitefish and white sturgeon also reside in the reservoir. Bald eagles are known to winter on the CJSWMA. Two endangered molluscs, the Idaho Springsnail and the Bliss Rapids Snail, inhabit C.J. Strike Reservoir.

Surface and Groundwater Protection

The Snake River flows through some very deep canyon sections and provides unique geographic and scenic values as well as recreational opportunity. In 1988 the Idaho legislature, legislation HB780, Idaho code 42-1734A, directed the Idaho Water Resources Board to develop a comprehensive statewide water plan, and also proposed interim protection status to selected water bodies in Idaho, including segments in the Middle Snake River between Milner and King Hill, Idaho (IWRB 1993 *cited in* Hurley et al. 2002; Table 6).

Both surface and groundwater are receiving critical attention in this subbasin, because of concerns for both human and aquatic health and production. Protection measures include sole source aquifer designations and establishment of groundwater management areas.

Table 6. Stream segments designated for protection under State Water Plan (IWRB 1993a; 1996; 1998 *all cited in* Hurley et al. 2002).

River	Reach	Designation	Length (miles)
Snake River	Milner to Murtaugh	Recreational	7.0
Snake River	Murtaugh to Twin Falls	Natural	9.5
Snake River	Twin Falls to Hagerman	Recreational	35.0
Snake River	Hagerman to King Hill	Recreational	20.0

The Eastern Snake River aquifer was designated as a sole source aquifer by EPA in 1990. A sole source aquifer is that which provides at least 50 % of the drinking water consumed, and the Eastern Snake River aquifer was found to supply nearly 100% of drinking water for the local population, and there are concerns with decreasing groundwater levels and increasing levels of nitrates. Nitrate levels in groundwater have been increasing and in places exceed the 10 mg/L drinking water standard.

The Director of Idaho Department of Water Resources (IDWR) is granted the authority to designate "critical ground water areas" (CGMA) and "ground water management areas" (GWMA) under Idaho Code Title 42, Chapter 233a and 233b, respectively. Groundwater water rights are generally junior to surface water rights, and the primary purpose of the groundwater management designations is to ensure adequate supply of surface water for senior water rights. This indirectly affects aquatic biological resources through the type and amount of surface flow and inputs. The CGMA's and GWMA's that occur fully or partly within the subbasin are included in

Table 7. Descriptions of the GWMA's are summarized in Harrington and Bendixen (1999 *cited in* Hurley et al. 2002), and include purpose, aquifer characteristics, maps and ground water status.

A CGMA is all or part of a ground water basin that does not have sufficient ground water to provide a reasonably safe supply for irrigation or other uses at the current or projected rates of withdrawal. The Director of IDWR can deny an application for a proposed use if the point of diversion lies within the designated area and may require water users to report diversions or other information (Harrington and Bendixen 1999 *cited in* Hurley et al. 2002).

A GWMA is all or part of a ground water basin that may be approaching the "critical" conditions of a CGMA. Applications for new water appropriations may be approved only after it is determined that sufficient supply is available and other prior water rights will not be injured. The director may require reporting of water use by water users within the area (Harrington and Bendixen 1999 *cited in* Hurley et al. 2002).

Table 7. IDWR Ground Water Management Areas within the Middle Snake subbasins (IDWR 2004).

Name	Type	Date Designated	Subbasin Coverage
Big Wood River	GWMA	1991	Full
Twin Falls	GWMA-Geothermal	1984	Full
Blue Gulch	CGWA	1970	Partial
Oakley Fan/Artesian City	CGWMA	1967-1982	Partial
Banbury Hot Springs	GWMA-Geothermal	1983	Full
Mountain Home	CGWA -CGWMA	1982	Full
Grandview-Bruneau	CGWA	1982	Partial
Cinder Cone Butte	CGWA	1981	Full
Mountain Home	GWMA	1982	Full

The Nature Conservancy (TNC)

The mission of TNC is to find, protect, and maintain the earth's rare plants and animals by protecting the lands and water they need to survive. TNC owns and manages four preserves within the Middle Snake subbasins.

The Thousand Springs Preserve borders the Snake River approximately 5 miles southeast of Hagerman, Idaho. The preserve contains two of last remaining undeveloped springs of the Snake River Plain aquifer. The goals of the preserve are to protect the springs, improve wildlife habitat, and keep the preserve open to the public. The 420 acre site contains habitat for the largest known population of Shoshone sculpin. It also provides habitat for the Utah valvata snail and Banbury Springs limpet. Giant helleborine is known to occur on the canyon walls.

The Silver Creek Preserve is located approximately 30 miles southeast of Sun Valley Idaho. Silver Creek is a spring fed tributary to the Little Wood River. TNC owns 880 acres and has conservation easements on an additional 9,000 acres. It is a renowned fly fishing stream for rainbow and brown trout. Much of the original sagebrush - grass habitat in the valley has been converted to barley and alfalfa. The preserve provides habitat for the Wood River sculpin, bald eagle, and two sensitive plants, Buxbaum's sedge and yellow ladies slipper. This is one of only two known populations of the yellow ladies slipper in the state of Idaho. It is an outstanding example of a desert aquatic ecosystem.

Strapp-Soldier Creek Preserve is located approximately 10 miles north of Fairfield, Idaho. This 93 acre site provides habitat for the Wood River sculpin and the sensitive plant Camas goldenweed.

The 44 acre Hemmingway Preserve is located just north of Ketchum, Idaho along the Big Wood River. It contains stands of undisturbed black cottonwood forest on islands in the river and in the floodplain. The area provides habitat for the Wood River sculpin and possibly the leatherside chub.

Wood River Land Trust (WRLT)

The WRLT works to protect, maintain, and restore the existing high quality habitat and open space values of the Wood River Valley. To date, the WRLT owns approximately 39 acres in fee simple, including property along the Big Wood River and its tributaries (Lake Creek and Independence Creek). The WRLT has also permanently protected 1,362 acres via conservation easements, including riverfront parcels along the Big Wood River (and tributaries Threemile Creek, Chimney Creek, Silver Creek, and Willow Creek).

2.9 Water Quality

Water quality is intimately connected to water quantity and use in the subbasin. Pollutant inputs are from point and nonpoint sources (Buhidar 1999). Point sources include aquaculture, food processors, municipalities, and industry. Nonpoint sources include irrigated and nonirrigated agriculture, grazing, confined feeding operations, National Pollutant Discharge Elimination System (NPDES) permitted confined feeding operations, urban runoff/storm sewers, and recreation.

Poor water quality limits the productivity and health of the aquatic system and impedes recreational use. Over 1,400 stream miles—including 10 reservoirs, 12 Snake River segments, 2 springs, and 95 tributary segments—have been classified as water quality limited in the subbasin under § 303(d) of the Clean Water Act (Some waterbodies are subject to differing criteria of multiple states). A complete list of streams listed under § 303(d) is provided in Appendix A. In addition to the parameters described in Appendix A, the U.S. Bureau of Reclamation (USBR 1998) identifies sediment as a problem pollutant for all mainstem Snake River reaches between C.J. Strike Dam and the town of Weiser.

The highly impacted flow regimes that result from dams and irrigation diversions influence pollutant transport and processing within the subbasins. Pollutants such as sediment, mercury, and nutrients tend to accumulate behind these structures. Concentration of nutrient and organic loads in impoundments may result in nuisance algae growth and dissolved oxygen depletion. Reduced dissolved oxygen, in turn, can degrade aquatic habitat, kill fish, and increase nutrient and toxin release at the sediment–water interface (IDEQ and ODEQ 2003).

Nearly the entire length of the mainstem Snake River in the subbasin is listed as water quality impaired. The major water quality issues in the Snake River develop from a variety of point and nonpoint sources include excessive sediment loading, elevated temperatures, reduced flows, reduced dissolved oxygen, excessive aquatic plant growth, and nutrient enrichment. Pesticide presence is also a substantial concern in the upper portions of the subbasins (Clark et al. 1998, Buhidar 1999).

Nutrient loading to the Snake River comes from the upstream segment of the Snake River, drains, tributaries, and point sources. The primary nutrient impairing beneficial uses is phosphorus although high ammonia and nitrate levels can also be toxic to fish and humans. A total phosphorus target of 0.07 mg/L (May-September) has been set for the Middle Snake River–Succor Creek watershed (IDEQ 2002). The IDEQ (Buhidar 1999) determined from nearly 900 samples collected from 1995 to 1997 that nitrate and phosphate levels commonly exceed applicable water quality levels in upper portions of the Middle Snake subbasins (Table 8).

Pollutant sources and an input budget were quantified in 1995 for the Snake River from Milner Dam to King Hill (Clark 1997): springs contributed 60% of total nitrogen; aquacultural effluent was a major source of ammonia (82%), organic nitrogen (30%), and total phosphorus (35%); and tributary streams were a major source of organic nitrogen (28%) and suspended sediment (58%). In proportion to its discharge (less than 1%), the Twin Falls sewage-treatment plant was a major source of total phosphorus (13%).

Table 8. Percent exceedance of nitrate, ammonia, and phosphate samples over water quality standards.

Criteria	Nitrate	Ammonia	Phosphate
Salmonid protection levels	99.5%	0.5%	83.5%
Eutrophication prevention levels	89.9%	N/A	N/A

Sediment is a major and consistent problem in most sections of the Snake River in the subbasins. Fine sediment deposits occur in the slack-water parts of the river, along river margins, and behind dams. These sediment deposits can be quite extensive in slack-water areas of the river. Only 24% of sediment is transported into the subbasins from upstream; most of the sediment is from local inputs, which include tributary streams, irrigation return flows, bank erosion, and irrigation drains (Clark et al. 1998). Both irrigation practices and the type of crop affect sediment loss and transport from agriculture. Most soil erosion on agricultural land is generated from gravity irrigation (erosion potential of irrigation: flood > furrow >sprinkler irrigation).

Instream channel erosion is the primary source of sediment loading in studied tributaries (Castle Creek, Sinker Creek, and Succor creeks). Land management practices contribute to unstable banks, and this resultant instability leads to sediment delivery to the stream channel. The IDEQ (2002) estimated that 80% bank stability was a surrogate target that would help achieve suitable (≤ 28%) levels of fine sediment in these creeks (IDEQ 2002).

Abundant macrophyte growth occurs on the sediment deposits in slack waters and is nourished by high nutrient levels in both the water column and the sediments. The macrophytes are considered a nuisance to recreation and also modify the aquatic habitat. The aquatic macrophyte community is dominated by *Potamogeton pectinatus*, *Potamogeton crispus*, and *Ceratophyllum demersum*. Also, filamentous green algae (*Hydrodictyon* and *Cladophora* sp.) form dense mats on the water surface (Falter and Burris, Buhidar 1999). The algal growth and macrophyte beds can reduce nightly dissolved oxygen concentrations in the water from diel fluctuations in demand, especially during periods of low flow and high temperature. During fall senescence, dissolved oxygen is consumed by bacteria as they break down the organic matter from algae and macrophytes collecting on the sediments.

The presence of mercury in surface waters is a water quality concern, especially when mercury is present in readily mobile and easily accumulated forms such as methylated mercury. Elevated mercury levels in fish tissues have been observed in portions of the Snake River (Rinella et al.

1994 and Clark and Maret 1998, both cited in IDEQ and ODEQ 2003; Maret 1995). Common sources of mercury in the subbasins are legacy mining activities and natural geologic materials. Mercury itself was mined from portions of the subbasins, but more frequently it was used to amalgamate mined gold and silver. Mercury is still present in the tailing piles associated with such operations (IDEQ and ODEQ 2003). Mercury concentrations from fish and macroinvertebrate tissue samples taken in the subbasins are summarized in Table 9.

Table 9. Average concentrations of mercury in sampled tissues of aquatic organisms (fish or caddis flies) from various locations throughout the Middle Snake subbasins.

Reach	River Miles	Number of Samples	Year	Average Mercury (mg/kg wet weight)	Average Mercury (mg/kg dry weight)	Source
Snake River near Buhl	unknown	unknown	1992		0.17 (est.[a])	Maret 1995
Snake River at King Hill	unknown	unknown	1992		0.22	Maret 1995
Rock Creek at Daydream Ranch	unknown	unknown	1992		0.05 (est.[a])	Maret 1995
Malad River near Gooding	unknown	unknown	1992		0.03 (est.[a])	Maret 1995
Upper Snake River	409–335	16 9 2	1970 1990 1997	0.79 0.20 0.28		IDEQ and ODEQ 2003
Brownlee Reservoir	335–285	33 130 5	1970 1994 1997	0.45 0.39 0.26		IDEQ and ODEQ 2003
Downstream Snake River	247–188	2	1997		0.15	IDEQ and ODEQ 2003

[a] estimated from graphs provided in online document—no actual number is stated

2.10 Demographics and Economics

This summary is intended to provide a brief description of demographic, economic, and social conditions within the Middle Snake subbasins. It provides an elementary overview of prominent economic activities in the subbasin, connections to natural resources, and levels of related income and employment as called for in the *Recommendations and Guidance for Economic Analysis in Subbasin Planning* of the Independent Economic Analysis Board (2003). This analysis has been based primarily on census data available from the Idaho Department of Commerce (IDOC 2002), the Northwest Income Indicators Project of Washington State University (WSU 2001), and the U.S. Census Bureau (2000a) and is generally presented as an average of the 19 counties (Ada, Adams, Baker, Blaine, Camas, Canyon, Cassia, Elko, Elmore, Gooding, Jerome, Lincoln, Malheur, Minidoka, Owyhee, Payette, Twin Falls, Wallowa, and Washington) in the subbasins, except where noted.

2.10.1 Idaho State

Population

The majority of the Middle Snake subbasins lies in Idaho, with small areas in Oregon and Nevada. Idaho ranks 39th among the states in population and 11th in size. The projected population of Idaho in 2025 is approximately 1.7 million, compared with 4.2 million in Oregon, 2.3 million in Nevada (Figure 13), and 308 million in the United States.

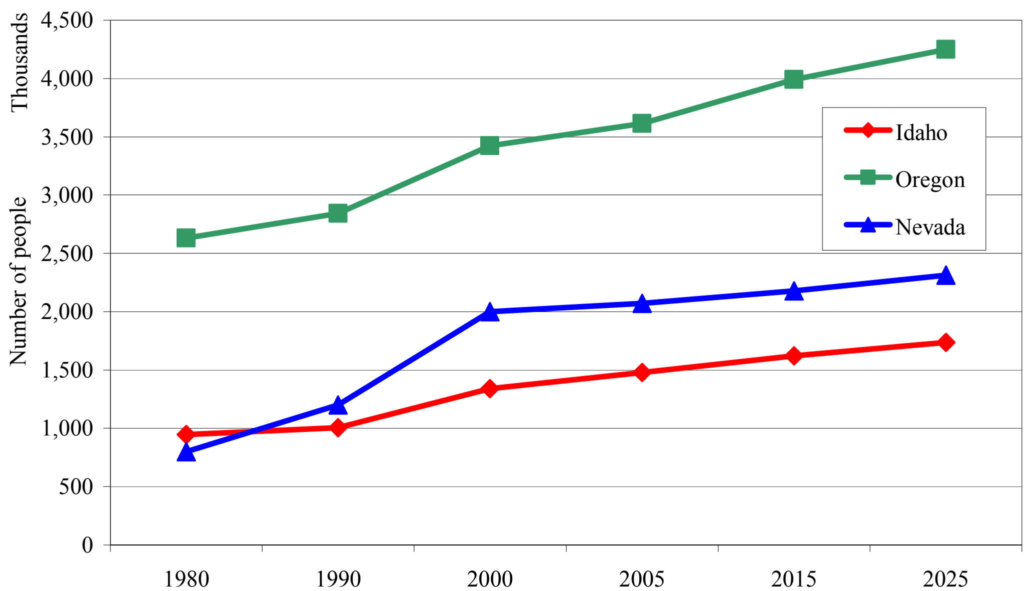

Figure 13. Past and projected population of Idaho, Nevada, and Oregon (U.S. Census Bureau 2000a).

Economics

The federal government manages 63% of Idaho's land. Manufacturing, agriculture, and tourism are important components of Idaho's economy. The civilian labor force unemployment rate decreased in the state from 7.9% in 1980 to 4.9% in 2000 (Figure 14).

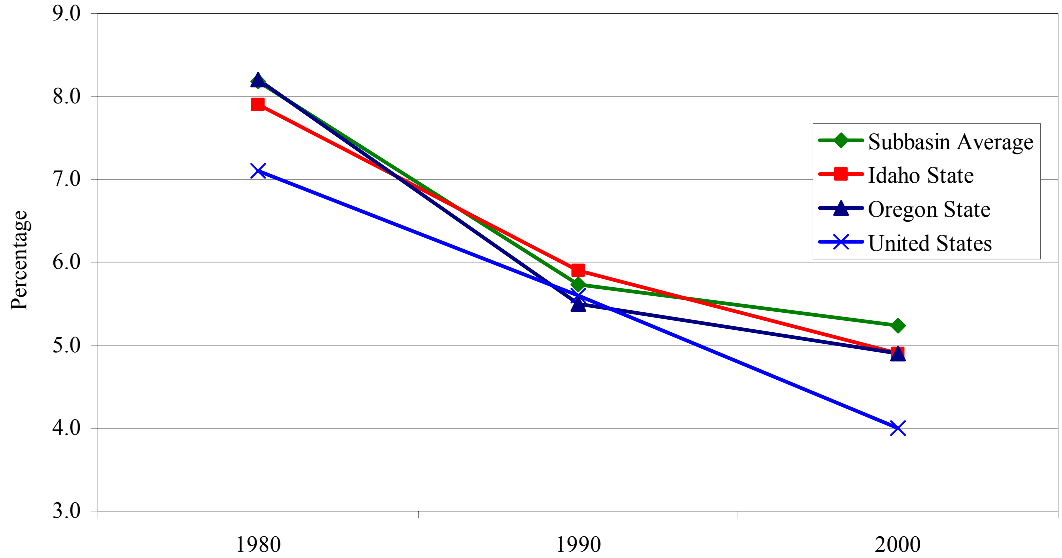

Figure 14. Percent civilian labor force unemployment trends from 1980 to 2002 in the Middle Snake subbasins, state of Idaho, and United States (U.S. Census Bureau 2000b,c; IDOC 2002).

2.10.2 Subbasin Summary by County

Land Area

The counties with greater than 10% of their land area in the Middle Snake subbasins are Blaine, Elmore, Owyhee, and Twin Falls (Table 10).

Table 10. Relative land area of counties in the Middle Snake subbasins (calculated using GIS, ESRI 1999).

County	State	Acres	Percentage (%) of Subbasin in County
Ada	ID	200,804	2.4
Adams	ID	172,723	2.1
Baker	OR	298,174	3.6
Blaine	ID	1,030,904	12.4
Butte	ID	178	0.002
Camas	ID	408,416	4.9
Canyon	ID	91,318	1.1
Cassia	ID	39,768	0.5
Custer	ID	793	0.01
Elko	NV	781,481	9.4
Elmore	OR	1,017,893	12.2

County	State	Acres	Percentage (%) of Subbasin in County
Gooding	ID	437,800	5.3
Jerome	ID	27,633	0.3
Lincoln	ID	414,284	5.0
Malheur	ID	385,411	4.6
Owyhee	ID	1,523,876	18.3
Payette	ID	59,267	0.7
Twin Falls	ID	1,149,334	13.8
Wallowa	OR	34,929	0.4
Washington	ID	263,004	3.2

Population

According to 2002 estimates based on the 2000 census, the most populous counties in the subbasin are Ada and Canyon counties, with 319,687 and 144,983 people, respectively (Figure 15). The population of Ada County generally resides in the city of Boise (189,847 people), which lies outside the subbasin boundary. Likewise, the cities of Caldwell and Nampa, also outside the subbasin boundary, account for the majority of the population in Canyon County. In 2000, the most populous cities in the subbasin included Twin Falls (34,469), Mountain Home (11,143), Jerome (7,780), Hailey (6,200), and Buhl (3,985), which are located in Twin Falls, Elmore, Jerome, Blaine, and Twin Falls counties, respectively.

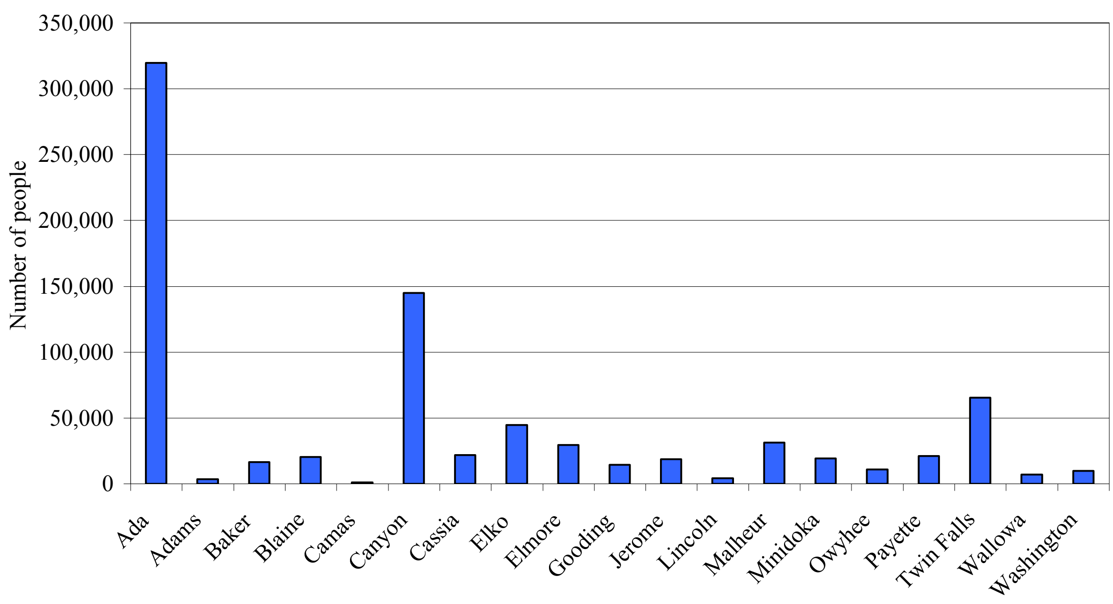

Figure 15. Population of the counties in the Middle Snake subbasins in 2002 (WSU 2001, IDOC 2002).

From 1980 to 2002, the populations of most counties in the subbasin remained stable. Exceptions include an increase in the population of Ada County, from about 175,000 residents in 1980 to about 320,000 in 2002. Other population changes in the subbasin occurred in Canyon County, where the population increased from around 85,000 people in 1980 to nearly 145,000 in 2002 (Figure 16).

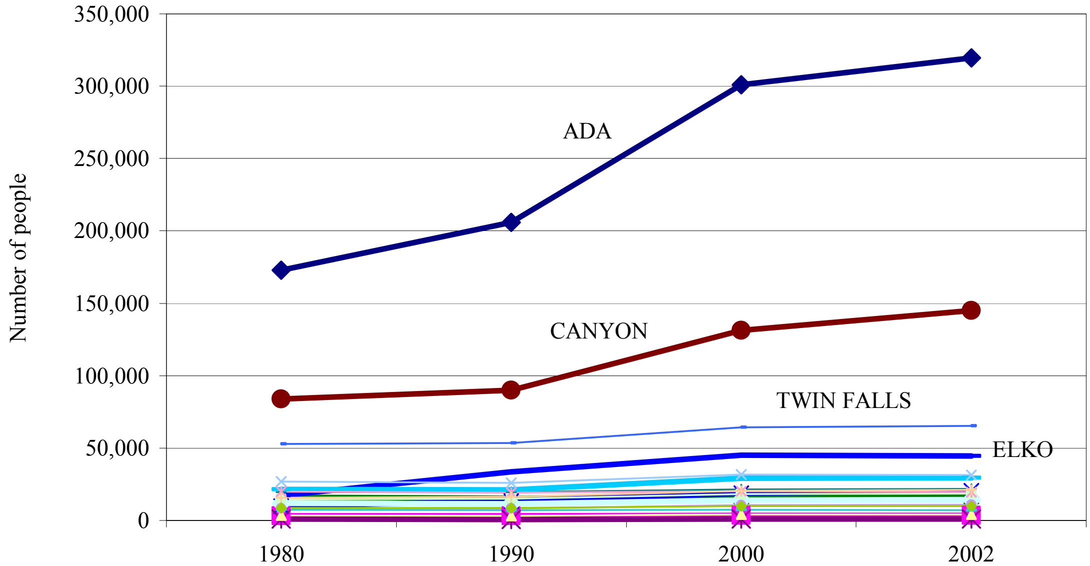

Figure 16. Population trends from 1980 to 2002 in the Middle Snake subbasins (IDOC 2002).

Employment by Industry

The main sources of employment in the subbasins (based on average number of jobs in counties with major land area in the subbasin: Adams, Baker, Blaine, Elko, Elmore, Gooding, Malheur, Owyhee, Twin Falls, Washington) are in services, retail trade, state and local government, and farming (see Figure 17 for a list of the major employers in these counties). Farming occurs on most of the flat terrain adjacent to the Snake River; however, almost the entire subbasin that is not farmed or urbanized is grazed. On average, industries in the categories of agricultural services, forestry, fisheries, and other; mining; construction; and finance, insurance, and real estate experienced the highest percentage of growth in the past decade—45, 44, 40, and 34%, respectively (Figure 17). (See Appendix B for a list of the largest employers in all counties within the Middle Snake subbasins.)

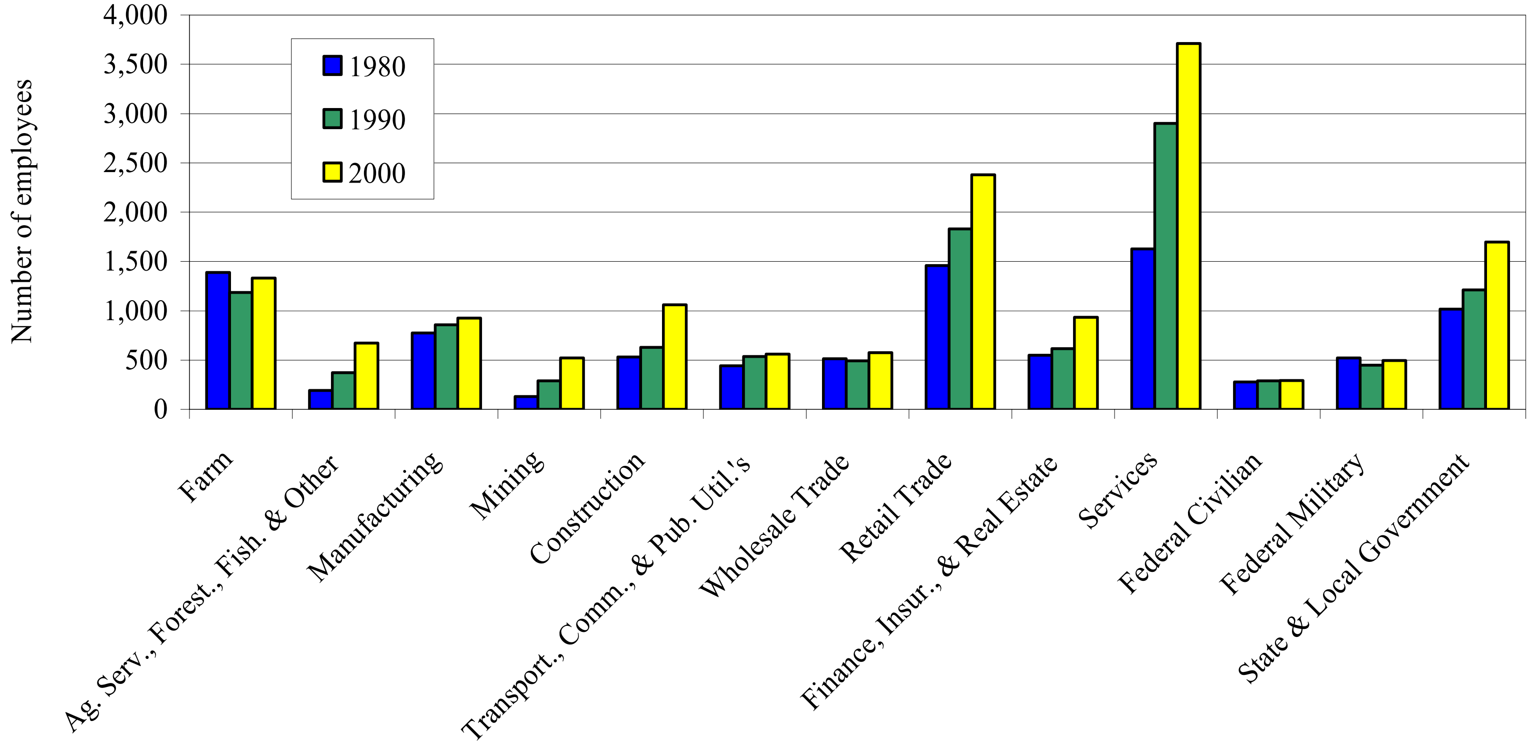

Figure 17. Average employment by industry in the Middle Snake subbasins from 1980 to 2000, including counties with greater than 10% land area in the subbasin (IDOC 2002).

Employment by Tourism and Recreation

Forestry, fishing, and agriculture service economies saw steady growth from 1980 to 2000 (Figure 17). The recreation and tourism industry was difficult to measure on a county basis. However, the *2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation* (USFWS and U.S. Bureau of Census 2002) found that, in 2001, 486,000 Idaho residents and nonresidents (ages 16 and older) spent nearly $755 million dollars in Idaho for fishing and hunting and an additional $982 million for wildlife viewing and related activities. The International Association of Fish and Wildlife Agencies modeled the survey data (Southwick Associates 2001) and estimated the number of jobs created in Idaho from all hunting activities as 6,197. The number of jobs created from all fishing activities was not modeled, but higher estimates could be made based on the higher percentage of fishing expenditures (57%) than hunting expenditures in Idaho. Rural community economies are generally considered to benefit from hunting and fishing activities, while some are highly dependant on those activities (Southwick Associates 2001).

A summary of 2002 sales of resident hunting and fishing licenses by county illustrates the areas where most sportsmen live in the subbasins (assuming that people purchase licenses in the county of their residence). Ada, Canyon, and Twin Falls counties had the highest number of license sales that year: 65,745, 30,848, and 15,317, respectively (Figure 18). The 1991 *National Survey of Fishing, Hunting, and Wildlife-Associated Recreation* (USFWS and U.S. Bureau of Census 2002) found that 49% of all hunters and 52% of freshwater anglers traveled less than 25 miles to the sites they used most often (Figure 19). This percentage would suggest that the majority of hunting and fishing activity in the subbasins occurs near Ada, Canyon, and Twin Falls counties.

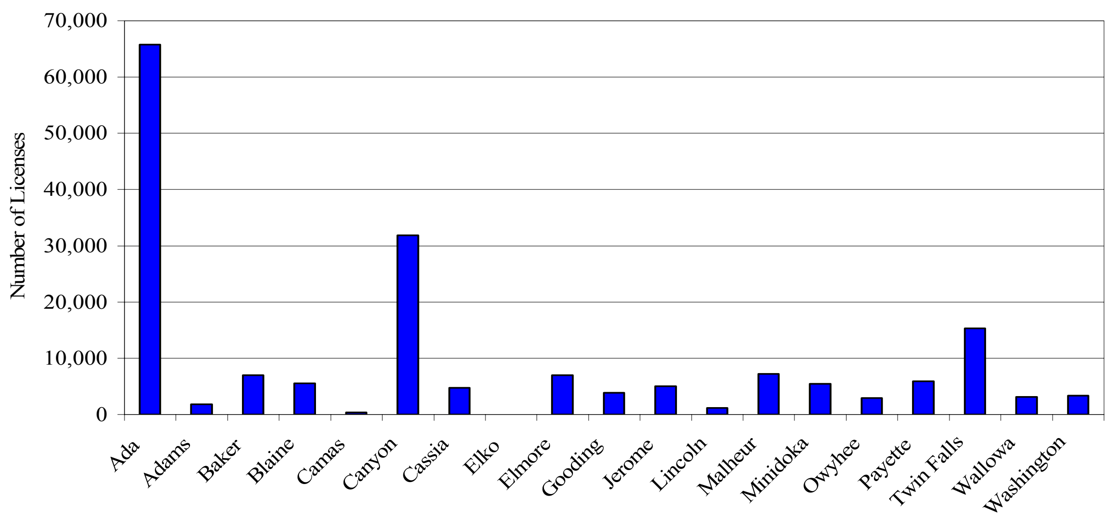

Figure 18. Resident hunting and fishing license sales in 2002 for counties in the Middle Snake subbasins (IDFG 2003b, ODFW 2003).

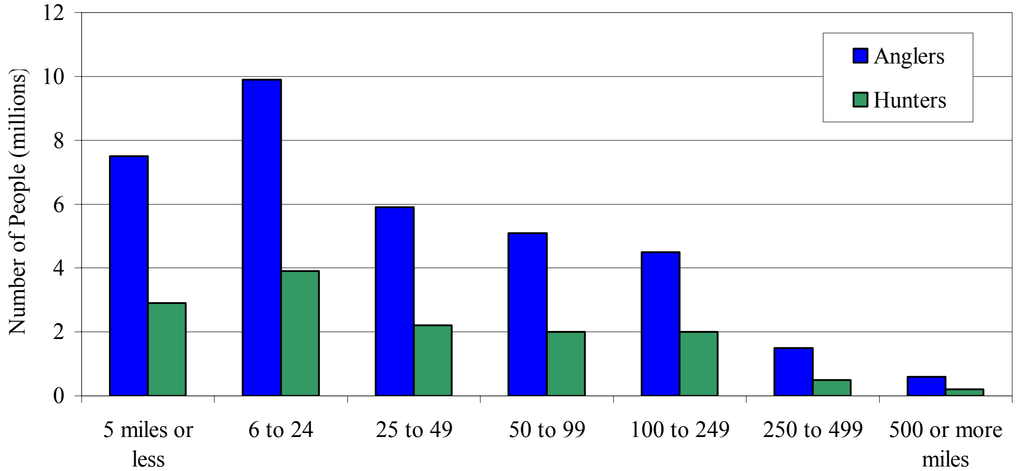

Figure 19. Distance traveled one-way to sites used most often by hunters and fisherman (USFWS and U.S. Bureau of Census 2002).

Income

The average per capita income during 2000 in the Middle Snake subbasins is slightly lower than that for Idaho, but similar to the national average (Figure 20).

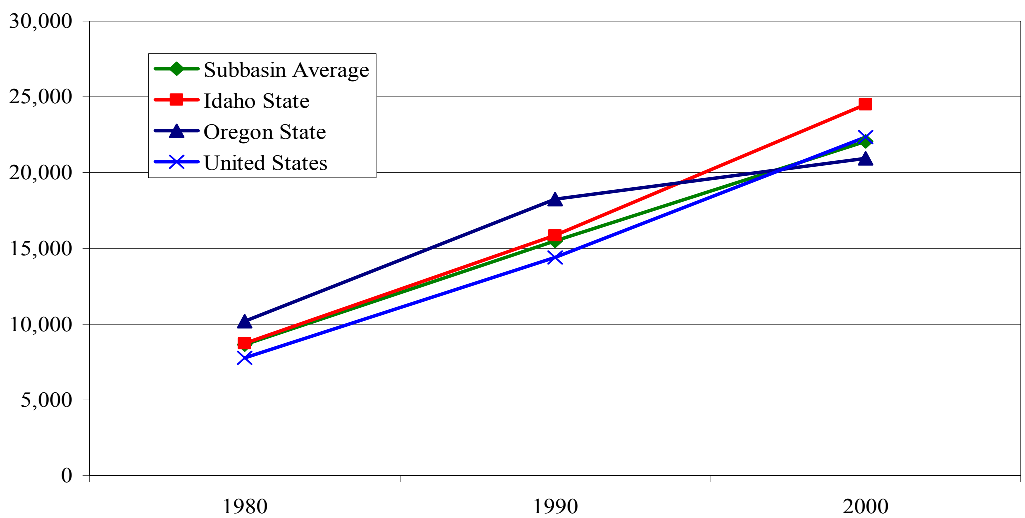

Figure 20. Per capita income trends from 1980 to 2000 in the United States, the states of Idaho and Oregon, and the Middle Snake subbasins (U.S. Census Bureau 2000b, WSU 2001, IDOC 2002).

Unemployment

Between 1980 and 2000, the average unemployment rate in the Middle Snake subbasins decreased, as did the rates in Idaho, Oregon, and the nation (Figure 14). The average unemployment rate in the subbasin around the year 2000 was 5.2%, compared with 4.9% in Idaho. The average unemployment rate in the subbasins decreased 2.9% since 1980.

Poverty

The percentage of families or persons living below the poverty level in the subbasins was only slightly higher than the percentage in Idaho, Oregon, Nevada, and the United States. The percentage of families below poverty is generally 3.5% lower than the percentage of people below poverty (

Figure 21). In 1999, Adams County had the highest percentage of people below poverty (15.1%), while Ada County had the lowest (7.7%). The counties with the greatest land area in the subbasins (Adams, Baker, Blaine, Elko, Elmore, Gooding, Malheur, Owyhee, Twin, and Washington) together had a higher average percentage of people below poverty (13.3%) than did all the counties together in the subbasins (12.8%).

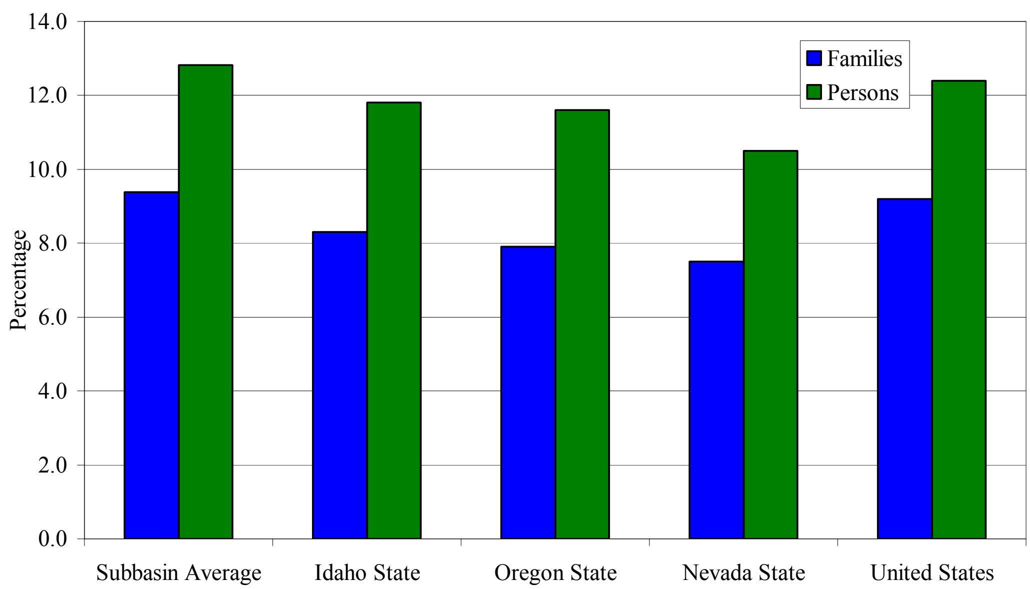

Figure 21. Percentage of families and persons living below poverty in the Middle Snake subbasins, Idaho, Oregon, Nevada, and the United States (U.S. Census Bureau 2000b, IDOC 2002).