Draft

Bruneau Subbasin Summary

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Prepared for the Northwest Power Planning Council

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Bruneau Subbasin Summary

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Bruneau Subbasin Summary

Introduction

The Bruneau subbasin summary has been generated as part of the Northwest Power Planning Council's (NWPPC) Rolling Provincial Review Process. The NWPPC developed this process in February 2000 in response to recommendations by the Independent Scientific Review Panel (ISRP) and the Columbia Basin Fish and Wildlife Authority (CBFWA). This document is a compilation of the existing information about the Bruneau subbasin (Figure 1), including the historic and present status of fish and wildlife species, past and ongoing fish and wildlife activities, and current management plans, objectives and strategies. The summary provides context for project proposals during the provincial reviews while a more extensive subbasin plan is developed.

The development of this subbasin summary was initiated at an August 2, 2001 meeting in Boise, Idaho. A series of meetings were held in Boise between August 2nd and October 4, 2001. Representatives from interested agencies and groups participated in planning and providing feedback on this document. Agencies in Nevada and Idaho provided information and reports, and participated in the review process.

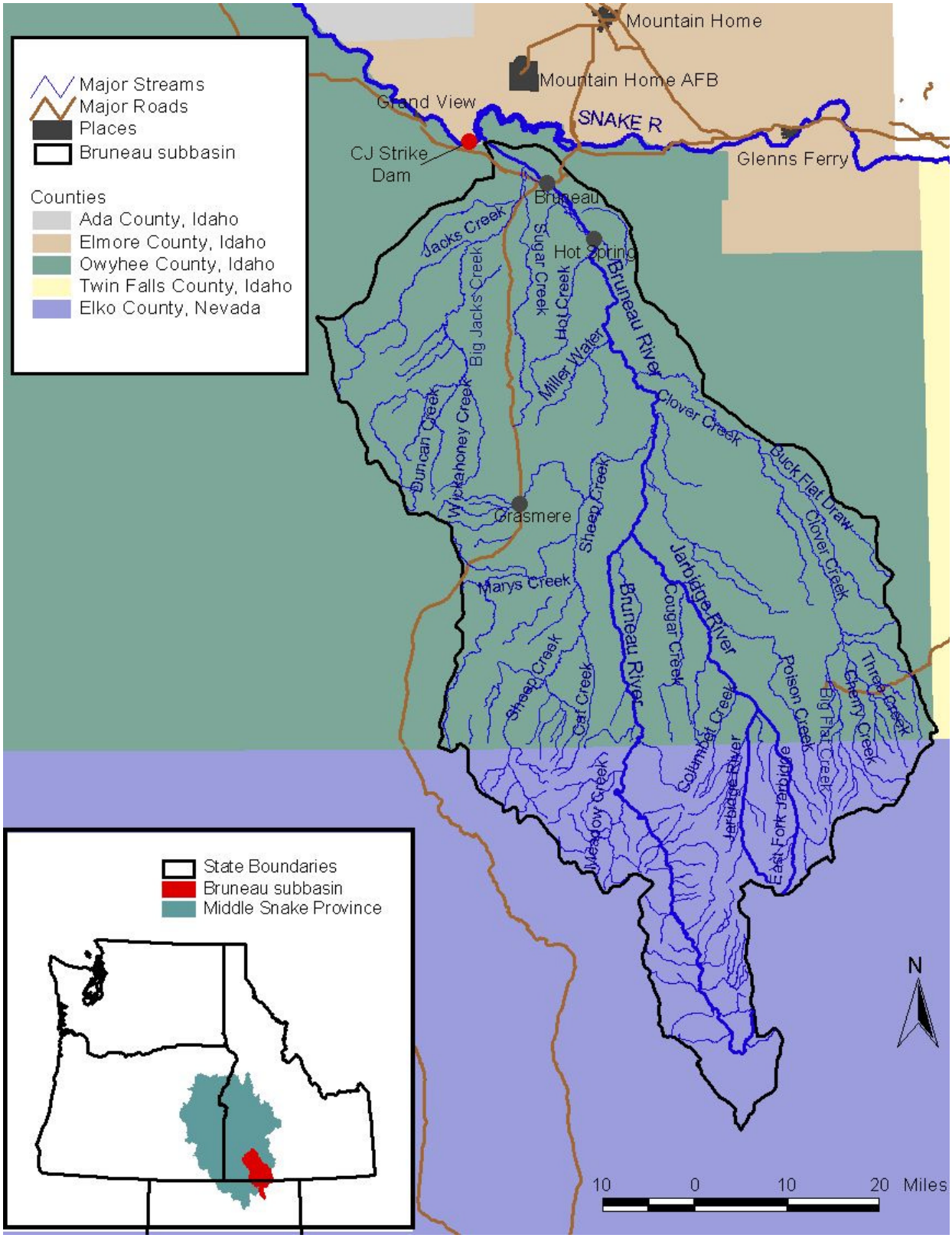

Figure 1. Major features of the Bruneau subbasin and location in the Middle Snake Province

Subbasin Description

General Description

Subbasin Location

The Bruneau subbasin is one of ten subbasins within the Middle Snake Province. It is located in south central Idaho and northeastern Nevada and covers approximately 3,305 square miles (see Figure 1) (Lay and IDEQ 2000). Approximately 76% of the subbasin (2,504 square miles) lies in Owyhee County, Idaho, with the remaining 24% (801 square miles) in Elko County, Nevada (Table 1).

The Bruneau River system originates in Nevada's Jarbidge Mountains and flows in a northerly direction to the Snake River in Idaho. The subbasin is bounded on the south by the Jarbidge Mountains, on the west by the Owyhee Mountains and the Chalk Hills, on the north by the Snake River and on the east by the Bruneau Plateau.

Table 1. Land area of counties containing the Bruneau subbasin

State	County	Acres in Subbasin	Kilometers^2 in Subbasin	Miles^2 in Subbasin	Percent of Subbasin
Idaho	Owyhee	1,602,408	6,485	2,504	75.8
Nevada	Elko	512,748	2,075	801	24.2
Total		2,115,157	8,560	3,305	100.0

Climate

The subbasin has a semi-arid climate. Precipitation falls primarily from October through March; rainfall is infrequent during the summer. Surface water runoff accounts for 0.2 to 2 inches per year. The remainder evaporates, transpires or recharges groundwater (DAF 1998).

Mean annual precipitation across the Bruneau subbasin is 13.3 inches, but ranges from a minimum of 7 inches at the lower elevations near the confluence of the Bruneau and Snake Rivers to a maximum of 41 inches in the Jarbidge Mountains (Figure 2).

The subbasin is characterized by low relative humidity and large variations in average daily and annual temperature (DAF 1998). Due to prevailing westerly winds, the area is often affected by Pacific air masses. These masses lose most of their moisture over the Cascade Mountain Range to the west, thereby contributing to the region's semi-arid climate. The Rocky Mountains and Continental Divide protect the area from the continental Arctic air masses that impact the northern Great Plains to the east. Warm, dry continental air masses typically influence the area during the summer. The passage of storm systems throughout the year creates widely variable wind speeds (DAF 1998).

Summers are characterized by hot days (average daily maximum temperature is 90˚ F) and warm nights (average daily minimum temperature is 54˚F). Winters have cool days (average daily maximum temperature is 43˚F) and cold nights (average daily minimum temperature is 24˚F) (Berenbrock 1993).

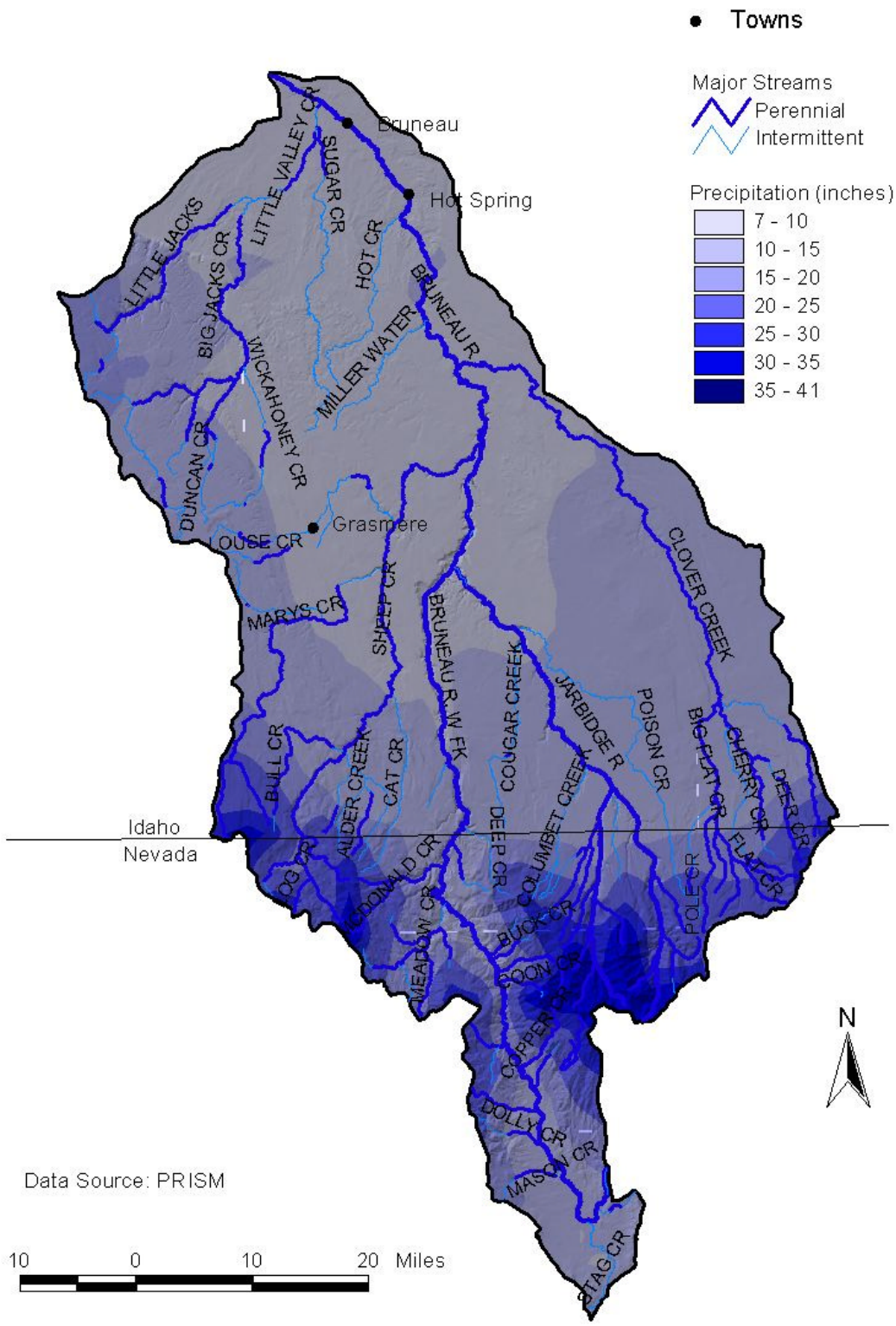

Figure 2. Precipitation and stream flow patterns, Bruneau subbasin

Topography

High plateaus incised by sheer-walled canyons are characteristic topographic features in the Bruneau subbasin (Figure 3). The highest elevations are found in the East Fork of the Jarbidge River (10,839 feet), while the lowest elevations (2,400 feet) occur at the confluence of the Bruneau and Snake River at C.J. Strike Reservoir (Lay and IDEQ 2000).

The Jarbidge and Copper Mountains, located in the southernmost extension of the subbasin, provide the majority of precipitation storage for streams and rivers. Prominent peaks in the Jarbidge range include Jarbidge Peak (10,789 feet), Matterhorn Mountain (10,839 feet), Cougar Peak (10,559 feet), Mary's River Peak (10,585 feet), and God's Pocket Peak (10,184 feet). The drainages in Nevada are typically steep-sided and contain small, rapidly flowing creeks.

Elevational variation in the subbasin is highly pronounced throughout the plateau landforms. Topographic irregularities in these areas are created by expanses of rough, irregular basalt flows, depressions, rolling hills, and mountainous landforms that occur along the perimeter of the subbasin (Lay and IDEQ 2000). Slopes on the plateaus are generally less than 5%. The plateau landforms are punctuated by canyonlands containing highly entrenched tributaries, which in some areas range from 700 to 1,200 feet in depth (Bureau of Outdoor Recreation 1977). Along the middle portion of the Bruneau River, the lower portions of the Jarbidge River, Sheep Creek, and the East Fork Bruneau River, cliffs rise almost vertically out of the streambeds. Desert tributaries generally begin in the high plateaus and drop steeply in their final few miles before joining the major rivers (Lay and IDEQ 2000).

Topographic relief in the lower portion of the subbasin is less pronounced. Sixteen miles upstream from C.J. Strike Reservoir the river emerges from the deep canyon and meanders through a broad, fertile valley occupied by farms, ranches and the town of Bruneau (Bureau of Outdoor Recreation 1977). The Bruneau Arm of C.J. Strike Reservoir floods the bottom six miles of the Bruneau River, including the confluence with Little Jacks and Big Jacks Creeks.

Geology

The subbasin lies within the Northern Basin and Range Province and the Snake River Province. The Northern Basin and Range ecoregion crosscuts the basin in Nevada. This is an area of faulted metamorphic and sedimentary rocks uplifted into mountains, separated by basins deeply filled with alluvium (Figure 4; Lay and IDEQ 2000). The Snake River Province, which was created through a series of geologic events, represents an intrusion and burying of the old Basin and Range Province. The province began to form at the intersection of Nevada, Oregon and Idaho approximately 14-17 million years ago. It is a deep, wide structural basin filled with a veneer of volcanic basalt deposits overlying rhyolite.

Volcanic activity in the Snake River Valley began with catastrophic rhyolitic eruptions that created enormous calderas across southern Oregon and Idaho. All major volcanic activity in the Bruneau subbasin originated from the Bruneau-Jarbidge eruptive center. The volcanism began at least 12 million years ago as continuing eruptions of the

Yellowstone mantle plume progressed eastward. Large quantities of ash and lava were released before the central cone of the volcano collapsed into an enormous crater 30 by 60 miles across (Orr and Orr 1996). Rhyolitic flows from the Bruneau-Jarbidge volcano were typically 300 feet deep with the largest exceeding 800 feet (Orr and Orr 1996). The caldera resulting from the subsidence of the volcano was filled from 9-6 million years ago with a series of rhyolite lava flows. More than 40 small basalt shield volcanoes erupted from 8-4 million years ago, resulting in a thin veneer of basalt that contributed to the present day, nearly flat topography of the Idaho portion of the subbasin.

Towards the end of the basalt eruptions, the western Snake River Plain graben began to form. In this structural subsidence Lake Idaho formed from approximately 8 to 1.5 million years ago, filling an area from the Oregon border to Twin Falls. Sediments deposited within the lake basin (Idaho Group Sediments) exist in the lower portion of the subbasin and are intermingled in some places with basalt from the Bruneau-Jarbidge eruptive center.

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. As a result, the Snake and Bruneau rivers began to downcut. The Bonneville Flood increased this downcutting about 14,500 years ago when the Great Salt Lake (North) drained through the Snake River Canyon, flushing a final veneer of sand and gravel into the subbasin (Orr and Orr 1996). The flood deepened and widened the Snake Canyon, which in turn led to further downcutting of the Bruneau Canyon. Narrow, deep, steep-walled, gorges have resulted from this erosive activity, measuring over 800 feet deep in sections of the Jarbidge River, Sheep and Clover Creeks and up to 1,300 feet deep along portions of the main stem Bruneau (Orr and Orr 1996). Most recently, stream alluvium has been deposited in river and stream bottoms and lake sediments have been deposited by wind and water in depressions in the basalt flows.

The Jarbidge River watershed is one of the most actively eroding watersheds in the subbasin. The watershed geology is dominated by the Jarbidge rhyolite formation, which occurs across 76% of the land surface of the watershed (Parrish 1998). Geologic features also include a mixture of dust sediments, ash, volcanic glass, and rock fragments that were spread across the landscape by the force of volcanic explosions. Alluvium, glacial till, landslide deposits and colluvium have been transported through various erosional processes (McNeill et al. 1997). The resulting landscape is unstable and dominated by mass wasting forms of erosion such as debris torrents, avalanches, and earth slumps (McNeill et al. 1997). Much of the material delivered to stream channels through these processes is actively transported and redeposited throughout the length of the Jarbidge, forming the wide cobble and gravel bars characteristic of the river. Other forms of erosion include surface, rill, gully, and dry ravel erosion, which are most problematic on moderate to steep slopes (McNeill et al. 1997).

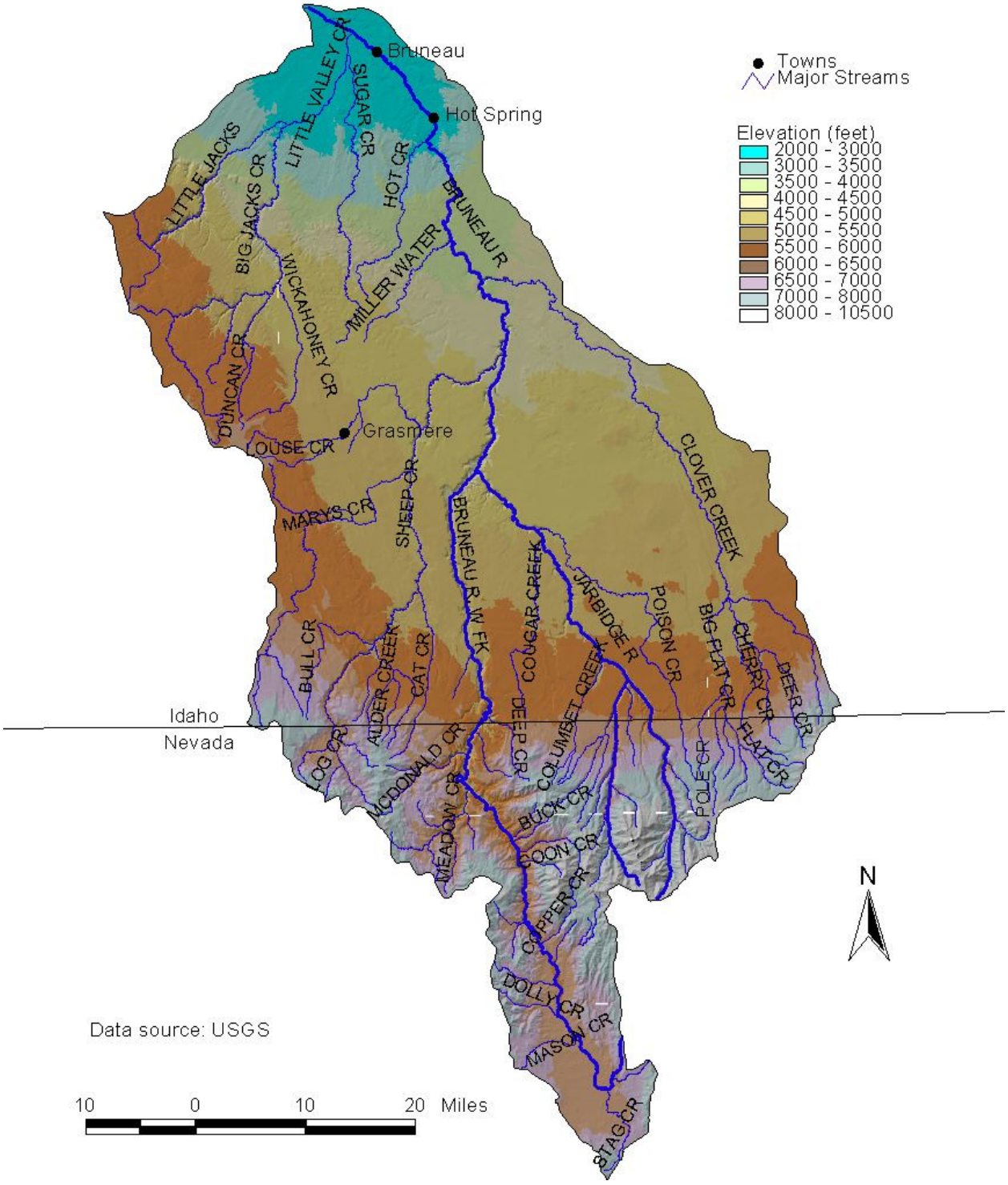

Figure 3. Topography and elevation in the Bruneau subbasin

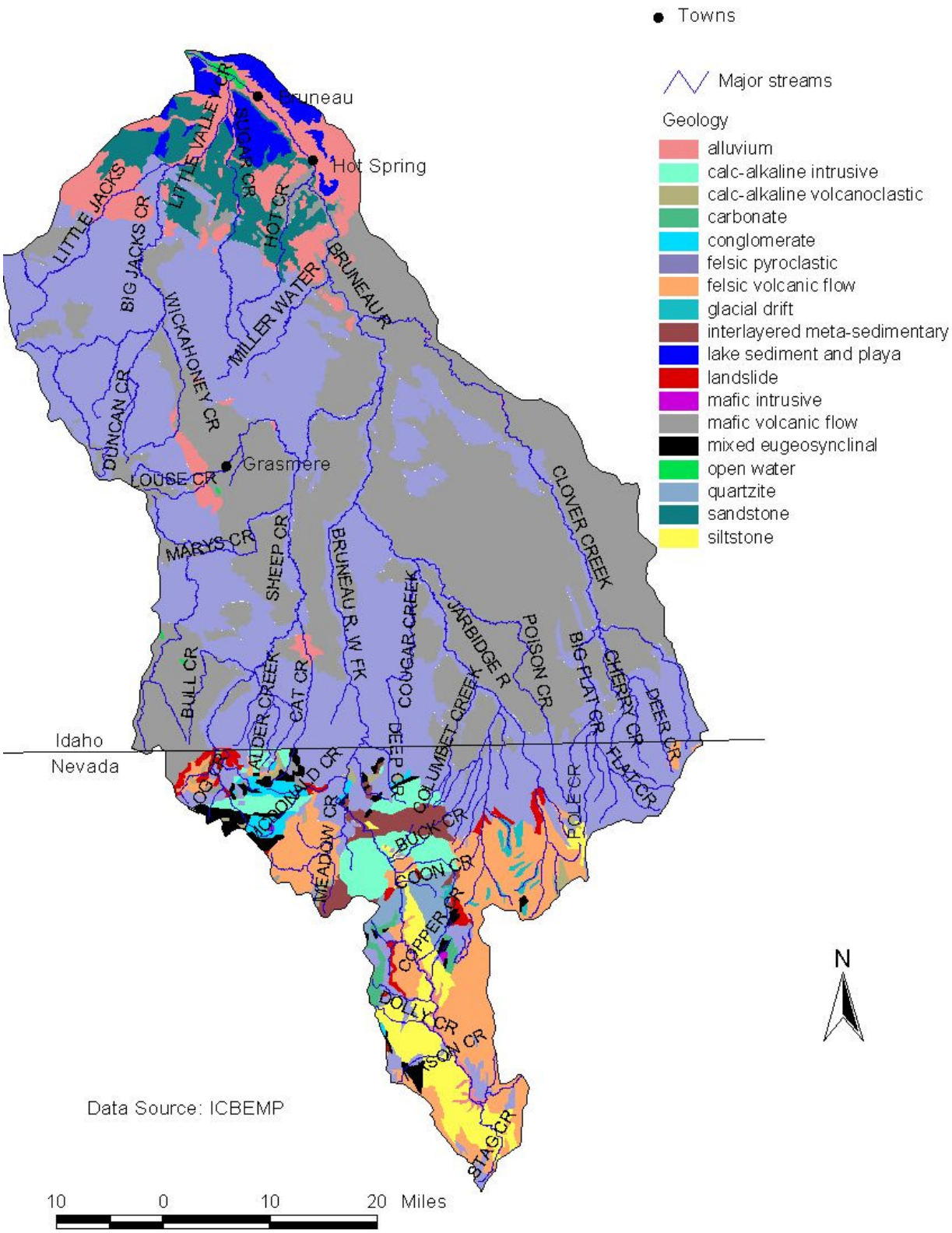

Figure 4. Geologic features of the Bruneau subbasin

In the Jarbidge watershed, Dry, Snowslide, Gorge and Bonanza Gulches exhibit a defined stream channel originating in unchanneled colluvial hollows grading into channeled colluvial valleys (McNeill et al. 1997). The gulches in these tributaries are transport limited, and colluvium accumulates in and along the channels for extended periods of time. Periodic climatological events, such as the 1995 flood, result in flushing some or all accumulated colluvium in a debris torrent causing inundation of the main channel and development of alluvial fans at the mouth of each gulch draining the west side of the Jarbidge Mountains (McNeill et al. 1997).

Soils

Lay and IDEQ (2000) identified four soil provinces in the subbasin: (1) clayey and loamy soils of plateaus, (2) loamy soils of the fluvial canyons, (3) highly stratified alluvial soils in the lowest portions of the subbasin, and (4) alpine glacial soils in the Jarbidge Mountain Province. K-factors indicate that rangelands have low-to-moderate soil erosion potential and sediment production from rangelands is low (Figure 5). Lay and IDEQ (2000) identified valley bottom and channel sources of sediment to be the most important for streams listed on the Idaho 1998 §303(d) list.

Soils in the Jarbidge Mountains tend to be shallow, erosive, coarse, and are moderately to highly productive. Inherent permeability is generally slow and moderate to well drained. Many soils in the Jarbidge watershed have duripan, claypan, or shallow depth to bedrock, which increases the potential for slumping (McNeill et al. 1997). Despite this, sediment production in the Jarbidge tends to have localized, rather than systemic impacts, as reflected by lack of significant cobble embeddedness in substrate surveys (Partridge and Warren 2000).

Hydrology

There are approximately 3,995 miles of streams and rivers in the Bruneau subbasin. Of this total, 986 miles are perennial and 3,009 miles are intermittent. In addition, there are an estimated forty-seven miles of canals and ditches (Lay and IDEQ 2000). Most perennial streams originate in the mountains of Nevada. Most small, low elevation mountain streams become intermittent during summer months due to evaporation, seepage, irrigation withdrawals and loss of bank storage. Coldwater and geothermal springs, seeps, and groundwater discharge supplement surface flows in tributary and mainstem reaches of the Bruneau River. The majority of geothermal springs occur in the lower subbasin (Lay and IDEQ 2000).

Major tributaries in the subbasin include the East and West Forks of the Bruneau River, the East and West Forks of the Jarbidge River, Sheep Creek, Mary's Creek and Little Jacks and Big Jacks Creeks. These tributaries are perennial and support resident salmonid populations. The Jarbidge River is the largest tributary to the Bruneau River, contributing approximately 66% of the combined flow at its confluence with the West Fork Bruneau River.

Streams throughout the subbasin are subject to occasional flooding (DAF 1998). Snowmelt-related floods primarily occur at high elevations, while thunderstorm-caused

floods generally occur below 6000 feet. Rain-on-snow events occur on a 10-year cycle and mirror regional climatic cycles in and adjacent to the northern Great Basin (USDA 1998).

The morphology of the mainstem Jarbidge is largely influenced by debris inputs from low frequency, high magnitude flood and landslide events. Cobble and gravel bars, which are often located at the mouths of steep, ephemeral or perennial tributaries, are often transient and shift in location depending upon runoff flows and/or deposition from source streams (USDA 1998; Parrish 1998). Because the majority of these high gradient tributaries enter the mainstem Jarbidge from the west, the deposition of alluvium commonly forces the mainstem channel to the eastern side of the valley (USDA 1998). This lateral movement however, is constrained by bridges, dikes, and road prisms, which force the channel into a narrow profile and potentially increase its velocity and/or capacity for flooding (USDA 1998).

Water Quality

In a recent subbasin assessment, Lay and IDEQ (2000) rated water quality in the Idaho portion of the subbasin as good. Sediment is the most commonly listed pollutant in the subbasin. Other pollutants and stressors include nutrients, low dissolved oxygen, temperature, flow and bacteria (Lay and IDEQ 2000). The water quality in many reaches is sufficient to support fisheries and other biota.

Listed Streams

Section §303(d) of the Clean Water Act (CWA) requires that water bodies violating State or Tribal water quality standards be identified and placed on a §303(d) list (Table 2; Figure 6). It is the State's and Tribe's responsibility to develop their respective §303(d) list, to establish a Total Maximum Daily Load (TMDL) for the parameter(s) causing water body impairment (Table 3), and de-list stream segments when conditions warrant (Table 4). Currently, no known point or significant non-point pollution sources have been identified in the Idaho portion of the subbasin.

Nevada did not list any streams in the Bruneau subbasin on its 1998 §303(d) list due to insufficient monitoring data (Nevada 1998 §303(d) List.PDF).

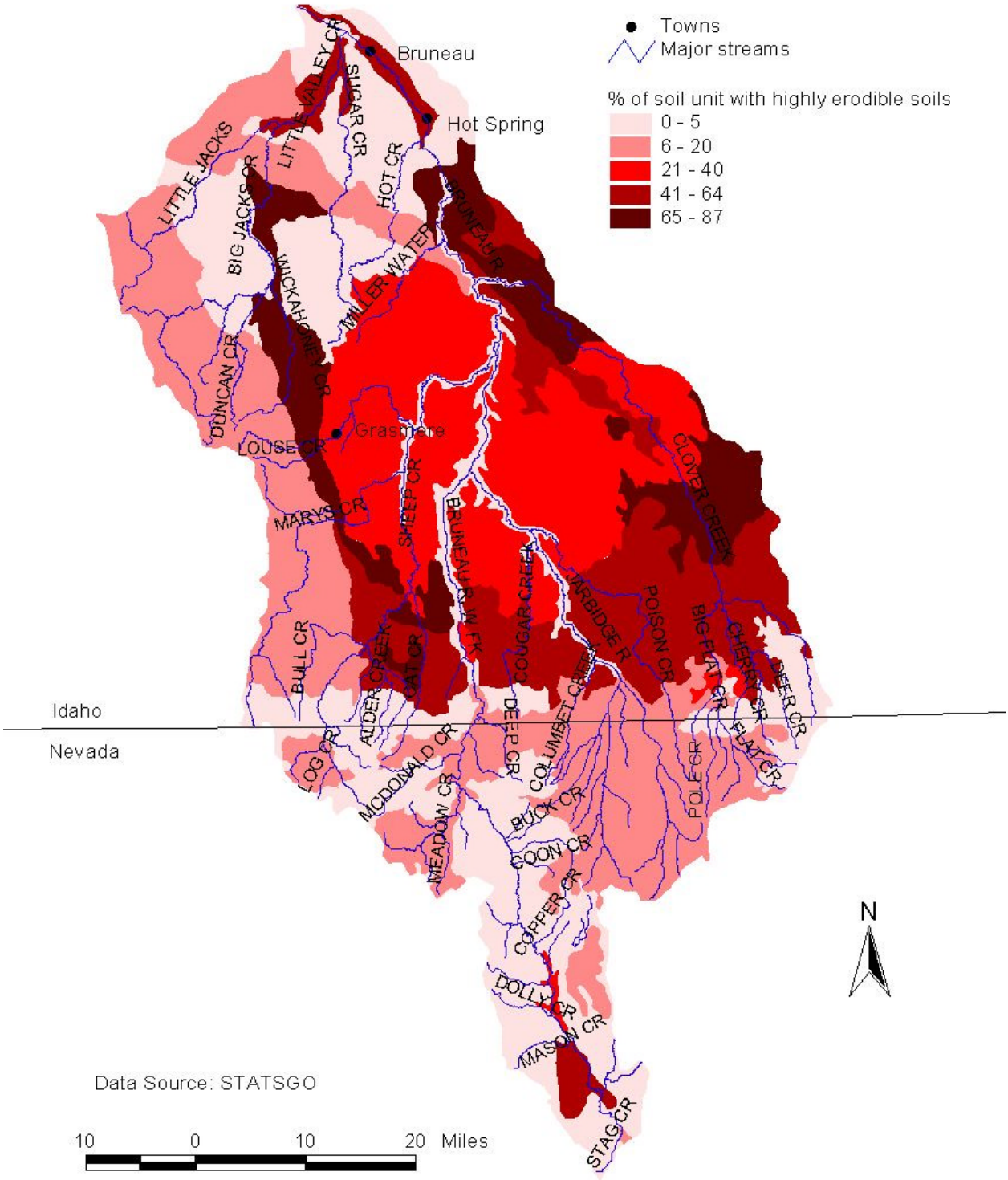

Figure 5. Soil erodibility in the Bruneau subbasin

Table 2. 1998 §303(d) listed stream segments in the Bruneau subbasin (from Lay and IDEQ 2000)

Water Body	Segment (HUC[1]/PNRS[2])	Boundaries	Pollutants and Stressors
Bruneau River	17050102/549	Hot Creek to C.J. Strike	Sediment, Nutrients, Temperature, Flow Alteration
Hot Creek	17050102/557	Headwaters to Bruneau River	Sediment, Flow Alteration, Pathogens
Jacks Creek	17050102/551	Little Jacks to C.J. Strike	Nutrients, Sediment, Flow Alteration' Temperature, Dissolved Oxygen
Wickahoney Creek	17050102/555	Headwaters to Big Jacks Creek	Sediment, Flow Alteration
Sugar Creek	17050102/552	Headwaters to Jacks Creek	Sediment
Three Creek	17050102/561	Headwaters to Clover Creek	Sediment
Clover Creek	17050102/558	71 Draw to Bruneau River	Sediment
Cougar Creek	17050102/567	Headwaters to Jarbidge River	Sediment
Poison Creek	17050102/568	Headwaters to Jarbidge River	Sediment

[1]HUC = Hydrological Unit Code designation by USGS for Upper Snake Basin.
[2]PNRS = Pacific Northwest River Study Designation number.

Table 3. TMDLs to be completed in the Bruneau subbasin (from Lay and IDEQ 2000)

Segment	TMDL-pollutant	TMDL-pollutant	TMDL-pollutant	TMDL-pollutant
Bruneau River	Nutrients; TP			
Jacks Creek	Nutrients; TP	DO; TP	Bacteria	Sediment; TSS
Sugar Valley Wash	Nutrients; TP	DO; TP	Bacteria	Sediment; TSS
Clover Creek	Bacteria			
Three Creek	Sediment; % fines			

TP=total phosphorus; DO=dissolved oxygen; TSS=total suspended solids

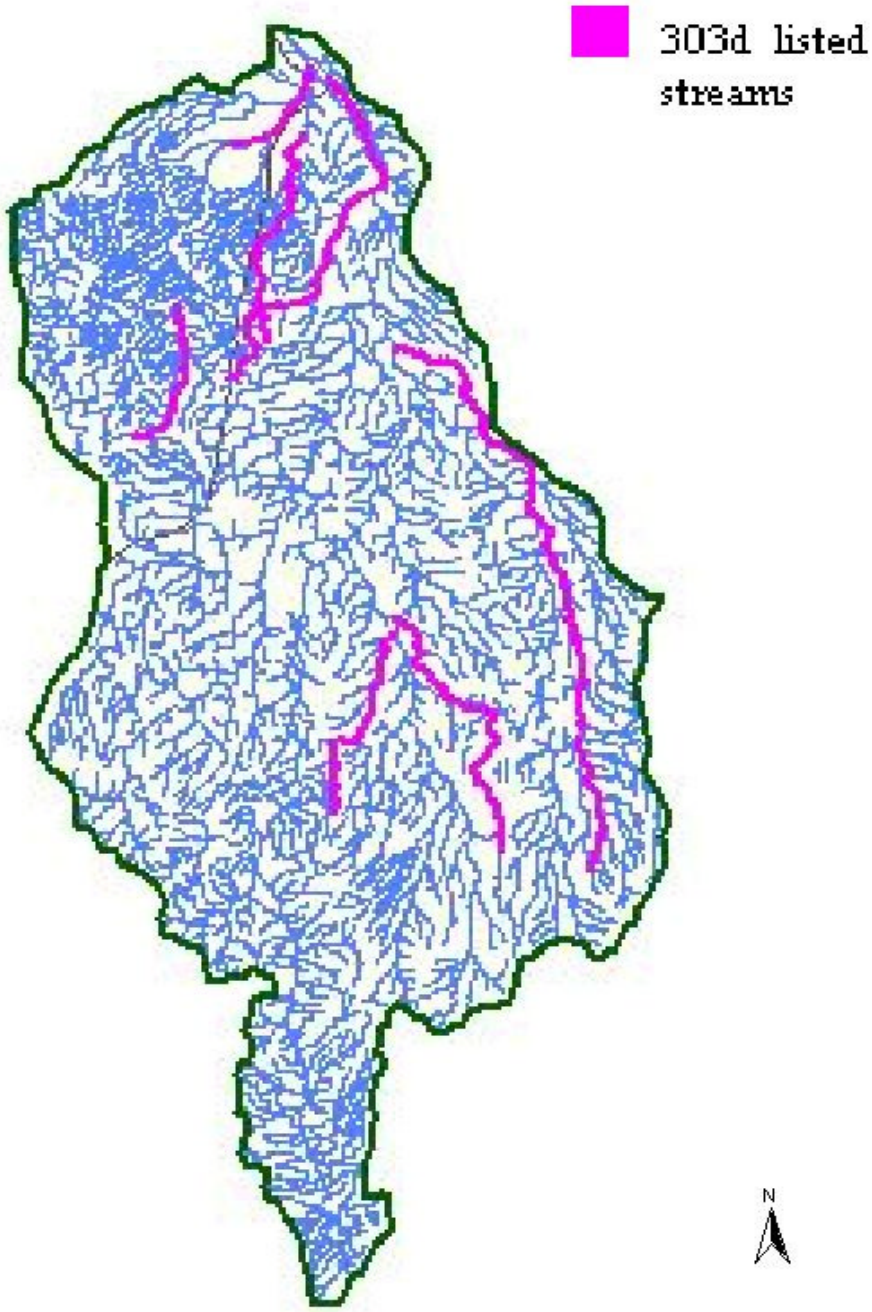

Figure 6. Location of §303(d) listed stream segments, Bruneau subbasin

Table 4. Proposed delistings in the Bruneau subbasin (from Lay and IDEQ 2000)

Segment	TMDL-pollutant	TMDL-pollutant
Bruneau River	Sediment	
Hot Creek	Sediment	Bacteria
Clover Creek	Sediment	
Cougar Creek	Sediment	
Poison Creek	Sediment	
Sugar Creek	Sediment	
Wickahoney Creek	Sediment	

Sediment

Sediment is a pollutant of concern, but for most reaches the suspended sediment concentrations are relatively low. The exceptions are the elevated suspended concentrations during spring in Jacks Creek, and the elevated percent fines in Three Creek (Lay and IDEQ 2000).

Nutrients

High concentrations of nutrients (TP) have been documented in Jacks Creek, which has resulted in locally dense mats of macrophytes along the creek channel. Slightly elevated TP concentrations have been found in the Bruneau River, which may be impacting C.J. Strike Reservoir (Lay and IDEQ 2000). The Saylor Creek [bombing] Range, located in the central portion of the subbasin, represents an additional source of nutrients to stream channels. Small amounts of phosphorus from spotting charges may be left on the ground as residues. Leaching of chemicals from training ordnance however, is unlikely.

Temperature

Temperature appears to be a limiting factor to fish movement in the subbasin. In the mainstem Bruneau River, fish are restricted to above the confluence of the Jarbidge and Bruneau River during the warmer months of the year. IDFG found maximum summer temperatures near the confluence of 18.9˚C in 1994 and 21.9˚C in 1995 (IDFG 1995). Temperatures in the Jarbidge River were typically 3˚ to 7˚ C lower.

In the lower portion of the subbasin, hot springs have a significant impact on a number of tributaries and the mainstem Bruneau River.

The most important cause of increased water temperature is reduction of riparian vegetation. This problem is widespread across the subbasin.

Other Problems

In the Jarbidge River system, acidic wastewater brought to the surface by historic mining activities continue to impact the watershed, with documented pH values and temperatures outside salmonid tolerance limits (Parrish 1998).

Groundwater

The Bruneau subbasin is underlain by two aquifers: a thin, cold water aquifer of small area extent and a geothermal aquifer. The coldwater aquifer is unconfined and underlies the alluvium along stream channels. Recharge is from infiltration of precipitation, streamflow and applied irrigation water. Small quantities of recharge may be from upward-moving geothermal water (Berenbrock 1993).

The geothermal aquifer underlies a 600 square mile area, which includes Little Jacks and Sugar watersheds (in the northwest portion of the subbasin) and the Bruneau Valley. The aquifer discharges from faults or fractures to form natural, geothermal springs where the ground surface level or elevation is lower than the hydraulic head of the aquifer (Wood 2000). Waters reach temperatures as high as 150˚ F near Bruneau and 90˚F at Murphy Hot Springs (Orr and Orr 1996).

Numerous wells, pipelines and watering troughs occur throughout the subbasin. Well withdrawals from the aquifer have led to declining groundwater levels (Wood 2000). In the past 30 years, discharge from the geothermal springs along Hot Creek and the Bruneau River has significantly decreased or ceased altogether. At Indian Bathtub Spring, discharge fell from 2,400 gallons per minute in 1964 to zero in 1989 (DAF 1998).

Prior to extensive groundwater development, about 10,100 acre-feet were discharged by springs annually (Berenbrock 1993). Groundwater development began in the 1890s, and until 1951, annual discharge was less than 10,000 acre-feet. From 1952 to 1978, annual discharge increased to approximately 40,600 acre-feet. Well discharge peaked at 49,900 acre-feet in 1981 and declined to 34,700 acre-feet in 1991 (Berenbrock 1993). Groundwater development has caused hydraulic heads in the southern part of the aquifer to decline by an average of 30 feet (Berenbrock 1993).

Vegetation

The Bruneau subbasin lies within the Sagebrush Province/Sagebrush Steppe Ecosystem regional landform and vegetation classification, which spreads over much of southern Idaho, eastern Oregon, eastern Washington, and portions of Nevada, California and Utah (USDI 1999a). This ecosystem ranges from sagebrush-covered plateaus to rugged mountains covered with juniper woodlands and grasslands (Table 5; Figure 7; DAF 1998).

The majority of the subbasin is comprised of plateaus and low buttes that contain shrub-steppe communities of Wyoming big sagebrush (*Artemisia tridentata* ssp. w*yomingensis*), rabbitbrush (*Chrysothamnus* spp.), bitterbrush (*Purshia tridentata*), golden currant (*Ribes aureum*), bluebunch wheatgrass (*Agropyron spicatum*), and Great Basin wildrye (*Clymus cinereus*). Wyoming big sagebrush/Idaho fescue (*Festuca idahoensis*) and Wyoming big sagebrush/bluebunch wheatgrass plant communities dominate the overall subbasin (DAF 1998). On the plateaus along the Jarbidge River in Idaho, vegetation consists primarily of big sagebrush-sandberg bluegrass (*Poa secunda*) sites intermixed with smaller acreages of big sagebrush-bluebunch wheatgrass and shadscale (*Atriplex gardneri*) sites.

The river canyons support the highest biological diversity of plant communities. Plant associations within the floodplain area include meadow communities and tall shrub communities, which may include willows (*Salix* spp.), rose (*Rosa* spp.), or stringers of

cottonwood (*Populus* spp.) (DAF 1998). Basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) communities are found at the edge of sandbars, at the confluences of creeks, and around seeps (DAF 1998). The canyon walls are dominated by Wyoming big sagebrush*)* and low densities of shrubs such as rabbitbrush, golden currant, bitterbrush, four-wing saltbrush (*Atriplex canescens*), and shadscale (*Atriplex* spp.). The benches are characterized by small groups of trees, such as juniper (*Juniperus* spp.), hackberry (*Celtis* spp.) mountain mahogany (*Cercocarpus* betuloides), or aspen (*Populus* spp.). Dominant grass species vary according to moisture regime and include bluebunch wheatgrass, Idaho fescue, and Great Basin wildrye (DAF 1998).

Sagebrush, mahogany, aspen, conifers and grasslands dominate the uplands in the Humboldt-Toiyabe National Forest in Nevada.

Wetland and riparian habitat is limited and comprises only 6.47 percent of the Idaho portion of the subbasin (Lay and IDEQ 2000). Riparian vegetation on intermittent streams is generally the same as that of the surrounding landscape. Perennial streams with moderate flows may be lined with alder (*Alnus* spp.), willow, cottonwood, rose and mock orange (*Syringa* spp.) (Lay and IDEQ 2000). Along the lower Jarbidge River lush riparian areas are lined with western juniper and dense stands of rushes (*Juncus* spp.), sedges (*Carex* spp.), poison ivy and grasses. Along the West and East Forks of the Jarbidge River, alder and willow are widespread. Cottonwood is more abundant in the East Fork than in the West Fork of the Jarbidge River, presumably because of less human disturbance and use in the East Fork (USDA 1997).

Table 5. Land cover in the Bruneau subbasin (USGS LULC data)

Description	Acres	Kilometers^2	Miles^2	Percent
Open Water	2,784.5	11.3	4.4	0.13
Perennial Ice/Snow	18.7	0.1	0.0	0.00
Low Intensity Residential	22.0	0.1	0.0	0.00
High Intensity Residential	0.7	0.0	0.0	0.00
Commercial/Industrial/Transportation	254.6	1.0	0.4	0.01
Bare Rock/Sand/Clay	1,098.8	4.4	1.7	0.05
Transitional	26.5	0.1	0.0	0.00
Deciduous Forest	17,871.0	72.3	27.9	0.84
Evergreen Forest	28,597.6	115.7	44.7	1.35
Mixed Forest	215.3	0.9	0.3	0.01
Shrubland	1,630,056.4	6,596.7	2,547.0	77.06
Grasslands/Herbaceous	390,827.3	1,581.7	610.7	18.48
Pasture/Hay	18,519.3	74.9	28.9	0.88
Row Crops	5,573.8	22.6	8.7	0.26
Small Grains	9,245.2	37.4	14.4	0.44
Fallow	6.2	0.0	0.0	0.00
Urban/Recreational Grasses	1.1	0.0	0.0	0.00
Woody Wetlands	7,815.0	31.6	12.2	0.37
Emergent Herbaceous Wetlands	2,365.3	9.6	3.7	0.11
Total	2,115,299.4	8,560.5	3,305.2	100.00

The most heavily cut areas for mine timbers were the headwater slopes near Sawmill Creek and Deer Creek drainages. Current pine and fir communities occupy 21% of the West Fork Jarbidge River watershed in a randomly mosaic pattern (USDA 1997). Aspen covers 29% of the surface acres in the West Fork Jarbidge River watershed and 11% in the East Fork Jarbidge watershed (USDA 1997). 53% of the Jarbidge River watershed is dominated by some type of tree cover type, with only 36% of the East Fork Jarbidge covered with similar vegetation types (USDA 1997). Aspen is considered a seral expression for coniferous cover types and the large percentage of aspen supports the hypothesis that the Jarbidge River watershed is a recovering watershed (USDA 1997).

Sensitive Plant Species

The Bruneau is home to a variety of sensitive, rare or endemic plants. Many of these occur in association with salt desert shrub habitats with soils derived from lakebed sediments (Table 6). The remainder occurs in low and mountain big sagebrush communities, on barren hard bottom playas, or by hot or cold water springs (USDI 2000b). Cheatgrass and star thistle encroachment into riparian areas currently represents one of the primary risks to sensitive plant species.

Noxious Weeds

Noxious weeds are a significant problem in the subbasin (Table 7). The most common weed is cheatgrass (*Bromus tectorum*), which dominates the understory in many areas, grows in nearly pure stands in others, and offers few habitat values. Other species of concern include Canada thistle (*Cirsium arvense*), Russian thistle (*Salsola kali*), and tumble mustard (*Sisymbrium altissimum*) (Table 7).

Land Use

Land Ownership

Approximately 86.2% of the land in the subbasin is federally owned and managed. The BLM manages 69.8% of the land base (Figure 8). Only 8.4 percent of the subbasin is in private ownership (Table 8, Figure 8).

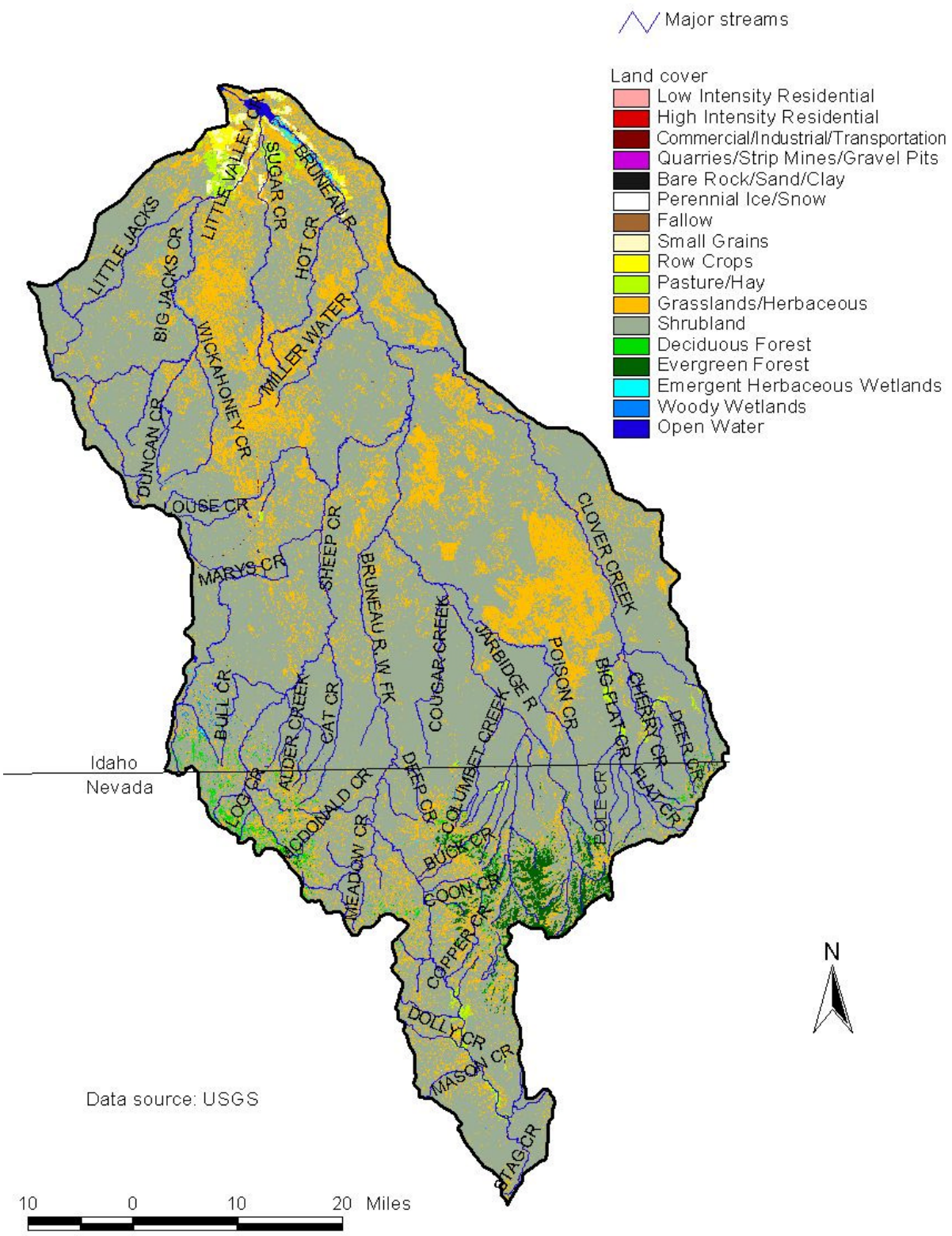

Figure 7. Current land cover patterns in the Bruneau subbasin

Table 6. Sensitive plant species in the Bruneau/Jarbidge Subbasin (N= not confirmed, P=Present)(Jim Klott, personal communication 2001; USDI 2000b)

Sensitive Plant Species Name	Common Name	Confirmed or Suspected
Artemisia packardiae	Packards sagebrush	P
Artemisia papposa	Owyhee sagebrush	P
Astragalus atratus inseptus	Mourning milkvetch	N
Astragalus mulfordiae	Mulford's milkvetch	P
Astragalus purshii ophiogenes	Snake River milkvetch	P
Astragalus yode-williamsii	Mud Flat milkvetch	P
Chaenactis stevioides	Desert pincushion	P
Cymopteris acaulis greeleyorum	Greeley's wave-wing	N
Eatonella nivea	White eatonella	N
Epipactis gigantea	Chatterbox orchid/giant helleborine	P
Eriogonum salicornoides	Annual salt buckwheat	P
Eriogonum shockleyi	Cowpie buckwheat	P
Glyptopleura marginata	White-margined waxplant	P
Ipomopsis polycladon	Spreading gilia	P
Lepidium davisii	Davis peppergrass	P
Lepidium papilliferum	Slick-spot peppergrass	P
Leptodactylon glabrum	Bruneau River prickly phlox	P
Nemacladus rigidus	Rigid threadbush	P
Pediocactus simpsonii robustior	Simpson hedgehog cactus	P
Penstemon janishiae	Janish penstemon	P
Peteria thompsoniae	Spine-noded milkvetch	P
Psathyrotes annua	Turtleback	P
Spiranthes diluvialis	Ute ladies-tresses (T)	N
Stylocline filaginea	Stylocline	N
Teucrium canadense occidentale	American wood sage	P

Table 7. Noxious weeds in the Jarbidge Resource Area. C=common, U=uncommon, N=no data (Jim Klott Pers. com. 2001; USDI 1999a)

Noxious Weed Species	Status
Diffuse knapweed	U
Russian knapweed	N
Spotted knapweed	U
Yellow star-thistle	N
Black henbane	U
Field bindweed	U
Rush skeletonweed	U
Purple loosestrife	U
Canada thistle	C
Scotch thistle	U
Musk thistle	N
Dalmation toadflax	U
Puncture vine	N
White-top	U

Table 8. Land ownership in Bruneau subbasin

Ownership	Acres	Kilometers^2	Miles^2	Percent
Bureau of Land Management	1,476,340	5,975	2,307	69.8
Water	3,243	13	5	0.2
Private	177,676	719	278	8.4
State Land	88,699	359	139	4.2
Dept of Defense	28,992	117	45	1.4
Tribal Land	22,314	90	35	1.1
Forest Service	318,034	1,287	497	15.0
Total	2,115,296	8,560	3,305	100.0

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 down into Nevada and Utah, a portion of which is today referred to as the Middle and Upper Snake Provinces of the Columbia River Basin.

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 the summer, large groups traveled to Wyoming and Western Montana to hunt bison. The summer months were a time of inter-tribal gatherings. Tribes met along the Snake River to trade, hunt, fish, and to 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).

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 (*Oncorhynchus tschawytscha*), steelhead (*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).

Ranching and Grazing

Over ninety percent of the Bruneau subbasin is grazed. Three BLM districts (Bruneau, Jarbidge and Elko Resource Areas), the Idaho Department of Lands, and the Humboldt-Toiyabe National Forest oversee grazing leases on state and federal lands.

The earliest documented livestock use in the Jarbidge watershed was in 1885 by "rogue" sheep outfits (Parrish 1998). By the 1890s, the potential of many range sites in the Jarbidge and upper Bruneau had been greatly reduced. Rates of 95% utilization were common on all uplands and accessible riparian areas. In 1906, complaints regarding overgrazing led to the inclusion of the Jarbidge River Canyon to the Forest Reserve System. Current grazing in the Jarbidge is dominated by cattle but includes some domestic sheep. Because of the steep canyon walls and minimal forage, grazing impacts on the riparian corridor are minor (Parrish 1998). Historic sheep grazing probably impacted the intensity and frequency of debris avalanches, but this is difficult to prove. The soils in the Jarbidge are coarse and do not tend to compact, so the most significant impacts were vegetation removal (USDA 1997).

The Humboldt-Toiyabe National Forest manages 15 grazing allotments in the 318,000-acre portion of the subbasin that they manage in northern Nevada. Ranching and mining have been the primary land uses in area since it was designated a national forest in 1906 (USDA 1997).

The Bruneau, Jarbidge and Elko Resource Area offices of the BLM manage grazing leases on approximately 1.47 million acres it oversees in the subbasin.

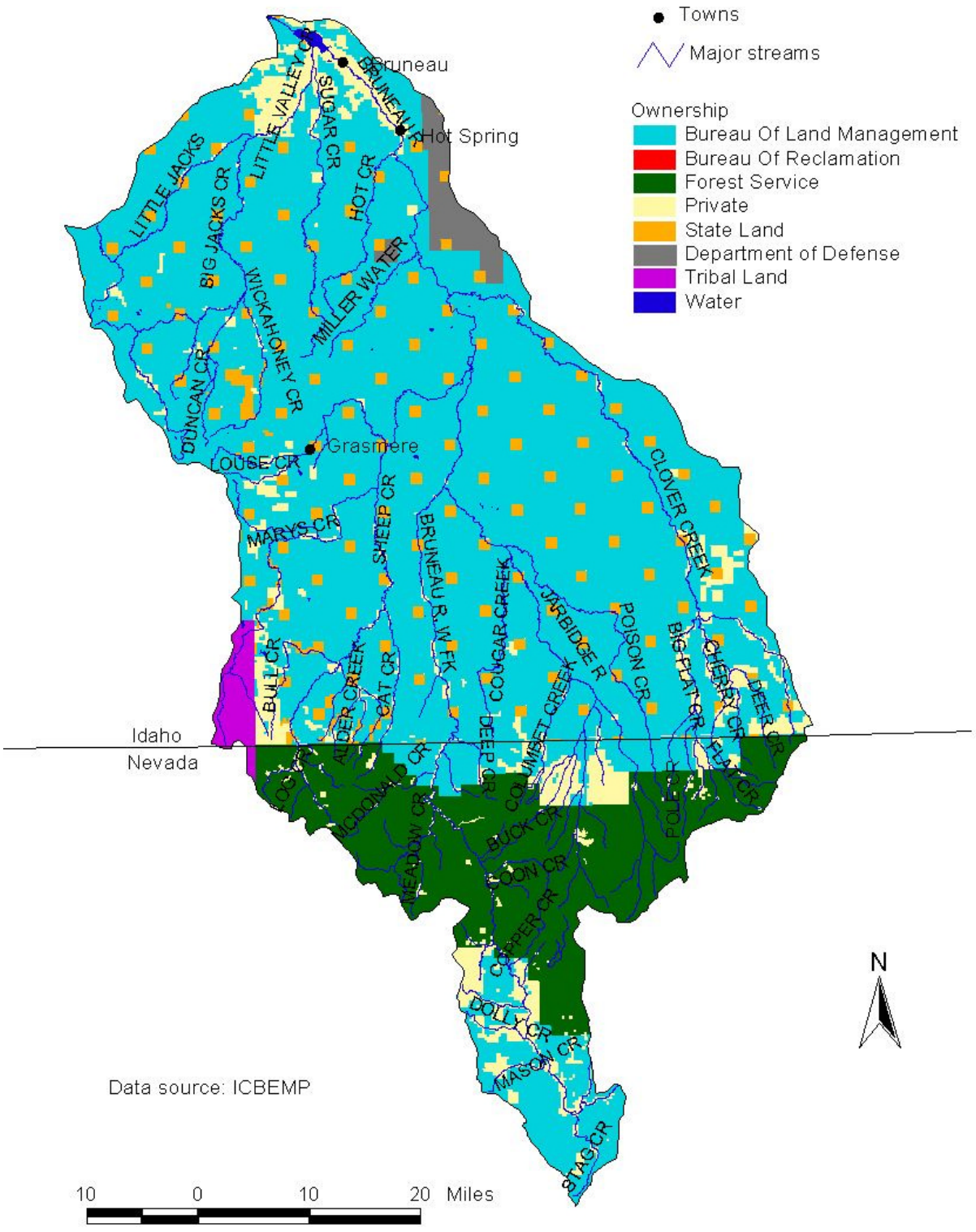

Figure 8. Land ownership in the Bruneau subbasin

Agriculture

The majority of agricultural crops are grown in the lower elevation portions of Idaho. In 1990, approximately 25,000 acres of cropland were irrigated with surface water and 20,000 acres were irrigated with groundwater (Berenbrock 1993). Most private lands are used for agriculture. No agriculture occurs in the Jarbidge River watershed within Idaho and the only surface water rights that have been issued by the Idaho Department of Water Resources have been for domestic use (Parrish 1998).

In Nevada, approximately 640 acres of private land on the West Fork Bruneau River are irrigated for hay production.

Recreation

The Bruneau and Jarbidge Rivers provide whitewater rafting and kayaking opportunities to the public and recreation-based employment to local communities. The canyons offer stretches of whitewater with class 5 and 6 difficulty (Bureau of Outdoor Recreation 1977). The Jarbidge and Bruneau Rivers averaged more than 600 visitor days per year through the 1980s.In 1993 over 2,000 recreationists floated the rivers. (Parrish 1998). Most recreation use occurs from the confluence of the Jarbidge and Bruneau Rivers to the Snake River.

The Jarbidge and upper Bruneau Rivers offer fishing opportunities for trout and whitefish. Use is focused along the Jarbidge Road, the Bruneau River, and Meadow Creek Road. Fishing, hunting and non-consumptive uses of wildlife contribute to both state and local economies.

Timber Harvest

The only significant timber in the Bruneau subbasin occurs in the Jarbidge Mountains. Historically, timber was cut and large woody debris removed from the Jarbidge River to shore up mine tunnels, build towns and provide fuel for heat and cooking (Parrish 1998). Forests in the Jarbidge area were virtually removed and, when trees became too scarce, sagebrush was harvested by the wagonload (Northwest Nevada 2001). No commercial harvest has occurred in the Jarbidge system and impacts from historical logging are not considered a threat to the aquatic system (Parrish 1998).

Transportation

Highway 51 is the main access road through the subbasin. The only other paved road is the Rogerson Cutoff that connects the town of Rogerson to the Three Creek/Murphy Hot Springs area. The remainder of the subbasin is covered by a network of dirt and gravel roads, most of which are not maintained (Lay and IDEQ 2000). Most river canyons in the subbasin remain unroaded due to steep cliffs, narrow canyon bottoms and lack of access.

In the Jarbidge River system, roads were placed within the floodplain of the East and West Forks of the Jarbidge River. Roads in the area have been surfaced with fine-grained native materials, which contribute sediment to the river during minor events and

vast quantities when road segments fail (Parrish 1998). Beavers have also caused problems by damming the Jarbidge River during low flows and backing the river onto the roadbed.

Mining

A number of active mining claims and leases occur in the subbasin (Figure 9). The Bruneau jasper mines are located just downstream of the confluence of the Bruneau and Jarbidge rivers near Indian Hot Springs. These mines have been in operation for the past 30-40 years and produce several thousand pounds of jasper annually (DAF 1998). Eight other mining claims occur in the Indian Hot Springs area (BLM 1987). In the lower subbasin, guano claims exist on Clover Creek and a sand and gravel pit occurs on Three Creek Road. (Figure 9).

Historically, mining strongly influenced water quality in the Jarbidge River. When gold was discovered in the early 1900s, fish were reported to be plentiful. By 1935, the river was described as "polluted by mine tailings, starting two miles upstream of the town of Jarbidge, and unfit for fish" (Parrish 1998).

Gold mines in the watershed used cyanide during milling and separation operations at Bluster, Pavlak, and Elkoro mill sites. By the early 1920s the Jarbidge Mining District had 10 major mines with over 90,000 feet of underground workings and 8 processing mills. Two of these mills, the Long Hike (later Elkoro) and Pavlak were adjacent to the Jarbidge River. Both mills dumped mill tailings directly into the river (USDA 1997). The actual volume of dumped tailings is unknown (Parrish 1998).

Mine shafts were pumped to allow continued ore extraction, contributing acidic and thermally heated water to the river system. The overall quantity of pumped water is unknown. Thermally heated water was still flowing from the Pavlak adit at 42 gallons per minute (gpm) in 1996 (USDA 1997). The Greyrock shaft at the Elkoro mill began filling with thermally heated water in the mid 1930s. Dewatering operations were initiated between 1937 and 1941, during which over 7 billion gallons of warm water was dumped into the Jarbidge River at a continuous rate of 31 cfs. This volume exceeded six times the base flow of the Jarbidge River for a period equivalent to 696 days (Parrish 1998). It is estimated that the thermal plume from this discharge would have persisted in the river from August through April, raising base temperatures well above tolerance limits for bull trout, macro invertebrates and other cold water biota (Parrish 1998).

Water quality was tested at the Elkoro adit in 1977 and at the Pavlak adit in 1996 (McNeill et al. 1997). Water from the Elkoro adit had a pH of 6.27; the Pavlak adit pH was 8.18 (McNeill et al. 1997).

Arsenic, copper and iron have also been found in the lower Jarbidge River at levels that may be affecting aquatic fauna (McNeill et al. 1997).

The BLM currently has Public Land Order 6890 (PLO No. 6890) in effect for the Idaho portion of the Bruneau/Jarbidge River system. This order, which is being considered for a ten-year extension, withdrew public and private land from surface entry and mining (Figure 10). The objective of the restriction was to protect the recreational, scenic, and cultural values of 52,353 acres of public land and 1,280 acres of reserved mineral interests

on private lands (USDI 2001). If the order is not renewed, jasper-mining activity could increase and lead to the construction of access roads and drill pads for exploration. These types of activities could cause severe and irreparable damage to the river canyons.

The proposed continuation of PLO 6890 has broad public support, is consistent with approved resource management plans, and represents the best long-term stewardship for these exceptional public lands.

Urban and Rural Development

The population in the subbasin is very low. Bruneau, the largest town in the area, has a population of approximately 300 people (Berenbrock 1993). In the Jarbidge River watershed, the population peaked at 1200 people in 1911 during the mining boom. With the decline of mining, the population began a slow decline until the last commercial mine closed in 1932 (Parrish 1998). Less than 50 full-time residents currently live in the town of Jarbidge (Parrish 1998). Steep topography, frequent flooding, and isolation from public services have limited urban development (Parrish 1998).

Military Facilities

Mountain Home Air Force Base (AFB) lies to the north of the Bruneau subbasin. Simulated missions are flown over portions of the subbasin, including the 110,000 acre Saylor Creek Range (SCR) in the northern portion of the subbasin. The Air Force has been training in the region for over 50 years. Environmental effects of the range include noise disturbance, disturbance of cultural resources, disruption of recreation and visual resources, and disturbance of fish and wildlife resources.

Diversions, Impoundments, and Irrigation Projects

The Bruneau River supplies irrigation water to the lands bordering the Snake River. Approximately 3.61 cfs is diverted on the east side of the Bruneau River to Buckaroo ditch and about 2.03 cfs on the west side to the Hot Springs ditch. About .75 cfs is diverted into the South Side Canal during irrigation season (Lay and IDEQ 2000).

Large portions of several streams are dewatered annually including Deadwood Creek, Cherry Creek, Devil Creek, Flat Creek, Deer Creek, Jim Bob Creek, House Creek, Antelope Creek, and Three Creek. Water diversions have rendered many miles of streams unsuitable to support aquatic species. This has caused fragmentation of habitat and isolation of fish populations. The construction and operation of Swan Falls Dam resulted in the loss of anadromous species from the subbasin.

In Nevada, water diversion structures and instream channelization are common in Copper Creek, Rattlesnake Creek, Meadow Creek, Miller Creek, McDonald Creek and the length of the West Fork of the Bruneau River in the Humboldt-Toiyabe National Forest (USDA 1995). These practices have disrupted normal stream channel processes (USDA 1995).

Seven known impoundments exist in the subbasin. No known control structures exist in the Jarbidge River system (Parrish 1998) (Table 9). Figure 11 shows locations for 5 of the 7 structures. The C.J. Strike Reservoir on the Snake River inundates the lower 6 miles of the Bruneau River above its confluence with the Snake River, including the confluence of Jacks Creek and the Bruneau River.

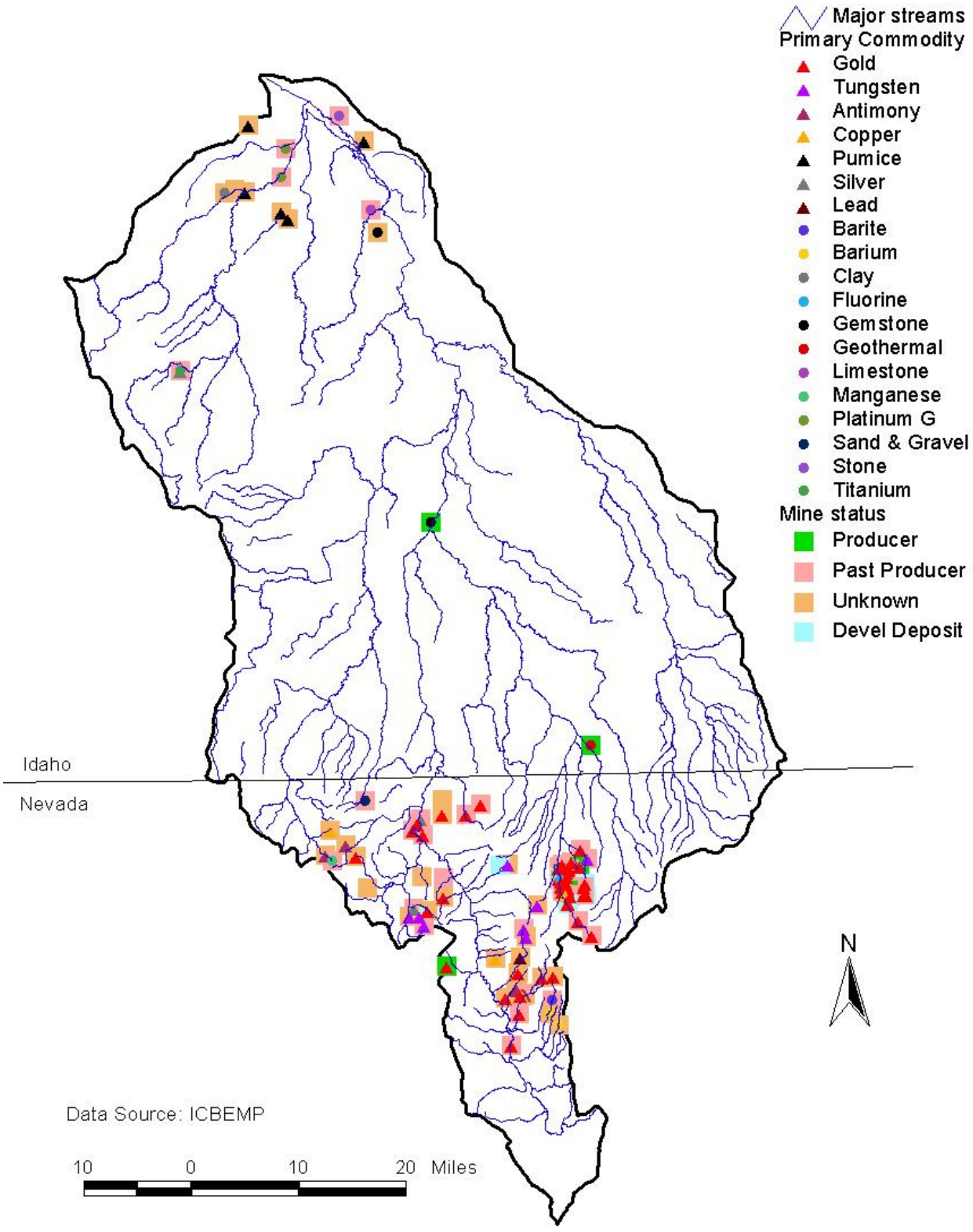

Figure 9. Historic and active mines in the Bruneau subbasin

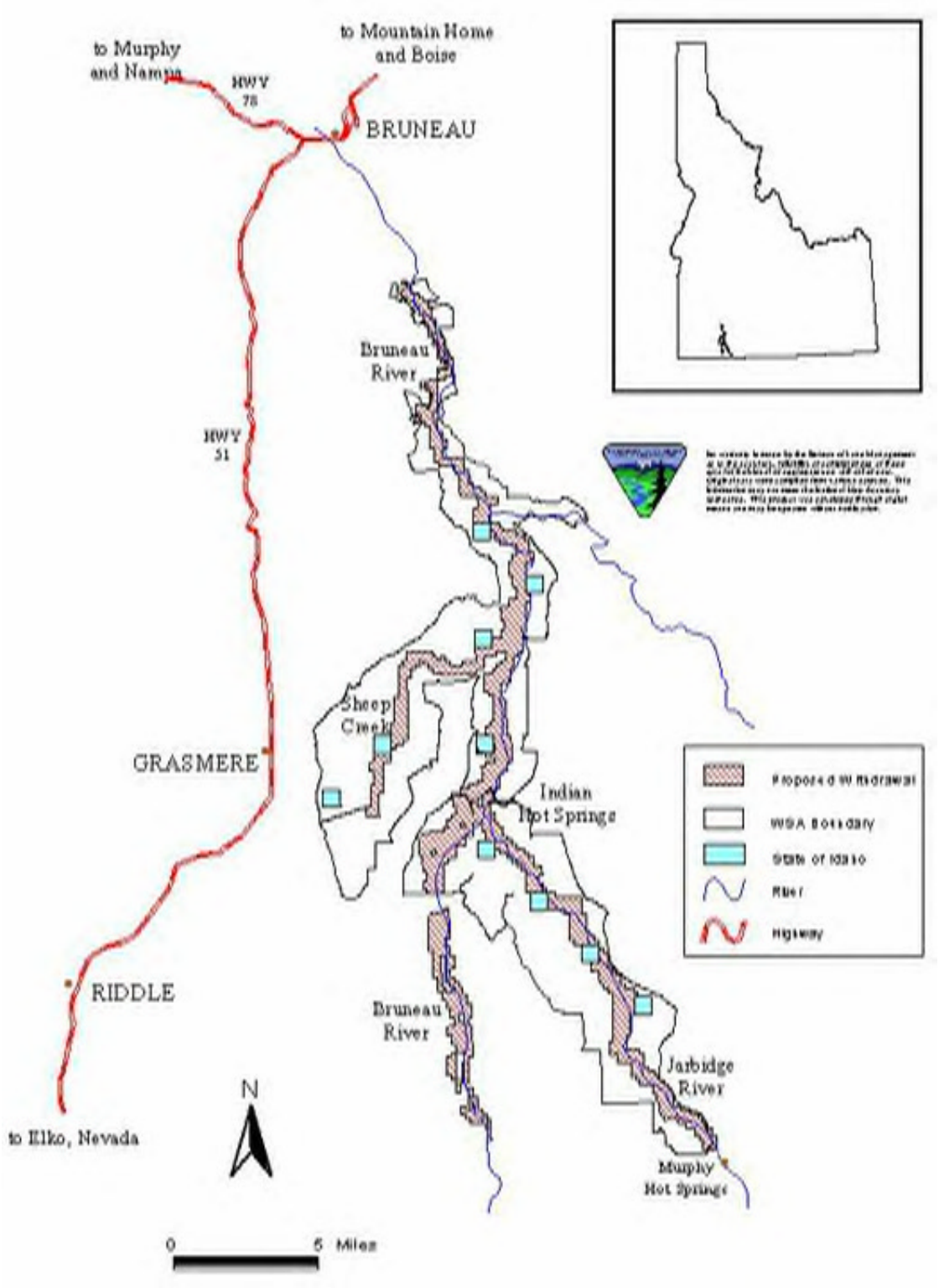

Figure 10. Area covered by State of Idaho PLO #6890 (BLM 2001)

Barriers

No known physical barriers to fish passage exist in the Jarbidge portion of the subbasin (Parrish 1998). A culvert prevented fish passage in Jack Creek in the upper Jarbidge until it was replaced with a bridge in 1997 (Partridge and Warren 2000). No documentation of fish passage problems in other areas of the subbasin was found. Current assessment of instream barriers represents a data gap.

Table 9. Impoundments in the Bruneau subbasin (Pacific States Marine Fisheries Commission data)

Name	Year Complete	Length (ft.)	Height (ft.)	Max Storage (acre-feet)	Type	Purpose
Diamond A	1931	345	26	3926	EARTH	Fire Protection; Stock
Grasmere North	1936	1520	18	1075	EARTH	Irrigation; Water Supply
Snow Creek North	1957	760	7	320	EARTH	Irrigation; Water Supply
Blackstone	1927	950	28	560	EARTH	Irrigation; Water Supply
Bull Creek	1951	760	10	130	EARTH	Irrigation
Charleston Reservoir	-	-	-	-	-	-

Protected Areas

A number of protected or specially managed areas exist within the subbasin. These include Research Natural Areas (RNA's), the Jarbidge Wilderness Area, Wild and Scenic Rivers, and Areas of Critical Environmental Concern (ACEC) (Figure 12).

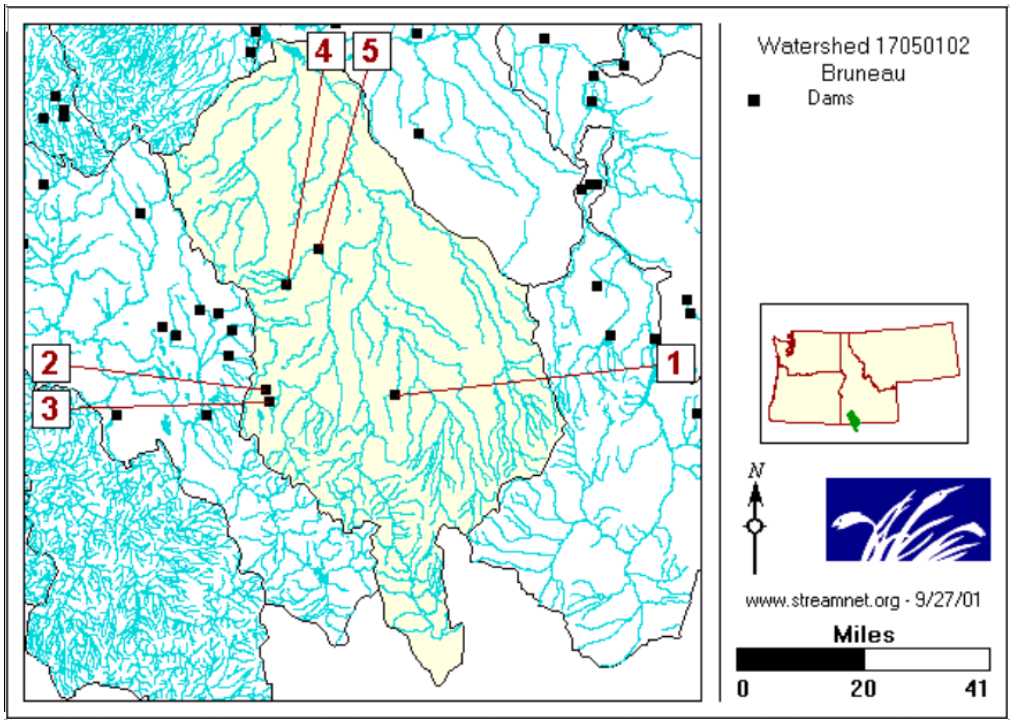

Figure 11. Impoundments within the Bruneau subbasin (Pacific States Marine Fisheries Commission data)

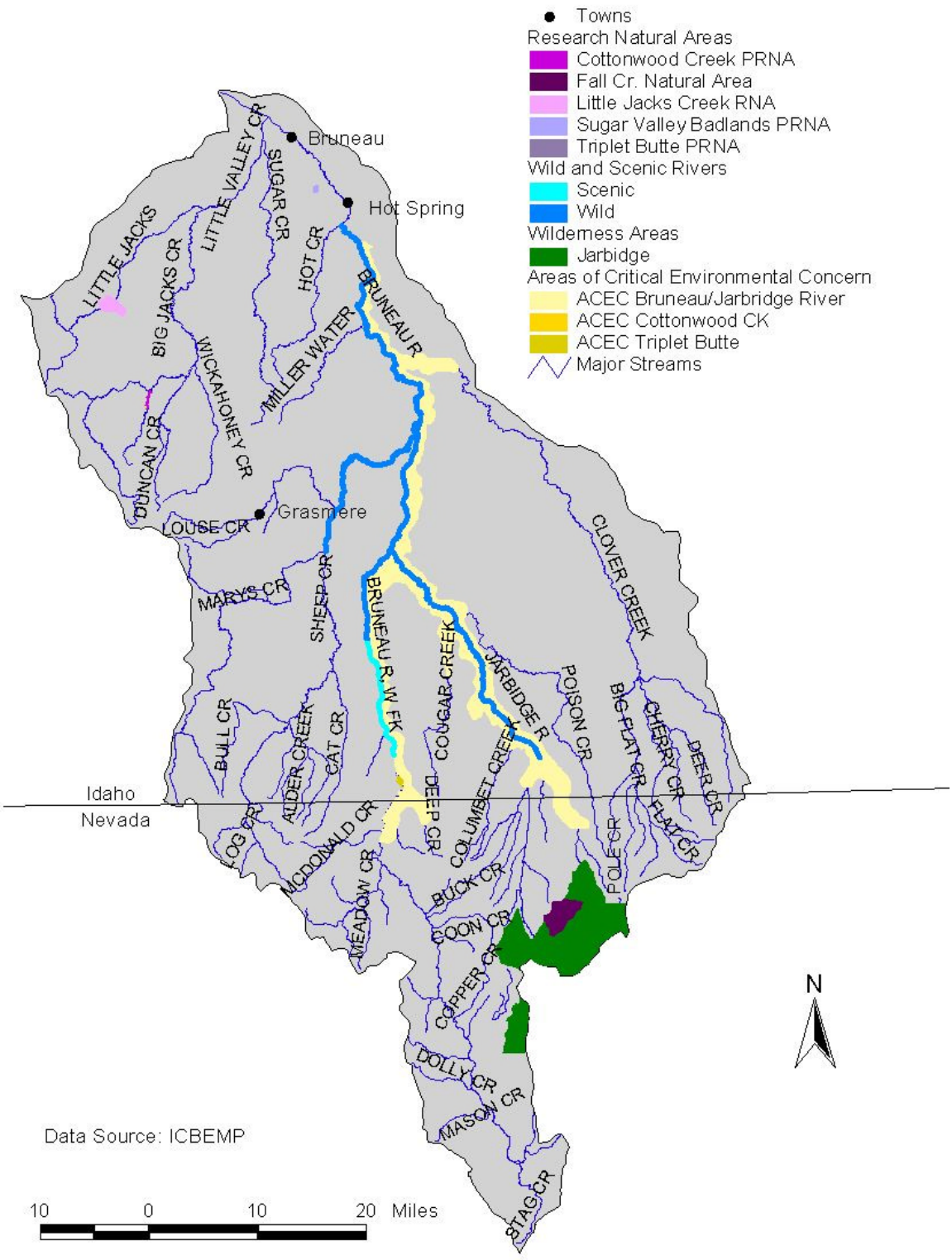

Figure 12. Areas in the Bruneau subbasin with conservation-based management or protection

Fish and Wildlife Resources

Fish and Wildlife Status

Fish

There are 25 species of fish inhabiting the Bruneau subbasin, including 16 native species (Table 10). The most numerous native species are in the salmonid, cyprinid, and cottid families. Exotic species include introduced sport or forage species, primarily centrarchids, ictalurids, and salmonids.

Table 10. Fish species inhabiting the Bruneau subbasin

Species – Common Name	Scientific Name	Origin
Redband/Rainbow trout	*Oncorhynchus mykiss*	Native / Exotic [1]
Bull trout	*Salvelinus confluentus*	Native
Brook trout	*Salvelinus fontinalis*	Exotic
Mountain whitefish	*Prosopium williamsoni*	Native
Mosquito fish	*Gambusa afinis*	Exotic
Carp	*Cyprinus carpio*	Exotic
Northern pikeminnow	*Ptychocheilus oregonensis*	Native
Tilapia	*Tilapia zilla*	Exotic
Black bullhead	*Ictalurus melas*	Exotic
Largescale sucker	*Catostomus machrocheilus*	Native
Bridgelip sucker	*Catostomus columbianus*	Native
Mountain sucker	*Catostomus platyrhyctius*	Native
Chiselmouth	*Acrocheilus alutaceus*	Native
Peamouth	*Mylocheilus caurinus*	Native
Longnose dace	*Rhinichthys cataractae*	Native
Speckled dace	*Rhinichthys osculus*	Native
Leopard dace	*Rhinichthys fakcatus*	Native
Redside shiner	*Richardsonius balteatus*	Native
Bluegill	*Lepomis macrochirus*	Exotic
Pumpkinseed	*Lepomis gibbosus*	Exotic
Black crappie	*Pomoxis nigromaculatus*	Exotic
Yellow perch	*Perca flavescens*	Exotic
Mottled sculpin	*Cottus bairdi*	Native
Shorthead sculpin	*Cottus confusus*	Native
Paiute sculpin	*Cottus beldingi*	Native

[1]/ Includes exotic resident rainbow trout

Four fish species have been chosen as focal species: redband/rainbow trout (*Oncorhynchus mykiss gairdneri*), bull trout (*Salvelinus confluentus*), mountain whitefish (*Prosopium williamsoni*), and brook trout (*Salvelinus fontinalis*). Focal species may serve

as indicators of larger communities, are listed by federal and/or state agencies as species of concern or, in the case of brook trout, have the potential to negatively impact other selected species.

Distribution and status information for the four focal species was compiled using multiple data sources, including regional, state, and localized databases, recent agency publications and assessments, and personal interviews with regional biologists. For the purpose of starting with consistent and subbasin-wide distribution and status information for each species, GIS layers were obtained from the most recent updates to the ICBEMP (2000) database.

Information is also provided for the historic anadromous fishery and additional species of interest for which only limited data exists. Although species status is discussed, data limitations prohibit substantial discussion.

Anadromous Fish

Limited historical information about anadromous fish in the Bruneau exists. The earliest documentation is qualitative and describes the Bruneau as a great producer of salmon and steelhead. The only salmon species mentioned by name is Chinook, and most observers do not separate steelhead from salmon in their comments. This makes it difficult to describe species or productivity for the subbasin.

R.F. Maury, in a letter written in 1863, describes the Bruneau as having the "greatest abundance of salmon," greater than any other river entering the Snake River that he knew of (Vigg et al. 2000). Anadromous fish runs were blocked from the Bruneau River when Swan Falls Dam was built on the Snake River in 1901 (Bureau of Outdoor Recreation 1977).

Redband Trout

Redband trout (*Oncorhynchus mykiss gairdneri*) are thought to represent the resident form of steelhead trout in areas where they coexisted historically, although the subspecies also exists in areas outside the historic range of anadromy (Behnke 1992). Despite a lack of historic documentation, the range of Snake River steelhead undoubtedly extended into the Bruneau subbasin (e.g. Vigg et al. 2000). Their influence on redband populations is unknown. however it is probable that their elimination from the Bruneau represented an impact to population connectivity, genetic diversity, and/or refounding capacity. In general, the impacts from the loss of anadromous fish on the aquatic system have resulted in a decrease in available nutrients and a loss of prey base for bull trout, large resident redband, raptors and other wildlife. Interior redband trout are currently designated a species of special concern by the American Fisheries Society and the states of Idaho and Nevada. Prior to 1997 redband were classified by the USFWS as a C2 species (candidate for threatened/endangered). Redband sub-groups and other C2 species have since been dropped from this list. The U.S. Forest Service and Bureau of Land currently classify redband as a sensitive species (Quigley and Arbelbide 1997).

The Interior redband trout in the Bruneau are distinct from coastal varieties (*Oncorhynchus mykiss irideus*) in that they appear to be selectively adapted to the severe

climatic and environmental conditions common to desert areas of southern Idaho, Nevada and eastern Oregon (Behnke 1992; Wallace 1981 cited in Schnitzspahn et al. 2000). Habitat conditions include low stream flows (<0.003 $m^3 s^{-1}$), excessively high (≥ 20°C) water temperatures, and low dissolved oxygen concentrations. Zoellick (1999) identified populations in Little Jacks and Big Jacks Creeks that tolerated temperatures above 26˚C. He found fish actively foraging at 26.2˚C and tolerating a maximum temperature of 29˚C (Zoellick 1999). Genetic analysis conducted by Leary et al. (1983) established that fish sampled from Little Jacks Creek contained a rare phosphoglucomutase genetic variant that may provide a physiological advantage over those lacking the variant in converting energy into biomass under adverse conditions. Other taxonomic and genetic analyses indicate that Bruneau redband populations appear to be predominantly native interior rainbow, showing minimal evidence of hybridization with hatchery rainbow trout (Williams et al. 1991).

Currently, redband trout are the most widely distributed and abundant salmonid in the Bruneau subbasin. Major subwatersheds supporting redband include Jacks Creek, Sheep Creek, portions of the mainstem Bruneau River, the Jarbidge River, and Clover Creek (Figure 13). The current status of redband trout has been mapped through the ICBEMP (Figure 13) and inferred from agency surveys. ICBEMP data identifies redband "stronghold" areas (refer to Appendix A for status definition) in the Jacks Creek subwatershed, central portions of the West Fork Bruneau River, and the Jarbidge watershed.

The Jacks Creek population appears to be most robust near the western boundary of the subwatershed, occupying the entire Little Jacks watershed and headwater portions of Big Jacks and Duncan Creeks. Surveys conducted in 1980 in Little Jacks Creek estimated an average density of 0.68 adult (>100 mm) fish/m^2 (USDI 1999b). Resurveys of the same reaches in 1995-96 estimated average densities to be 0.76 fish/m^2, which did not differ significantly from the 1980 densities (P=0.82; USDI 1999b). Total densities of adult and juvenile redband in upstream and downstream portions of Little Jacks Creek from the 1980 surveys were 135 and 94 fish/100m^2 (respectively; Figure 14). The Little Jacks Creek population is isolated from other populations during low flow periods, but may potentially have genetic interchange with redband from the Big Jacks watershed when connectivity is reestablished during storm events in the winter and during early spring runoff (USDI 1999b). In 1980, the estimated densities of adult and juvenile redband in upstream and downstream reaches of Big Jacks Creek were 68 and 2 fish/100m^2 (respectively; Figure 14). Recent (1995-1998) estimates of adult redband densities in Big Jacks Creek (0.14 fish/m^2) do not differ significantly from those measured in 1980 (USDI 2000b). Population densities of trout in Big Jacks Creek declined significantly with distance from cold headwater springs as stream temperatures increased and habitat conditions declined (USDI 2000b). Redband also occur in the lower sections of Wickahoney Creek, a tributary to Big Jacks Creek, but are limited in distribution due to an upstream barrier (culvert) at Wickahoney Crossing, and a downstream low flow barrier created by a stock watering pond (Lay and IDEQ 2000). During periods of low flow, the Wickahoney redband trout are thought to rely on a spring that discharges into the creek near the old Wickahoney town site. Lay and IDEQ (2000) propose that the Wickahoney fish will disperse downstream as

much as 3-5 km during more favorable conditions, and could presumably migrate past the downstream barrier.

Redband trout occurring in Sheep Creek are currently considered to be present but depressed (ICBEMP). In the late 1980's, the BLM considered the Sheep Creek population to be "healthy" (BLM 1989). Resurveys of Sheep Creek in 1994 and 1995 however, did not identify any redband in tributary or mainstem reaches (Allen et al. 1995). Investigators considered lack of flow to be the primary limiting factor.

Stronghold redband populations exist throughout portions of the mainstem Bruneau River (West Fork Bruneau) above the confluence with the Jarbidge River, and are commonly associated with tributary watersheds (see Figure 13). Surveys conducted by the BLM on the West Fork Bruneau River at two sites near its confluence with the Jarbidge River and at three upstream locations documented redband at all five sample sites, but at low densities (Allen et al. 1996). Estimated population densities ranged from 0.08 to 0.84 trout/100m^2 for all size classes. Absence of age 0 or age 1 fish was also documented, indicating a possible year class failure. Surveys conducted by the Humboldt-Toiyabe National Forest in the West Fork Bruneau River identified redband trout in 91.4 miles of the 113.7 miles of fishable stream length. Trout densities were low and distributions limited (USDA 1995).

Redband populations occurring below the confluence with the Jarbidge River are currently listed as "present depressed" (see Figure 13). Based on anecdotal evidence cited in Lay and IDEQ (2000), redband are only present in the lower reaches during spring runoff. Lay and IDEQ (2000) describe how fish are forced out of the system following the runoff period due to elevated water temperatures caused by geothermal spring discharge. The fish remain either in headwater portions of the subbasin or C.J. Strike Reservoir until the following year's runoff (Lay and IDEQ 2000). The absence of redband trout in the lower Bruneau also occurs during non-irrigation periods, "…supporting the hypothesis that the system may function as a warm water fishery during certain times of the year" (Lay and IDEQ 2000).The Jarbidge watershed represents one of the primary stronghold areas for redband trout in the subbasin. This includes the entire length of the mainstem and the majority of the headwater watersheds (i.e. Buck, Deer, Bear, Pine, Jack, and Rattlesnake, East and West Forks) (see Figure 13). In a 1992 sampling effort of the Idaho portion of the Jarbidge, Warren and Partridge (1993) documented redband presence at all sites surveyed. Redband trout densities were estimated in six of the seven-electro-fishing sites on the East and West Forks Jarbidge, and ranged from 1.7 to 16.2 trout/100m^2. At snorkeling transects, fish densities in the East Fork and mainstem Jarbidge River ranged from 0 to 8.3 trout/100m^2. When the same sampling sites were resurveyed in 1994 and 1995, generally lower trout densities were observed (Zoellick et al. 1996). Allen et al. (1996) found redband trout slightly upstream from the confluence with the Bruneau River, with sampling densities for all size classes at 1.82 trout/100$m^{2.}$ Variations in flow levels and sampling protocols could have accounted for the differences. Trapping efforts in 1998 documented four times as many redband trout in the East Fork (211) as in the West Fork (48) Jarbidge River (Partridge and Warren 1998). Trapping efforts in 1999 suggested that redband trout movement downstream in the Jarbidge increased as water temperatures dropped during the fall (Partridge and Warren 2000).

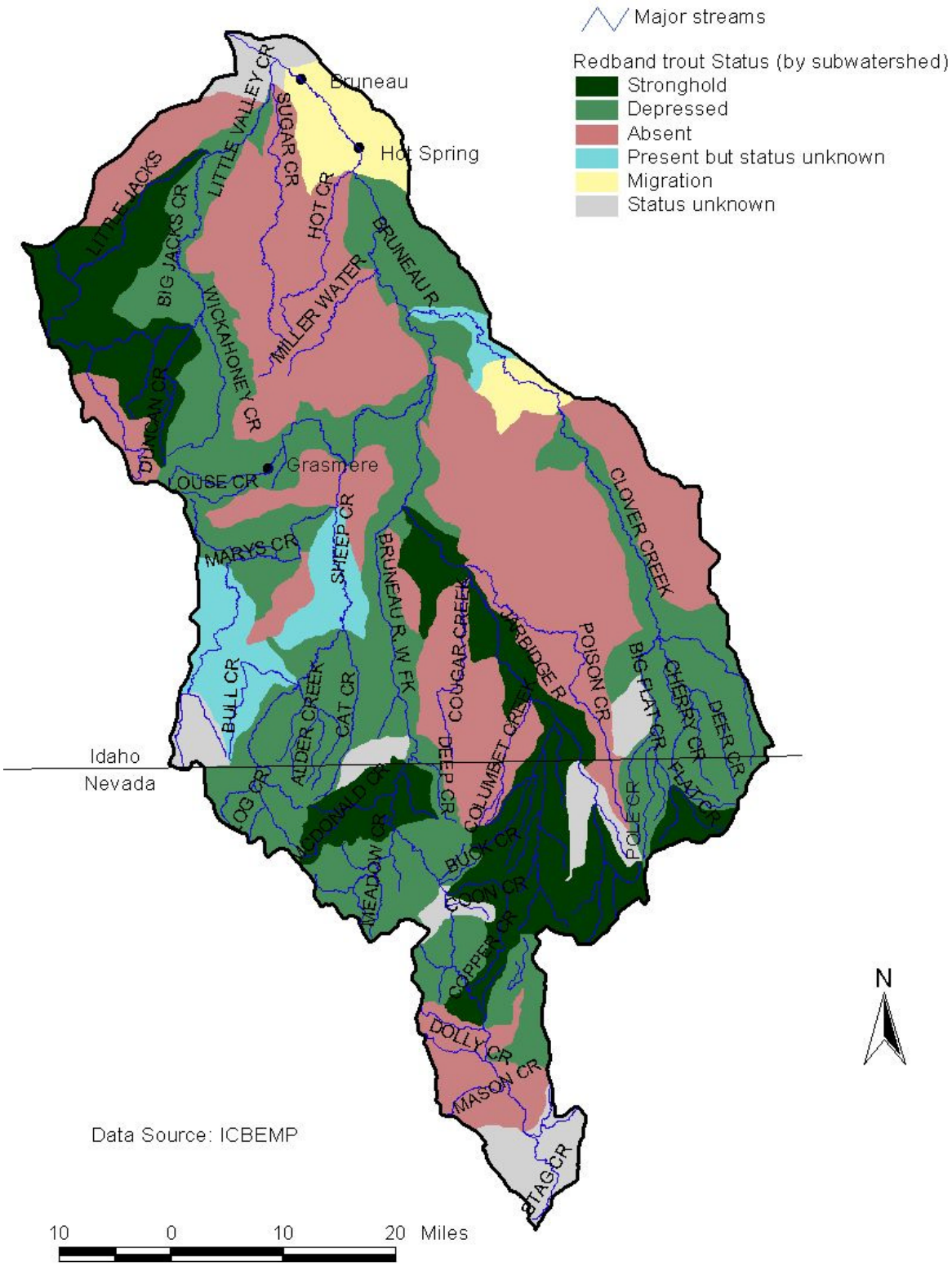

Figure 13. Redband trout status and distribution as modeled through the ICBEMP

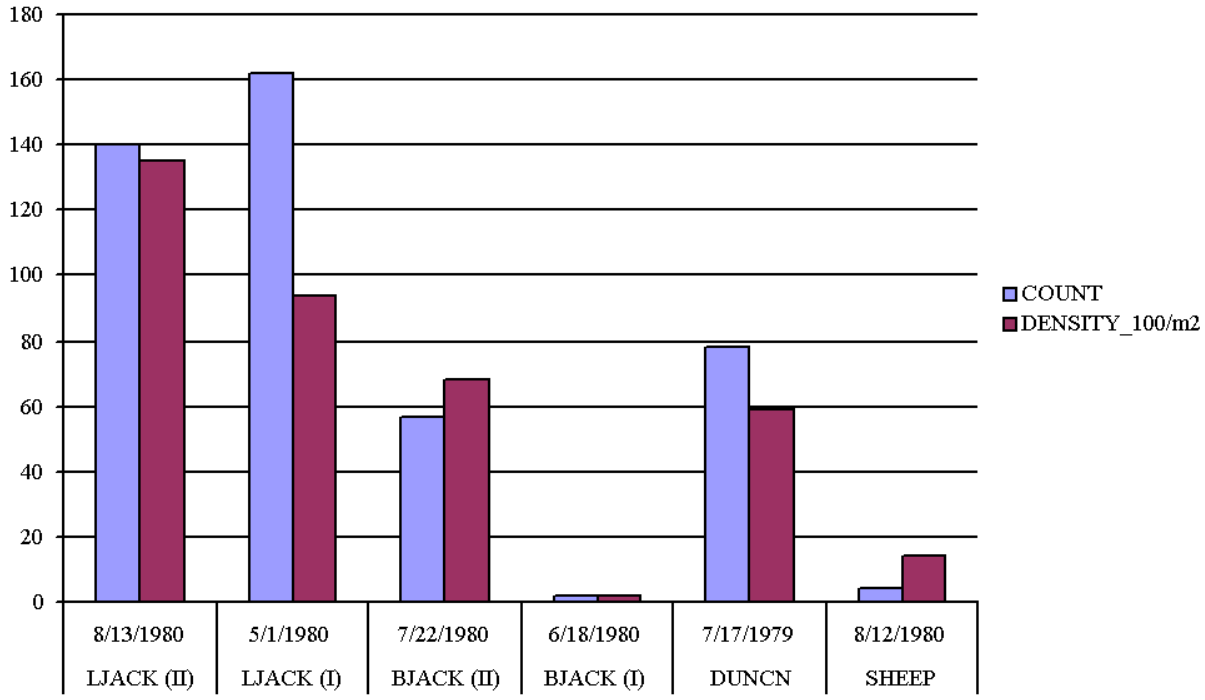

Figure 14. BLM redband survey data for streams in the Bruneau subbasin (1979-1980). Roman numerals II and I represent upstream and downstream (respectively) sample locations.

Redband trout have been documented in the Clover Creek drainage. Redband populations in the lower three-quarters of the subwatershed are considered present but depressed, or absent during certain times of the year (see Figure 13). Stronghold designations have been made in headwater tributaries, including Raker, Caudle, and Flat Creeks. In 2000, IDEQ electro-fishing surveys documented multiple age classes of redband trout in upper Clover Creek, including several large "rainbow" trout (Lay and IDEQ 2000). The same reach of river was reported as dry in 2001.

Rainbow Trout Harvest

Although trend data is lacking, rainbow trout were managed for harvest in the Jarbidge River. Harvest regulations from 1945 to 1998 reflect declines in relative abundance of trout and the accordant shifts in management strategies (Table 11).

Bull Trout

The Bruneau River populations of bull trout (*Salvelinus confluentus*) were listed as threatened under the Endangered Species Act on July 10, 1998 (Federal Register, June 10, 1998, Vol. 63, 31647). The only known population of bull trout in the Bruneau subbasin occurs in the Jarbidge River in southern Idaho and northern Nevada. This group represents the southern-most population of bull trout in the world (USFS 1998) and has been designated as a Distinct

Population Segment (DPS) by the USFWS in rule making processes associated with the 1973 ESA, as amended (Johnson 1999).

In August 1998, bull trout in the Nevada portion of the Jarbidge were classified as emergency endangered by the USFWS (Federal Register, November 1, 1999, Vol. 64, No. 210). The special ruling was made by the USFWS in an effort to conserve an "imminently" threatened species (Federal Register, November 1, 1999, Vol. 64, No. 210). Bull trout are considered a species of special concern in the State of Idaho (Parrish 1998). The Inland Native Fish Strategy identified the Jarbidge River as a "priority watershed" for bull trout recovery (USDA 1998).

Table 11. Fisheries harvest management history in the Jarbidge River (1945-1988)

YEAR	SEASON	RULES
1945	May 21- Nov 15	20 trout or 15 pounds and 1 trout/day. Not more than 5 trout less than 6 inches.
1946	May 21 – Nov 15	20 trout or 10 pounds and 1 trout/day. Not more than 5 trout less than 6 inches.
1947-1949	Jun 4 – Oct 31	20 trout or 10 pounds and 1 trout/day. Not more than 5 trout less than 6 inches.
1950-1954	Jun 4 – Oct 31	20 trout or 7 pounds and 1 trout/day. Not more than 5 trout less than 6 inches. Fishing hours 4 a.m. to 10 p.m.
1955-1956	June 4 – Oct 31	15 trout or 7 pounds and 1 trout/day. Not more than 5 trout less than 6 inches. Fishing hours 4 a.m. to 10 p.m.
1957-1962	June 4 – Oct 31	15 trout or 7 pounds and 1 trout/day. Fishing hours 4 a.m. to 10 p.m.
1963-1968	Sat. near Jun 1 – Oct 31	15 trout or 7 pounds and 1 trout/day. Fishing hours 4 a.m. to 10 p.m.
1969-1971	Sat near Jun 1 – Nov 30	15 trout or 7 pounds and 1 trout/day.
1972-1975	Open year round	10 trout or 7 pounds and 1 trout/day
1976 (5?)	Open year round	10 trout, not more than 5 greater than 12 inches.
1977-1989	Open year round	6 trout, not more than 2 greater than 16 inches.
1990-1991	Open year round	6 trout
1992-1993	Sat of Memorial weekend – Nov 30	2 trout
1994-1998	Sat of Memorial weekend – Nov 30	2 trout, closed to the harvest of bull trout.

Historically, bull trout were found only in the anadromous streams and rivers of Idaho and Nevada (Parrish 1998). Anecdotal accounts describe a fluvial form of bull trout that migrated with anadromous salmonids from the mainstem Snake to portions of the Jarbidge River. Although these historic accounts are largely unsubstantiated, the current distribution and life history strategies of the Jarbidge bull trout population, which consists of migratory forms in

Idaho reaches (Parrish 1998) and resident/migratory forms in Nevada reaches (Zoellick et al. 1996), may represent a historical relic of fluvial fish from the Snake River (Parrish 1998). This population is physically barred from other populations by dams on the Snake River (Klott 1996).

The relative distribution and abundance of the Jarbidge population of bull trout is less uniform and at much lower densities than redband trout (USFS 1998) (Figure 15). The Jarbidge population is small and isolated, and at the fringe of bull trout range (USDA 1998). In Idaho, nineteen bull trout have been collected in 13 separate sampling efforts between 1954 and 1998, indicating a very low population density in the Idaho portion of the subwatershed (Parrish 1998). In an intensive survey effort conducted in late summer and fall of 1998, Johnson (1999) found bull trout in the Nevada portion of the Jarbidge River in all suitable habitats.

Parrish (1998) was unable to project bull trout population viability in the Jarbidge due to insufficient data. No bull trout were identified in the Idaho portion of either forks of the Jarbidge River or in the mainstem of the Jarbidge River in a 1992 survey effort (Warren and Partridge 1993). However, 1992 marked the close of an extended period of below normal precipitation and above normal temperatures throughout southern Idaho (Parrish 1998). In 1994 and 1995 survey efforts, bull trout were sampled in the West Fork of the Jarbidge River 2.4 km downstream of the Idaho-Nevada border (1 bull trout) and in Jack Creek at its confluence with the West Fork of the Jarbidge River (6 bull trout) (Zoellick et al 1996). In Nevada, bull trout were found at all sample sites in, and 2 of 14 sample sites outsidethe Jarbidge Wilderness Area (Johnson 1999). Mean bull trout linear density within the wilderness area was estimated at 258.7 fish per mile (Johnson 1999). The minimum population size for this group of fish was estimated at 492 fish. Age I, II, and IV fish were present, with the dominant year class being the Age II fish (57%). In non-wilderness samples, average bull trout density was estimated to be 7 fish per mile (Johnson 1999). The minimum population size for this group of fish was estimated at 87 fish. Although fewer fish occupied non-wilderness areas in the Nevada portion of the Jarbidge, those that were encountered were slightly larger than the wilderness fish (188 mm vs. 128 mm). The largest bull trout caught in the Jarbidge River in Nevada was 550 mm long (Gary Johnson, NDOW, pers. comm. cited in Zoellick et al. 1996).

Bull trout have been documented in Dave Creek, Slide Creek, Fall Creek (Klott 1996), Jack Creek, Pine Creek and headwater tributaries that are physically linked by the mainstem Jarbidge River (USDA 1998). Bull trout may overwinter in habitat downstream of the confluence of the East and West Forks of the Jarbidge River, but have not been documented in this area during summer months (Klott 1996).

Genetic sampling in 1998 indicated that three separate resident populations remain in the upper Jarbidge River watershed in Nevada, with very little evidence of genetic mixing (Spruell personal communication cited in Parrish 1998).

USDA (1998) determined that bull trout populations in the Jarbidge may be depressed and at risk to management-induced or random extinction mechanisms. Available data is not sufficient to make a valid projection of population viability, although it is premature to suggest that the Jarbidge population is stable (USDA 1998). Habitat modification and mining-related pollution may have reduced bull trout numbers between 1865 and 1945 (USDA 1998).

Mountain Whitefish

Mountain whitefish (*Prosopium williamsoni*) are the only other native salmonid in the Bruneau subbasin. The historic distribution of mountain whitefish was likely similar to current distribution (Figure 16). Mountain whitefish have been documented at low densities in the West Fork Bruneau River within the Humboldt-Toiyabe National Forest (USDA 1995). They were detected in upper Clover Creek during IDEQ electro-fishing efforts in 2000 (Lay and IDEQ 2000).

Second only to dace, Mountain whitefish were the most common fish trapped in the East and West Forks of the Jarbidge between September and December 1999 (Partridge and Warren 2000). Similar to other salmonid species, Mountain whitefish will occupy a given reach only when temperature conditions are suitable. In their 1999 study, Partridge and Warren (2000) found that mountain whitefish movement appeared to be related to changes in temperature. The number of fish sampled increased later in the fall as water temperatures dropped (Partridge and Warren 2000). Habitat conditions in the East Fork Jarbidge appear to be more suitable than those in the West Fork Jarbidge, as Partridge and Warren (2000) found nearly ten times more whitefish in the East Fork than in the West Fork.

Brook Trout

Brook trout (*Salvelinus fontinalis*), an introduced salmonid, are primarily restricted to portions of the Clover Creek (East Fork Bruneau) subwatershed and a landlocked lake in Nevada (Figure 17; Chuck Warren, personal communication, 2001). Surveys conducted by the BLM in 1997 estimated 2.0 trout/100 m^2 in the middle reach of Flat Creek, and 3.0 fish/100 m^2 in the upper reach of Flat Creek (Table 12No brook trout were documented in the lower reach. It appears that spawning and rearing habitat is limited to the uppermost portions of the watershed, as these were the only areas containing age 0 fish. No bull trout were detected during the 1997 survey effort.

Table 12. 1997 BLM brook trout survey data for Flat Creek, Idaho (BLM unpublished data)

Flat Creek Reach	Transect Length (m)	Density (fish/100m^2)	No. of 0 yr.	No. of ≥1 yr.
Lower	60.0	0	0	0
Middle	77.4	2	0	10
Upper	110.9	3	9	9

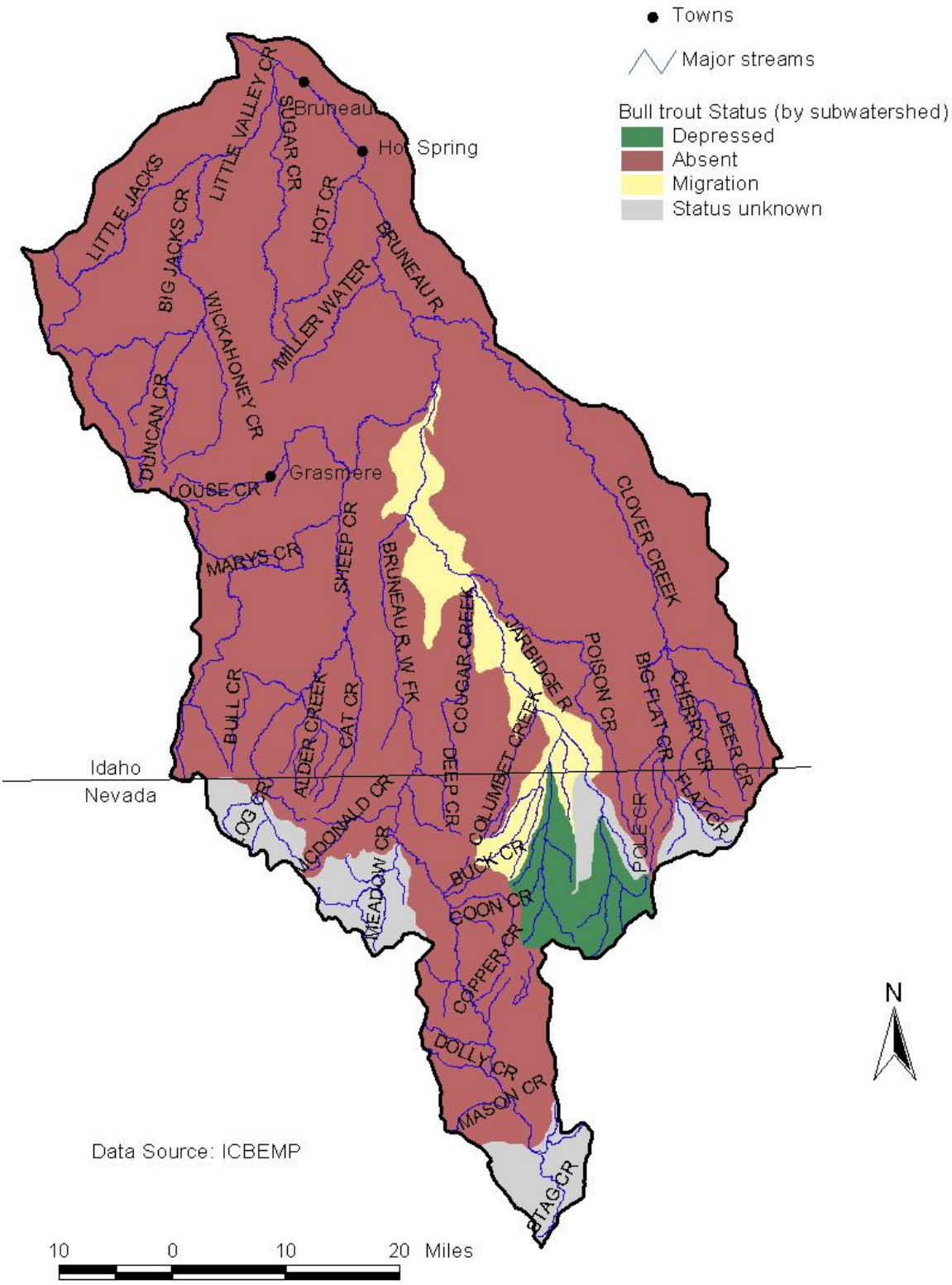

Figure 15. Status and distribution of bull trout in the Bruneau subbasin

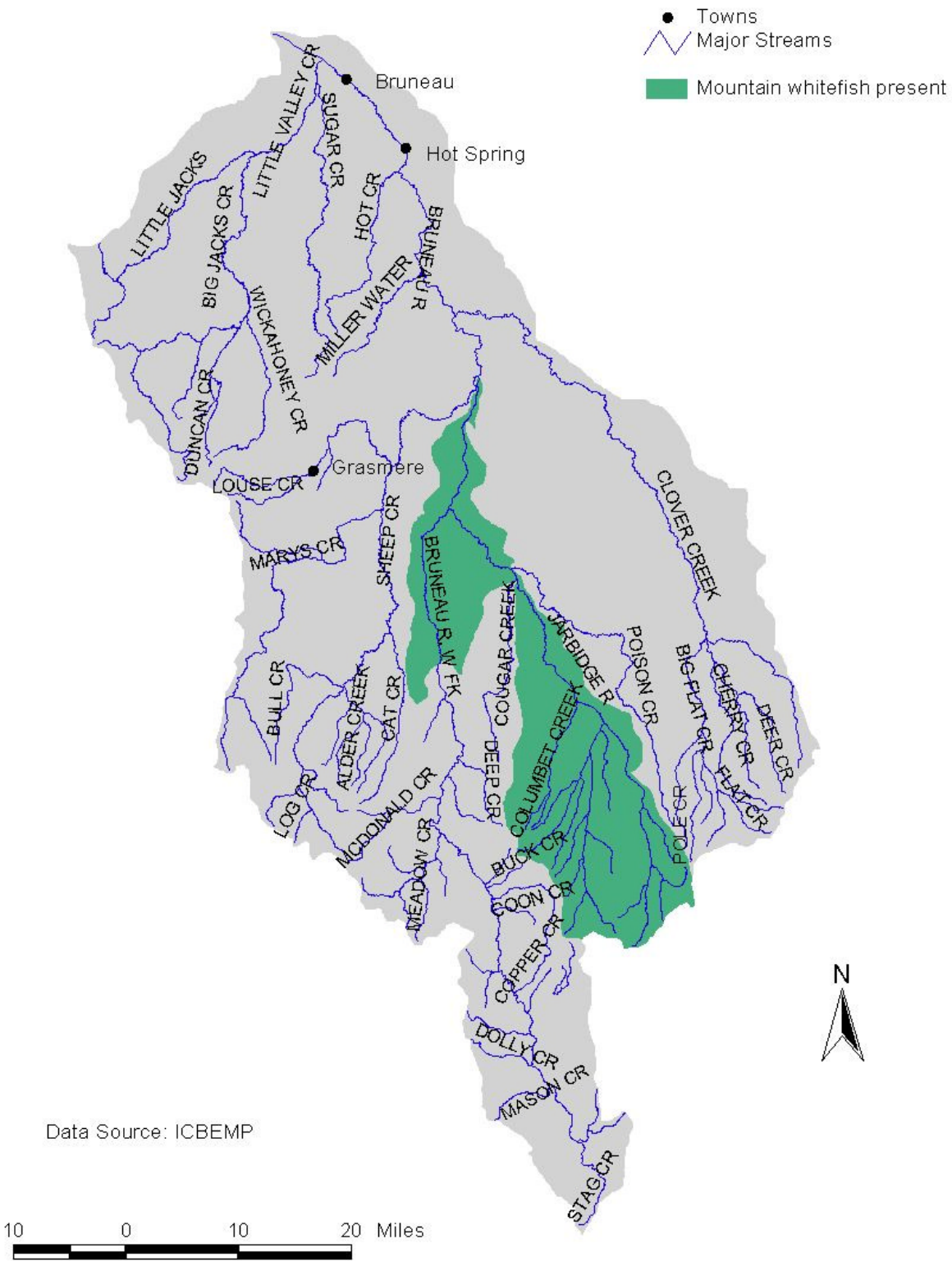

Figure 16. Mountain whitefish distribution in the Bruneau subbasin.

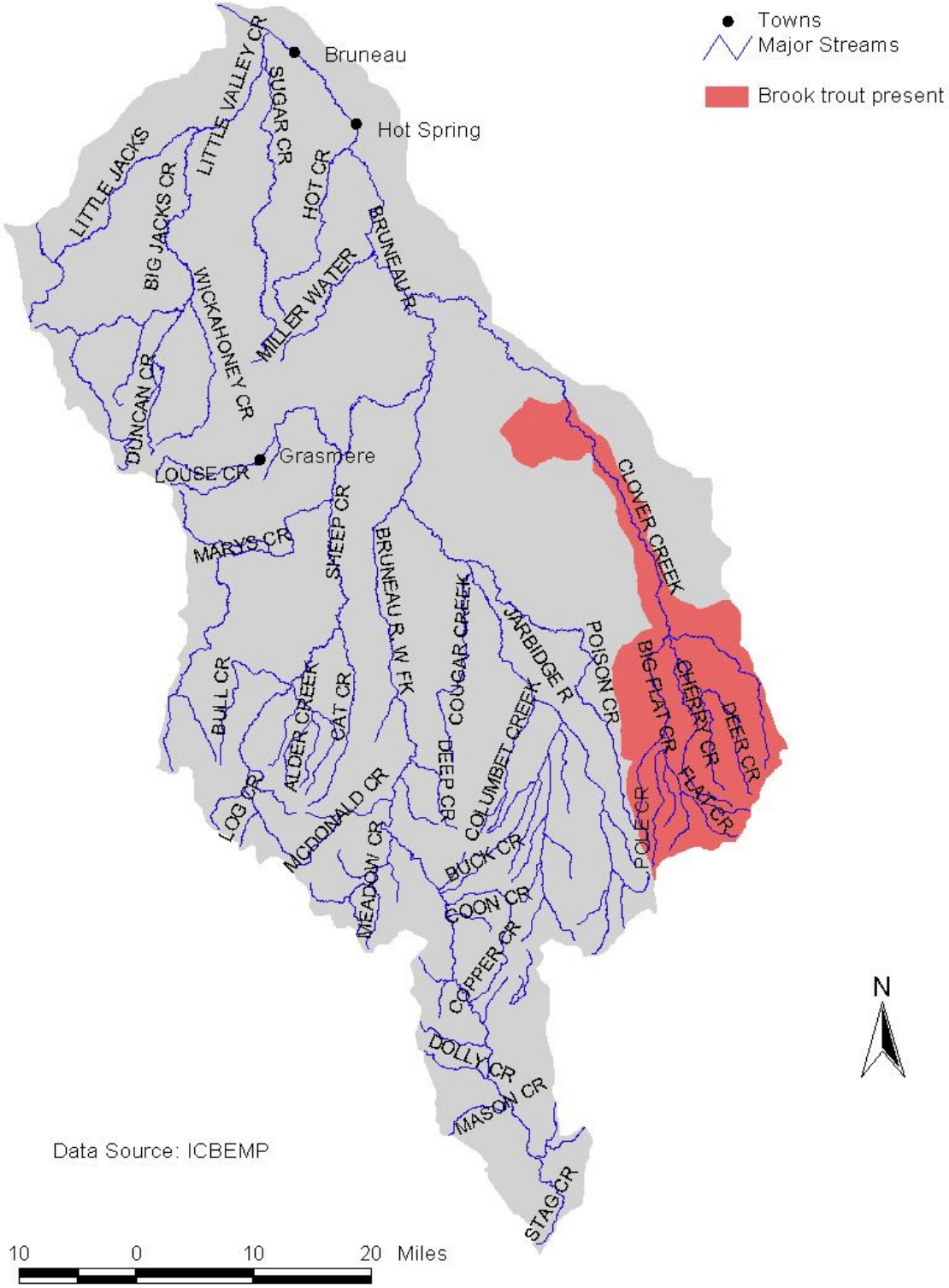

Figure 17. Brook trout distribution in the Bruneau subbasin

Other Fish Species

Little investigation has been made into distribution, status, trends, or life history requirements of non-native non-game fish in the Bruneau subbasin. Mosquito fish (*Gambusa affinis*) and tilapia (*Tilapia zilla*) are present in Hot Creek. These exotic fish have been studied to determine their impact on the Bruneau hot springsnail (refer to wildlife section for discussion). They appear to have flourished in the warm water temperatures of Hot Creek.

Wildlife

The Bruneau subbasin has been identified as a "Center of Biodiversity" and portions of the lower subbasin have been identified as a "Center for Endemism and Rarity" (ICBEMP). The subbasin is part of the largest contiguous center of shrub-steppe biodiversity in the Interior Columbia Basin (Quigley and Arbelbide 1997, Schnitzspahn et al. 2000).

A list of vertebrate wildlife species thought to occur in the Bruneau subbasin is found in Appendix B. This list is based on the availability of suitable habitat, as determined by the Idaho Gap Analysis, Draft Wildlife Habitat Relationship Models (2001), and the experience of local wildlife biologists. For many species basic information on distribution and population trends have not been collected and represents a data gap. Even less information exists on invertebrate species.

This document summarizes the existing data on the forty-eight wildlife species listed as candidate, sensitive, threatened, or endangered by one or more land management agencies in the subbasin. A discussion of important game species is also included (Table 13).

Table 13. Listed wildlife species of the Bruneau subbasin (DAF 1998; Lay and IDEQ 2000).

Species		Idaho State	US Forest Service	BLM	Federal
Amphibians and Reptiles					
Bufo boreas	Western toad	SOC-Undetermined	Sensitive	Sensitive	SOC
Crotaphytus bicinctores	Mojave black-collared lizard	Special concern		Sensitive	
Rana luteiventris	Columbia spotted frog	SOC-Undetermined	Sensitive	Sensitive	Candidate
Rana pipiens	Northern leopard frog	Special concern	Sensitive	Sensitive	
Rhinocheilus lecontei	Longnose snake	Special concern		Sensitive	
Sonora semiannulata	Ground snake		Sensitive		
Birds					
Accipiter gentilis	Northern goshawk	SOC1-Undetermined	Sensitive	Sensitive	SOC
Ammadramus savannarum	Grasshopper sparrow			Sensitive	
Buteo regalis	Ferruginous hawk	Protected		Sensitive	SOC
Circus cyaneus	Northern harrier			Sensitive	
Falco mexicanus	Prairie falcon	Endangered		Sensitive	Endangered
Falco peregrinus anatum	Peregrine falcon	Endangered			SOC

Species		Idaho State	US Forest Service	BLM	Federal
Ammodramus savannarum	Grasshopper sparrow			Sensitive	
Amphispiza belli	Sage sparrow			Sensitive	
Catharus ustulatus	Swainson's thrush			Sensitive	
Centrocercus urophasianus	Sage grouse			Sensitive	
Childonias niger	Black tern				SOC
Cygnus buccinator	Trumpeter swan	Special concern		Sensitive	SOC
Cypseloides niger	Black swift			Sensitive	
Dendroica nigrescens	Black-throated gray warbler			Sensitive	
Dendroica petechia	Yellow warbler			Sensitive	
Dendroica townsendi	Townsend's warbler			Sensitive	
Dolichonyx oryzivorus	Bobolink			Sensitive	
Empidonax hammondii	Hammond's flycatcher			Sensitive	
Empidonax oberholseri	Dusky flycatcher			Sensitive	
Empidonax occidentalis	Cordilleran flycatcher			Sensitive	
Empidonax trailii	Willow flycatcher			Sensitive	SOC
Haliaeetus leucocephalus	Bald eagle	Endangered		Sensitive	Threatened
Lanius ludovicianus	Loggerhead shrike	SOC-Priority		Sensitive	SOC
Melanerpes lewis	Lewis' woodpecker			Sensitive	
Numenius americanus	Long-billed curlew			Sensitive	
Oporornis tolmiei	MacGillivray's warbler			Sensitive	
Oreortyx pictus	Mountain quail	SOC-Priority	Sensitive	Sensitive	SOC
Otus flammeolus	Flammulated owl		Sensitive		
Pelecanus erythrorhynchos	American white pelican	Special concern		Sensitive	
Pipilo chlorurus	Green-tailed towhee			Sensitive	
Plegadis chihi	White-faced ibis	Protected		Sensitive	SOC
Selasphorus rufus	Rufus hummingbird			Sensitive	
Wilsonia pusilla	Wilson's warbler			Sensitive	
Mammals					
Brachylagus idahoensis	Pygmy rabbit			Sensitive	
Euderma maculatum	Spotted bat	SOC-Undetermined		Sensitive	
Lontra canadensis	River otter			Watch	
Microdipodops megacephalus	Dark kangaroo mouse			Sensitive	
Myotis evotis	Long-eared myotis			Sensitive	
Myotis thysanodes	Fringed myotis	Special concern		Sensitive	
Myotis volans	Long-legged myotis			Sensitive	
Myotis yumanensis	Yuma myotis			Sensitive	SOC
Ovis canadensis	Bighorn sheep			Sensitive	SOC
Invertebrates					

Species		Idaho State	US Forest Service	BLM	Federal
Cicindela arnicola	Idaho Dunes tiger beetle			Sensitive	SOC
Fluminicola columbiana	Columbia pebblesnail			Sensitive	
Pyrgulopsis bruneauensis	Bruneau hot springsnail	Endangered		Sensitive	Endangered

Amphibians and Reptiles

The Bruneau subbasin an area of exceptional herptile diversity (Gerber et al. 1997) (Table 13, Table 14). Gerber et al. (1997) conducted field studies in Big Jacks and Little Jacks Creeks to determine habitat associations in the deep canyons of the Bruneau system. They found 16 species of reptiles and amphibians, of which 13 were associated with deep canyons. They found that use of canyon bottoms and rims was highest, with little or no vertical movement of reptiles between habitat types

Table 14. Reptiles and amphibians in Big Jacks and Little Jacks Creek Drainages (Gerber et al 1997).

Species	Common name
Crotalus viridis	Western rattlesnake
Piruophis caterifer	Great basin gopher snake
Coluber constrictor	Western yellow-bellied racer
Masticophis taeniatus	Western striped whipsnake
Sonora semiannulata	Western ground snake
Hypsiglena torquata	Night snake
Rinocheilus lecontei	Western longnose snake
Gambelia wislizenii	Longnose leopard lizard
Cnemidophorus tigris	Western whiptail
Phrynosoma platyrhinos	Desert horned lizard
Phrynosoma douglassi	Short horned lizard
Uta stansburiana	Side-blotched lizard
Sceloporus occidentalis	Western fence lizard
Sceloporus graciosus	Sagebrush lizard
Crotaphytus bicinctores	Mojave black-collard lizard
Eumeces skiltonianus	Western skink
Pseudacris regilla	Pacific treefrog

Six species that occur in the subbasin are listed as species of concern by one or more of the land management agencies. These species are: the western toad *(Bufo boreas),* northern leopard frog *(Rana pipiens)*, spotted frog *(Rana luteiventris)*, western ground snake *(Sonora semiannulata)*, longnose snake *(Rhinocheilus lecontei)*, and Mojave black-collared lizard *(Crotaphytus bicinctores)*. Distribution and population trends are discussed below.

Western Toad

Unpublished mitochondrial DNA work by Anna Goebel at the University of Colorado indicates that at least two subspecies and potentially two separate species of western toad *(Bufo boreas)* inhabit Idaho. These subspecies (species) are separated by the Snake River. Populations north of the Snake River appear to be stable, but populations south of the river appear to be declining (Engle and Harris 2001). Western toads were documented at two locations in the Jarbidge Resource Area (Klott 1996) in 1994. Surveys conducted by the BLM in the Nevada portion of the subbasin failed to detect this species (they were, however, documented in the adjacent Owyhee subbasin) (Elko BLM GIS).

Mojave Black-collared Lizard

Historically, Mojave black-collared lizards *(Crotaphytus bicinctores)* occupied Elmore, Canyon and Owyhee Counties in Idaho. Their current range is restricted to Owyhee County (Engle and Harris 2001). In the Bruneau subbasin, Mojave black-collared lizards have been documented in the Bruneau River Canyon southeast of Hot Creek (Klott 1996) and in the Jacks Creek drainage in the northwestern portion of the subbasin (Gerber et al 1997). The species occupies sparsely vegetated, arid, rock canyons. They are most commonly found along canyon rims or in areas with boulders, piles of rocks and talus slopes at cliff bases.

Spotted Frog

The Columbia spotted frog is a USFWS candidate species (Engle and Munger 1998). The BLM conducted frog surveys in the western portion of Owyhee County but only limited survey work has occurred east of Highway 51. The Idaho Conservation Data Center (CDC) has one record of a Columbia spotted frog *(Rana luteiventris*) occurrence in the headwaters of Mary's Creek. Surveys conducted by the BLM in Nevada documented the species in the headwaters of Sheep, Meadow, Corral and Copper Creeks (Elko BLM GIS; Figure 35).

Spotted frogs are associated with slow moving water bodies (rather than riffles), areas of warmer water temperatures, and stream segments with greater sinuosity and little or no downcutting (Munger et al. 1997). Researchers have noted that although frogs are found in areas of relatively high grazing, an inverse relationship existed between grazing intensity and frog abundance. Long-term overgrazing is associated with stream downcutting, lowered water tables, and loss of pool habitat, all of which are detrimental to spotted frogs (Munger et al. 1997)

Engle and Munger (1998) are conducting two studies in Owyhee County to assess gene flow between frog populations. A radio-tracking study is underway that examines frog movement patterns and habitat use. A genetics study will examine the genetic similarity of populations in the region.

Western Ground Snake

Western ground snakes *(Sonora semiannulata)* occur in desert areas with sandy soils that are adjacent to talus slopes (Klott 1996). The species is found in the lower portion of the Bruneau River Canyon, Little and Big Jacks Creeks and in the Bruneau Sand Dunes area (Klott 1996). Populations are thought to be declining due to loss of habitat (Engle and Harris 2001).

Longnose Snake

Longnose snakes *(Rhinocheilus lecontei)* have a very limited distribution in southern Idaho (Engle and Harris 2001). They have been documented in the Bruneau Arm and Bruneau Dunes State Park areas (Klott 1996), as well as in Big Jacks and Little Jacks Creek areas (Gerber et al 1997). No trend information is available. However, data collected from surveys conducted by the BLM in 1978 and 1998 in the Snake River Birds of Prey Natural Area (adjacent to the Bruneau subbasin) indicated a 44% decline in occupied sites over a twenty year period. Longnose snakes appear to be sensitive to habitat loss due to invasion of exotic weeds and conversion to agriculture (Engle and Harris 2001).

Raptors

Bald Eagle

Bald eagles *(Haliaeetus leucocephalus)* are listed as endangered in the state of Idaho and as threatened by the U.S. Fish and Wildlife Service (USFWS). The species is found in the northern-most portion of the subbasin near the Snake River (Klott 1996).

Peregrine Falcon

Peregrine falcon *(Falco peregrinus anatum)* populations in the U.S. dramatically declined primarily due to DDT-induced reproductive failure. Protection as an endangered species under ESA and captive breeding programs resulted in the recovery and delisting of the species in 1999. Peregrine falcons nest almost exclusively on cliffs, often on ledge overhangs or in small caves. The subbasin contains many ideal nesting sites. In 1992, a pair of peregrines was observed in the Jarbidge Resource Area, but no nest was confirmed (Klott 1996). Peregrine falcons have been reported in the Jarbidge and Bruneau River Canyons, but the sightings were not verified (Klott 1996).

Northern Goshawk

Northern goshawks *(Accipiter gentilis)* have been designated as a C2 species by the USFWS. The species usually nests in older, taller forests that are associated with openings near water. The species has been found to nest in small isolated aspen/conifer stands throughout the West Fork of the Bruneau River in the Humboldt-Toiyabe National Forest (USDA 1995).

Ferruginous Hawk

As a higher order predator, the health of ferruginous hawk (*Buteo regalis*)populations can be indicative of the health of prey populations and in many cases the ecosystem as a whole.

Ferruginous hawk nesting territories have been documented at 28 locations east of the Bruneau River. Klott (2001) estimates that 12 nests occur in the BLM Jarbidge Resource Area but notes that a complete inventory has not been conducted. The Department of Air Force (DAF) located an active nest at their Juniper Butte Study Area in 1995 (DAF 1998) and documented a ferruginous hawk sighting at their Grasmere Study Area in 1996. Threats to ferruginous hawks include shooting and large scale fires that reduce sagebrush habitat and destroy nest trees. Human disturbance can cause nest abandonment (Klott 1996).

Northern Harrier

Northern harriers (*Circus cyaneus*) use a variety of habitats including: mountain shrub, sagebrush/grass, crested wheatgrass seedlings, annual grasslands, wet meadows, and riparian areas (Klott 1996). Populations in Idaho and Montana have experienced significant and steady declines, although the species is one of the more commonly observed raptors in the Jarbidge Resource Area (Klott 1997).

Threats to northern harrier include: loss of wetlands, habitat degradation, conversion of native habitats to exotic annual grasses, and loss of prey diversity and abundance (Klott 1997).

Prairie Falcon

Prairie falcons (*Falco mexicanus)* are a BLM sensitive species. Populations in Idaho appear stable, but are declining throughout the West (Klott 1997). Prairie falcon habitat consists of sagebrush/grass, desert grassland, or other arid habitats in close proximity to cliffs. Prairie falcons are concentrated near the Bruneau River, Jarbidge River, and East Fork of the Bruneau River. Nests have been found in all of the major canyon systems (Klott 1997).

Threats to the prairie falcon include disturbance from rock climbing, shooting, and conversion of native shrub-steppe habitat to exotic annual grasslands or introduced perennial grasslands (Klott 1997).

Other Listed Birds

Flammulated Owl

The flammulated owl *(Otus flammeolus)* is a forest-dependent species that nests in conifer stands and cottonwood trees. Suitable owl habitat is found in mixed conifer, mixed conifer/deciduous forest, and aspen communities in the southernmost portion of the subbasin. The species is present but rare in the West Fork of the Bruneau River watershed in the Humboldt-Toiyabe National Forest (USDA 1995). A flammulated owl was observed near Jarbidge, Nevada in a cottonwood riparian zone (Klott 1997).
Threats to the species include habitat fragmentation and loss of old-growth forests.

Lewis' Woodpecker

Lewis' woodpeckers *(Melanerpes lewis)* require open forest with a shrubby understory (Klott 1997). They nest in snags, pinyon-juniper habitats, ponderosa pine, cottonwood, aspen and riparian woodlands (Klott 1997). Little information exists about current trends, although a general decline in the West appears to be occurring (Klott 1997). Two Lewis' woodpeckers were observed in the Jarbidge River portion of the subbasin: one north of Three Creek in a Wyoming sagebrush/grass habitat; the other near Murphy Hot Springs in a cottonwood riparian zone (Klott 1997).

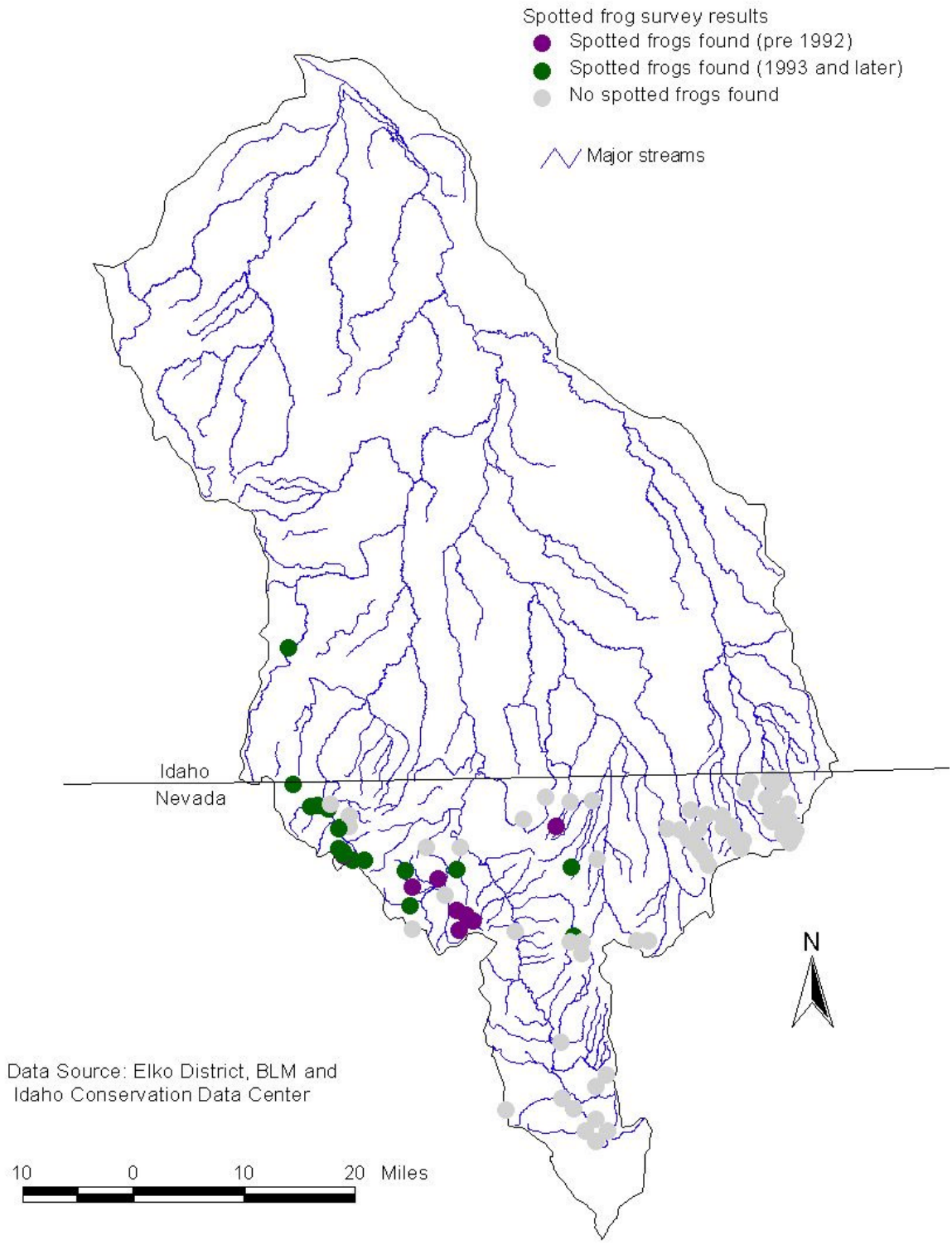

Figure 18. Spotted frog survey results, Bruneau subbasin

Black-throated Gray Warbler

Black-throated gray warblers *(Dendroica nigrescens)* nest in chaparral, shrubby openings in coniferous forests, and pinyon-juniper. In the subbasin, they are known to nest in open juniper communities with a sagebrush understory (Klott 1997). They have been observed in mountain mahogany habitats, but nesting in that community has not been confirmed. Black-throated gray warblers have been documented in Columbet Creek, a tributary to the East Fork Jarbidge River (Klott 1997).

Black Swift

Black swifts *(Cypseloides niger)* occupy steep mountain cliffs or canyons. The species may have been observed in the Bruneau River Canyon and in the East Fork of the Bruneau River Canyon (Clover Creek) (Klott 1997). Nesting habitat appears to be limited to riparian canyons along the Nevada-Idaho state line (Klott 1997).

Long-billed Curlew

Long-billed curlews (*Numenius americanus)* nest on the ground in grasslands and prairies. In the subbasin, the species is strongly associated with annual grasslands and grazed crested wheatgrass seedings (Klott 1996). They have been seen scattered through uplands in the Bruneau subbasin, with concentrations in the Bruneau Arm area and the Grindstone Farm area.

Grasshopper Sparrow

Grasshopper sparrows (*Ammadramus savannarum)* occupy low elevation prairie and grasslands. They use agricultural crops, such as grains and alfalfa. (Klott 1997) and have been detected in well rested or lightly grazed crested wheatgrass seedings (Klott 1997).

Sage Grouse

Sage grouse *(Centrocercus urophasianus)* occur in areas of the subbasin where sagebrush dominates the landscape. The historical record indicates that sage grouse were common and easily harvested. One resident from the 19th century stated that "sage chickens were so plentiful in the 1890s that they clouded the sky…the birds were always thick in the meadows. As I passed by they would raise up like a bunch of blackbirds" (cited in Vigg et al. 2000).

IDFG, BLM, ODFW and NDOW data indicate that sage grouse populations have been declining across the subbasin since the 1950s (Northeast Nevada 2001; Figure 19; Klott 1997). Forty years of wing barrel data collected by IDFG (Figure 19), suggests a declining trend in juvenile recruitment Wing barrel data from Elko County from 1996-2000 indicate that the average number of juveniles per hen was 1.48, well below the rate (2.25 juveniles/hen) needed to maintain a stable population (Northeast Nevada 2001). IDFG has been monitoring sage grouse leks since the 1950s and have noted steep declines in lek attendance and number of leks since surveys began (Figure 20).

Two studies are currently underway that will fill some gaps in our knowledge about sage grouse in the subbasin. A 2000-2001 study in the central portion of Owyhee County is nearing completion. Sage grouse were radio-tracked during spring and summer each year to determine habitat use, nest site selection, hen success and productivity. IDFG conducted aerial surveys during the fall and winter to determine habitat use and overwinter survival. A final report will be completed in May 2002. A second study is underway in the Jarbidge Resource Area. A second study was initiated in 2000 by the BLM and IDFG to determine sage grouse use of fragmented habitats. The study area lies between Clover Creek and the Jarbidge River and from Clover Butte to the Nevada state line. A PhD student will examine sagebrush patch size selection, nest site selection, seasonal movements, and seasonal habitat use in fragmented versus continuous habitat. The study will be complete in 2004 (Commons 2001).

Mountain Quail

Mountain quail *(Oreortyx pictus)* require a diversity of habitat types during all phases of their life history. These include coniferous forests, forest and meadow edges, riparian areas with dense cover and canyon bottoms (BLM 1989). In arid environments, the species can be found adjacent to sagebrush uplands (Klott 1996).

Quail populations have declined dramatically since the 1950s (BLM 1989). Little Jacks Creek, Big Jacks Creek and Duncan Creek (BLM 1989) support small quail populations. In 1992 and 1993, mountain quail were heard during surveys in the Black Rock Pocket area of the Bruneau River (Klott 1996). Big Flat Creek, Deer Creek, Cherry Creek, and the East Fork of the Jarbidge River all appear to have the dense shrub cover preferred by the species, although tree cover may be lacking (Klott 1996). No information on their actual occurrence in these areas is available.

White-faced Ibis

The breeding range of the white-faced ibis *(Plegadis chihi)* includes southern Idaho and northern Nevada. The species arrives at breeding sites in marshes, swamps, ponds or rivers in the spring. They construct nests on the ground or low in trees or shrubs. Ibises forage in wetlands and irrigated agricultural fields. A pair of white-faced ibises was observed near the DAF Grasmere Study Area in 1996. Potential breeding habitat exists in Wickahoney and China Ponds near Grasmere (DAF 1998).

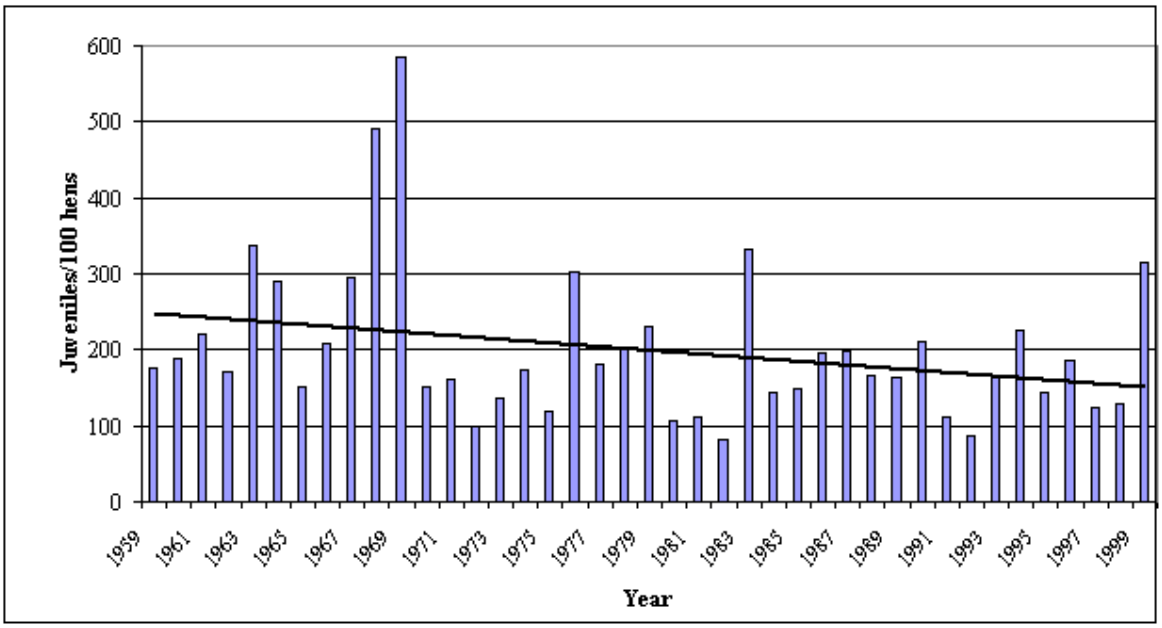

Figure 19. Hen productivity, estimated using IDFG wing barrel data from Owyhee County (1959-1999)

Wilson's Warbler

Wilson's warbler (*Wilsonia pusilla*) habitat includes willow and riparian thickets as well as brushy patches at the edge of meadows, ponds and boggy areas. They are riparian habitat specialists that utilize areas with few trees and dense shrub cover (Klott 1997). Idaho populations exhibit a sharp declining trend (Dobkin 1994 cited in Klott 1997). Wilson's warblers have been documented in the Clover Creek area.

Yellow Warbler

Yellow warblers *(Dendroica petechia)* are associated with shrub communities that are part of deciduous riparian habitats, particularly willows, alder and birch (Klott 1997). Less commonly, they have been found nesting in aspen and cottonwood riparian habitats. The species appears to be declining in Idaho. Yellow warblers have been documented in Clover Creek and the East Fork of the Jarbidge River (Klott 1997). Threats to species include habitat fragmentation, habitat conversion, channel straightening, habitat degradation, and nest parasitism by brown-headed cowbirds (Klott 1997).

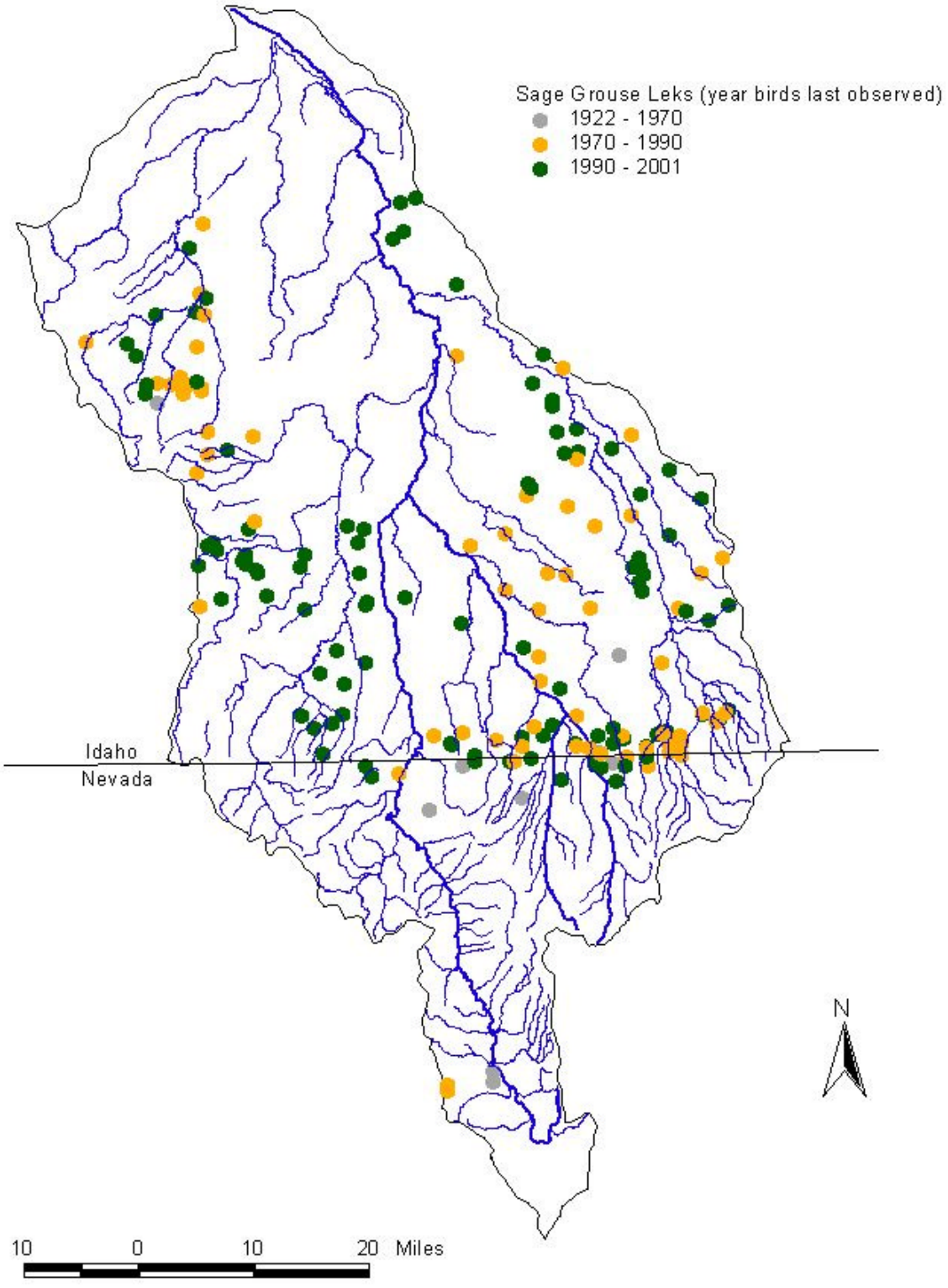

Figure 20. Sage grouse lek locations, Bruneau subbasin

Mammals

Bat Species

The canyons and uplands of the Bruneau-Jarbidge River system provide unique habitat features for a number of insectivorous bat species. High relief, plunging cliff faces and permanent water sources provide excellent forage and roosting habitat for bats (Schnitzspahn et al. 2000). Roosting habitat includes living trees and snags, cracks in cliff faces, large boulder piles, slide rock, talus, caves and mines.

Doering and Keller (1998) documented spotted bats (*Euderma maculatum)*, considered one of the rarest North American mammals, at 5 of 11 collection sites in the subbasin. Doering and Keller (1998) identified the subbasin as one of only a handful of areas that support resident populations and, as such, should be considered important or even critical to the species (Table 15). The species was common throughout the study area with the highest concentrations in the Mary's Creek area. The spotted bat flew over all habitat types, even far from canyons. Heavy spotted bat foraging was detected over sagebrush uplands adjacent to riparian areas (Doering and Keller 1998).

Table 15. Bat species in the Bruneau subbasin (from Doering and Keller 1998)

Species	Common name	Occurence[1]
Antrozous pallidus	Pallid bat	Unconfirmed
Corynorhinus townsendii	Townsends' big-eared bat	Yes
Euderma maculatum	Spotted bat	Yes
Eptesicus fuscus	Big brown bat	Yes
Myotis Californicus	California myotis	Highly likely
Myotis cilioabrum	Western small-footed myotis	Yes
Myotis evotis	Long-eared myotis	Yes
Myotis lucifugus	Little brown bat	Yes
Myotis thysanodes	Fringed myotis	Possible
Myotis volans	Long-legged myotis	Highly likely
Myotis yumanensis	Yuma myotis	Yes
Pipistrellus hesperus	Western pipistrelle	Highly Likely
Tadarida brasiliensis	Brazilian free-tailed bat	May occur

1 "Yes" on occurrence are based on mist net or unambiguous ANABAT results. "Highly likely" are based on high confidence ANABAT results. "Possible" species classifications are based on low confidence ANABAT results. "Unconfirmed" species were predicted but not detected. "May occur" refers to an unlikely or nonpredicted species whose ANABAT results suggest occurrence.

Sagebrush, talus and boulder slide areas provide good foraging habitat for a number of bat species. A significant number of bats flew from presumed roosting areas within the canyons to forage over crested wheatgrass dominated habitats.

Beaver

Beaver (*Lontra canadensis*) populations have declined significantly since pre-settlement times. Historically, beavers probably dominated the valley bottom from RM6 through RM 14 of the West Fork Jarbidge River and beaver ponds would have influenced riparian plant communities and altered the flow regime of the Jarbidge River (McNeill et al. 1997).

Beavers were trapped out of the Bruneau/Jarbidge River system between 1811 and 1840 in an attempt by the Hudson Bay Company to provide a buffer between British and American fur companies.

Invertebrates

Bruneau Hot Springsnail

The Bruneau hot springsnail (*Pyrgulopsis bruneauensis*) was listed as endangered by the USFWS in 1993. It was later taken off the list and relisted in 1998. The springsnail only occurs in springs and seeps that arise from a thermal aquifer along a 5.5 mile reach of the lower Bruneau River (Klott 1996). A survey in 1996 found the springsnail in 110 of 204 (54%) seeps and springs along the Bruneau River (Mladenka and Minshall 1996). Wood (2000) revised this estimate to 89 of 155 geothermal springs and seeps along a 4.3 mile reach of the Bruneau River and Hot Creek, based on a 1999 range wide survey.

Mladenka (1992) found temperature to be the most important factor affecting distribution of the springsnail. The thermal tolerance range of the species is 15.7˚ to 36.9˚ C. They are found in the highest densities at temperatures ranging from 22.8˚ to 36.6˚ C (Wood 2000). Springsnails survive on all types of substrate, but large substrate is thought to provide the most suitable because it provides surfaces conducive to egg-laying (Mladenka 1992, Sant and Minshall 1998).

Flood events in 1991 and 1992 deposited high quantities of silt, sand and gravel into Hot Creek. The Indian Bathtub area habitat was reduced to less than one half of its size, apparently decimating the springsnail population (Varricchione, Sant and Minshall 1998). An intensive search along the length of Hot Creek found no springsnails (Sant and Minshall 1998). A rock face seep refuge 1.8 meters from Hot Creek contained a relict population of approximately 238,660 snails. The density of snails decreased with distance from the seep. Research conducted in 1998 identified several barriers to springsnail recolonization in Hot Creek. Protruding substrate was added to the creek, a thermal barrier was bypassed and a fish exclosure was erected, which enabled the springsnail to recolonize the area. As of November, 1999, the total springsnail population in Hot Creek was estimated at 300-400 individuals (Myler and Minshall 2001).

Wild mosquito fish and tilapia were suspected as limiting recovery of the springsnail in Hot Creek, but gut content analysis indicated that tilapia were not preying on springsnails (Varricchione and Minshall 1995). Follow-up research by Myler and Minshall (1999) indicated that tilapia recognized springsnails as prey, both when the fish were starved and when they were fed generously. The study concluded that tilapia negatively impact springsnail populations in Hot Creek (Myler and Minshall 2001). Threats to springsnail populations include: loss habitat due to agriculture-related groundwater mining (Varricchione and Minshall 1995b), degradation of habitat due to streambank and spring trampling, and introduction of exotic species that may compete with or prey on

springsnails. Direct mortality caused by livestock trampling has been documented on both mature and juvenile springsnails (Mladenka 1992 cited in Klott 1996).

The aquatic community associated with the Bruneau hot springsnail includes three rare species: an endemic snail (*Ambrysus mormon minor*) that has been found in Hot Creek and a few adjacent springs; the skiff beetle (*Hydroscapha natans*), historically present but not identified in 1991 surveys; and the giant helleborine (*Epipactis gigantea*), a rare orchid that has been found in Hot Creek and along the Bruneau River in association with geothermal spring outflows (Wood 2000).

Idaho Dunes Tiger Beetle

Idaho Dunes tiger beetle is a predatory insect that occupies sand dunes and sandy soils. USFWS listed the Idaho Dunes tiger beetle as a C2 species in 1984. The only known population in the subbasin is at Bruneau Dunes State Park.

Baker et al. (1997) speculate that climatic conditions are probably the most important factors impacting survival. Extended drought during hatching may cause larvae to exhaust their food reserves and perish before they can establish burrows and capture prey (they require moist sand to build their burrows in) (Baker et al. 1997).

Baker et al. (1997) documented an increasing number of larvae over the three-year period from 1993–1995. The researchers attributed the increase in larvae to favorable weather conditions. Spring precipitation in 1993 and 1995 was above average and, although 1994 was a drought year, the timing of spring rains may have been optimal for the life cycle of the beetle. They estimated that the larval population increased by from 4,200 in 1993 to 7,500 in 1995 (a 56% increase). The researchers documented new areas of larval habitat in 1994. Several known or suspected threats to Idaho Dunes tiger beetle exist: off-road vehicles may destroy larval habitat, livestock may trample larval burrows and cause mortality, and commercial collecting may threaten populations (Klott 1996). At present, human activity in the area does not appear to be negatively impacting the beetle population. The remote nature of the site and newly constructed boundary fence offer some habitat protection. Less than 3% of the general habitat area is affected by motor vehicles (Baker et al. 1997). Baker et al. (1997) suggested that current management of beetle habitat appears sufficient, provided that monitoring continues.

Game

The Bruneau subbasin contains all or part of three Idaho game management units (GMUs): 41 46 and 47. The Nevada portion of the subbasin contains portions of four hunt units: 061, 071, 072 and 073 (Figure 21).

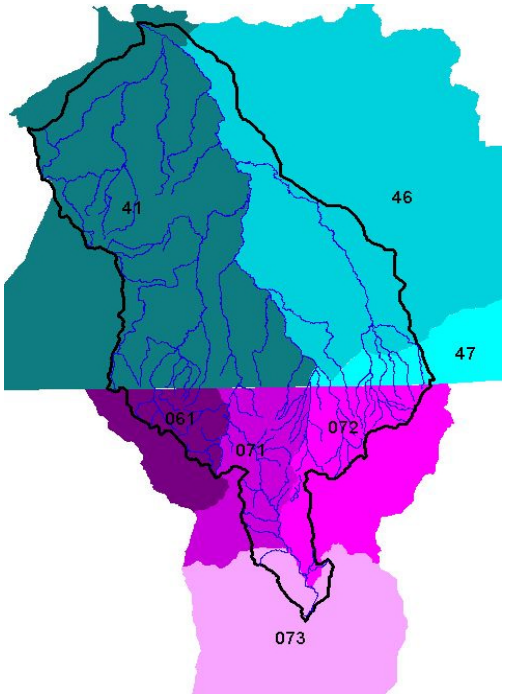

Figure 21. Idaho Department of Fish and Game GMUs and Nevada hunt units in the Bruneau subbasin.

Elk

Elk *(Cervus elaphus)* use aspen, conifer, and mountain mahogany vegetative community types for thermal and hiding cover during summer and fall and the adjacent sagebrush, grassland and mountain brush communities for high value forage. Elk winter range consists of mountain mahogany communities, south facing slopes and ridge tops at middle to lower elevations. Suitable elk habitat is found in the southern portion of the subbasin.

Elk have been at low population levels since at least 1900 (IDFG 2000a). NDOW initiated an elk translocation program in 1990-1 when they released 81 elk into the Jarbidge Ranger District of the Humboldt-Toiyabe National Forest. Several of these elk have been documented in Willis Creek and Rattlesnake Canyon in the upper Bruneau River area. As many as 25 elk currently inhabit the West Fork of the Bruneau River in Humboldt-Toiyabe National Forest (to the west of the Jarbidge Mountains). NDOW and the Elko County Elk Working Group have recently convened to develop an elk management plan for the Elko County portion of the subbasin. Beck and Peek (2000; 2001) conducted a three year study (1998-2000) on elk diet and habitat use in the Jarbidge Mountains. A report analyzing their research findings will be completed in early 2002.

California Bighorn Sheep

California bighorn sheep *(Ovis canadensis californiana)* were once numerous in the subbasin. Residents in the 19th century considered them plentiful and more numerous than deer (Vigg et al. 2000). The species was extirpated from the subbasin by the 1930s as a result of the combined effects of competition for forage with domestic livestock, introduced diseases, unregulated hunting and habitat degradation (IDFG et al. 1997). In

1967, a reintroduction program was initiated. California bighorn sheep were translocated from British Columbia into historical habitat along Little Jacks Creek (GMU 41) (IDFG 2000b). The program was a success and in subsequent years sheep from the Little Jacks Creek herd were translocated to other areas in the subbasin. (Table 16). Permits to hunt bighorn in the Idaho portion of the subbasin were first issued in 1975.

Table 16. Bighorn sheep transplants into and out of the Bruneau subbasin.

Year	Capture Site	Release Site	Number Translocated
Oct-67	Chilcotin, B.C.	Little Jacks Creek	12
Mar-80	Little Jacks Creek	Granite Mountain, NV	12
Feb-81	Little Jacks Creek	Jarbidge River, NV	12
Dec-84	E.F. Owyhee	Bruneau/Jarbidge River, ID	11
Mar-84	Chilcotin, B.C.	Bruneau/Jarbidge River, ID	12
Dec-84	E.F. Owyhee River	Bruneau/Jarbidge River, ID	11
Jan-85	Little Jacks Creek	Bruneau/Jarbidge River, ID	1
Jan-85	Little Jacks Creek	S.F.Owyhee River	9
Dec-86	E.F. Owyhee River	Cottonwood Creek	15
Dec-87	Little Jacks Creek	Cottonwood Creek	14
Feb-88	Chilcotin, B.C.	Big Jacks Creek	14
Mar-88	E.F. Owyhee River	Big Jacks Creek	2
Nov-88	Shoofly Creek	Cottonwood Creek	14
Dec-89	Little Jacks Creek	W.F. Bruneau River	12
Nov-90	E.F. Owyhee River	W.F. Bruneau River	16
Dec-93	E.F. Owyhee River	Bruneau, Jarbidge Rivers and Cottonwood Creek	45

Post-reintroduction bighorn sheep populations in the Little/Big Jacks Creek and Bruneau/Jarbidge River confluence areas peaked in the early 1990s. Population surveys in 1994 indicated a substantial decline in bighorn sheep in Little Jacks Creek. As a result, translocation to other areas was discontinued and hunting permits were reduced. Recent surveys indicate that bighorn populations in the Jacks Creek area have not yet returned to pre-1994 levels (Figure 22). In 2000, an estimated 225 bighorn sheep occupied the Big and Little Jacks Creek area.

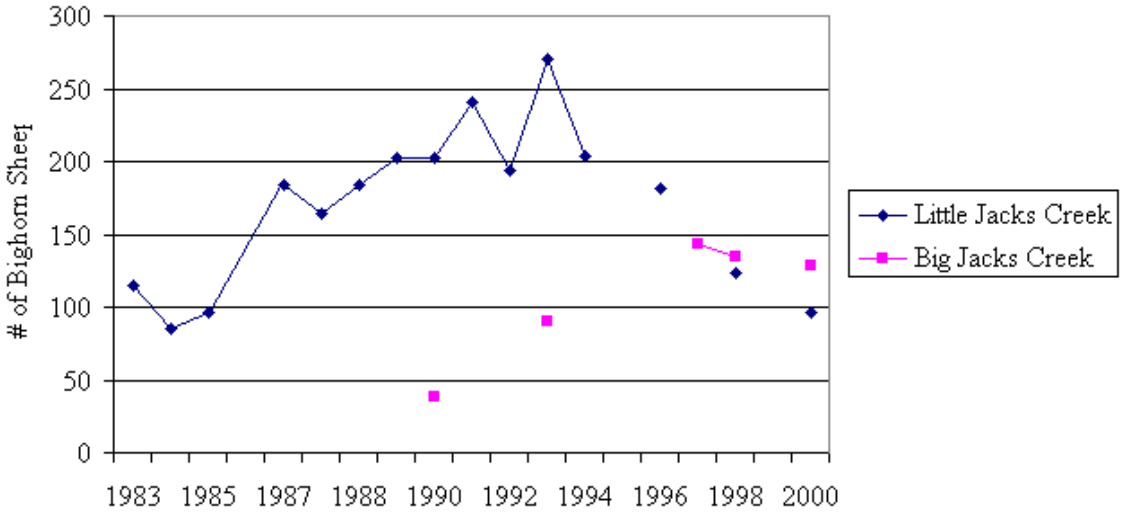

Figure 22. Bighorn sheep population trends, Big and Little Jacks Creeks.

The primary threat to bighorn sheep in the Bruneau subbasin is the degradation of habitat due to invasive annual grasses and weeds (Klott 1996). While bacterial pneumonia is a serious threat in other regions it does not appear to be an issue in the subbasin because domestic sheep grazing and bighorn habitat do not overlap.

Mule Deer

The Bruneau subbasin supports a substantial herd of mule deer *(Odocoileus hemionus)*. Populations peaked in the late 1980s, but have since declined due to poor climate conditions and habitat degradation (NDOW 2000). In the northwest and central west portions of the subbasin, mule deer populations were estimated to be 3-10 animals per square mile in the late 1980s, with higher densities occurring near the canyons and riparian areas (BLM 1989). Deer seasonally migrate between states and management jurisdictions which makes it difficult to quantify the exact number of deer in the subbasin. IDFG identifies population data as the primary information need for the southern Idaho/northern Nevada herds (IDFG 2001c). Post-season 2000 surveys estimated the mule deer population at 4,164 in northeastern Elko County, which is below the long-term average of 4,556 (NDOW 2001). Colder than average winter temperatures during the winter of 2000 and a late season green-up in spring 2001 contributed to a fawn overwinter mortality rate of 24% (NDOW 2001).

Even under optimal climatic conditions, deer populations in the area may not return to 1980 numbers due to a reduction in habitat quality and quantity (NDOW 2001). Wildfires have destroyed large portions of winter range across the subbasin, including in GMUs 41, 46 and in the Upper Jarbidge and Bruneau Rivers (IDFG 2000c and NDOW 2001). The reduction in deer habitat in the subbasin may be permanent if burned areas continue to be dominated by cheatgrass.

Coyotes, bobcats and mountain lions are the primary predators of deer. Mountain lion populations increased during the late 1980s and early 1990s in response to higher deer numbers.

Pronghorn

Pronghorn populations in GMUS 46 and 47 increased from 1987 to 1992 in response to a series of mild winters (IDFG 2001d). The combined effects of drought and harsh conditions during the 1992-1993 winter resulted in a substantial decline in pronghorn numbers region wide. Losses in the Bruneau subbasin were not as significant as those north of the Snake River (IDFG 2000d). Hunting permits were reduced in response to the declines (Figure 23). This management response, in combination with good to excellent fawn production and mild winters, has facilitated the recovery of this herd (IDFG 2000d, NDOW 2001).

NDOW estimates the current population of Hunt Units 061, 062, 063, 064, 071 and 073 to be 900 animals. In an attempt to keep the population from exceeding its carrying capacity, a hunting season directed at female pronghorn was adopted in 2001. In years when weather conditions are favorable, trapping and transplanting pronghorn may be required (NDOW 2001).

Habitat Areas and Quality

Aquatic Habitat

At the subbasin scale, high quality, coldwater habitat is restricted to headwater tributaries and portions of the Jarbidge watershed. Less complex, cool-warm water habitat exists throughout the remainder of the subbasin, but is variable due to climatic conditions. In general, tributary habitat is used for salmonid spawning and rearing, while some mainstem reaches provide migratory and overwintering habitat. Unique habitat conditions exist in the subbasin, affording habitat for specialized, non-salmonid species.

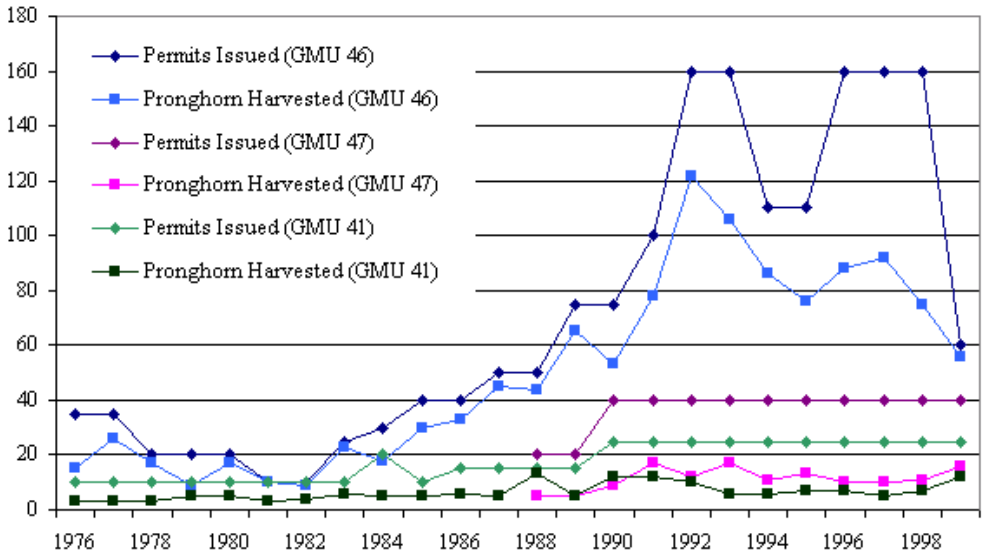

Figure 23. Permits issued and pronghorn harvested in Idaho Fish and Game GMUs

Habitat of a quality sufficient to support all life history phases of redband trout and bull trout exists, but is limited in extent. Approximately 28% of stream channels in the subbasin are perennial. Drought conditions occur several times each decade, reducing the percentage of perennial streams and reducing habitat quality, especially in the lower portions of the subbasin.

To determine current stream health relative to potential natural conditions found on a particular stream segment, protocols developed by BLM were used (refer to USDI, USDA 2000; USDI, USDA 1996; USDI 1997 for specific methods), which define the ecological condition of streams into five categories: proper functioning condition (PFC), functioning at risk with an upward trend (FAR u), functioning at risk with a static trend (FAR na), functioning at risk with a downward trend (FAR d), and non-functioning condition (NF). Of the 131 stream segments surveyed in the subbasin between 1995 and 1999, 46% were considered to be in PFC while 3% were NF (Figure 24). Stream segments considered as 'NF' occurred in the Clover Creek (East Fork Bruneau) subwatershed and include Cedar, Cherry, House, Pole, Shack, and Three Creek. Upward and downward trends of streams classified as FAR were similar, as were those FAR segments that showed little or no change. The same BLM protocols were applied to assess riparian conditions in the Jarbidge Resource Area for the 1998-1999 fiscal years (Figure 25; Figure 26).

Aquatic Habitat Condition of the Jarbidge Subwatershed

The majority of high quality coldwater aquatic habitat in the subbasin occurs in the Jarbidge watershed. This watershed has a sufficient quantity of suitable habitat to support bull trout. Spawning occurs only in the Nevada portion of the watershed (Parrish 1998). The entire Jarbidge River within Idaho is considered a migratory corridor or wintering habitat for bull trout, with no perennial tributaries suitable for spawning or juvenile rearing purposes.

In the Idaho portion of the Jarbidge River system, Warren and Partridge (1993) found the substrates to be in excellent condition, to be dominated with gravel or rubble, with the highest percentages of silt or sand being 17 percent. The fish habitat was extremely variable with pools, runs, pocket water, and riffles and no backwater habitat. Although riparian vegetation was in good condition, few large trees existed to provide large woody debris or cover. Despite the survey taking place during a multi-year drought (starting in 1996), the streambed remained watered and the habitat diverse. Temperature in the Idaho portion of the East and West Forks and mainstem Jarbidge River limits bull trout use during much of the year, and during drought years, impacts redband and other species as well (Warren and Partridge 1993).

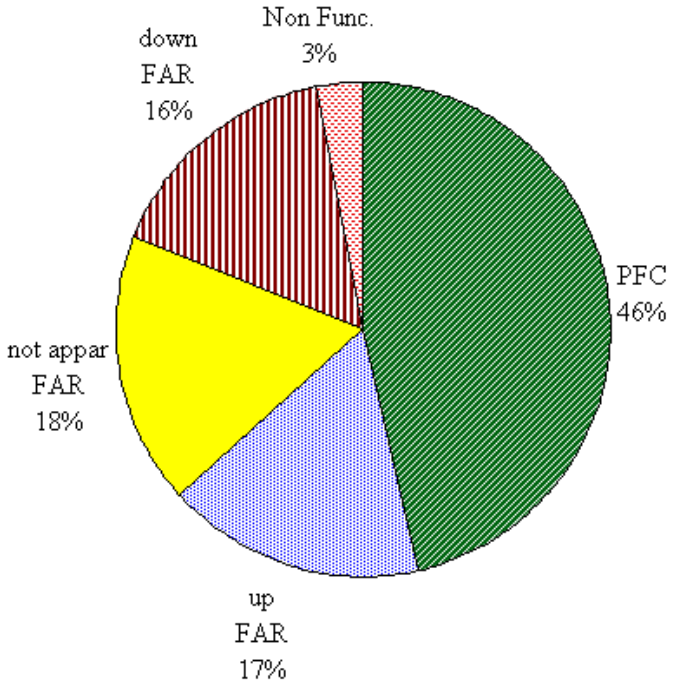

Figure 24. Known conditions of streams in the Bruneau subbasin (BLM unpublished data). PFC=properly functioning condition; FAR=functioning at risk; NF=not functioning

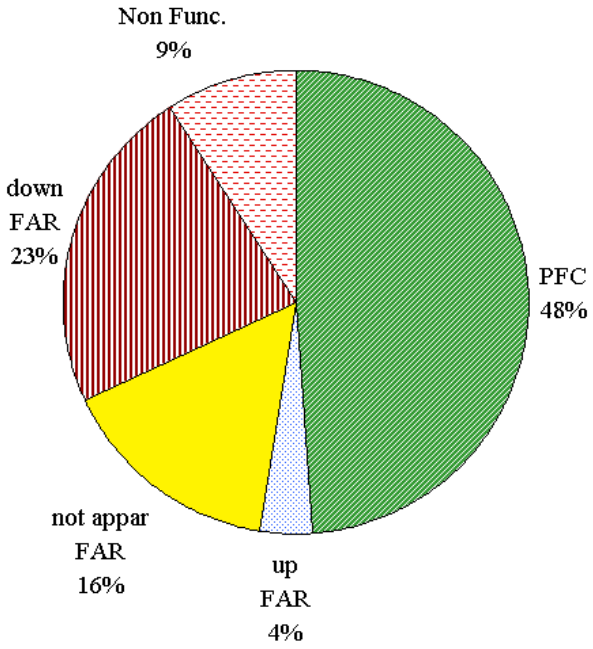

Figure 25. Riparian condition of streams in fiscal year 1998 in the JRA (BLM unpublished data)

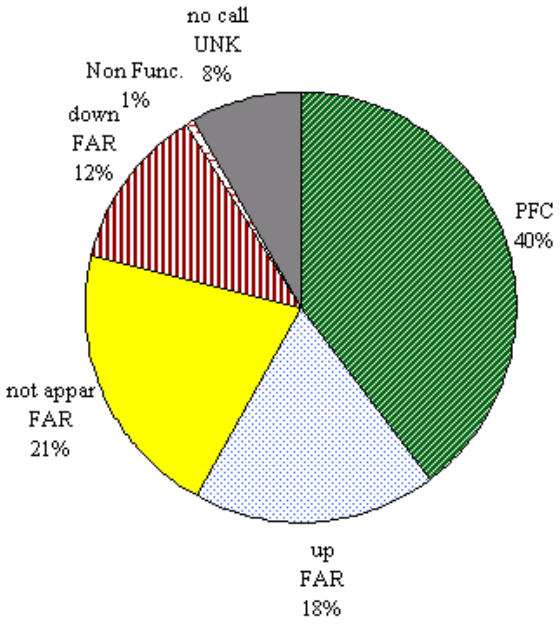

Figure 26. Riparian condition of streams in fiscal year 1999 in the JRA (BLM unpublished data)

The geology of the Jarbidge contributes to a nutrient "poor" condition in the river system (Parrish 1998), which has been compounded following the loss of anadromy. Macroinvertebrate sampling found more than three times the productivity in the West Fork of the Jarbidge River as in the East Fork. The higher prevalence of large woody debris (LWD) in the West Fork could explain these differences in productivity (Parrish 1998).

Large woody debris in the Jarbidge system is sparse and concentrated in logjams. Most LWD is recruited from the forests in Nevada rather than the high deserts of Idaho (Parrish 1998). Large rocky structures provide most cover in the system, although some over-hanging banks and willows exist below the confluence of the East and West Fork in Idaho.

Most of the Jarbidge system has confined channels with little channel erosion. In 1979, the West Fork Jarbidge River in Nevada was channelized. Quality pools developed within 6 years of the project (Parrish 1998). No known barriers to fish exist in the Jarbidge system other than seasonal high water temperatures in the lower portion of the system. Protecting the Jarbidge Canyon Road from annual high water events has often included pre-flood treatment and channel work (USDA 1998). Flood control in the past has included blasting boulders, removal of large wood from the stream channel, heavy machinery work and an extensive channelization project (USDA 1998). Habitat conditions reflect the channel modifications. A 1985 GAWS survey found that 35% of quality pools in the Jarbidge River fell between river mile 16.8 and 18.75, the upper 10% of the river. The East Fork Jarbidge River has nearly two times the number of pools as the Jarbidge River, even though the Jarbidge River has a narrower profile and higher volume of large

wood (USDA 1998). A survey for LWD 1996 (USDA 1998) found that the upper 10% of the river above Snowslide Wilderness Portal (which has not been treated for flood control since at least 1974) exceeded Riparian Management Objectives for large wood. The reach below Snowslide Wilderness Portal, which had been treated for flood control, had only 25% of the Riparian Management Objective for large wood (USDA 1998).

Water temperatures in the headwater areas of the Jarbidge River meet coldwater biota requirements in most years. The lower 60% of the river, however, may sustain afternoon water temperatures exceeding 18˚C from mid-July through mid-August, and water temperatures may fluctuate as much as 9 degrees within a 12 hour period (McNeill et al. 1997). These temperatures affect bull trout. Zoellick et al. (1995) did not find bull trout in the Jarbidge River when water temperatures exceeded 14˚C. As water temperatures increase to unfavorable levels in July and August, bull trout are forced upstream and into tributaries that have lower water temperatures. Studies conducted by Warren and Partridge (1993) documented quality salmonid spawning and rearing habitat in 14 of 19 sites sampled on Idaho reaches of the Jarbidge. In general, sampled sites had low percentages of sand and silt and high percentages of gravel, cobble or rubble. These conditions were typical of high gradient sample sites. Jarbidge River habitat information collected in Nevada was consistent with Idaho surveys (McNeil et al. 1997). Due to the confined nature of the channel, sand, silt, and gravel are commonly deposited on the floodplain during high water events (McNeil et al. 1997).

The West Fork of the Jarbidge River has six perennial fish-bearing tributaries: Buck, Jack, Bear, Pine and Fox Creeks. Moore, Bonanza, Bourne and Dry Gulch(s) are intermittent or ephemeral, contributing flow to the Jarbidge River on a seasonal basis. Total miles in the perennial tributaries and mainstem Jarbidge exceed 42 miles (McNeill et al. 1997).

Strong sculpin populations in the West Fork of the Jarbidge River below Snowslide Creek, indicate that embeddedness is low. Sculpins are benthic feeders that rely on cobble-boulder substrate for cover (McNeill et al. 1997).

Woody debris, which lends to channel complexity, is scarce in the non-forested portions of the subbasin. Parrish (1998) found the amount of woody debris in the Idaho portion of the Jarbidge to be sparse and primarily concentrated in aggregates. Parrish (1998) proposes that the majority of LWD occurring in reaches bordered by the high desert plateaus of Idaho has been recruited from upriver forested areas of Nevada. Thirty-five percent of all pools in the Jarbidge River above the confluence with the East Fork are in the upper 10% of the river. Over 50% of the pools in this section are large wood-related pools, compared to only 7% of pools below this area (McNeill et al. 1997).

McNeill et al. (1997) considered the Jarbidge River watershed to be a system in recovery from intense land use impacts that occurred between 1885 through 1945. They emphasized that current channel morphology and habitat is a product of 90 years of channel and riparian area modification from human activities and that low bull trout numbers are also a product of this modification (McNeill et al. 1997). Salmonid habitat in Clover Creek was identified as unstable.

Aquatic Habitat Condition of Other Salmonid-Bearing Subwatersheds

Habitat quality, as judged by the strength of salmonid populations, should also be considered adequate in redband stronghold areas. A study conducted by the Bruneau Resource Area BLM (USDI 1999b) documented changes in stream habitat conditions in Little Jacks Creek over a fifteen-year period, and related accordant changes in redband population densities. Trout densities in Little Jacks Creek remained unchanged from 1980 to 1995, even with drought-like conditions from 1990-1994. High quality habitat exists in Little Jacks Creek, Big Jacks Creek, Duncan Creek and Cottonwood Creek. Lesser quality, but still valuable habitat exists in Wickahoney Creek. Wickahoney Creek habitat is impacted by periodic drought effects, which limit populations (Lay and IDEQ 2000). Redband strongholds also occur in the central portion of the West Fork of the Bruneau River, the Jarbidge watershed and headwater portions of Clover Creek (see Figure 13).

Sheep Creek and Mary's Creek contain aquatic habitat of sufficient quality to support redband trout in most years. These creeks have been know to completely dry up under drought conditions (USDI 1989; Allen et al. 1995; 1996)

In the Humboldt-Toiyabe National Forest stream surveys conducted between 1988 and 1992 documented a total of 16.9 miles of stream habitat (11.3%) in good condition, 118.1 miles (79%) in fair condition and 14.5 miles (9.7%) in poor condition (USDA 1995). Limiting factors identified by these surveys were water flow, streambank cover, pool quality, stream bottom embeddedness, and pool-riffle ratios. Stream widths of many of the higher order streams, especially the Bruneau River itself, were deemed excessive, which indicates a shortage of quality pools. These exposed reaches of stream are less hospitable to fish populations due to temperature extremes both in the summer and winter. The streambanks in the system (with some exceptions) exhibit good stability which is characteristic of the geomorphology of the area (USDA 1995). The surveys and analysis concluded the primary limiting influence on aquatic habitats and fish population densities was livestock grazing, which removed and trampled streambank vegetation.

Water diversions have resulted in making many miles of streams unsuitable to support aquatic species. Large portions of several streams are dewatered annually including Deadwood Creek, Cherry Creek, Flat Creek, Deer Creek, Jim Bob Creek, House Creek, Antelope Creek, and Three Creek (Klott 1996). This has resulted in fisheries habitat becoming more fragmented and populations becoming isolated.

Dams have resulted in salmon and steelhead being eliminated from the Bruneau subbasin. Bull trout in the Jarbidge River are now isolated from all other bull trout populations. (Klott 1996)

Wildlife Habitat

Shrub-steppe

Shrub-steppe habitat is widely variable across the subbasin. Remnant high quality patches occur some areas, but broad expanses of highly degraded and fragmented habitat are also present, particularly east of the Bruneau River.

Shrub-steppe habitat in the Big Jacks Creek and Little Jacks Creek areas is used year around by pronghorn and provide important winter/spring habitat (BLM 1989). Big Jacks Creek has 16,000+ acres of relict sagebrush-steppe and its tributary, Duncan Creek, contains another 4,500 acres. Little Jacks Creek has 9,000 acres rated in excellent condition, and 1,000 acres (Jacks Creek Research Natural Area) in near-pristine condition (BLM 1989).

The Sheep Creek area has some of the best summer habitat in the region (in the Bruneau Wilderness Study Area west of Bruneau mainstem). This area has the highest diversity of plant communities in the Boise District of BLM (USDI 1989).
In the upper West Fork of the Bruneau River, mule deer use the low elevation sagebrush communities for winter habitat. Approximately 24,000 acres of the Humboldt-Toiyabe National Forest Study Area provide critical mule deer winter range

Grasslands

Grassland vegetation communities in the subbasin are dominated by exotic perennial seedlings (intermediate wheatgrass, crested wheatgrass), non-native weedy annuals (cheatgrass, tumble mustard, peppergrass), and to a lesser extent by native perennials (bluebunch wheatgrass, Idaho fescue, Sandberg's bluegrass, needle-and-thread) (DAF 1998).

During the past decade over 90% of the Jarbidge Resource Area burned in an attempt to prevent establishment of cheatgrass, large areas were seed-drilled with crested wheatgrass, a non-native species. Crested wheatgrass out competes cheatgrass, is more resistant to fire, and helps control erosion. However, the species provides little habitat value to sage grouse and other native wildlife species (Parrish 1998).

Riparian and Wetland Areas

Although not documented throughout the entire subbasin (e.g. Klott, unpublished data), riparian and wetland areas are generally in poor condition and should be considered a limiting factor to fish and wildlife resources. For example, of the 85,238 acres of uplands located in the Bruneau-Jarbidge-Sheep Creek BLM management unit in Idaho, only 10,716 acres (12.6%) were considered in "excellent" or "good" condition (Parrish 1998). The majority was considered "fair" or "poor" (Parrish 1998).
Many of the upland wet meadows, springs and intermittent stream areas in the Humboldt-Toiyabe National Forest Bruneau River Study Area have been significantly impacted by grazing. Incised drainages, headcuts and lost or reduced large woody overstory are evidence of these impacts (USDA 1995).

Upland Forests

Woodlands at higher elevations are composed of juniper, aspen and mountain mahogany. The forests transition to small stands or isolated trees that dot the drier high desert plateaus (DAF 1998). Aspen stands are a small but disproportionately important habitat component. Aspen is generally associated with wet or moist sites, including seeps, meadows, and streams.
Upland forests are limited in extent and largely confined to the Humboldt-Toiyabe National Forest.

Agricultural Areas

Agricultural areas support relatively limited wildlife populations but some species thrive here. Magpies, California quail, and European starlings are well adapted to these sites and their numbers have increased.

Hot Springs and Seeps

A USFWS survey conducted in 1996 located Bruneau hot springsnail in 110 of 204 (54 %) seeps and hot springs along the Bruneau River (Table 17) (Mladenka and Minshall 1996). Wood (2000) reduced this estimate of occupied habitat to 89 of 155 based on 1999 habitat surveys. This habitat has been considerably reduced in quantity and quality by groundwater pumping for agricultural uses (Varricchione, J.T. and G.W. Minshall 1995b).

Table 17. Total number of springs and total number of springs occupied by Bruneau hot springsnail, and water levels of two wells near Indian Bathtub spring (table from Wood 2000)

Date	Total number of Springs	Number of Occupied Springs	October Elevation of Well #03BDC1	October Elevation of Well #03BDC2
1991	211	131	2672.74 feet	2672.56 feet
1993	201	128	2671.65 feet	2671.45 feet
1996	204	116	2671.65 feet	2671.39 feet
1998	155	89	2671.57 feet	2671.23 feet

Habitat near the Indian Bathtub area was dramatically impacted by a high runoff event in 1991, which reduced habitat in the area to less than half the previous amount (Varricchione, Sant and Minshall 1998). Habitat in Hot Creek has been impacted by sediment inputs from an ephemeral channel. Habitat assessments carried out between 1995 and 1997 rated riparian vegetation communities to be intermediate to high in quality and substrate to be low. Particle size distribution data showed that ≥65% of Hot Creek's substrate was less than 1 cm in diameter and ≥29% was less than 0.1 cm in diameter (Varricchione, Sant, and Minshall 1998). They concluded that overall habitat conditions in Hot Creek are "very poor and appear to be the result of poor land management practices on the watershed upstream" (Varricchione, Sant and Minshall 1998). Wood (2000) indicates that portions of the Indian Bathtub are currently under 3 meters of sediment and points towards reduced spring flow as limiting the ability of the spring to flush itself clean from the sediments.

Cliffs and Canyonlands

California bighorn sheep occupy approximately 29,000 acres of habitat in the Little Jacks/Shoofly Creek areas in the northwest portion of the subbasin. The steep rocky slopes and cliffs provide escape, bedding and lambing habitats and the plateaus provide forage. Little Jacks Creek is considered suitable to maintain a population of 125 animals and is supplemented by habitat in the adjacent Shoofly drainage. Human disturbance limits the use of the northern portion of the Little Jacks Creek WSA. Big Jacks Creek contains an

additional 30,000 acres of potential habitat. Duncan Creek, a tributary to Big Jacks Creek, contains about 4,500 acres of potential bighorn habitat, including important relic areas of relatively undisturbed sagebrush-steppe Steppe vegetation.

A 1994 BLM helicopter survey found that the best bighorn sheep habitat along the Bruneau and Jarbidge Rivers in Idaho occurred near the Nevada state line (Taylor et al. 1998). Bighorn sheep occupied the eight best habitats in this area. Taylor et al. (1998) found several adjacent habitat blocks near the Bruneau/Jarbidge confluence, which did not score well separately, but complemented each other to provide necessary habitat components. Together, the confluence of the Bruneau and Jarbidge Rivers, Long Draw, Cedar Tree, Lookout and Cougar/Poison habitat blocks make up approximately 24,000 acres of suitable habitat, enough to support a population of 400. The current population is approximately 200.

Many of the habitats surveyed could be improved by managing grazing, improving the vegetation community or developing water. In some habitat areas, exotic weeds such as cheatgrass, tumble mustard, tansy mustard and Russian thistle dominate the vegetative communities (Taylor et al. 1998).

Watershed Assessment

Four primary types of documents are addressed in this section: watershed assessments, biological assessments, TMDLs, and broad scale plans for resource management within the Bruneau subbasin. Watershed assessments provide information for planning and implementation. Biological assessments address potential impacts of proposed land use activities on sensitive species. TMDLs are required for water bodies listed as impaired on the §303(d) list. The TMDL process includes a watershed assessment and, potentially, a load allocation and implementation plan.

Bruneau Subbasin Assessment and Total Maximum Daily Loads of the §303(d) Water Bodies

A subbasin assessment and TMDL document was drafted for the Bruneau subbasin in December 2000. It provided a general overview of the subbasin including geophysical, biological and land use factors that affect water quality. Nine water bodies were identified as impaired and included on the §303(d). The authors requested that IDEQ de-list three of the listed segments because of errors or because stream status reflects natural conditions. The document outlined the existing water quality problems and beneficial uses affected.

ICBEMP (http//:www.icbemp.gov)

The Interior Columbia Basin Ecosystem Management Project (ICBEMP) is a regional-scale land-use plan that covers 63 million acres of federal lands in the Interior Columbia River Basin (www.icbemp.gov). It was produced by federal land management agencies, including the Forest Service (USFS) and the Bureau of Land Management (BLM). This document (if approved) will affect how federal agencies prioritize actions and undertake and fund restoration activities. The BLM and USFS released a Supplemental Draft Environmental Impact Statement (EIS) for the ICBEMP Project in March 2000. The EIS focused on the critical broadscale issues related to landscape health, aquatic and terrestrial habitats, human needs, and products and services. .

Jarbidge River Watershed Analysis

The watershed analysis documents historic land use impacts and current conditions in the mainstem Jarbidge River above the confluence with East Fork Jarbidge River. When possible it compares the East Fork with the mainstem, using the East Fork as a qualified example of reference conditions due to lesser human impacts in that system.

Limiting Factors

Fish

Insufficient habitat quantity and quality, and the loss of connectivity between populations appear to be the primary factors limiting production of coldwater fish species in the Bruneau subbasin. However, the degree to which coldwater species are limited is unknown since no historic baseline data exists. Nevertheless, studies have documented declines in salmonid populations and habitat and related them to natural and anthropogenic influences.

Natural Influences on Habitat Quantity and Quality

The semi-arid climate of the Bruneau subbasin significantly affects the amount and quality of coldwater fish habitat. The highest quantity of suitable trout habitat occurs in the higher elevation portions of the subbasin, which are areas that receive the highest amount of precipitation. Even in these areas, fish habitat may be annually and/or seasonally restricted by inadequate streamflows. The most important mechanism driving these conditions, especially when considering inland redband trout populations, appears to be periodic drought cycles and their accordant effects on streamflow and water temperatures (e.g. Allen et al. 1995; 1996; Parrish 1998). During non-drought years, salmonid populations in the Bruneau subbasin have been shown to react favorably to the increased amount of habitat offered by lower water temperatures and higher flows (e.g. USDI 1999). During drought years, salmonids are restricted to small habitat patches (e.g. USDI 1999). Extended periods of drought (such as that which occurred from 1988-1994) can cause the isolation of small numbers of individuals into short perennial reaches. Population stability may be compromised when critical habitat for salmonid cohorts is reduced. Allen et al. (1996) documented the absence of age 0 and 1 redband trout in the West Fork Bruneau River and suggested that previous drought conditions may have prohibited spawning or rearing success.

Coldwater habitat quantity and quality in the Little Jacks and Sugar watersheds and the Bruneau Valley is limited by the natural discharge of geothermal springs. The contribution of these flows to cooler water bodies is significant in areas, and has shaped current salmonid distribution patterns in affected watersheds.

Anthropogenic Influences on Habitat Quantity and Quality

Grazing, irrigated agriculture, and road construction and maintenance are among the most notable land use practices influencing salmonid habitat in the subbasin. These factors, when coupled with the natural severity of the environment, may potentially limit the persistence of coldwater species in the subbasin. Streamflow reduction, removal or destruction of riparian vegetation, habitat simplification, and impairment of water quality

often result from these land use activities and may directly or indirectly affect the amount and/or condition of salmonid habitat.

Streamflow Reduction

In the Nevada portion of the subbasin, diversion of streamflows via instream structures and channelization has allowed arid ground to be converted to irrigated pasture (USDA 1995). These practices have reduced the amount of instream habitat by removing a significant portion of annual flow from streams and disrupting normal channel processes (USDA 1995). Lay and IDEQ (2000) determined that flow reductions resulting from irrigation, aquaculture, and small dam construction, have contributed to the listing of the mainstem Bruneau, Jacks Creek, Wickahoney Creek, and Hot Creek to the §303(d) list (Table 18). Other streams or stream segments annually dewatered include Cedar Creek, Deadwood Creek, Cherry Creek, Devil Creek, Flat Creek, Deer Creek, Jim Bob Creek, House Creek, Antelope Creek, and Three Creek (Klott 1996).

Groundwater mining for irrigation purposes represents a considerable limitation to surface water volume. As mentioned previously (refer to Hydrology section), increasing well withdrawals from the aquifer have led to declining groundwater levels (Wood 2000) and have in turn affected surface flows. Wood (2000) considers agricultural-related groundwater withdrawal and pumping to be the most important threat to the persistence of the Bruneau hot springsnail.

Table 18. Water quality limited stream segments in the Bruneau subbasin (Lay and IDEQ 2000)

Water Body	**SOURCE AGENCY: USBLM**				**SOURCE AGENCY: IDEQ**		
	Pollutant Source	**Pollutant**			**Pollutant Source**	**Pollutant**	
Bruneau R.	Irrigated Crop	SED			Irrigated Crop	NUT	SED
	Pasture	SED	Q		Pasture	NUT	SED
	Range	SED			Aquaculture	NUT	SED
	Aquaculture	NUT	TEMP	Q			
	Flow Regulation	Q					
	Riparian Habitat Removal	H					
	Streambank Destabilization	H					
	Small Dam Construction	Q					
	Natural	TEMP					
Jacks Cr.	Irrigated Crop	SED			Irrigated Crop	NUT	SED
	Pasture	SED	Q		Pasture	NUT	SED
	Range	SED			Aquaculture	NUT	SED
	Aquaculture	NUT	TEMP	Q	Feed Lots	O	
	Flow Regulation	Q					
	Riparian Habitat Removal	H					
	Streambank Destabilization	H					
Sugar Cr.					Irrigated Crop	SED	
					Pasture	SED	
					Aquaculture	SED	
Wickahoney Cr.	Range	SED	Q				
	Riparian Habitat Removal	H					
	Streambank Destabilization	SED					
	Range	SED			Range	SED	
	Flow Regulation	Q	H				

Water Body	SOURCE AGENCY: USBLM			SOURCE AGENCY: IDEQ	
	Pollutant Source	Pollutant		Pollutant Source	Pollutant
Hot Cr.	Riparian Habitat Removal	H			
	Streambank Destabilization	SED	H		
	Recreation	BACT			
Clover Cr.				Range	SED
Three Cr.				Range	SED
Cougar Cr.				Range	SED
Poison Cr.				Range	SED
Pollutants and/or stressors: NUT=Nutrients; SED=Sediment; Q=Flow Alteration; TEMP=Temperature; BCAT=Pathogens; O=Organic Enrichment; H=Habitat alteration.					

Removal or Destruction of Riparian Vegetation

In a system that inherently suffers from high water temperatures and low flows, the additive effects of widespread and prolonged grazing on aquatic resources are magnified. One of the most notable effects of grazing has been the reduction or removal of riparian vegetation. The general effects of grazing on riparian areas, as they relate to salmonid habitat, are well documented (e.g. Chaney et al. 1993; Kauffman and Krueger 1984; Platts 1985; 1991; Reid 1993). In the Bruneau subbasin however, grazing has most notably affected the insolation and water storage capacity offered by riparian vegetation, as demonstrated by surveys conducted by Klott (2001), the USDI (1999) and Allen et al. (1995; 1996).

Changes in channel morphology have been documented in streams within grazing allotments and include: increases in width/depth ratios, reductions in pool quality and/or frequency, increased frequency of unstable banks, and a higher incidence of stream incision in low gradient areas (USDA 1995; USDA 2000). The relative magnitude of these habitat alterations extends to other aquatic species such as gastropods and amphibians.

Habitat Simplification

Reductions in habitat complexity through land use activities such as road construction and maintenance, grazing, and possibly agriculture, has resulted in a net decrease in habitat for salmonid species.

Although road density in the Bruneau subbasin is not as extensive as in other subbasins, road construction and maintenance still represents one of the more notable land use practices that have contributed to a reduction in habitat complexity, and ultimately habitat quantity and quality. Many roads have been constructed in floodplain areas and/or along stream channels. Road placement influences the hydrological function of the stream, reduces or eliminates habitat areas, and contributes fine sediment to stream channels. The concentration of traffic onto the limited road network also represents a potential limiting factor to aquatic species since the probability for spills of hazardous materials into streams is heightened. In the Nevada portion of the Jarbidge, approximately 300 yards of bull trout habitat were modified by road construction activities which subsequently led to an "Emergency Listing" by the USFWS in August of 1998 (Trout Unlimited 2001). Other road construction and channel straightening activities have been documented throughout

the Jarbidge portion of the subbasin. The degree to which they represent a limiting factor to aquatic species has not been assessed. Finally, roads provide access to large wood in the rivers. In the West Fork Jarbidge River, large woody debris has been removed for flood control and firewood (Parrish 1998).

Grazing has contributed to a net loss in habitat complexity throughout various portions of the subbasin. The removal or reduction of riparian vegetation through herbivory and/or trampling is considered to be a primary limiting factor on aquatic habitats and fish population densities in portions of the Bruneau subbasins in Nevada, as measured by poor streambank cover, pool quality, width/depth ratios, and stream bottom embeddedness (USDA 1995). The effects of agriculture on habitat complexity are largely unknown in the subbasin. In 1990, approximately 45,000 acres of croplands were irrigated in the Idaho portion of the subbasin (Berenbrock 1993). And, as shown in Figure 7, the majority of these areas (most notably pasture and hay land cover types) occur proximal to stream channels. Although speculative, it may be assumed that a proportionate amount of the riparian vegetation in these areas has been converted to irrigated crops, thus decreasing the potential contribution of habitat-forming woody debris to stream channels. Assessment of agriculture as it relates to habitat complexity currently represents a data gap.

Water Quality

Unsuitable water quality is a key factor limiting the quantity and quality of aquatic habitat in the Bruneau subbasin. Water quality parameters of concern include excessive temperatures, nutrients, and sediment.

As mentioned previously, elevated stream temperatures in the subbasin exceed coldwater biota standards. Although this problem is considered by some to be a natural phenomenon exacerbated by geothermal discharge (e.g. Lay and IDEQ 2000), it has been shown by others (e.g. McNeil et al. 1997; Zoellick et al. 1995; USDA 1995; USDI 1999) to be a much more pervasive and widespread issue. One of the most commonly cited sources for thermal pollution in stream segments is the lack of riparian shading caused by grazing. In 1994-96, the USDI (1999) found that Idaho State criteria for coldwater biota was not met in the portions of Little Jacks Creek that had no restrictions on grazing, and was met in restricted portions. Other sources for thermal pollution include mines in the upper subbasin that discharge thermally heated water to coldwater stream segments (Parrish 1998). Their influence on habitat quantity and quality is unknown.

Irrigated pastures, crops, and aquaculture have all been cited by Lay and IDEQ (2000) as causing elevated nutrient levels in some stream segments within the Bruneau subbasin (see Table 18). Total phosphorus (TP) concentrations in Jacks Creek are related to non-sediment sources (such as animal concentrations) rather than from fertilizer applications and runoff from agriculture fields.

All stream segments identified as water quality limited by Lay and IDEQ (2000) had sediment cited as a pollutant (see Table 18; Lay and IDEQ 2000). High embeddedness levels recorded between 1988-1990 in a Humboldt-Toiyabe National Forest watershed study were considered the principle factor limiting habitat quality (USDA 1995). Excessive sedimentation is common in areas of the subbasin that have been heavily grazed.

The mean percent of fine sediment (sand and smaller sized particles) in streams within the Battle Creek Allotment (i.e. Little Jacks and Big Jacks Creeks) differed significantly (P = 0.02) among streams with different levels of livestock access (USDI 1999). Fine sediment percentages were greatest in livestock-accessible stream segments grazed in the spring (USDI 1999). Excessive sedimentation is also a problem in Hot Creek springsnail. Fine silts and sands have covered high quality substrate utilized by the gastropod, and have eliminated a majority of its habitat. Potential sediment sources upstream need to be stabilized and restoration of cobbles needs to be initiated to allow recolonization of previously utilized habitat.

One other notable pollution source that may be directly related to salmonid persistence is noise pollution. The effects of sound and shock waves associated with jets from the Air Force training range in Idaho (refer to land use section for a description of the training range) represent a potentially limiting factor to bull trout in the Idaho portion of the Jarbidge. Potential effects from sonic booms include disruption of normal behavior, physiological stress responses, and increased mortality of eggs due to noise-related vibrations during critical periods of development (USAF 1998). Little research exists to judge the significance of this threat to bull trout in the subbasin (Parrish 1998).

Wildlife

High quality areas of habitat exist in Upper Little Jacks Creek, Big Jacks Creek, Duncan Creek and Cottonwood Creek in the lower subbasin, and in the Jarbidge River watershed in the upper portion of the subbasin. River canyons that have been protected from livestock influences also provide critical habitat for a number of species. However, large areas of habitat have been degraded, and vegetative communities altered, by past and present land management practices. The two most critical threats to wildlife species in the subbasin are (1) the rapid expansion of cheatgrass and subsequent conversion of sagebrush-steppe to annual grasslands, and (2) the loss and degradation of riparian habitat.

Reductions in quantity and quality of sagebrush and perennial grassland habitat

Shortening of Fire Return Intervals and Cheatgrass Invasion

Sagebrush/native bunchgrass communities evolved with fire. Mountain big sagebrush communities burned every 20-30 years while Wyoming big sagebrush communities burned every 50-100 years (USDI 1998). The introduction of exotic species and fire suppression activities have altered natural fire regimes which has greatly influenced the distribution, composition, and structure of rangeland vegetation. Impacts to vegetative communities include:

- Increased tree density in former savanna-like stands of juniper and ponderosa pine
- Encroachment of conifers into non-forested vegetation
- Increased density or coverage of big sagebrush and other shrubs, and loss of understory vegetation
- Increased homogeneity of many landscapes (USDI 1998).

In many cases, fire suppression has led to unnaturally high densities of big sagebrush (DAF 1998) which reduces or eliminates perennial grasses and forbs that wildlife depend on. This leads to increased fuel loads and increased risk of stand-replacing

fires. Large wildfires fragment habitat for sage grouse and other shrub obligate species. Mule deer and pronghorn winter range and fawning habitat have declined across the subbasin (IDFG 2000c). The prey base for raptors and mammalian predators has also been reduced (Jim Klott personal communication 2001). As a consequence of fire, much of the subbasin east of the Bruneau River is now dominated by exotic annual grasslands or exotic perennial grasses.

Shrub-steppe communities are also threatened by the expansion of cheatgrass. Cheatgrass cures early in the season and forms a continuous, fine fuel source that ignites easily and allows fire to spread rapidly (DAF 1998). In years with above average spring precipitation, larger fires often develop due to increased grass production (USDI 1998).

Destruction of Biological Crusts

Biological crusts moderate surface temperature extremes, enhance seedling establishment, and improve soil stability, productivity, and moisture retention (Wisdom et al. 2000). They are an important component of the shrub-steppe and grassland ecosystems. These crusts have been damaged or destroyed by grazing, humans, off-road vehicles, exotic plant invasion and fire (USFS 1999), which has facilitated the invasion of exotic weeds and increased erosion in many areas. The BLM identifies biological crust restoration as a priority for the area (Schnitzspahn et al. 2000).

Noxious Weeds and Exotic Invasive Species

Noxious weeds pose significant long-term threats to ecosystem health. These species reduce plant biodiversity, habitat quality and quantity and generally lowers the ecological quality of the habitat (Figure 27). Cheatgrass and other weeds can increase fire frequency in shrub-steppe habitats which eventually results in the conversion of shrub-steppe to annual grasslands. Most of the subbasin is at high risk from cheatgrass invasion (Figure 27).

Grazing impact on sagebrush steppe communities and riparian areas. Heavy livestock grazing pressure in sagebrush-steppe communities can reduce the quality and quantity of understory vegetation, damage or destroy microbiotic soil crusts and increase soil erosion. These factors combine to make conditions favorable for invasion by exotic species.

All allotment evaluations and watershed assessments on portions of the subbasin rank grazing as a leading cause of degraded riparian area (USDI 1989, 1997, 2000b; McNeill et al. 1997; Parrish 1998; Jarbidge 2001; Klott 1996; Klott, BLM, personal communication August 26, 2001; Schnitzspahn et al. 2000; USDA 1995, 1998). Grazing has led to a loss of more succulent forbs and other plants favored by sage grouse, elk, mule deer and other wildlife, and has impacted aquatic habitat by raising stream temperatures, contributing sediment through collapsing stream banks, reducing bank storage and generally altering stream hydrologic processes.

Off Highway Motor Vehicles OHMV

Off Highway Motor Vehicle (OHMV) use in the subbasin and surrounding areas is expected to increase by 70% over the next twenty years (USDI 1999). OHMV use sometimes occurs in critical or important wildlife habitats, and at cultural sites. Species

most likely to be negatively impacted include: western toad, western ground snake, longnose snake, long-billed curlew, burrowing owl, kit fox and Bruneau Dunes tiger beetle. These impacts include direct mortality, loss of habitat, burrow collapse, and depletion of prey species.

Landscaping rock collecting

Rapid population growth within southwest Idaho has resulted in an increased demand for decorative rock for landscaping and building construction. This has resulted in an increase in both the legal and illegal removal of rock from the subbasin. These activities may result in reduced habitat suitability for many rock dwelling species, including the Mojave black-collared lizard, western ground snake, Longnose snake, ringneck snake, and bats.

Roads

No subbasin-specific information regarding road impacts on wildlife populations was located. Thirteen road-associated factors and their potential effects on wildlife are noted in Table 19 (Wisdom et al. 2000).

Artificial Production

Rainbow trout is the only salmonid stocked in the subbasin. IDFG stocked 2000-5000 rainbow trout annually in the Jarbidge subwatershed from1970 and 1989 (Figure 28) (Warren and Partridge 1993). The IDFG stocking program ceased in 1989. NDOW stocked rainbow trout in the Jarbidge until). 1997 (Parrish 1998).

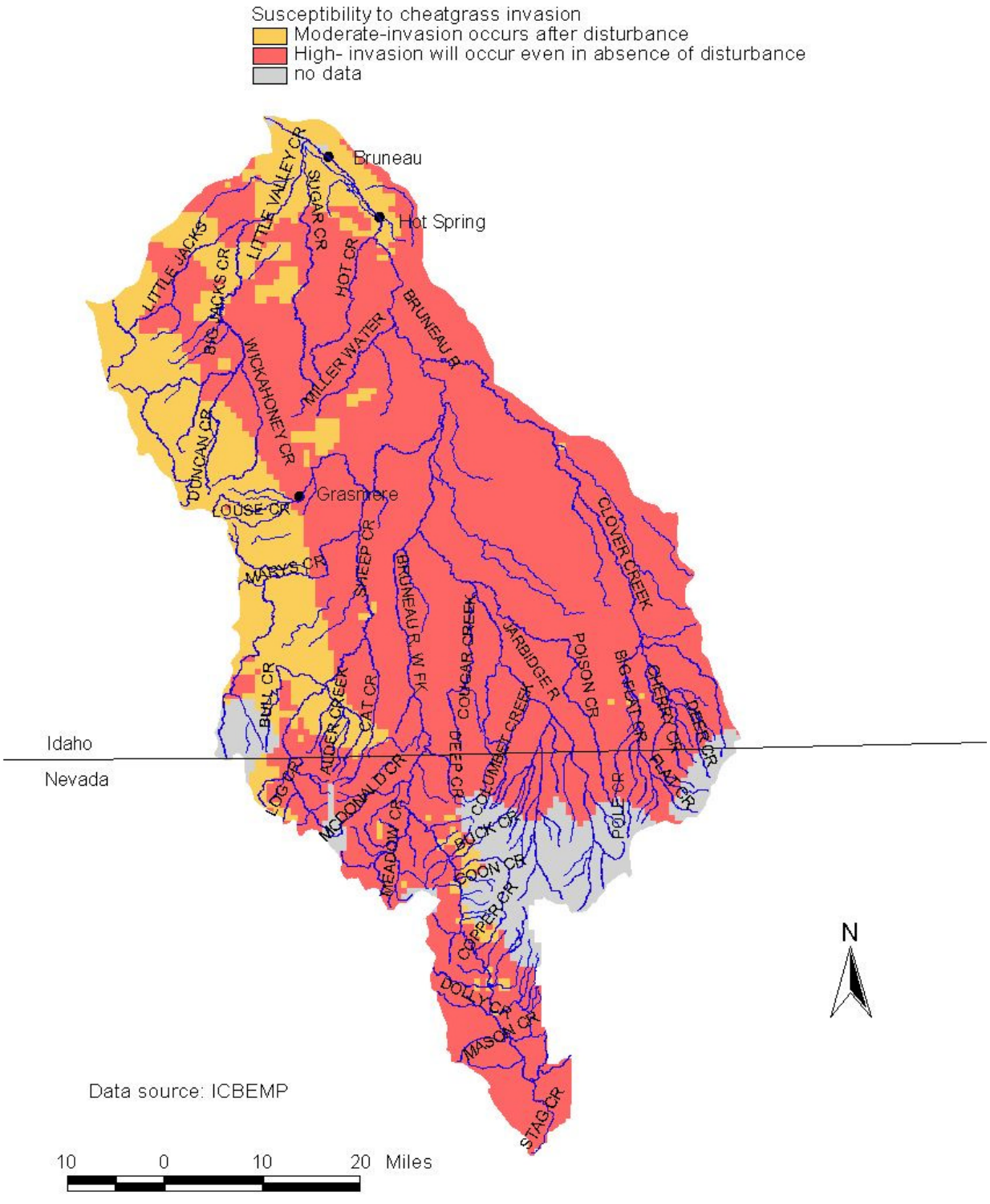

Figure 27. Susceptibility to cheatgrass invasion

Table 19. Thirteen road-associated factors with deleterious impacts on wildlife (Wisdom *et al* 2000).

Road-associated Factor	Effect of Factor in Relation to Roads
Snag reduction	Reduction in density of snags due to their removal near roads, as facilitated by road access
Down log reduction	Reduction in density of large logs due to their removal near roads, as facilitated by road access
Habitat loss and fragmentation	Loss and resulting fragmentation of habitat due to establishment and maintenance of road and road right-of-way
Negative edge effects	Specific case of fragmentation for species that respond negatively to openings or linear edges created by roads
Over-hunting	Nonsustainable or nondesired legal harvest by hunting as facilitated by road access
Over-trapping	Nonsustainable or nondesired legal harvest by trapping as facilitated by road access
Poaching	Increased illegal take (shooting or trapping) of animals as facilitated by road access
Collection	Collection of live animals for human uses (e.g., amphibians and reptiles collected for use as pets) as facilitated by the physical characteristics of roads or by road access
Harassment or disturbance at specific use sites	Direct interference of life functions at specific use sites due to human or motorized activities, as facilitated by road access (e.g. increased disturbance of nest sites, breeding leks or communal roost sites)
Collisions	Death or injury resulting from a motorized vehicle running over or hitting an animal on the road
Movement Barrier	Preclusion of dispersal, migration or other movements as posed by a road itself or by human activities on or near a road or road network
Displacement or avoidance	Spatial shifts in populations or individual animals away from a road or road network in relation to human activities on or near a road or road network
Chronic negative interaction with humans	Increased mortality of animals due to increased contact with humans, as facilitated by road access

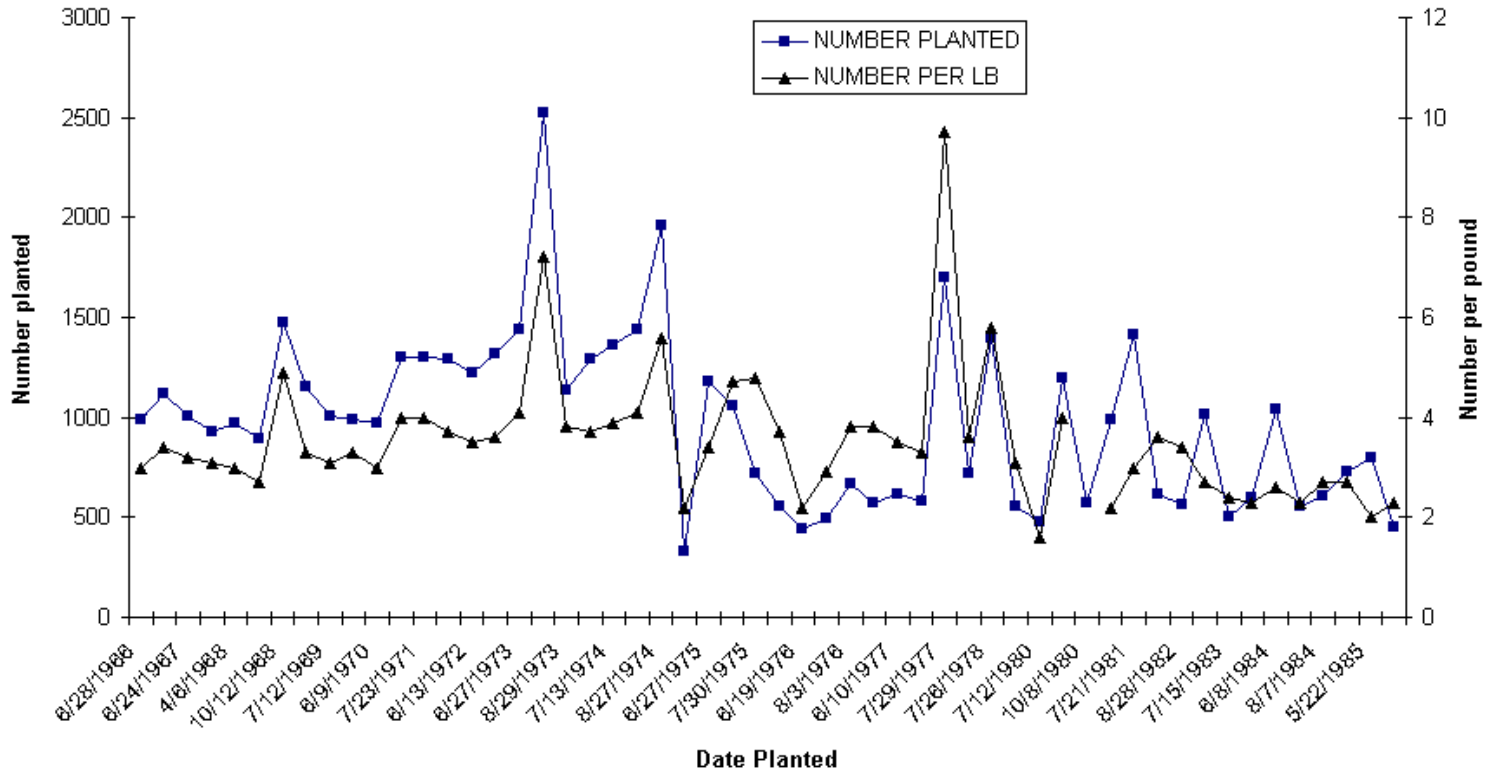

Figure 28. Idaho Department of Fish and Game rainbow trout stocking in the Bruneau subbasin, 1970-1989

Present Subbasin Management

Existing Management

Federal Government

As a result of the federal government's significant role in the Columbia Basin, through the development of the federal hydropower system, as a land manager, and in reference to its responsibilities under Section 7(a) of the Endangered Species Act (ESA), several important documents have been published in the last year that will guide federal involvement in the Bruneau subbasin and Middle Snake Province. These documents are relevant to and provide opportunities for states, tribes, local governments, and private parties to strengthen existing projects, pursue new or additional restoration actions, and develop the institutional infrastructure for comprehensive fish and wildlife protection. The key documents include: the FCRPS Biological Opinion, the federal All-H paper entitled, *Conservation of Columbia Basin Salmon: A Coordinated Federal Strategy for the Recovery of the Columbia-Snake River Basin Salmon*, and the Interior Columbia Basin Ecosystem Management Project (ICBEMP). All are briefly outlined below.

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).

Columbia Basin Fish and Wildlife Authority

CBFWA is made up of Columbia Basin fish and wildlife management agencies (federal, state and tribal). CBFWA's intent is to coordinate management among the various agencies and agree on goals, objectives and strategies for restoring fish and wildlife in the Columbia Basin.

Farm Services Agency (FSA)

FSA is a department within the U.S. Department of Agriculture that ensures the well-being of American agriculture, the environment, and the American public through efficient and equitable administration of farm commodity programs, farm ownership, operating and emergency loans, conservation and environmental programs, emergency and disaster assistance, domestic and international food assistance and international export credit programs. Conservation program payments that FSA administers include Conservation Reserve Program (CRP) and the Environmental Quality Incentives Program (EQIP). Technical assistance for these programs is provided by NRCS. Delivery of programs is through county offices.

Natural Resource Conservation Service (NRCS)

NRCS provides technical assistance to private land users, tribes, communities, government agencies, and conservation districts. NRCS assists in developing conservation plans, provides technical, field-based assistance, and encourages the implementation of conservation practices to improve water quality and fisheries habitat. Programs include CRP, Public Law 566 (Small Watershed Program), River Basin Studies, Forestry Incentive Program, Wildlife Habitat Improvement Program (WHIP), EQIP, and Wetlands Reserve Program (WRP).

National Marine Fisheries Service (NMFS)

The NMFS is part of the National Oceanic and Atmospheric Administration (NOAA) under the U.S. Department of Commerce. NMFS has ESA administration and enforcement authority for anadromous fish. NMFS reviews ESA petitions, provides regulations and guidelines for activities that affect listed species, and develops and implements recovery plans. NMFS is involved in primary research on anadromous and marine species.

NMFS developed the recent FCRPS Biological Opinion and the Basinwide Salmon Recovery Strategy, which contain actions and strategies for habitat restoration and protection throughout the Columbia River Basin. Agencies are identified to lead fast-start efforts in specific aspects of restoration on non-federal lands. Federal land management is guided by current programs that protect aquatic habitats (PACFISH, ICBEMP). Actions within the FCRPS Biological Opinion are intended to be consistent with or compliment the Northwest Power Planning Council's amended Fish and Wildlife Program and state and local watershed planning efforts.

Northwest Power Planning Council (NWPPC)

The NWPPC was created by Congress under the Northwest Power Act of 1980. The intent was to give citizens a stronger voice in determining issues related to hydropower and fish and wildlife in the Columbia River Basin. The governors of Idaho, Montana, Washington and Oregon each appoint two members to serve on the eight member Council. The NWPPC has three principal mandates:

- Development of a 20 year electric power plan to use all available resources, ensuring adequate and reliable energy and lowest possible economic and environmental costs,
- Development of a program to protect and rebuild fish and wildlife populations affected by the hydropower system,
- Educate and involve the public in the Councils decision-making process.

U.S. Army Corps of Engineers (USACE)

The USACE is responsible for river and harbor development. The Federal Water Pollution Control Act of 1972 gave the USACE authority to enforce section 404 of the Act dealing with discharge of dredged or fill material into waters of the U.S., including wetlands. The USACE is also responsible for flood protection, regulating flows, regulating reservoir

levels, and for operation of some federal dams (including fish passage on dams in the Columbia and Snake Rivers).

Bureau of Land Management (BLM)

The BLM administers federal lands in the West not claimed by the end of the homesteading era of the 19th century, and not set aside as National Forests, National Parks, or other special federal land use designations. The BLM took over the functions of the Grazing Service (established in 1934 by the Taylor Grazing Act) and the General Land Office in 1946 when these agencies were merged. Lands administered by the BLM consist primarily of dry grasslands and desert within the intermountain West. These lands are currently managed for multiple use under authority of the Federal Land Policy and Management Act (FLPMA) of 1976. Primary commodity uses are grazing and mining. Wildlife, wilderness, archaeological and historic sites, recreation, and mineral leasing are also managed on BLM lands. The BLM manages 69.8% of the land in the subbasin. Three BLM offices have responsibilities in the subbasin: Bruneau Resource Area (based in Boise, ID), Jarbidge Resource Area (based in Twin Falls, ID) and Elko Resource Area (based in Elko, NV).

U.S. Environmental Protection Agency (EPA)

Formed in 1970, the EPA administers the Federal Air, Water, and Pesticide Acts. EPA sets national air and water quality standards. The EPA provides funding through Section 319 of the Clean Water Act for TMDL implementation projects. Section 319 funds are administered by each states' Department of Environmental Quality

U. S. Fish and Wildlife Service (USFWS)

The USFWS administers the ESA for resident fish and wildlife species. The USFWS also enforces the Lacey Act (1900) to prevent interstate commerce in wildlife taken illegally, and the North American Migratory Bird Treaty Act. The USFWS distributes monies to state fish and wildlife departments from a federal tax on the sale of hunting and fishing equipment under the authority of the Pitman-Robertson Federal Aid in the Fish and Wildlife Restoration Act (1937) and the Dingle-Johnson Act. The USFWS manages a national system of wildlife refuges and provides funding for the restoration of riparian areas, wetlands, and native plant communities through the Partners in Wildlife Program.

USFWS is active in the subbasin. They have conducted research and monitoring activities on the Bruneau hot springsnail and have recently published a draft recovery plan for the species (Wood 2000). They have provided funding for research on the spotted frog, a USFWS candidate species.

U. S. Forest Service (USFS)

The USFS is responsible for the management of all National Forests and National Grasslands in the United States. The multiple use mandate for the USFS was emphasized in the Multiple Use Sustained Yield Act of 1960, and the forest planning process used for over the last 20 years was established under the Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974, and the National Forest Management Act (NFMA)

of 1976. The Humboldt-Toiyabe National Forest comprises 318,034 acres of the Nevada portion of the subbasin.

U. S. Geological Survey (USGS)

The USGS monitors hydrology and maps soil, geological and geomorphologic features. The USGS conducts a portion of the fish and wildlife research formerly done by the USFWS. USGS has been active in the Bruneau subbasin collecting information and modeling the geothermal aquifer to determine potential sources of water for irrigation.

Tribal Government

Shoshone-Paiute Tribes

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 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 towards the goal of restoring properly functioning ecosystems and species assemblages for present and future generations to enjoy.

State Government

Idaho Department of Agriculture (ISDA)

The ISDA serves the state's agricultural community by providing technical and financial assistance, laboratory testing, national and international marketing, inspection, and licensing programs (ISDA 2000).

ISDA is composed of divisions. Through these divisions, ISDA monitors pesticide use and application, groundwater, wildlife, and noxious weeds (ISDA 2000).

Idaho Department of Environmental Quality (IDEQ)

The IDEQ is responsible for protecting human health and preserving the quality of Idaho's environment. IDEQ administers core federal environmental protection programs, which monitor and evaluate point and nonpoint pollution sources, air and water quality, contaminated sites, and restoration areas. Lay and IDEQ (2000) worked collaboratively on the Bruneau TMDL. IDEQ implements regulations adopted by the Idaho Board of Environmental Quality (IDEQ Strategic Plan 2002 – 2006).

Idaho Department of Fish and Game (IDFG)

Under Title 36 of the Idaho Code, the IDFG is responsible for preserving, protecting, perpetuating, and managing fish and wildlife in the state of Idaho, as well as providing continued supplies of fish and wildlife for hunting, fishing, and trapping.

Idaho Conservation Data Center (CDC)

The CDC, located within the IDFG, was established in 1984 (as the Idaho Natural Heritage Program) through a cooperative effort involving IDFG, Idaho Department of Parks and Recreation, and The Nature Conservancy. In 1987, the program merged with the IDFG. The CDC is part of an expanding international network of Natural Heritage Programs that collect and maintain information on the status of rare, threatened, and endangered plant and animal species; ecological reference and natural areas; terrestrial and aquatic habitats; and plant communities using an integrated, relational data management system (The Nature Conservancy 1982; The Nature Conservancy et al. 1996).

Idaho Department of Lands (IDL)

The IDL is charged with managing state owned lands as well as providing other services to residents and businesses in Idaho. IDL is composed of five Bureaus: Administration, Fire Management, Forest Management, Forest Assistance, and Lands (IDL Web Page 2000).

The Lands, Range, and Minerals Bureau is responsible for range management and surface leasing of state lands as well as administering weed control and water rights filings. It also manages Public Trust Lands, which are those below high water mark of navigable water bodies. Other responsibilities of this division include land sales and exchanges, mineral leasing, lake protection, and the regulation of oil and gas exploration (IDL Web Page 2000).

Idaho Department of Parks and Recreation (IDPR)

The IDPR formulates and executes a long range, comprehensive plan and program to acquire, plan, protect, operate, maintain, and wisely develop areas of scenic beauty, recreational utility, or historic, archaeological, or scientific interest. The IDPR manages Bruneau Dunes State Park.

Idaho Geological Survey (IGS)

IGS is a special public service and research agency at the University of Idaho that collects and disseminates geologic and mineral data for the state. The IGS studies and reports on the general geology, environmental geology and geological hazards, metallic and nonmetallic deposits, surface and ground water, and energy resources in the state. The information is made available through oral and written communication and in publications. The Survey is governed by an Advisory Board, whose members represent the mining industry, public agencies, higher education, and earth sciences (IGS 2000).

Idaho Rangeland Resource Commission (IRRC)

IRRC provides programs that result in an informed public that understands and supports balanced, responsible management of Idaho's economically vital private and public

rangelands. IRRC is a flagship for the industry's important long-term information and education needs through implementation of their mission statement. (IRRC 2001).

Idaho Soil and Water Conservation Districts

Soil and Water Conservation Districts (SWCDs) are subdivisions of state government consisting of five to seven-member boards of locally elected supervisors. SWCDs coordinate technical and financial assistance to protect and conserve natural resources, primarily on privately owned lands. In implementing resource conservation measures, SWCDs work with the ISCC, NRCS, tribal, and other local, state, and federal technical specialists.

SWCDs develop Five Year Resource Conservation Plans to manage conservation efforts throughout their district, updating the plan annually. In this planning effort, goals, objectives, and tasks are prioritized and specified for resource concerns including soil erosion, water quality, and fish and wildlife habitat. These five-year plans are available from each SWCD

The SWCDs in the Bruneau Subbasin are listed below.

Soil (and Water) Conservation Districts	**Location**
Bruneau River	Bruneau
Balanced Rock	Twin Falls

Idaho Soil Conservation Commission (ISCC)

The ISCC consists of five members appointed to five-year terms by the Governor. A 25 member staff is responsible for delivery of natural resource improvement and administrative programs. The ISCC has the following authorizations:

- Soil Conservation District Law

Provide assistance and guidance to the supervisors of soil conservation districts in order to enhance their capabilities in carrying out effective local conservation programs

- Idaho Water Quality Law

Designated agency for grazing activities and agricultural activities

- Idaho Agricultural Pollution Abatement Plan (Ag Plan)

State-level agency to implement the Ag Plan for private and state agricultural lands

The ISCC administers the following natural resource programs in the subbasin through a partnership consisting of local soil and water conservation districts and the Natural Resources Conservation Service:

- Water Quality Program for Idaho

Provides cost-sharing to owners and operators of agricultural lands for agricultural and grazing improvements to protect water quality. Priority areas include TMDL watersheds, watersheds with threatened aquatic species under the Endangered Species Act, and ground water quality protection areas.

- RCRDP – Loans

Low interest loans to agricultural operators to implement practices for the enhancement of soil and water resources, improvement of riparian areas and fish and wildlife habitat, and to increase agricultural productivity.

- RCRDP – Grants

Provides 50 percent cost-sharing for installation of agricultural conservation practices to protect water quality and enhance critical fish and wildlife habitat.

- Grazing Land Conservation Initiative

Allocate funding to develop grazing and riparian conservation plans.

- Natural Resources Conservation Income Tax Credit

Tax credit to owners and operators of private lands for installation of riparian protection practices.

Nevada Department of Conservation and Natural Resources (NDCNR)

NDCNR is responsible for establishing and administering goals, objectives, and priorities that preserve the state's natural resources. The Director's office provides administrative, technical, budgetary, and supervisory support for nine divisions and 10 boards and commissions.

Nevada State Conservation Commission (NSCC)

NSCC guides and regulates its two Conservation Districts within the Owyhee subbasin in natural resource policy, planning, enforcement, information distribution, collaboration, and cooperation among and between districts and state and federal government.

Nevada Division of Conservation Districts (NDCD)

NCDC provides administrative support to the State Conservation Commission. Conservation districts provide services to individual landowners and coordinate with other public and private agencies to protect and develop the state's renewable resources. NCDC is the official state agency cooperating with the Natural Resources Conservation Service, which provides technical assistance to the conservation districts.

Nevada Division of State Parks (NDSP)

NDSP plans, develops, and maintains a system of parks and recreation areas for residents and visitors. NDSO also preserves areas of scenic, historic, and scientific significance in Nevada.

Nevada State Environmental Commission (NSEC)

NSEC is an 11 member quasi-judicial and quasi-legislative agency that achieves and maintains state-regulated air and water quality and solid and hazardous waste management systems. NSEC hears and decides contested cases through appeals. This includes final decisions made by the Division of Environmental Protection in regard to enforcement actions and permits. NSEC also responds to changes in federal laws and regulations that affect Nevada's environmental programs.

Nevada Division of Water Planning (NDWP)

The roles and responsibilities of NDWP are to develop a plan for water use within the state that includes alternate sources, storage, protection of existing water rights, current demand, and future needs.

Nevada Division of Water Resources (NDWR)

NDWR conserves, protects, and manages the state's water resources for Nevada's citizens through the appropriation and reallocation of public waters. In addition, NDWR is responsible for quantifying existing water rights, monitoring water use, distributing water in accordance with court decrees, and reviewing water availability.

Nevada Division of State Lands (NDSL)

NDSL acquires, holds, and disposes of all state lands and interests in lands; provides technical land use planning assistance, training, and information to local units of government or other agencies; develops policies and plans for the use of lands under federal management; and represents the state in its dealings with federal land management agencies.

Nevada Division of Forestry (NDF)

NDF coordinates and manages forestry, nursery, threatened and endangered plant species and watershed resource activities on certain public and private lands. NDF's Natural Resource Management Program includes financial incentives, technical assistance, and education to landowners for scientifically-based forestry, conservation, and restoration practices.

Nevada Division of Wildlife (NDOW)

NDOW protects, restores, and manages wildlife and wildlife habitat for the aesthetic, scientific, educational, recreational, and economic benefit of Nevada and U.S. citizens. The NDOW has bureaus dealing with conservation education, fisheries management, game regulations, habitat enhancement, law enforcement, and licensing.

Nevada Wild Horse Preservation Commission (NWHPC)

NWHPC serves to sustain viable herds of wild horses on public lands throughout Nevada by acting as an advocate through participation with federal agencies. NWHPC participates in programs designed to encourage and promote the protection of wild horses by providing information to the general public and news media.

Nevada Natural Heritage Program (NNHP)

NNHP maintains an inventory and current database on the locations, biology, and conservation status of all threatened, endangered, and sensitive species and biological communities in the state. NNHP continually evaluates conservation priorities for over 600 species of native plants and animals. NNHP supplies information and technical services to meet diverse conservation, planning, development, and research needs.

Nevada Department of Agriculture (NDA)

NDA was established in 1915 by Chapter 561 of the Nevada Revised Statutes. NDA promotes the advancement and protection of the livestock and agricultural industries of Nevada. Programs include: continuing education, pesticide and fertilizer product registration, entomology, and invasive weed strategies.

Nevada Department of Transportation (NDT)

NDT ensures a safe and effective transportation system for Nevada's economic, environmental, and social needs.

Local Government

Soil and Water Conservation Districts

There is one soil and water conservation district in the Bruneau subbasin. The SWCD is responsible for protecting and promoting the natural resources within the county boundaries. Staff members work directly with landowners on conservation management and planning. They utilize programs such as: erosion and non-point source pollution control, groundwater protection, and education.

Other Entities and Organizations

The Nature Conservancy

The mission of The Nature Conservancy (TNC) is to preserve the plants, animals, and natural communities that represent the diversity of life on earth by protecting the lands and waters they need to survive. TNC has a strong tradition of working with landowners, local communities, tribes, and public agencies to achieve conservation goals. TNC has been instrumental in protecting important habitat areas through purchase of lands and conservation easements.

In order to achieve this mission, TNC has identified priorities for conservation action. To identify these priorities, TNC (1) identified "conservation targets," consisting of the species, natural communities and ecosystems representative of the ecoregion; (2) set conservation goals that define how much of a target species or ecosystem needs to be conserved for long-term survival; (3) assembled and mapped information using a Geographic Information System (GIS); (4) designed a portfolio of conservation sites that best "capture" the conservation targets and consider factors such as ecosystem processes, land ownership and linkages among the sites; and (5) established priorities among conservation sites on the basis of biological values, threats, the feasibility of taking conservation action and potential leverage for accomplishing conservation at other sites.

The Nature Conservancy has identified two conservation sites within the Bruneau subbasin that provide exceptional opportunities for conservation of biological diversity: the Bruneau/Jacks Creek Canyonlands and the Jarbidge River.

The Bruneau/Jarbidge Canyonlands Conservation Site is an area of roughly 530,000 acres. The site encompasses Little Jacks Creek, Big Jacks Creek, and the lower Bruneau River as well as substantial areas adjacent to the canyon rims. These rugged and remote canyonlands contain extensive areas of high quality riparian, wetland, and shrub steppe habitats. This site also has important populations of redband trout, sage grouse, and

California bighorn sheep. Six rare plants and numerous rare plant communities make this area a biodiversity hotspot. Rare invertebrate species within this site include the Idaho springsnail, the St. Anthony Dunes tiger beetle, and the Bruneau hot springssnail. Key threats include invasive species, altered fire regimes, poorly managed grazing, hydrologic alteration, and groundwater withdrawals.

The Jarbidge River Conservation Site is an area of roughly 335,00 acres in Idaho and Nevada. The site includes the East Fork, West Fork, and mainstem Jarbidge River, areas adjacent to the canyon rims, and the Jarbidge Mountains. Key conservation targets for this site include bull trout, redband trout, California bighorn sheep, and riparian vegetation. Threats to this area are regarded as relatively minor and include poorly managed grazing, recreational development, altered fire regimes, roads, and invasive species.

Columbia River Basin Forum

Formerly called The Three Sovereigns, the Columbia River Basin Forum is designed to improve management of fish and wildlife resources in the Columbia River Basin. The process is an effort to create a forum where the federal government, Northwest states and tribes could better discuss, coordinate, and resolve basinwide fish and wildlife issues under the authority of existing laws. The forum is a vehicle for implementation of the Basinwide Salmon Recovery Strategy.

Nevada Wildlife Federation (NWF)

NWF is the state's oldest nonprofit conservation organization, representing Nevada sportsmen and conservationists concerned about issues that affect local wildlife, wetlands, streams, forests, and ranges. It is an affiliate of the National Wildlife Federation, the world's largest conservation organization.

Past and Existing Fish and Wildlife Projects

Table 20. BPA-funded Fish and Wildlife Projects

BPA Project # / Description	Funding/Lead Agency	Status
9701100 / Habitat enhancement and protection – Shoshone-Paiute Reservation	Shoshone-Paiute Tribes	Ongoing

Table 21. Non BPA-funded Fish and Wildlife Projects

Project	Funding/Lead Agency	Status
Replace culvert on Jack Creek to remove passage barrier	Jarbidge Bull Trout Group	Completed in 1997
Fenced off Bruneau hot springsnail habitat from cattle grazing	BLM	Completed 1992
Fenced off Indian Bathtub in Hot Creek Watershed	USFWS	Completed 1990
Agricultural component of comprehensive TMDL implementation plans for the Bruneau subbasin	ISCC	Initiated
SWCD Agricultural Implementation Projects: The Bruneau River SWCD is currently working with private landowners to apply agricultural BMPs on 1,800 acres of cropland with the objective of preserving Bruneau hot Springsnail habitat, and improving groundwater quality. The project also includes planting native plants in the corners of center pivot irrigation systems to provide for critical wildlife habitat.	SWCD	Ongoing

Existing Goals, Objectives, and Strategies

The Bruneau subbasin has diverse populations of fish and wildlife and unique areas of habitat that are economically, ecologically and culturally significant to the people of Idaho and Nevada The overarching subbasin goal is to restore and/or maintain the health and function of ecosystems to ensure continued viability of these important populations. Numerous federal, tribal, state, and local entities are charged with maintenance and protection of natural resources in the subbasin.

Federal Government

USFWS

Bruneau Hot Springsnail Recovery Goals and Strategies (from Wood 2000)

- To recover the Bruneau hot springsnail to the point where delisting is warranted
- Implement conservation measures to increase water levels in the regional geothermal aquifer (Priority 1)
- Continue implementation of the state's strategy
- Maintain and evaluate the Groundwater Management Area
- Develop a water management district
- Repair leaking artesian wells
- Expand groundwater monitoring in the Bruneau, Sugar and Little Valleys to include the effects of granting additional water rights
- Investigate opportunities to use groundwater from the coldwater aquifer in lieu of water from the geothermal aquifer

- Implement the Conservation Reserve Program (CRP) to conserve the use of geothermal water
- Implement a groundwater monitoring program to assess increases or declines, in the geothermal aquifer (Priority 1)
- Monitor the survival and recovery of the Bruneau hot springsnail and its habitat (Priority 1)
- Continue expanded springsnail monitoring program
- Continue surveys of all geothermal springs in the recovery area on biannual or triennial basis
- Develop and implement a control program for non-native fish that prey on the Bruneau hot springsnail within the recovery area
- Evaluate the feasibility of controlling non-native fish in the recovery area
- Manage Federal lands to promote recovery of the Bruneau hot springsnail
- Install fencing along the east side of the Bruneau River
- Assess and regulate any federal land exchanges within the Little, Sugar or Bruneau Valleys
- Develop a groundwater recharge model that will assist in determining levels of pumping that do not result in continued decline of the geothermal aquifer
- Conduct research to determine the feasibility of restoring Upper Hot Creek as suitable springsnail habitat
- Develop and utilize a model to determine the amount of water withdrawal that can occur while maintaining geothermal spring discharge at the 816.96 meter (2,678.54 foot) elevation level
- Evaluate the feasibility of restoring Indian Bathtub and Hot Creek below Indian Bathtub as suitable springsnail habitat
- Determine the feasibility of translocation and establishment of additional springsnail colonies
- Seek funding for implementation of recovery tasks
- Recovery plan assessment
- Biannually assess the overall success of the recovery program and revise the recovery plan on a 5 year basis, if necessary

Basinwide Salmon Recovery Strategy (from Federal Caucus 2000)

Federal Caucus goals

- Conserve species. Avoid extinction and foster long-term survival and recovery of Columbia Basin salmon and steelhead and other aquatic species.
- Conserve ecosystems. Conserve the ecosystems upon which salmon and steelhead depend.
- Assure tribal fishing rights and provide non-tribal fishing opportunities. Restore salmon and steelhead populations over time to a level that provides a sustainable harvest sufficient to allow for the exercise of meaningful tribal fishing rights and provide non-tribal fishing opportunities.

- Balance the needs of other species. Ensure that salmon and steelhead conservation measures are balanced with the needs of other native fish and wildlife species and do not unduly impact upriver interests.
- Protect historic properties. Consistent with the requirements of the National Historic Preservation Act and other applicable laws, assure that effects of recovery measures on historic properties are identified and addressed in consultation with all interested and affected parties.
- Consider resources of cultural importance to tribes. In implementing recovery measures, seek to preserve resources important to maintaining the traditional culture of basin tribes.

Biological Objectives

- Maintain and improve upon the current distribution of fish and aquatic species, and halt declining population trends within 5-10 years.
- Establish increasing trends in naturally-sustained fish populations in each subregion accessible to the fish and for each ecologically significant unit (ESU) within 25 years.
- Restore distribution of fish and other aquatic species within their native range within 25 years (where feasible).
- Conserve genetic diversity and allow natural patterns of genetic exchange to persist.

Ecological Objectives

- Prevent further degradation of tributary, mainstem and estuary habitat conditions and water quality.
- Protect existing high quality habitats.
- Restore habitats on a priority basis.

Water Quality Objective

In the long term, attain state and tribal water quality standards in all critical habitats in the Columbia River and Snake River Basins.

Socio-Economic Objectives

- Select actions to restore and enhance fish and their habitat that achieve the biological and ecological objectives at the least cost.
- Mitigate for significant social and economic impacts and explore creative alternatives for achieving these objectives.
- Seek adequate funding and implementation for strategies and actions.
- Coordinate restoration efforts to avoid inefficiency and unnecessary costs.
- Restore salmon and steelhead to population levels that will support tribal and non-tribal harvest.
- Select actions that consider or take into account tribal socio-economic or cultural concerns.

Strategies for Habitat:

- Protection: to prevent further degradation of habitat conditions and water quality for all life stages.
- Restoration: to increase the amount of high quality habitat and high water quality for spawning, rearing, and migration.
- Complexity: to restore the complexity and range of habitat conditions for all life stages.

USFS and BLM (PACFISH)

Fish and Fish Habitat Goals

- Restore water quality that provides for stable and productive riparian and aquatic ecosystems.
- Restore stream channel integrity, channel processes, and sediment regimes under which riparian and aquatic ecosystems developed.
- Restore instream flows supporting healthy riparian and aquatic habitats, stable and effectively functioning stream channels, and rerouted flood discharges.
- Restore natural timing and variability of the water table elevation in meadows and wetlands.
- Restore diversity and productivity of native and desired non-native plant communities in riparian zones.
- Restore riparian vegetation through a) providing large woody debris characteristic of natural aquatic and riparian ecosystems, b) providing adequate summer and winter thermal regulation within the riparian and aquatic zones, c) achieving rates of surface erosion, bank erosion, and channel migration characteristic of those under which the communities developed.
- Restore riparian and aquatic habitats necessary to foster the unique genetic fish stocks that evolved within the specific geo-climatic region.
- Restore habitat to support populations of well-distributed native and desire non-native plant, vertebrate, and invertebrate populations that contribute to the viability of riparian-dependent communities.

Fish and Fish Habitat Objectives (Riparian Management Objectives - RMO)

Objective 1. Establish Pool Frequencies dependent on width of wetted stream (Table 22).

Table 22. Pool Frequency goals for various stream widths (number of pools per mile)

Width	10	20	25	50	75	100	125	150	200
# pools	96	56	47	26	23	18	14	12	9

Objective 2. Comply with state water quality standards in all systems (max < 68°F)

Objective 3. Establish large woody debris in all forested systems (> 20 pieces/mi, > 12 in diameter, > 35 ft length).

Objective 4. Ensure > 80% bank stability in non-forested systems

Objective 5. Reduce bank angles (undercuts) in non-forested systems (> 75% of banks with < 90% angle).

Objective 6. Establish appropriate width/depth ratios in all systems (< 10, mean wetted width divided by mean depth).

General Riparian Area Management

Objective 1. Identify and cooperate with federal, tribal, and state and local governments to secure instream flows needed to maintain riparian resources, channel conditions, and aquatic habitat

Objective 2. Fell trees in Riparian Habitat Conservation Areas when they pose a safety risk. Keep felled trees on site when needed to meet woody debris objectives.

Objective 3. Apply herbicides, pesticides, and other toxicants/chemicals in a manner to avoid impacts that are inconsistent with attainment of Riparian Management Objectives (RMOs).

Objective 4. Locate water drafting sites to minimize adverse effects on stream channel stability, sedimentation, and in-stream flows.

Watershed and Habitat Restoration

Objective 1. Design and implement watershed restoration projects in a manner that promotes the long-term ecological integrity of ecosystems, conserves the genetic integrity of native species, and contributes to attainment of RMOs.

Objective 2. Cooperate with federal, state, and tribal agencies, and private landowners to develop watershed-based CRMPs or other cooperative agreements to meet RMOs.

Fisheries and Wildlife Restoration

Objective 1. Design and implement fish and wildlife habitat restoration and enhancement activities in a manner that contributes to attainment of the RMOs.

Objective 2. Design, construct, and operate fish and wildlife interpretive and other use-enhancement facilities in a manner consistent with attainment of RMOs.

Objective 3. Cooperate with federal, state, and tribal wildlife management agencies to identify and eliminate wild ungulate impacts inconsistent with attainment of RMOs.

Objective 4. Cooperate with federal, state, and tribal fish management agencies to identify and eliminate impacts associated with habitat manipulation, fish stocking, fish harvest, and poaching that threaten the continued existence and distribution of native fish stocks inhabiting federal lands

USDA Natural Resources Conservation Service

The following is from the Natural Resources Conservation Service Strategic Plan 2000 – 2005 (USDA Natural Resources Conservation Service 2000)

Goal 1. Enhance natural resource productivity to enable a strong agricultural and natural resource sector.
Objective 1.1. Maintain, restore, and enhance cropland productivity.
Objective 1.2. Maintain, restore, and enhance irrigated land.
Objective 1.3. Maintain, restore, and enhance grazing land productivity.
Objective 1.4. Maintain, restore, and enhance forestland productivity.

Goal 2. Reduce unintended adverse effects of natural resource development and use to ensure a high quality environment.
Objective 2.1. Protect farmland from conversion to non-agricultural uses.
Objective 2.2. Promote sound urban and rural community development.
Objective 2.3. Protect water and air resources from agricultural non-point sources of impairment.
Objective 2.4. Enhance animal feeding operations to protect the environment.
Objective 2.5. Maintain, restore, or enhance wetland ecosystems and fish and wildlife habitat.

Goal 3. Reduce risks from drought and flooding to protect individual and community health and safety.
Objective 3.1. Protect upstream watersheds from flood risks.
Objective 3.2. Protect watersheds from the effects of chronic water shortages and risks from drought.

Goal 4. Deliver high quality services to the public to enable natural resource stewardship.
Objective 4.1. Deliver services fairly and equitably.
Objective 4.2. Strengthen the conservation delivery system.
Objective 4.3. Ensure timely, science-based information and technologies.

Strategies

NRCS will work with the conservation partnership to achieve stated goals and objectives. Detailed lists of strategies pertaining to individual goals and objectives are presented in the Natural Resources Conservation Service Strategic Plan, 2000 – 2005 (USDA Natural Resources Conservation Service 2000).

Tribal Government

Shoshone-Paiute Tribes of the Duck Valley Indian Reservation (Guy Dodson, Personal Communication, October 15, 2001).

Goals:

- Protect, preserve, and perpetuate fish and wildlife species on the Duck Valley Indian Reservation for present and future generations in order to meet tribal members' subsistence, cultural and economic needs.
- Work cooperatively with federal, state, county and private entities throughout the subbasin to enhance, protect and/or restore fish and wildlife habitat.

Objectives:

- Coordinate subbasin-wide land acquisitions, conservation easements and riparian habitat improvements.
    - Strategy 1: Fund and facilitate coordinator position and activities in subbasins where the Shoshone-Paiute Tribes have historical natural resource and cultural interests and rights.
    - Strategy 2: Facilitate development of cooperative funding and implementation of habitat protection and restoration across state and jurisdictional boundaries.
- Determine wildlife species composition, distribution and abundance on Duck Valley Indian Reservation.
    - Strategy 1: Work with USFWS to establish survey/monitoring protocols for candidate, threatened, and endangered species. Where appropriate, request USFWS assistance with field crew training.
    - Strategy 2: Work with IDFG, NDOW, USFWS, BLM and other interested organizations and individuals to develop data collection methods.
    - Strategy 3: Share wildlife information with appropriate agencies (e.g. Nevada's Natural Heritage Program, Idaho Conservation Data Center, Wildlife Federation, Rocky Mountain Elk Foundation, Ducks Unlimited).
    - Strategy 4: Develop long-term monitoring program for Duck Valley Indian Reservation.
    - Strategy 5: Identify Threatened and Endangered species in the Bruneau subbasin and important protection actions necessary for recovery.
- Develop and implement a sage grouse conservation plan on Duck Valley Indian Reservation.
    - Strategy 1: Participate in local sage grouse working groups (Owyhee, Jarbidge and Northeastern Nevada Stewardship Groups) to gather and share information and to identify collaborative opportunities.
    - Strategy 2: Work with IDFG, NDOW, BLM and other biologists to assess sage grouse habitat on Duck Valley Indian Reservation.
    - Strategy 3: Have conservation plan reviewed by USFWS, IDFG, NDOW and BLM.
    - Strategy 4: Secure funding source for sage grouse monitoring program.
- Protect, enhance, and/or acquire wildlife mitigation properties in Middle Snake Province, with emphasis on the Owyhee and Bruneau subbasins.
    - Strategy 1: Work with local landowners to discuss habitat enhancement/protection/acquisition opportunities.
    - Strategy 2: Develop method to evaluate habitat enhancement/protection/acquisition opportunities in the subbasin.
    - Strategy 3: Work collaboratively with interested entities in the subbasins including, but not limited to The Nature Conservancy, IDFG, NDOW, local sage grouse working groups, Owyhee Initiative Workgroup, BLM, USFS, and NRCS.

Strategy 4: Explore opportunities to develop "grass banks" in Owyhee and Bruneau subbasins.

- Explore opportunities to protect wetland areas on the Duck Valley Indian Reservation.
  Strategy 1: Conduct wetland evaluation
  Strategy 2: Establish waterfowl monitoring program
  Strategy 3: Work with IDFG, NDOW, Ducks Unlimited, Nature Conservancy, NRCS and others to explore collaborative opportunities for management/enhancement of wetland complex
- Evaluate feasibility of construction/operation of an artificial production facility on Duck Valley Indian Reservation
  Strategy 1: Secure funding to conduct feasibility study
  Strategy 2: Conserve genetics of high risk populations of redband
  Strategy 3: Determine feasibility of outplanting juvenile redband and bull trout for possible supplementation in areas with high risk populations
  Strategy 4: Continue outplanting and monitoring on Lake Billy Shaw
  Strategy 5: Expand monitoring program to include research on feasibility of redband supplementation
  Strategy 6: Expand outplanting and monitoring on existing reservoirs to include stocking of native fish or other suitable species.

- Protect streams, associated wetlands and riparian areas on Duck Valley Indian Reservation
  Strategy 1: Continue spring protection project
  Strategy 2: Work with Natural Resources Department to revise grazing management plan for Reservation
  Strategy 3: Continue to construct fences to exclude domestic stock from sensitive areas on Reservation
  Strategy 4: Work with NRCS and other appropriate agencies to identify possible cost-share projects
- Work collaboratively with IDFG, NDOW, BLM and USFS to identify data gaps and to develop a research and monitoring plan to fill those gaps
  Strategy 1: Determine potential thermal migration barriers using FLIR or remote sensing technologies
- Determine long-term viability of redband metapopulations in the Owyhee, Bruneau and Middle Snake Area
  Strategy 1: Determine priority risks to isolated redband populations in the South Fork Owyhee River watershed
  Strategy 2: Survey and assess condition of redband populations and habitat in Duck Valley Indian Reservation, lower Blue Creek and the North Fork Owyhee River to develop data sets and assessment resources on par with information in other portions of the subbasin.

Strategy 3: Determine function of Duck Valley Indian Reservation habitat in maintaining connectivity and overall population viability in the upper Owyhee subbasin

Strategy 4: Develop integrated databases and GIS resources that combine data collected in different states and jurisdictions to develop understanding of population and habitat dynamics across the Owyhee and Bruneau subbasins

- Restore anadromous fish to the Owyhee and Bruneau subbasins

  Strategy 1: Conduct feasibility study on passage for anadromous species through Hells Canyon Complex and Owyhee Dam

  Strategy 2: Evaluate various passage options.

  Strategy 3: Conduct habitat studies of potential spawning areas to determine viability of natural reproduction above Owyhee Dam.

State Government

Idaho Department of Fish and Game

Overall Department Goals

GOAL 1. Preserve, protect, perpetuate, and manage Idaho's 500+ fish and wildlife species, as steward of public resources.

Objective 1. Minimize the number of Idaho species identified as threatened or endangered under provisions of the Endangered Species Act of 1973, as amended.

Strategy 1.1.1: Protect, preserve, and perpetuate fish and wildlife resources for their intrinsic and ecological values, as well as their direct benefit to humans.

Strategy 1.1.2: Actively support and participate in efforts to protect or enhance the quality of water in Idaho's lakes, rivers, and streams.

Strategy 1.1.3: Advocate land management practices that protect, restore and enhance fish and wildlife habitat, especially habitats such as wetlands and riparian areas that benefit a wide variety of fish and wildlife species.

Strategy 1.1.4: Be an advocate for wildlife and wildlife users in legislation, land and water use activities, policies, or programs that result in significant and unwarranted loss of fish and wildlife habitat or populations, and encourage project designs that eliminate or minimize such losses.

GOAL 2. Increase opportunities for Idaho citizens and others to participate in fish- and wildlife-associated recreation.

Objective 1. Emphasize recreational opportunities associated with fish and wildlife resources.

Strategy 2.1.1: Support hunting, fishing, and trapping as traditional and legitimate uses of Idaho's fish and wildlife resources.

Strategy 2.1.2: Manage fish and wildlife resources for recreational and other legitimate benefits that can be derived primarily by residents of Idaho.

Strategy 2.1.3: Manage fish and wildlife to provide a variety of consumptive and non-consumptive recreational opportunities as well as scientific and educational uses.

Strategy 2.1.4: Manage wildlife at levels that provide for recreational opportunity but do not result in significant damage to private property.

Resident Fish Management

Objective 1. Coordinate with other agencies on data availability and identify additional data gaps.

Objective 2. Wild native populations of resident will receive priority consideration in management decisions.

Objective 3. By 2005, evaluate the current status of bull trout populations in the subbasin.

Action 1. Summarize trends in bull trout densities for all available general pair monitoring sites with existing data and expand field sample locations as needed to provide sufficient statistical power for effective monitoring.

Action 2. Evaluate bull trout extinction risk (PVA) using existing literature guidelines and EPS estimates.

Objective 4. By 2005, determine the status and distribution of redband trout in the subbasin.

Action 1. Develop strategies to protect, improve and restore degraded habitat.

Native Salmonid Assessment Research (Kevin Meyers, Personal Communication, October 2001)

Goal 1. Protect and rebuild populations of native salmonids in the middle and upper Snake River provinces to self-sustaining, harvestable levels. Associated with this goal are three specific objectives, which are being implemented in phases:

Objective 1. Assess current stock status and population trends of native salmonids and their habitat.

Strategy 1. Coordinate with other ongoing projects and entities to avoid data duplication and to prioritize sampling efforts.

Strategy 2. Use electro-fishing and snorkeling to estimate presence/absence and abundance of salmonids throughout the middle and upper Snake River provinces.

Strategy 3. Identify, describe, and measure stream habitat and landscape-level characteristics at the fish sampling sites.

Strategy 4. Collect genetic samples (fin clips) from native salmonids to determine (using microsatellite DNA markers) the purity of populations and the degree of genetic variability among and within populations.

Strategy 5. Develop models that explain the occurrence and abundance of native salmonids based on measurable characteristics of stream habitat and landscape features. Results will identify populations at risk and in need of recovery strategies, and will guide study design for Objective 2.

Objective 2 Based on results from Objective (or Phase) 1, initiate studies to identify major limiting factors and life history and habitat needs for native salmonid populations throughout the middle and upper Snake River provinces, especially for populations most at risk of extirpation.

Objective 3 Develop and implement recovery and protection plans based on results from Objectives (or Phases) 1 and 2.

Idaho Conservation Data Center (CDC).

The CDC works with federal, state, and private agencies and organizations to maintain high quality information on the conservation of biological diversity. CDC staff contribute to conservation planning efforts within the subbasin through dissemination and synthesis of information on the distribution and abundance of species populations and habitats. Availability of high quality information on biological diversity allows proactive conservation planning and reduces administrative delays related to fulfillment of regulatory procedural requirements.

Goal 1. Maintain biodiversity information within the Idaho portion of the subbasin.

Objective 1. Maintain high quality, accurate, and timely information on the occurrence of rare, threatened, and endangered plant and animal species.

Strategy 1. Conduct appropriate population inventory monitoring work for priority species.

Strategy 2. Maintain and develop sufficient funding to provide adequate facilities and staffing for the acquisition, maintenance, and dissemination of information on species populations.

Objective 2. Maintain high quality, accurate, and timely information on the distribution, abundance, and ecological status of plant and animal habitats, representative ecological reference areas, and plant communities.

Strategy 1. Conduct appropriate inventories of, and monitor, priority plant and animal habitats and plant communities.

Action 1. Inventory and map the current and potential distribution of ponderosa pine-dominated plant communities within the subbasin. Inventory, map, and gather population data for ponderosa pine associated wildlife and plant species.

Action 2. Inventory and map the distribution of canyon grasslands within the subbasin.

Action 3. Inventory and map the distribution of whitebark pine communities within the subbasin.

Action 4. Investigate fire disturbance and stand dynamic processes in whitebark pine-dominated forest and woodlands of the subbasin.

Strategy 2. Serve as an information repository for ecological data regarding the distribution, composition, and structure of vegetation within the subbasin.

Action 1. Acquire existing data sets where possible and compile meta-data information according to national standards.

Strategy 3. Develop and disseminate descriptive information on high quality reference stand structure, composition, and ecological functions.

Strategy 4. Maintain and develop sufficient funding to provide adequate facilities and staffing for the acquisition, maintenance, and dissemination of information on plant and animal habitats, representative ecological reference areas, and plant communities.

Goal 2: Assist with conservation actions within the subbasin.

Objective 1. Assist with species and ecosystem conservation management actions within the subbasin.

Strategy 1. Provide recommendations for conservation site selection and management. Protect high quality; representative stands of priority plant associations and habitats.

Action 1. Inventory and prepare conservation plans for high quality, representative stands of canyon grasslands within the subbasin.

Action 2. Inventory and prepare conservation plan for high quality, representative stands of sagebrush steppe within the subbasin.

Action 3. Acquire lands when opportunities arise for improved habitat protection, restoration, and connectivity for priority plant communities and for mitigation of lost wildlife habitat (land purchases, land trusts, conservation easements, landowner cooperative agreements, exchanges).

Strategy 2. Provide recommendations for the establishment and management of ecological reference areas.

Action 1. Monitor use of existing reference areas to assure consistency with the maintenance of ecologic values.

Action 2. Identify candidate sites for the establishment of ecological reference areas based on current needs assessments. Periodically update ecological reference area needs assessments.

Action 3. Establish and maintain permanent baseline monitoring systems for priority ecosystems and species.

Strategy 3. Provide recommendations for species conservation and management. Prepare and update species conservation management plans.

Idaho Soil and Water Conservation Districts

The following descriptions of existing goals, objectives, and strategies are not separated into fish and wildlife conservation/restoration categories. Each action agency described

conducts work on watershed scales, emphasizes natural resource conservation, fish and wildlife protection, habitat improvement, and has Clean Water Act priorities. These groups serve, although not exclusively, private land ownership in state of Idaho. Standards and specifications for agricultural Best Management Practices (BMPs) to reduce non-point pollution and conserve soil and water derive from the U.S. Natural Resources Conservation Service Field Office Technical Guide. Other standards and specifications derive from partnership agencies with relative expertise in the project. The following sections do not represent entire documents but have been paraphrased, except where noted, for use in this review.

(Idaho SWCD Annual Work Plan/Five Year Resource Conservation Plan, 2001)

Goals

- Encourage and promote BMPs to reduce soil erosion, and enhance water quality
- Improve water quality on §303(d) listed streams
- Improve fish and wildlife habitat

Objectives

- Enhance education and information program
- Coordinate with NRCS and other state and federal agencies engaged in conservation

Strategies

- Encourage and provide assistance for conservation planning on private lands
- Encourage and provide assistance for riparian and upland BMP implementation
- Design and implement road treatments in cooperation with Idaho County Road Department
- Design and implement animal waste treatment plans, riparian and crop management plans, and septic system plans through the CWA Section 319 program and Div II-wide WQPA project.

County Government

Owyhee County Commissioners – Owyhee Initiative

Goal:

To develop and implement a landscape-scale program in Owyhee County that preserves the natural process that create and maintain a functioning, unfragmented landscape supporting and sustaining a flourishing community of human, plant and animal life, that provides for economic stability by preserving livestock grazing as an economically viable use, and that provides for the protection of cultural resources.

Objectives:

- Implement a landscape-based research, management and restorative program that identifies current state of scientific knowledge of the area, identifies information gaps and needed research, identifies and builds on successful management

strategies and research and restoration projects, and identifies management strategies designed to achieve the objectives.
- Develop and implement "grass banking" in Owyhee County in order to advance research and restoration
- Establish a National Sage Grouse Research and Restoration Area
- Evaluate and consider a series of voluntary land exchanges that benefit the resource, the landowners, management of federal lands and the further interests of the county
- Create incentives for conservation
- Authorize and fund implementation of sagebrush-steppe restoration programs at sites identified by science advisory committee as providing opportunity for high probability of success.
- Resolve status of Wilderness Study Areas and management issues associated with WSA-related management restrictions.

Owyhee County Sage Grouse Working Group

Goal:

- Preserve and increase sage grouse populations in Owyhee County

Objectives:

- Map locations of all known active and historic sage grouse leks in Owyhee County by the end of 2001.
- Identify and map sage grouse breeding (nesting and early brood) habitat associated with active leks by the end of 2004.
- Identify and map known sage grouse wintering habitat by the end of 2001.
- Perform a qualitative assessment of sage grouse breeding (nesting and early brood) habitat associated with active leks.
- Map undesirable disturbance and habitat.
- Develop maps that identify sage grouse habitat for high priority protection from wildfire
- Develop allotment specific grazing management plans
- Reseed sites that have been burned.
- Implement sagebrush restoration projects in historic sage grouse habitat.
- Identify existing and potential loss of sage grouse habitat due to juniper encroachment. Prioritize sites and perform juniper control activities.
- Using radio-telemetry tracking of sage grouse, determine the effect of predation on sage grouse.
- Perform artificial nest studies in selected parts of Owyhee County to compare artificial nest fate in different types of habitats.
- Use interviews with local landowners, hunters, and others to gather data on predators.
- Review data collected during 1999 and 2000 and, if necessary, recommend more restrictive hunting seasons.

- Support legislation to allow IDFG Habitat Improvement Program funds to be used for sage grouse habitat improvement.
- Recommend that the IDFG require a free permit to hunt sage grouse to allow better monitoring of sage grouse hunters and their harvest.
- Offer all sage grouse permit holder's mail-in envelopes for sage grouse wings. Include a letter explaining the need for the information obtained from wings.
- Maintain needed check stations and wing barrels.
- Use a telephone survey of permit holders to estimate sage grouse harvest in each county.
- Band sage grouse in selected areas to help estimate harvest rates in those areas.
- Provide a reliable estimate of the distribution and populations of sage grouse in Owyhee County by 2004.
- Coordinate efforts by IDFG, BLM, USAF and others to systematically survey and/or otherwise identify through landowner surveys all active leks and historic leks in the county by the end of the 2004 breeding season.
- Determine which sage grouse populations are non-migratory and migratory.
- Initiate radio-telemetry studies to determine causes of sage grouse chick mortality by 2002.
- Investigate the impact of different weather on variation in sage grouse numbers
- In Owyhee County.
- Encourage research on the impact of human disturbance of sage grouse.

Other Goals, Objectives and Strategies

Eastern Nevada Stewardship Group, Inc. (Northeast Nevada 2001)
Sage grouse recovery in Elko County

Goal:
To manage watersheds, basins, or subbasins in a manner that restores or enhances (as appropriate) the ecological processes necessary to maintain proper function ecosystems inclusive of sage grouse.

Subgoals:
- Improve juvenile recruitment
- Restore sage grouse habitat on areas currently occupied by annual grasslands and pinyon-juniper encroachment.
- Improve the macro diversity of habitats and the diversity of plants and wildlife
- Increase numbers or distribution of special status species where appropriate
- Improve forage quality and quantity for livestock in the basin

Objectives:
- Rehabilitate annual grasslands to perennial plant communities capable of supporting diverse land uses
- Create a mosaic of vegetation age classes on the landscape

- Restore sagebrush-herb community on range sites currently occupied by pinyon-juniper encroached woodlands
- Improve water quality and quantity within managed basin
- Manage uplands and riparian vegetation to improve systems at risk and nonfunctioning systems to proper functioning condition

(This plan continues with specific guidance to the types of restoration techniques that should be applied to meet the stated goals and objectives).

Jarbidge Sage Grouse Working Group (BLM, IDFG, local ranchers, sportsmen, environmental groups (Goals (from Rough draft 2001)

Goals:

- Maintain huntable and sustainable sage grouse populations
- Sustain, maintain or improve sage grouse habitat in the various sub-units of the Jarbidge Resource Area
- Maintain or improve livestock operations
- Encourage cooperation between land owners (private, state and federal)
- Work would be initiated on private land only with the land owners cooperation and permission
- Inform and educate landowners and the general public on sage grouse issues as they relate to various uses on the land

Objectives (summarized from detailed plans):

- Prevent fire in critical Wyoming big sagebrush, low sagebrush and mountain sagebrush communities and related cheatgrass and exotic annual grass infestations
- Rehabilitate areas following wild fire with native seeds before weed infestation occurs
- Control weed infestation into sage grouse habitat
- Develop active weed control programs
- Restore and enhance upland meadows with stock ponds and fenced (wildlife access only) watering troughs.
- Restore meadows impacted by head cuts.
- Control rabbitbrush where it has gained dominance through repeated disturbances
- Control predators through creating larger habitat blocks
- Close hunting in areas with depleted sage grouse populations
- Reduce impacts of grazing during April and May in sage grouse nesting habitat
- Restrict and better manage off highway vehicles

Mainstem Jarbidge River Management (McNeill et al. 1997).

- Proposed activities in source areas (highly erosive areas) in the Jarbidge should trigger extensive analysis
- Each bridge in upper watershed should be evaluated for effects on hydrologic regime and aquatic habitats

- All options should be explored for relocating developed facilities outside the meander belt width of the river
- USFS should explore long term options for relocating portions of Jarbidge Canyon Road out of riparian habitat conservation areas
- A road maintenance plan should be designed to reduce impacts to the Jarbidge River
- A comprehensive recreation plan should be developed that is responsive to projected increases in recreation pressure
- Retention of large wood and timber should be emphasized throughout the Riparian Habitat Conservation Area
- An intensive survey of the Jarbidge should be conduction for hazardous materials and conditions. Cleanup should be pursued where needed.
- Actions to restore existing Jarbidge dump site should be evaluated
- INFISH Riparian Management Objective for width/depth ratio should be modified to 30 feet or less
- An interagency public information program focused on natural stream dynamics specific to the Jarbidge should be initiated
- An interagency limiting factor analysis for bull trout using R4 basin survey protocol should be used as foundation of analysis in the Jarbidge
- Temperature devices should be installed to characterized long-term temperature profiles
- Long-term opportunities for a 3rd order soil survey should be explored
- A better streamside riparian vegetation database should be developed

Shoshone-Paiute Tribes Sage Grouse Working Group

Goal:

- To maintain a sustainable sage grouse population on the Duck Valley Indian Reservation, promote healthy ecosystems and preserve traditional and cultural appreciation of the species.

(The working group is made up of tribal members, Wildlife and Parks Department biologists and Tribal Business Council members. A conservation plan has not yet been drafted)

Southwest Basin Native Fish Technical Group (from Parrish 1998)

Bull trout in the Jarbidge River system

- "To recover spawning and juvenile rearing habitat and populations, state agencies should continue participation in the Jarbidge River Bull Trout workgroup formed to seek funding for the Jacks Creek bridge in Nevada. The group is comprised of private landowners, interested public, federal agencies and state agencies."
- "Local and state agencies need to identify ways to reduce road impacts and explore ways to move the road from the flood plain. Agencies, the local highway district, and residents need to develop a transportation plan for moving hazardous materials within the drainage."

- "Replace and increase number of fishing regulations and bull trout identification signing."
- "Continue enforcement efforts during the fall, winter and spring periods to reduce illegal harvest of bull trout."
- "Continue to work with the Bureau of Land Management and permitees to develop water gaps and off-stream livestock watering facilities."
- "Continue to work with the Bureau of Land Management and permittees to install riparian fencing to facilitate management of livestock in riparian areas."

The Nature Conservancy (Will Whelan, Personal Communication, October 15, 2001)

Goals:

- Shrub Steppe Habitat: Identify and protect the existing high quality shrub steppe habitat (late seral condition areas), while moving the fair quality shrub steppe (mid seral areas) into late seral conditions.
- Redband and Bull Trout: Protect and maintain population strongholds of redband trout by focusing on the protection and enhancement of riparian habitat within the stronghold population's watershed.
- Springs, Spring Creek Systems, and Wetlands: Maintain or improve the ecological conditions of all springs, spring creek systems, and wetlands so as to be rated in Proper Functioning Condition.
- Intermittent Streams and Rivers: Maintain the high quality and diversity of the riparian communities within and along intermittent streams and rivers and prevent the degradation of these systems.
- California Bighorn Sheep: Protect and maintain California bighorn sheep populations and their habitats.

Strategies:

- Develop community supported plans for conservation of key ecological values that also take into account economic and cultural values.
- Direct resources to highest priority projects within the subbasin as identified using a science-driven ecoregional planning process.
- Establish forage reserves on private lands to help ranchers alter their grazing patterns to meet ecological objectives.
- Emphasize protection of existing high quality habitats for a wide range of species and maintain existing areas of undisturbed shrub steppe habitat.
- Establish and provide enhanced funding for locally developed cooperative weed management programs that bring together private landowners, local, state, and federal agencies, and other interested parties. Plans will be developed that utilize best-integrated weed management practices to control and prevent weed infestations.
- Manage fire to achieve ecological objectives using adaptive management principles.

- Work with willing landowners and land managers to protect priority conservation lands through acquisitions, conservation easements, land exchanges, and management agreements.
- Support the use of best management practices for grazing to protect sensitive habitats.
- Work with stakeholders to implement a travel plan that adequately addresses potential impacts from construction or development of new roads and off-road vehicles on key conservation targets.
- Fund research and monitoring to address key uncertainties regarding management and protection of sage grouse.
- Conduct monitoring and evaluation to measure success of projects.

Research, Monitoring, and Evaluation Activities

Research, monitoring, and evaluation activities within the Bruneau subbasin that compliment fish and wildlife projects are provided in Table 23 and Table 24. More extensive descriptions of ongoing projects were included if available due to the paucity of information on projects.

Snake River Native Salmonid Assessment (Project No. 980002) (Kevin Meyer, Personal Communication, August 28, 2001)

This is an ongoing research project initiated in August 1998 to assess the status of native salmonids in the Middle and Upper Snake Provinces in Idaho (Phase I), identify factors limiting populations of native salmonids (Phase II), and develop and implement recovery strategies and plans (Phase III). The inventory phase is being used to assess presence/absence and abundance of native salmonids in all major watersheds of the Middle and Upper Snake Provinces, and concurrent habitat measurements are being used to preliminarily examine factors that influence this presence/absence and abundance. Genetic samples are being collected to assess the purity of populations and the degree of genetic variability among and within populations of native salmonids. Based on these findings, major limiting factors will be investigated during the second phase of the project. Recovery strategies for individual or groups of subbasins will be developed to address the factors most important in limiting the patterns of distribution and abundance of native salmonids.

To-date, no sampling has occurred in the Bruneau subbasin. However, in the first 3+ years of the project, fish and habitat surveys have been made at a total of 757 sites on private and public lands across southern Idaho in nearly all other major watersheds, including the Weiser, Owyhee, Payette, Boise, Goose, Raft, Rock, Bannock, Portneuf, Blackfoot, Willow, South Fork Snake, and Teton. Genetic samples of redband trout and Yellowstone cutthroat trout have been collected at a total of 155 sites, and results are available for 15 sites. Water temperature has been measured and/or obtained from other agencies at 97 stream sites across the Middle and Upper Snake River Provinces. A comprehensive database has been developed that includes data on native salmonid abundance and distribution, genetic samples, habitat summaries, and herpetofauna

observations. This project is also currently evaluating the effectiveness of electro-fishing to remove non-native brook trout as a means of reducing threats to native salmonids; after three years of removal in a Boise River tributary, the brook trout population has not been reduced (Meyer 2000; Meyer and Lamansky 2001, in progress). Other removal techniques (e.g., Young 2001) may be evaluated in subsequent years in an attempt to find a more viable method of removing non-native salmonids where the long-term persistence of native salmonids is being threatened by the presence of exotic species.

Because the inventory phase is ongoing and not completed for any one species (Yellowstone cutthroat trout will be completed in 2002), analysis to date has been preliminary and cursory (Meyer 2000; Meyer and Lamansky 2001). However, in a study of Yellowstone cutthroat trout densities across the upper Snake River province, densities remained unchanged and fish size structure improved over the last 20 years, suggesting that at least at some locations in the middle and upper Snake River provinces, native salmonid populations may be relatively stable (Meyer et al. in review). Maturity of Yellowstone cutthroat trout has been determined for a number of locations across southeast Idaho to assess effective population size for extinction risk analysis in Idaho.

Table 23. BPA-funded Columbia River Basin Fish and Wildlife Program research, monitoring, and evaluation activities

Ongoing Monitoring and Evaluation Projects	BPA #	Sponsor	Duration
Snake River Native Salmonid Assessment (since 1998)	9800200	IDFG	2015

Table 24. Non BPA-funded Columbia River Basin Fish and Wildlife Program research, monitoring, and evaluation activities

Project	**Funding/Lead Agency**	**Status**
Bruneau Hot Springsnail Cooperative Monitoring project	BLM and ISU	Ongoing since 1993
Rangewide surveys for all geothermal springs	USFWS and ISU	Ongoing (every 2-3 years) since 1993
Groundwater, spring discharge and annual well withdrawals monitoring	USFWS and USGS	Ongoing since 1993 (excluding 1997)
Bruneau Hot Spring Snail habitat monitoring project	USFWS and ISU	Ongoing since 1999
Spotted frog surveys	USFWS, IDFG, BSU	Ongoing
Sage grouse life history study	IDFG and UI	Data collected in 2000/2001, awaiting analysis
Sage grouse habitat fragmentation study	IDFG and UI	Ongoing

Statement of Fish and Wildlife Needs

Combined Aquatic and Terrestrial Needs

1. Acquire lands when opportunities arise for improved habitat protection, restoration, and connectivity and for mitigation of lost fish and wildlife habitat (land purchases, land trusts, conservation easements, landowner cooperative agreements, exchanges).
2. Protect existing pristine and key fish and wildlife habitats directly threatened by subdivision, recreation, or extractive resource uses.
3. Develop and implement BMPs on agricultural, mining, grazing, logging and development activities to protect, enhance, and/or restore fish and wildlife habitat, streambank stability, watershed hydrology, and floodplain function.
4. Synthesize historic and existing fish and wildlife resource data to determine what is known about the subbasin, and identify gaps for more efficient and meaningful assessment, monitoring and evaluation work.
5. Develop and implement comprehensive and consistent subbasin databases related to both aquatic and terrestrial resources and establish a centralized data repository. This will promote more effective resource management.
6. Coordinate M&E efforts at the subbasin and provincial scale to maximize effectiveness and minimize redundancy.
7. Continue ongoing, and establish new, monitoring and evaluation programs for fish supplementation, habitat restoration and improvement, habitat baseline conditions, water quality and water quantity improvements, conditions and trends. These M&E activities are critical to evaluating the effectiveness of projects in improving habitat, watershed health and enhancing production of target species.
8. Investigate effects of the l loss/lack of nutrients due to extirpation of anadromous fish populations from the subbasin, and coordinate and evaluate nutrient enhancement alternatives.
9. Continue and enhance the cooperative/shared approach in research, monitoring and evaluation between tribal, federal, state, local and private entities to facilitate restoration and enhancement measures. Protection and restoration of fish and wildlife populations and habitat will not be successful without the interest and commitment by all.
10. Continue to develop watershed assessments at multiple scales to facilitate integrated resource management and planning efforts.
11. Develop Federal Recovery Plans for threatened and endangered species to provide recovery guidance for state, tribal and local entities as required by law.

Fisheries / Aquatic Needs

1. Continue ongoing mitigation programs to provide sport and tribal fisheries.
2. Ensure natural river strategy alternative is implemented as required for recovery of listed anadromous species.
3. Continue to inventory native salmonids in the Middle Snake Province to determine current status and major factors limiting their distribution and abundance, and based on these findings, develop and implement plans and strategies for recovery where populations are at risk of extirpation.

4. Continue coordinated collection of water temperature data throughout the Middle Snake Province .

Water Quality

1. Continue coordinated temperature monitoring throughout the subbasin. Identify spatial and temporal gaps, establish additional flow and temperature gauging stations and upgrade existing ones to provide real-time data, and expand longitudinal profiles. Fish distribution and habitat quality are highly influenced by water temperature. This parameter must be monitored in both wilderness and managed watersheds to provide baselines to evaluate population recovery and watershed restoration activities.
2. Reduce stream temperature, sediment and embeddedness to levels meeting appropriate standards for supporting self-sustaining populations of aquatic species. This is the core of the objectives of the TMDL process.
3. Restore and augment streamflows at critical times using (but not limited to) water right leases, transfers, or purchases, and improved irrigation efficiency.
4. Reduce impacts from agricultural sediment, fertilizer, pesticide loading, confined animal operations, stormwater and road runoff and wastewater effluent.
5. Study diel pattern of dissolved oxygen, temperature and pH to evaluate the effects of nighttime oxygen sags due to aquatic plants in the Bruneau River and Jacks Creek.
6. Implement continuous temperature recordings and hot spring discharge measurements to better document and evaluate cold water biota as beneficial use in some streams
7. Investigate fisheries to determine if salmonid fishes spawn or use the riverine environments of the Bruneau River below Hot Creek.
8. Monitor TSS, TP and E. coli on bi-weekly basis for a full year to establish a competent baseline.
9. Study Chlorophyll in all segments to determine nuisance aquatic vegetation levels.
10. Conduct aquatic macrophyte surveys in all segments to determine levels of nuisance aquatic vegetation.

Habitat / Passage

1. Protect and restore riparian and instream habitat structure, form and function to provide suitable holding, spawning and rearing areas for resident fish.
2. Protect, restore and create riparian, wetland, and floodplain areas within the subbasin and establish connectivity.
3. Investigate connectivity between populations and the role of natural and artificial barriers in population isolation.
4. Develop an approach for determining the ecological potential of stream/riparian habitats and methods for assessing the existing condition of these resources relative to that potential, (recognizing that streams with different geology and geomorphology are inherently different).
5. Develop criteria for setting livestock management standards for streams and associated riparian habitats. This might entail identifying maximum use standards for specific types of streams. It might also entail identifying stream types that should not be grazed.

Aquatic Habitat Enhancement

1. Replace or remove culverts based on past or ongoing assessments.
2. Restore, protect, and create riparian, wetland and floodplain areas within the subbasin
3. Restore in-stream habitat to conditions that provide suitable holding, spawning, and rearing areas for anadromous and resident fish
4. Reduce stream temperature, sediment and embeddedness levels to levels meeting appropriate state standards
5. Restore and augment streamflows at critical times using (but not limited to) water right leases, transfers, or purchases, and improved irrigation efficiency
6. Reduce stream temperatures where appropriate and when feasible
7. Reduce sediment, fertilizer and pesticide loading from agricultural practices
8. Reduce the impacts of confined animals with regard to waste and sediment production
9. Address streambank instability issues where they are defined or can be shown to be a potential problem

Bull Trout

1. Collect life history, distribution, and homing behavior information of bull trout within the subbasin, and relevant core areas.
2. Evaluate connectivity and the degree of interchange between populations throughout the subbasin.
3. Monitor core populations to establish trends and measure population response to restoration.
4. Continue presence/absence surveys to locate bull trout populations.
5. Determine survival rates of different life stages and assess productivity.
6. Research the affects of U.S. Air force training missions on the productivity, behavior and survival of bull trout in the subbasin.

Redband Trout

1. Use genetic markers to detect and quantify levels of hatchery produced *O. mykiss* introgression within native redband trout populations and to delineate genetic population structure of redband trout throughout their historic range. This fundamental genetic information regarding introgressive hybridization and genetic population structure is needed to identify remaining pure populations, preserve existing genetic variability, and identify population segments for the development of management plans and the designation of conservation units/management units.
2. Compare rates of hybridization and introgression between hatchery-produced *O. mykiss* and native populations of redband trout. A greater understanding of the phenomenon of hybridization and introgression observed within *Oncorynchus* populations throughout the Middle and Upper Snake Provinces should allow a better assessment of the impacts of past hatchery produced *O. mykiss* introductions and allow a better evaluation of the possible future genetic risks native redband populations face with regards to hybridization and introgression.

Bruneau Hot Springsnail

1. Stabilize sediment sources upstream of habitat areas in Hot Creek, i.e. continued prevention of grazing in high risk areas within the watershed.
2. Implement immediate measures to rehabilitate Indian Bathtub-Hot Creek Area and restore habitat conditions to at least those found prior to July 1992.
3. Reduce intensity of groundwater mining on surrounding agricultural lands to restore reliable flows in perpetuity and provide greater chance for natural recolonization.
4. Permanently protect geothermal spring discharges in the recovery area.
5. Implement groundwater monitoring program to assess increases or decreases in the geothermal aquifer
6. Monitor survival and recover of the springsnail and its habitat
7. Develop and implement a control program for non-native fish that prey on the Bruneau hot springsnail within the recovery area.
8. Develop a groundwater recharge model to assist in determining levels of pumping that do not cause a continued decline of the geothermal aquifer.

Monitoring, Evaluation and Assessment

1. Continue to develop and update watershed assessments at multiple scales (i.e. transect, reach, watershed) to facilitate integrated resource management and planning efforts. Ensure that databases used for the development of assessments are sufficiently maintained and available to relevant entities.
2. Establish a centralized data repository.
3. Develop Federal Recovery Plans for threatened and endangered species to provide recovery guidance for state, tribal and local entities.

Enforcement / Education

1. Educate the public on issues and policies important to natural resource restoration, protection, and enhancement to encourage meaningful public participation.
2. Continue and improve enforcement of laws and codes related to protection of fish, wildlife and their habitats, through coordinated conservation enforcement activities, including increased efforts for in and out-of-season poaching and in road closure areas.
3. Continue compliance and effectiveness monitoring on federal and private land use activities (i.e. mining, grazing). Continue or implement enforcement of controls to ensure the protection of aquatic and terrestrial resources.

Wildlife / Terrestrial Needs

General

1. Fund the establishment of techniques, surveys, and programs to assess the health and trend of wildlife, wildlife habitat, and overall biodiversity in the subbasin. Existing surveys and information are inadequate, making it difficult to protect species or to evaluate progress toward goals stated in this summary.
2. Address and mitigate hydropower impacts on loss of wildlife and wildlife habitat within the subbasin, based on species-specific habitat units.
3. Continue long-term land bird monitoring.

4. Cooperate on threatened, endangered, and sensitive species recovery or conservation strategy efforts in the subbasin.
5. Acquire lands when opportunities arise for improved habitat protection, restoration, and connectivity and for mitigation of lost wildlife habitat (land purchases, land trusts, conservation easements, landowner cooperative agreements, exchanges).
6. Implement and (where applicable) continue noxious weed control programs.
7. Assist landowners with land holdings through easements or other means for restoration and enhancement of wildlife habitat.
8. Monitor use of existing reference areas to assure consistency with the maintenance of ecologic values.
9. Identify candidate sites for the establishment of ecological reference areas based on current needs assessments. Periodically update ecological reference area needs assessments.
10. Establish and maintain permanent baseline monitoring systems for priority ecosystems and species.
11. Conduct inventory of sensitive and rare plants in Bruneau River Canyon and Duck Valley Indian Reservation.
12. Conduct comprehensive survey of herptiles in the subbasin.
13. Collect life history, habitat use, distribution and movement information on bat species in subbasin.
14. Conduct comprehensive survey of avian species across the subbasin.
15. Conduct radio telemetry study of mule deer to determine movement patterns, habitat use, and competitive interactions with elk.
16. Conduct research on pronghorn populations in subbasin to collect life history information, movement data and assess herd productivity.

Classified Wetlands

1. Continue wetland inventory in watersheds throughout the subbasin.
2. Acquire lands when opportunities arise for improved habitat protection, restoration, and connectivity for classified wetlands and for mitigation of lost wildlife habitat for classified wetland associated species (land purchases, land trusts, conservation easements, landowner cooperative agreements, exchanges).
3. Protect, restore and create wetland and riparian habitat particularly springs and seeps.
4. Participate in a cooperative stewardship program to foster classified wetland community protection.

Noxious weeds

1. Monitor the spread of and evaluate the effectiveness of noxious weed control programs.
2. Continue control programs for noxious weeds to restore natural habitat conditions and communities for wildlife species.
3. Develop an information and education stewardship program for noxious weeds.
4. Conduct surveys throughout subbasin, on both private and public lands, to identify problem areas.

Bighorn Sheep

1. Manage areas identified by Taylor et al. (1998) as suitable habitat for bighorn sheep.
2. Monitor bighorn sheep populations throughout subbasin.
3. Develop a conservation strategy for bighorn sheep in the Bruneau subbasin.
4. Collect life history, genetic, distribution, and movement information on bighorn sheep in subbasin.
5. Identify opportunities to transplant bighorn sheep into or out of subbasin in an effort to provide for genetic interchange.

Sage Grouse

1. Expand on present research being conducted on sage grouse in the subbasin. Collect several more years' data on life history of species to establish trend for subbasin.
2. Conduct research on Duck Valley Indian Reservation population of sage grouse to gain understanding of the viability of population and to assist in management of the population.
3. Identify key seasonal habitat areas across subbasin and restore/enhance these areas on a priority basis.
4. Continue lek inventories throughout subbasin utilizing ground and aerial surveys. Research the relationship between riparian area condition and sage grouse productivity.
5. Collect sage grouse harvest data
    - Collect more information on vegetation communities and conditions
    - Map existing vegetation communities in GIS (this is being done on the Jarbidge resource area)
    - Evaluate crested wheatgrass seedings as sage grouse habitat
    - Evaluate which species of forbs can be planted within seedings that will maintain themselves and meet sage grouse needs
    - Research the role of alternative prey abundance on sage grouse predation
    - Research impact of spring grazing on sage grouse
    - Research improvements to seed planting technology

6. Develop seed bank of native forbs, grass and shrub species for restoration/reseeding of sagebrush-steppe habitat

Bruneau Subbasin Recommendations

Projects and Budgets

The following subbasin proposals were reviewed by the Middle Snake Provincial Working Group and Columbia Basin Fish and Wildlife Authority during April 2002 and are recommended for Bonneville Power Administration project funding for the FY2003-FY2005 funding cycle.

Table 1 provides a summary of how each project relates to resource needs, management goals, objectives, strategies and other activities in the subbasin.

Continuation of Ongoing Projects

Project: – 200007900 – Assess Resident Fish Stocks of the Owyhee/Bruneau Subbasins, DVIR

Sponsor: Shoshone-Paiute Tribes of the Duck Valley Indian Reservation (SPT)

Short Description:

Conduct a systematic resident fish species inventory and stock assessment in the Owyhee/Bruneau Subbasins, DVIR component. Use established protocols to evaluate the genetic composition/introgression of native trout populations on the DVIR.

Abbreviated Abstract

This is an ongoing project to determine level of hatchery introgression on native redband and genetic purity of bull trout. We are proposing a continuation of this project to assure an accurate and scientifically valid survey of all occupied habitats on the Duck Valley Indian Reservation. Work in 2001/2002 was limited to the East Fork Owyhee River drainage. The watersheds that will be inclusive of this proposal are the Three Forks and Mary's Creek (Bruneau River Drainage) areas as well as other streams in the East Fork drainage, South Fork drainage, and the Blue Creek drainages. The Bruneau drainage originates on the DVIR and is a historic area for ESA listed Bull Trout. Bull trout were observed in early 1998 during presence/absence snorkel surveys in the Mary's Creek drainage.

As part of a larger project to mitigate for societal and tribal losses associated with the extirpation of anadromous and decline of resident fish resources within the Columbia River basin, the Shoshone-Paiute Tribes are interested in identifying the distribution, species richness, density, relative abundance, and genetic structuring of fish populations in all portions of the Duck Valley Indian Reservation. This research project will provide baseline information on genetic variation within and among populations of native salmonids within the Owyhee and Bruneau River drainage. Also, all native and non-native species will be identified and quantified for further use as a management tool in the basin. Data collected from this research will assist our tribal biologists and managers in

determining direction for restoration and enhancement efforts. The usefulness of information gained from this work will be the identification of genetically pure populations from which interior redband trout and bull trout are located so protective measures and enhancement efforts will assure the existence and viability of these populations. The Tribes wishes are to locate these populations to promulgate these species for out-planting to historic areas and to our reservoirs.

Relationship to Other Projects

Project #	Title/Description	Nature of Relationship
199800200	Snake River Native Salmonid Assessment	Data share & coordination of monitoring activities
199701100	Enhance and Protect Habitat and Riparian Areas on the Duck Valley Indian Reservation	Habitat enhancement is a critical need for protection of fish and wildlife in the Owyhee and Bruneau Subbasins. Priority work will be given to streams with native trout species.
199501500	Lake Billy Shaw Fishery O&M	The Tribes wish to put native trout in Lake Billy Shaw, pending results of project 20007900

Relationship to Existing Goals, Objectives and Strategies

This project will address NWPPC measures 10.8C.2, 10.8C.3, and part of 10.8C.5 of the 1995 Amendments to the Council's Fish and Wildlife Program.

10.8C.2 Review Duck Valley Indian Reservation surface water and groundwater suitability for resident fish production facilities. Initiate a comprehensive genetic sampling of the redband trout in Owyhee Basin. Based on results of these studies, develop and implement strategies to protect wild redband trout populations from potential impacts caused by hatchery programs.

10.8C.3 Evaluate alternative sources of catchable and fingerling resident fish.

10.8C.5 Implement, monitor and evaluate resident fish habitat improvement and protection measures at the Duck Valley Indian Reservation. Include the following habitat protection and improvement measures: (1) management recommendations for reservoir pool levels; (2) reservoir rehabilitation measures for non-game fish and aquatic vegetation control; (3) reservoir inlet and outlet screening; (4) improvement of recreational fishing sites; (5) stream riparian zone restoration by planting vegetation, fencing overgrazed areas, and stream bank stabilization; and (6) baseline water quality survey to assess contaminants that may affect trout populations.

The work proposed identified in the statement of fish and wildlife needs in the Bruneau and subbasin summaries is as follows:

- Continue to inventory native salmonids to determine current status and major factors limiting their distribution and abundance and, based on these findings, develop and implement plans and strategies for recovery where populations are at risk of extirpation.
- Use genetic markers to detect and quantify levels of hatchery produced *O. mykiss* introgression within native redband trout populations and to delineate genetic population structure of redband throughout their historic range.
- Compare rates of hybridization and introgression between hatchery produced *O. mykiss* and native populations of redband trout.
- Survey habitat in the DVIR, the upper North Fork Owyhee, South Fork Owyhee and in Oregon to determine status of redband and mountain whitefish populations in areas that are currently data gaps.
- Determine degree of isolation and connectivity between salmonid populations and identify and implement strategies for increasing connectivity.
- Investigate feasibility and implement, if possible, genetic preservation actions for South Fork Owyhee populations of redband trout and other populations identified in risk of local extirpation.

Model historic redband population to determine ranges of variability in abundance and distribution with the subbasin.

Review Comments

CBFWA recommends that this project should be closely coordinated with Project 199800200 "Snake River Native Salmonid Assessment". CBFWA was unable to determine if much coordination is taking place. CBFWA believes that this project is a high priority and should be completed as soon as possible as results of this project are needed for other projects.

Budget

FY2003	FY2004	FY2005
$232,000 Category: High Priority Comments:	$245,000 Category: High Priority	$258,000 Category: High Priority

New Projects

Project: – 32007 – Bull trout habitat restoration/protection program – Bruneau Subbasin

Sponsor: Shoshone-Paiute Tribes of the Duck Valley Indian Reservation (SPT)

Short Description:

(Sponsor note: this project was revised during the ISRP response phase of the Provincial Review. Sponsors are requesting funding for project listed in Appendix of original proposal only). Protect and restore bull trout spawning habitat in Dave Creek, Jarbidge River Watershed.

Abbreviated Abstract

The proposed project would substantially increase the Jarbidge River bull trout population listed in 1999 as "threatened" under the Endangered Species Act, and significantly address the conservation needs of a disjunct bull trout population segment, artificially isolated from other bull trout population segments by impassable dams on the Snake River. The project activities would include the purchase of a temporary conservation easement for a 1000 acre private grazing allotment (for a period of four years or less, depending on how long it will take BLM to work out a land exchange with the private landowner), fencing four miles along the creek, placement of large woody debris into the stream channel and restoration of bull trout habitat at one road crossing.

Relationship to Other Projects

Project #	Title/Description	Nature of Relationship
200007900	Assess Resident Fish – Owyhee and Bruneau Subbasins - DVIR	Bull trout are suspected to occur in the headwater areas of the Bruneau subbasin on DVIR

Relationship to Existing Goals, Objectives and Strategies

This project will address priorities identified in the Jarbidge Bull Trout Problem Assessment (prepared by the Southwest Idaho Native Fishes Watershed Advisory Group) and the Idaho Bull Trout Conservation Plan.

This project addresses the following fish and wildlife needs identified in the Bruneau Subbasin Summary:

- Page 108 – Acquire lands when opportunities arise for improved habitat protection, restoration, and connectivity and for mitigation of lost fish and wildlife habitat (land trusts, conservation easements, landowner cooperative agreements, exchanges).
- Page 109 – Continue and enhance the cooperative/shared approach in research, monitoring, and evaluation between tribal, federal, state, local and private entities to facilitate restoration and enhancement measures. Protection and restoration of fish and wildlife populations and habitats will not be successful without the interest and commitment by all.
- Page 110 – Protect and restore riparian and instream habitat structure, form and function to provide suitable holding, spawning and rearing areas for resident fish.
- Page 110 – Protect, restore, and create riparian, wetland, and floodplain areas within the subbasin and establish connectivity.

This project is consistent with the Northwest Power Planning Council's 2000 Fish and Wildlife Program (FWP). The FWP seeks to:

- Restore native resident species (subspecies, stocks and populations) to near historic abundance throughout their historic ranges where original habitat conditions exist and where habitats can be feasibly restored (substitution for anadromous fish losses)
- Maintain and restore healthy ecosystems and watersheds, which preserve functional links among ecosystem elements to ensure the continued persistence, health and diversity of all species including game fish species, non-game fish species, and other organisms (resident fish losses)
- Pursue opportunities to integrate program strategies with other federal, state, tribal, Canadian, and volunteer fish and wildlife restoration programs (coordination with other regional programs).

Review Comments

The objective of this project is to improve stream and riparian habitat conditions for the Jarbidge bull trout population. CBFWA agrees with the sponsor's decision to consider only the Dave Creek project under the project request. The objectives are clearly defined and attainable in the stated time frame. The habitat analysis was comprehensive and nicely demonstrated the benefit of acquiring a Temporary Conservation Easement on critical bull trout spawning habitat to restrict livestock grazing and other streamside development and the need for habitat improvements. Although the proposal lacks an M&E plan, the plan is being developed with the BLM. The sponsors indicated that the BLM plan would be adopted when completed.

Budget

FY2003	FY2004	FY2005
$218,374 Category: High Priority Comments:	$323,651 Category: High Priority	$345,270 Category: High Priority

Project: – 32012 – Implement Best Management Practices to improve riparian habitat and upland conditions within the Clover Creek Watershed

Sponsor: Bruneau River Soil Conservation District (BRSCD)

Short Description:

Enhance riparian and upland habitat and reduce non-point source pollution within the Clover Creek watershed through the development of a Coordinated Resource Management Plan on private, state and federal land, focusing on private land improvements.

Abbreviated Abstract

Clover Creek, East Fork Bruneau Canyon, also known as the East Fork of the Bruneau River, lies within the Bruneau subbasin of the Columbia Basin's Middle Snake Province. The Clover Creek watershed consists of multiple species of concern, both aquatic and terrestrial, with redband trout and sage grouse being the primary species of focus along with other natural resource concerns.

Some extensive rangeland and riparian assessments have been completed in 1999, resulting in some natural resource problems identified and recommendations provided. The Idaho Department of Environmental Quality (IDEQ) has recently prepared a Total Maximum Daily Load (TMDL) watershed plan for the Bruneau River watershed, which includes Clover Creek. This TMDL requires point and non-point sources to reduce their loads to meet watershed specific state water quality standards. The TMDL focuses on bacteria for Clover Creek, where it has been found exceed state water quality standards for secondary contact recreation. Other pollutants and resource conditions related to aquatic and terrestrial health and sustainability have been identified, such as high stream temperatures, excessive bank erosion, lack of in-stream cover, poor upland vegetative conditions (cheatgrass), and historic overgrazing problems.

A Coordinated Resource Management Plan (CRMP) is being developed for the privately owned Clover Flat Ranch (Frank and Cindy Bachman, owners) and the adjoining Clover Crossing Allotment, which includes federal and state lands, managed by the Bureau of Land Management (BLM) and the Idaho State Department of Lands respectively. The CRMP is being developed in coordination with the landowner, the Bruneau River Soil Conservation District (BRSCD), BLM, IDL, the Duck Valley Shoshone-Paiute Tribe, the Natural Resources Conservation Service (NRCS), the Idaho Soil Conservation Commission (ISCC), IDEQ, the Idaho Department of Fish & Game (IDFG), local government, and other public interests to address natural resource problems and multiple objectives on these lands. Future application of Best Management Practices (BMPs) outlined in the CRMP will address multiple objectives through the holistic, ecological plan. The installation and application of those applicable BMPs will be done according to the CRMP and specific standards and specifications, primarily of those of the NRCS. These BMPs will also be evaluated as to their effectiveness on correcting the resource concerns and meeting the CRMP's objectives. The CRMP objectives will incorporate not only those of the landowner, agencies and local tribe, but those of the 2000 Columbia Basin Fish and Wildlife Plan and other state and regional plans and policies.

Relationship to Other Projects

Project #	Title/Description	Nature of Relationship
199800200	Snake River Native Salmonid Assessment	Data share & coordination of monitoring activities

Relationship to Existing Goals, Objectives and Strategies

This project addresses objectives in IDFG's 2001-2006 Fisheries Management Plan (FMP). The IDFG's primary management responsibility of resident fisheries is expressed in their mission statement "to preserve and perpetuate the wild, natural, and hatchery fish resources

of Idaho…" The maintenance, protection, and enhancement of naturally reproducing trout species is the critical objective. Clover Creek is identified in the FMP for wild redband trout, mountain whitefish, and bull trout, though it is not entirely clear whether or not it is a historic bull trout stream.

The Pacific Northwest Electric Power Planning and Conservation Act of 1980 directs the Northwest Power Planning Council (NWPPC) to develop a program, now the 2000 Fish and Wildlife Program, to "protect, mitigate and enhance fish and wildlife, including related spawning grounds and habitat, on the Columbia River and its tributaries…affected by the development, operation and management of the federal hydroelectric projects.

The Columbia Basin Fish and Wildlife Authority's (CBFWA) Multi-Year Implementation Plan objective "is to promote the long term viability of native fish and native habitats where possible…" Three elements of this plan relate to this proposed project: (1) protect, maintain, and enhance native fish populations and their habitats, (2) conduct research to better understand critical uncertainties, and to determine the best methods for resident fish protection and enhancement, and (3) monitor and evaluate actions designed to enhance resident fish populations in order to maximize the cost-effectiveness of the overall resident fish program, and to maximize basin-wide resident fisheries opportunities.

This project complements the ongoing soil and water conservation activities of the local Bruneau River Soil Conservation District and the Natural Resources Conservation Service. Through their programs, all natural resource problems are addressed, where feasible to the cooperating landowner, through technically sound environmental planning. The project CRMP process utilizes NRCS planning policy and meets NEPA and other local, state, and federal requirements and laws.

The FWS's Snake River Aquatic Recovery Plan objectives include: Objective 4: conduct research on the ecology of the native fishes of the Snake River; Strategy 3: secure remaining native cutthroat and redband trout habitats in the Snake River basin; Action 2: determine the status of remnant redband trout in Snake River tributaries; and Action 3: identify additional conservation measures to protect unique trout stocks between C.J. Strike Reservoir and American Falls Dam. The FWS will be consulted upon the development of the watershed monitoring plans and enhancement activities where appropriate.

Some goals and objectives of many agencies and interests relative to Clover Creek:

Federal Caucus goals:

- Conserve species. Avoid extinction and foster long-term survival and recovery of Columbia Basin salmon and steelhead and other aquatic species.
- Conserve ecosystems. Conserve the ecosystems upon which salmon and steelhead depend.
- Consider resources of cultural importance to tribes. In implementing recovery measures, seek to preserve resources important to maintaining the traditional culture of basin tribes.
- Maintain and improve upon the current distribution of fish and aquatic species, and halt declining population trends within 5-10 years.
- Protect existing high quality habitats.

- Coordinate restoration efforts to avoid inefficiency and unnecessary costs.
- Protection: to prevent further degradation of habitat conditions and water quality for all life stages.
- Restoration: to increase the amount of high quality habitat and high water quality for spawning, rearing, and migration.

USFS and BLM (PACFISH)

- Restore water quality that provides for stable and productive riparian and aquatic ecosystems.
- Restore stream channel integrity, channel processes, and sediment regimes under which riparian and aquatic ecosystems developed.
- Restore instream flows supporting healthy riparian and aquatic habitats, stable and effectively functioning stream channels, and rerouted flood discharges.
- Restore diversity and productivity of native and desired non-native plant communities in riparian zones.
- Restore riparian vegetation through (a) providing large woody debris characteristic of natural aquatic and riparian ecosystems, (b) providing adequate summer and winter thermal regulation within the riparian and aquatic zones, (c) achieving rates of surface erosion, bank erosion, and channel migration characteristic of those under which the communities developed.
- Restore habitat to support populations of well-distributed native and desired non-native plant, vertebrate, and invertebrate populations that contribute to the viability of riparian-dependent communities.

USDA Natural Resources Conservation Service

- Enhance natural resource productivity to enable a strong agricultural and natural resource sector.
- Reduce unintended adverse effects of natural resource development and use to ensure a high quality environment.

Tribal Government (Shoshone-Paiute Tribes of Duck Valley Indian Reservation)

- Work cooperatively with federal, state, county and private entities throughout the subbasin to enhance, protect and/or restore fish and wildlife habitat.
- Coordinate subbasin-wide land acquisitions, conservation easements and riparian habitat improvements.
- Protect, enhance, and/or acquire wildlife mitigation properties in the Middle Snake Province, with emphasis on the Owyhee and Bruneau subbasins.
- Work collaboratively with IDFG, NDOW, BLM and USFS to identify data gaps and to develop a research and monitoring plan to fill those gaps,
- Determine long-term viability of redband metapopulations in the Owyhee, Bruneau and Lower Middle Snake subbasins.

Idaho Department of Fish and Game

- Preserve, protect, perpetuate, and manage Idaho's 500+ fish and wildlife species, as steward of public resources.
- Coordinate with other agencies on data availability and identify additional data gaps.
- Wild native populations of resident fish will receive priority consideration in management decisions.
- By 2005, determine the status and distribution of redband trout in the subbasin.

Idaho Conservation Data Center (CDC)

- Maintain biodiversity information within Idaho portion of the subbasin.
- Maintain high quality, accurate, and timely information on the occurrence of rare, threatened, and endangered plant and animal species.
- Maintain high quality, accurate, and timely information on the distribution, abundance, and ecological status of plant and animal habitats, representative ecological reference areas, and plant communities.

Owyhee County Commissioners – Owyhee Initiative

- To develop and implement a landscape-scale program in Owyhee County that preserves the natural processes to create and maintain a functioning, unfragmented landscape supporting and sustaining a flourishing community of human, plant, and animal life, that provides for economic stability by preserving livestock grazing as an economically viable use, and that provides for the protection of cultural resources.

Owyhee Sage Grouse Working Group

- Preserve and increase sage grouse populations in Owyhee County.

Jarbidge Sage Grouse Working Group

- Maintain huntable and sustainable sage grouse populations.
- Maintain or improve livestock operations.
- Encourage cooperation between landowners (private, state and federal).
- Inform and educate landowners and the general public on sage grouse issues as they relate to various uses on the land.

The Nature Conservancy

- Redband and bull trout: protect and maintain population strongholds of redband trout by focusing on the protection and enhancement of riparian habitat within the stronghold population's watershed.
- Springs, spring creek systems, and wetlands: maintain or improve the ecological conditions of all springs, spring creek systems, and wetland so as to be rated in Proper Functioning Condition.

Intermittent streams and rivers: maintain the high quality and diversity of the riparian communities within and along intermittent streams and rivers and prevent the degradation of these systems.

Review Comments

Proposed work will cover 1/3 of all the private acres on Clover Creek, a location which has been identified as a TMDL stream segment. Reviewers suggest that due to the respect that other landowners have for the individual that has volunteered his land, this project could serve as a demonstration project that could lead other landowners, that are currently reluctant, to become willing to participate in similar activities. Although the proposed concept is valid, CBFWA questions the priority status of this project since the perception is that the ongoing work will continue regardless of whether BPA funds are secured. CBFWA found that most of the monitoring activities are being completed through various processes (e.g., TMDL) as well as general fish, wildlife and habitat monitoring by IDFG. CBFWA questions the appropriateness of allocating BPA funds to this proposal.

Budget

FY2003	FY2004	FY2005
$43,167 Category: Recommended Action Comments:	$19,062 Category: Recommended Action	$17,937 Category: Recommended Action

Research, Monitoring and Evaluation Activities

BPA-funded research, monitoring and evaluation activities:

- IDFG's Native Salmonid Assessment Project (199900200) is an ongoing research project initiated in August 1998 to assess the current status of native salmonids in the Middle and Upper Snake Provinces in Idaho (Phase I), identify factors limiting populations (Phase II), and develop and implement recovery strategies and plans (Phase III). The inventory phase is being used to assess presence/absence and abundance of native salmonids in all major watersheds, and concurrent habitat measurements are being used to preliminarily examine factors that influence this presence/absence and abundance. Genetic samples are being collected to assess the purity of populations and the degree of genetic variability among and within populations of native salmonids. Based on these findings, major limiting factors will be investigated during the second phase of the project. Recovery strategies for individual or groups of subbasins will be developed to address the factors most important in limiting the patterns of distribution and abundance of native salmonids.
  To-date, no sampling has occurred in the Bruneau subbasin.
- Assess Resident Fish Stocks of the Owyhee/Bruneau Subbasins, DVIR, Project 200007900 is similar in focus to phase one of the IDFG Project 199900200 but is restricted to the rivers and tributaries within the boundaries of the Duck Valley Indian Reservation. The objectives of the research are: (1) provide baseline information on genetic variation within and among populations of redband trout within the East Fork Owyhee River and Bruneau River drainage; (2) assess the extent of hatchery introduced rainbow trout introgression within these populations; and (3) provide baseline information on bull trout populations on the DVIR. Six of the ten streams scheduled for

sampling in 2001 were completed and fin clips are currently being analyzed at a regional genetics laboratory.

Non BPA-funded research, monitoring and evaluation activities:

- Several non-BPA funded research, monitoring and evaluation activities have recently been initiated or are underway in the subbasin:
- Spotted Frog Long-Term Monitoring Program – U.S. Fish and Wildlife Service – This ten year plan was initiated in 2001 for the following purposes: (1) collect long-term monitoring information on the Owyhee subpopulation of spotted frogs; (2) survey sites that are representative of the subpopulation; (3) provide federal and state land management agencies with information they can use to modify land management practices to ensure the persistence of the species.
- Sage Grouse Predator Project – Idaho Department of Fish and Game – This is the first year of a six year study that will monitor six sage grouse populations across the state, one of which is in the Sheep Creek drainage west of the Bruneau River. The objectives of the study are to: (1) evaluate the effect of predator control on sage grouse nest success; (2) evaluate the effect of predator control on sage grouse survival; (3) document cause-specific mortality of sage grouse eggs, juveniles and adults; (4) evaluate the effect of predator control on sage grouse breeding populations; (5) document the relative abundance and species composition of predators in different study areas; (6) document the relative change in predator numbers following removal efforts in different sage grouse habitats; and (7) assess the cost/benefit ratio associated with removing predators to increase sage grouse numbers.
- Sage Grouse Habitat Fragmentation Study – Idaho Department of Fish and Game – This is the second year of a four year study being conducted in the Jarbidge Resource Area. Researchers will monitor sage grouse using radio telemetry to determine sage grouse use of fragmented habitats. The study area lies between Clover Creek and the Jarbidge River, from Clover Butte to the Nevada state line. A Ph.D student will examine sagebrush patch size selection, nest site selection, seasonal movements, and seasonal habitat use in fragmented versus continuous habitat. The study is to be completed in 2004.
- Bruneau Hot Spring Snail Habitat Monitoring Project – U.S. Fish and Wildlife Service and Idaho State University – ongoing since 1999.
- Groundwater, spring discharge, and annual well withdrawals monitoring – U.S. Fish and Wildlife Service and U.S. Geological Survey – Ongoing since 1993.

Other monitoring activities:

- Periodic stream surveys and wildlife inventories and monitoring are conducted by the U.S. Forest Service and Bureau of Land Management on the lands they administer.
- Nevada and Idaho state fish and wildlife agencies conduct aerial big game surveys on an annual (Nevada) or periodic (Idaho) basis. Both states monitor sage grouse populations by conducting lek counts and through collection of wing barrel data.
- Project 32007 will monitor bull trout densities and habitat conditions annually to assess project effectiveness. Bull trout spawning surveys will also be conducted.

- Project 32012 monitoring objectives include: assessing water quality standards attainment and meeting grazing, fisheries and terrestrial objectives. Implementing BMPs and monitoring trends will be used to determine how well those BMPs are having an effect on the beneficial uses. It may be necessary to modify the proposed monitoring methods as BMP installation progresses or with natural occurrences, such as drought, which prohibit certain forms of monitoring.

Needed Future Actions

Fish Passage – Conduct studies to assess the feasibility of reintroducing anadromous fish to the area above C.J. Strike Reservoir.

Investigate effects of the loss/lack of nutrients due to extirpation of anadromous fish populations from the subbasin, and coordinate and evaluate nutrient enhancement alternatives.

Improve fluvial habitat conditions. Projects that promote increased instream flow and water quality are critical to meeting fish and wildlife objectives in the subbasin. Projects involving riparian management, rehabilitation, and/or restoration should be emphasized.

Improve ecological condition of riparian areas. In a system that inherently suffers from high water temperatures and low flows, the additive effects of reduction or removal of riparian vegetation on aquatic resources are magnified. In the Bruneau subbasin, the reduction of riparian vegetation has most notably affected the insulation and water storage capacity of stream segments.

Use genetic markers to delineate genetic population structure of the bull trout population within the subbasin and relate information across the species range. Limited genetic work in the subbasin suggests that three distinct sub-populations may exist but further testing is required for verification.

Acquire lands when opportunities arise for improved habitat protection, restoration, and connectivity and for mitigation of lost fish and wildlife habitat (land purchases, land trusts, conservation easements, landowner cooperative agreements, exchanges).

Fund the establishment of techniques, surveys, and programs to assess the health and trend of wildlife, wildlife habitat, and overall biodiversity in the subbasin. Existing surveys and information are inadequate, making it difficult to protect species or to evaluate progress toward goals stated in this summary.

Continue and enhance the cooperative/shared approach in research, monitoring and evaluation between tribal, federal, state, local and private entities to facilitate restoration and enhancement measures. Protection and restoration of fish and wildlife populations and habitat will not be successful without the interest and commitment by all.

Actions by Others

Coordination between tribal, county, state, federal, and private entities is critical to insure that comprehensive land use planning occurs in the subbasin. Issues regarding jurisdictional boundaries, agency mandates, research protocols, data management/ handling, etc. need to be understood and addressed if these entities are to draft and implement subbasin plans.

There is a need to encourage/promote implementation of conservation measures on private property. Federal and state agencies could assist private conservation organizations and landowners in obtaining grants and provide technical assistance in planning, design and project implementation.

There is a critical need to develop the technology, methods, and market for native seed production. Reseeding efforts on disturbed rangelands are using, in many cases, a native/exotic seed mix due to the lack of availability of site adapted native species.

Table 25. Subbasin Summary FY 2003 - Funding Proposal Matrix

Project Proposal ID	**200007900**	**32007**	**32012**
Provincial Team Funding Recommendation	**High Priority**	**High Priority**	**Recommended Action**
Continue to inventory native salmonids in the Bruneau subbasin to determine status and limiting factors	+		
Acquire land for improved habitat protection, restoration and connectivity and as mitigation for lost fish and wildlife habitat		+	
Continue and enhance the cooperative/shared approach in research, monitoring, and evaluation between tribal, federal, state, local and private entities to facilitate restoration and enhancement measures		+	+
Protect and restore riparian and instream habitat structure, form and function		+	+
Protect, restore, and create riparian, wetland, and floodplain areas within the subbasin and establish connectivity		+	+
Preserve and perpetuate the wild, natural, and hatchery fish resources of Idaho	+	+	+
Restore water quality that provides for stable and productive riparian and aquatic ecosystems		+	+
Restore stream channel integrity, channel processes, and sediment regimes under which riparian and aquatic ecosystems developed		+	+
Restore riparian vegetation through (a) providing large woody debris characteristic of natural aquatic and riparian ecosystems, (b) providing adequate summer and winter thermal regulation within the riparian and aquatic zones, (c) achieving rates of surface erosion, bank erosion, and channel migration characteristic of those under which the communities developed		+	+
Restore habitat to support populations of well-distributed native and desired non-native plant, vertebrate, and invertebrate populations that contribute to the viability of riparian-dependent communities.		+	+
Restore instream flows supporting healthy riparian and aquatic habitats, stable and effectively functioning stream channels, and rerouted flood discharges.		+	+
Restore diversity and productivity of native and desired non-native plan communities in riparian zones.		+	+

Project Proposal ID	200007900	32007	32012
Redband and bull trout: protect and maintain population strongholds of redband trout by focusing on the protection and enhancement of riparian habitat within the stronghold population's watershed.	+	+	+
Wild native populations of resident fish will receive priority consideration in management decisions.	+	+	+
200007900 - Assess Resident Fish Stocks of the Owyhee/Bruneau Subbasins, DVIR			
32007 - Bull trout habitat restoration/protection program – Bruneau Subbasin			
32012 - Implement Best Management Practices to improve riparian habitat and upland conditions within the Clover Creek watershed			

Note: + = potential or anticipated effect on subbasin objectives.

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