# Bruneau Subbasin Assessment

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## Prepared for the Northwest Power and Conservation Council


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# 1 Subbasin Overview

## 1.1 Introduction

The Bruneau Subbasin Assessment has been generated as part of the Northwest Power and Conservation Council's (NPCC, formerly the Northwest Power Planning Council or NPPC) Rolling Provincial Review Process. The NPCC 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 assessment utilizes existing information about the Bruneau subbasin, one of 10 subbasins within the Middle Snake Province (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 assessment is designed to provide a context for project proposals so that they will fulfill priority goals and objectives and work toward realizing the vision for the subbasin. It is designed to be a flexible, working document that will be revised as changes occur in the status of the watershed biota and habitat.

The Bruneau Subbasin Assessment is volume one of the Bruneau Subbasin Plan, which includes three interrelated volumes that describe the characteristics, management, and vision for the future of the Bruneau Subbasin. An adopted subbasin plan is intended to be a living document that increases analytical, predictive, and prescriptive ability to restore fish and wildlife. The Bruneau Subbasin Plan will be updated every three years to include new information. The Council views plan development as an ongoing process of evaluation and refinement of the region's efforts through adaptive management to protect and restore aquatic and terrestrial species and habitats. More information about subbasin planning can be found at www.nwcouncil.org. The Bruneau Subbasin Plan includes an assessment, inventory and management plan.

**Assessment--**The assessment is a technical analysis that examines the biological potential of the Bruneau Subbasin to support key habitats and species, and the factors limiting this potential. These limiting factors provide opportunity for restoration. The assessment describes existing and historic resources and conditions within the subbasin, focal species and habitats, environmental conditions, out of subbasin impacts, ecological relationships, limiting factors, and a final synthesis and interpretation. A **Technical Team** composed of scientific experts guided development of the assessment and technical portions of the management plan. They provided the biological, physical, and management expertise to refine, validate, and analyze data used to inform the planning process.

**Inventory--** The inventory summarizes fish and wildlife protection, restoration, and artificial production activities and programs within the Bruneau Subbasin that have occurred over the last five years or are about to be implemented. The information includes programs and projects as well as locally developed regulations and ordinances that provide fish, wildlife, and habitat protections. This includes a gap analysis that outlines where additional work needs to be developed.

**Management plan--** The management plan defines a vision for the future of the subbasin, developed collectively by the **Planning Team**. The management plan describes objectives and strategies for the next 10-15 years. The management plan includes a research, monitoring, and evaluation plan to determine success in addressing limiting factors and to reduce uncertainties and data gaps. The management plan also includes information about the relationship between proposed activities and the Endangered Species Act and the Clean Water Act. The completed plan was submitted to the Council by the Shoshone-Paiute Tribes on May 28, 2004.

## 1.2 Entities and Authorities for Resource Management

Multiple agencies and entities are involved in management and protection of aquatic and terrestrial species and habitats in the Bruneau subbasin. The Shoshone-Paiute Tribes, Nevada Division of Wildlife and Idaho Department of Fish and Game share co-management authority over fisheries resources in the subbasin. Numerous federal, state, and local land managers are responsible for multipurpose land and water use management, including the protection and restoration of fish and wildlife habitat and compliance with or enforcement of ESA responsibilities. The major management entities contractually involved in developing the Bruneau Subbasin Plan are outlined below. See the Bruneau Subbasin Inventory for a more complete list of all resource management entities involved in the Bruneau Subbasin.

### 1.2.1 Shoshone-Paiute Tribes (SPT) of Duck Valley Indian Reservation

The SPT served as lead entity for subbasin planning for the Bruneau Subbasin. The Tribes contracted with the NPCC to deliver the Bruneau Subbasin Plan. The Tribes provided an opportunity for participation in the process by fish and wildlife managers, local interests, and other key stakeholders, including tribal and local governments.

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

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

### 1.2.2 Northwest Power and Conservation Council

The NPCC has the responsibility to develop and periodically revise the Fish and Wildlife Program for the Columbia Basin. In the 2000 revision, the NPCC proposed that 62 locally developed subbasin plans be adopted into its Fish and Wildlife Program. The NPCC will administer subbasin planning contracts pursuant to requirements in its Master Contract with

Bonneville Power Administration (NPCC 2000). The NPCC will be responsible for reviewing and adopting each subbasin plan, ensuring that it is consistent with the vision, as well as biological objectives and strategies adopted at the Columbia Basin and province levels.

### 1.2.3 Bonneville Power Administration

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

### 1.2.4 Project Team

The Shoshone-Paiute Tribes subcontracted with Ecovista to facilitate the process and write plan documents. The Shoshone-Paiute Tribes subcontracted with the Idaho Council on Industry and the Environment (ICIE) to organize the public involvement and public relations tasks for the Bruneau Subbasin. A list of project team members occurs in Table 1.

Table 1. Bruneau Project Team

| Name | Affiliation | Position |
|---|---|---|
| Darin Saul | Ecovista | project coordinator, tech writer, and editor |
| Craig Rabe | Ecovista | fisheries ecologist, tech writer |
| Anne Davidson | Ecovista | wildlife biologist, GIS, tech writer |
| Susan Abele | Ecovista | wildlife biologist, tech writer |
| Tim Dykstra | Shoshone-Paiute Tribes | wildlife biologist |
| Pat Barclay | ICIE | public involvement coordinator |

### 1.2.5 Planning Team

The Bruneau Planning Team is composed of representatives from government agencies with jurisdictional authority in the subbasin, fish and wildlife managers, county, industry and user group representatives, and private landowners. The Planning Team’s guided the public involvement process, developed the vision statement, helped develop and review the biological objectives, and participated in prioritizing subbasin strategies. Regular communication and input among team members occurred throughout the planning process. The Planning Team met monthly throughout the project period. The Planning Team members are listed in Table 2.

Table 2. Bruneau Subbasin Planning Team

| Name | Affiliation |
|---|---|
| Guy Dodson Sr. | Shoshone-Paiute Tribes |
| Lisa Jim | Shoshone-Paiute Tribes |
| Steve Duke | US Fish & Wildlife Service |
| Sidney Erwin | Land Owner |
| Marilyn Hemker | US Fish & Wildlife Service |
| Thomas Grant | ID Dept. Water Resources |
| Frank Bachman | Bruneau Buckaroo Ditch |
| Cindy Bachman | Bruneau Buckaroo Ditch |
| Steven Lysne | US Fish & Wildlife Service |
| Kent McAdoo | University of Nevada, Elko |
| David Parrish | IDFG, Jerome |
| Bill Moore | Southwest Idaho RC&D, Meridian |

### 1.2.6 Technical Team

The Technical Team includes scientific experts who guide the development of the subbasin assessment and plan.  This team has the biological, physical, and management expertise to refine, validate, and analyze data used to inform the planning process.  The Technical Team also guides and participates in the development of the biological objectives, strategies and research, drafts monitoring and evaluation sections of the plan, and reviews all project documents.  The Bruneau Technical Team met monthly or bimonthly throughout the process, and participated in day or multi-day workshops focused on filling data gaps.  The following list of Technical Team members participated in meetings and other Technical Team activities (Table 3).

Table 3. Bruneau Technical Team

| Name | Affiliation |
|---|---|
| Guy Dodson Sr. | Shoshone-Paiute Tribes |
| Tim Dykstra | Shoshone-Paiute Tribes |
| Cary Myler | US Fish & Wildlife Service |
| Steven Lysne | US Fish & Wildlife Service |
| Marilyn Hemker | US Fish & Wildlife Service |
| Bruce Zoelick | US Bureau of Land Mgmt |
| Tony Lamansky | ID Fish & Game |
| Angelina Martin | US Air Force |
| Signey Sather Blaire | US Bureau of Land Mgmt |
| Jim Clark | US Bureau of Land Mgmt |
| Tim Burton | US Bureau of Land Mgmt |
| Jim Klott | US Bureau of Land Mgmt |
| Dave Parish | ID Fish & Game |
| Selena Werdon | NV Fish & Wildlife Service |
| Kevin Meyer | ID Fish & Game |

## 1.3 Public Outreach and Government Involvement

As the Bruneau Subbasin Plan was developed, four methods of outreach and participation from the public and governments involved in the Bruneau Subbasin were utilized: Technical team meetings, Planning Team meetings, public meetings, and a website.

### 1.3.1 Technical Team Participation

The technical meetings were held mornings of the fourth Thursday of every month at the Forest Service Headquarters in Mountain Home, and were open to the public. This information was posted on the Ecovista website and provided at public meetings. The Technical Team reviewed and gave input on the technical aspects of the subbasin plan.

### 1.3.2 Planning Team Participation

The Planning Team was composed of members with expertise and knowledge of the management of natural resources and socioeconomic issues in the Bruneau Subbasin. The meetings were held afternoons of the fourth Thursday of every month at the Forest Service Headquarters in Mountain Home, and were open to the public. This information was posted on the Ecovista website and provided at public meetings. The Planning Team guided and reviewed the subbasin plan.

### 1.3.3 Public Meeting Outreach

Three public meetings were held to introduce the subbasin plan and provide an opportunity for input from local people and resource managers. Pat Barclay of the Idaho Council for Industry and the Environment (ICIE) coordinated public meeting announcements and logistics for the Bruneau Subbasin. Public meeting outreach is summarized in Appendix A of the management plan.

### 1.3.4 Ecovista Website Information

As the Bruneau Subbasin Plan was developed, draft documents, meeting announcements, handouts, and other items were posted on the Ecovista website at www.ecovista.ws.

## 1.4 Review Process

The *Bruneau Subbasin Assessment* and *Bruneau Subbasin Management Plan* were available for review through e-mail notification lists compiled by the project team and during technical and planning team meetings beginning in January. The focal species, focal habitats, and limiting factors from the assessment were presented at the second and third public meetings in March and April (the first meeting was an introduction to subbasin planning). The Vision for the subbasin, problem statements, and objectives from the management plan were also presented in March. Prioritizations for the subbasin were presented and discussed during the April public involvement meeting. Through this review process, comments, suggestions, and clarifications were received from local, state, tribal, and federal representatives having relevant professional expertise, as well as from landowners and other stakeholders in the subbasin.

Time was not available to obtain letters of endorsement of the plan by the Planning Team. During development of Plan Section 5.2: Recommendations and Conclusions, the planning team described positive aspects of this process. The process provided positive interaction with stakeholders, resulting in information to direct future implementation activities in the subbasin. It also provides a rationale for increasing BPA funding for activities in the Bruneau subbasin. Pat Barclay is currently working to obtain letters of endorsement to be sent to the Council during the public review process. On behalf of the SPT, Ecovista forwarded the *Bruneau Subbasin Plan*, to the NPCC for adoption on May 28, 2004.

The summer schedule for the independent scientific review of subbasin plans has been developed. For a majority of the subbasin plans, the ISRP/ISAB review process will begin immediately following the May 28$^{th}$ deadline and conclude with submittal of final reports to the Council by August 12, 2004. The Bruneau Plan will be reviewed during Week 4: June 29$^{th}$ - July 2$^{th}$ (NPCC 2004).

To complete the review, about ten review teams, and one basin wide umbrella committee have been established. The review teams are organized to review sets of subbasin plans grouped by province. Each team consists of six or more reviewers and includes a mix of ISRP, ISAB, and Peer Review Group members. The umbrella group will help ensure a consistent level of review scrutiny and comment quality (NPCC 2004).

A review checklist and comment template is being developed for the ISRP/ISAB review of subbasin plans based on the Council's Subbasin Planning Technical Guide and will include the Council's review questions. Reviewers must evaluate: 1) whether the subbasin plans are complete, scientifically sound, and internally consistent following a transparent and defensible logic path; and 2) whether the subbasin plans are externally consistent with the vision, principles, objectives, and strategies contained in the Council's 2000 Fish and Wildlife Program. The checklist also asks reviewers to evaluate whether the plan satisfactorily provides the assessment, inventory and management elements requested by the Council and, to recommend the level of need to further treat a specific element of the subbasin plan before the plan meets the criteria of completeness, scientific soundness, and transparency. A sample of the checklist and template will be available in March (NPCC 2004).

*Subbasin Plan Adoptability Framework*

The Council's Legal Division is organizing a framework that the Council members and may use to make the determinations required by the Power Act relative to subbasin plan amendment recommendations. The framework is essentially a way of organizing the review around the Act's standards that apply to program amendments for the Fish and Wildlife Program measures found in section 4(h), and the standards set in the 2000 Fish and Wildlife Program in the unique context of subbasin plans. The framework will be discussed with Council members in the near future.

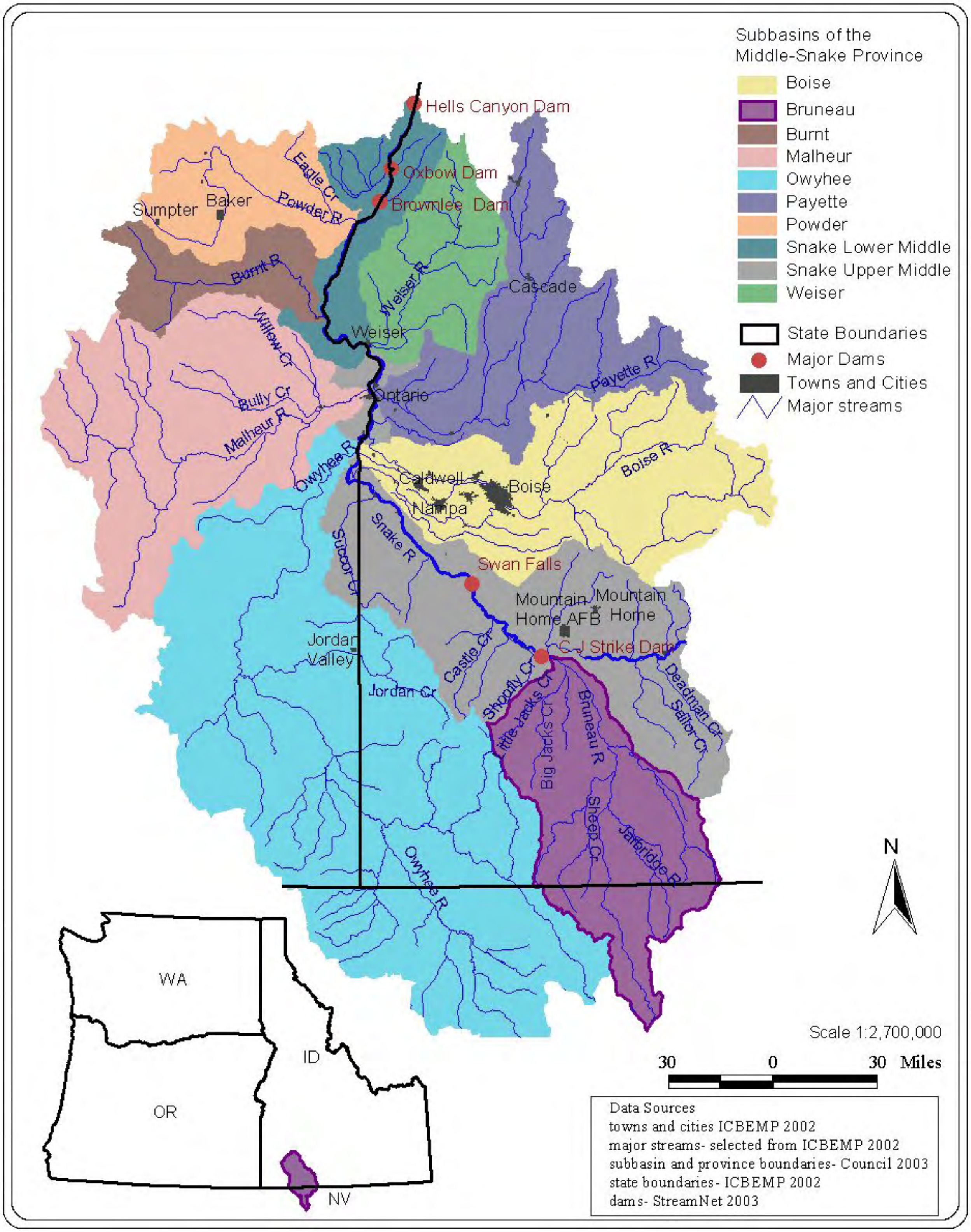


Figure 1. Subbasins, including the Bruneau subbasin, in the Middle Snake Province.

## 1.5 General Description

The following describes the demographic, geomorphic, and environmental context for an assessment of aquatic and terrestrial resources in the Bruneau subbasin.

### 1.5.1 Location and Size

The Bruneau subbasin is one of 10 subbasins within the Middle Snake Province (Figure 1). It is located in south-central Idaho and northeastern Nevada and covers approximately 3,305 square miles (Figure 2) (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 4).

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 Chalk Hills, on the north by the Snake River, and on the east by the Bruneau Plateau.

Table 4. Land area of counties containing the Bruneau subbasin.

| State | County | Acres in Subbasin | Kilometers$^2$ in Subbasin | Miles$^2$ in Subbasin | Percentage (%) 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** |

### 1.5.2 Climate and Weather

The Bruneau subbasin has a semiarid climate. Mean annual precipitation across the 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 3).

Precipitation falls primarily from October through March; rainfall is infrequent during the summer. Loss of precipitation to surface water runoff is 0.2 to 2 inches per year. The remainder of the precipitation evaporates, transpires, or recharges groundwater (USAF 1998).

The subbasin is characterized by low relative humidity and large variations in average daily and annual temperatures (USAF 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 Range to the west, thereby contributing to the region's semiarid 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 (USAF 1998).

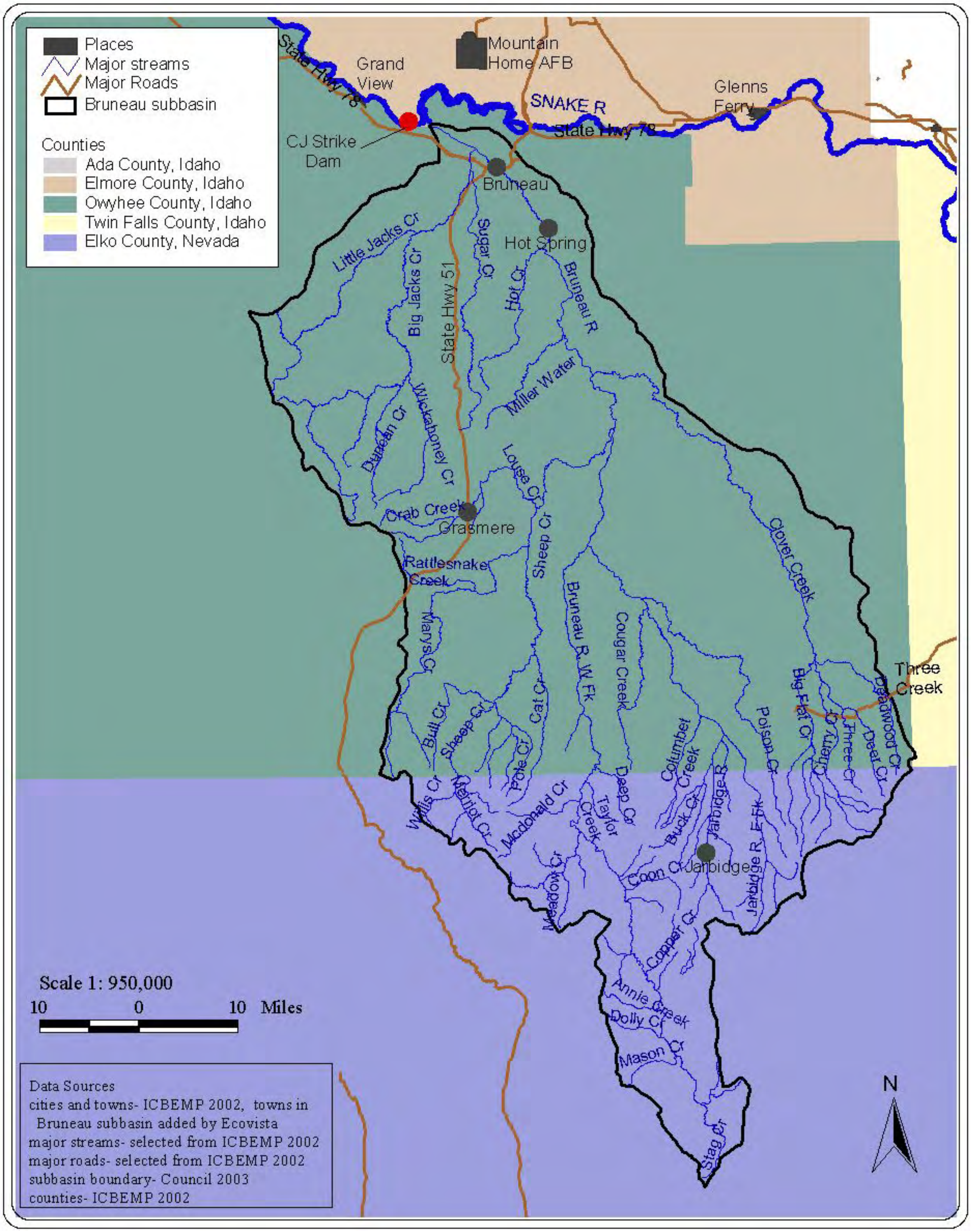


Figure 2. Location and major features of the Bruneau subbasin.

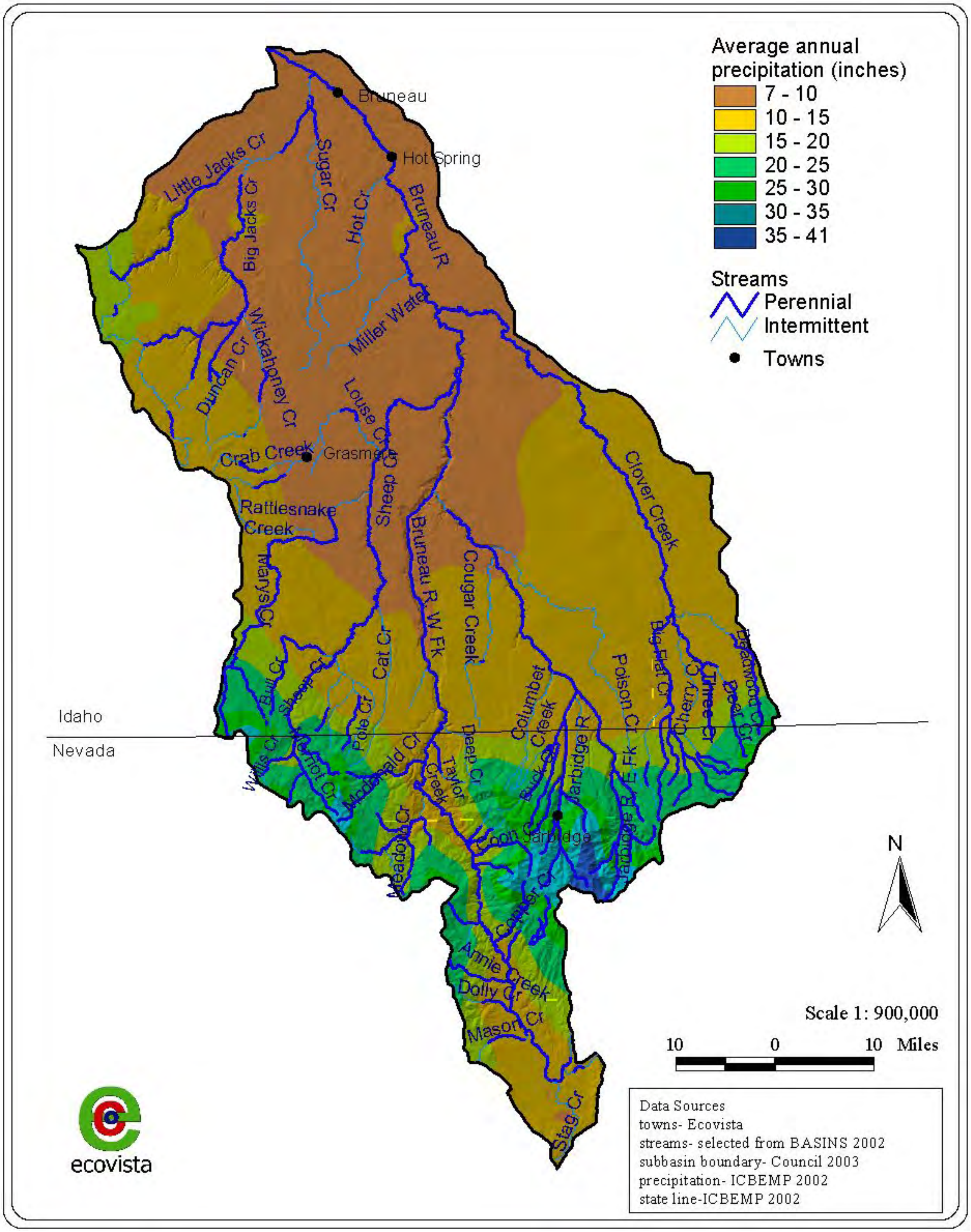


Figure 3. Precipitation and stream flow patterns, Bruneau subbasin.

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).

### 1.5.3 Topography

High plateaus incised by sheer-walled canyons are characteristic topographic features in the Bruneau subbasin (Figure 4). The highest elevations are found in the East Fork Jarbidge River (10,839 feet), while the lowest elevations (2,400 feet) occur at the confluence of the Bruneau and Snake rivers 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), Marys River Peak (10,585 feet), and Gods 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 6 miles of the Bruneau River, including the confluence with Little Jacks and Big Jacks Creeks.

### 1.5.4 Geology

The subbasin lies within the Northern Basin and Range Province and the Snake River Province. The Northern Basin and Range Province crosscuts the basin in Nevada. This area has faulted metamorphic and sedimentary rocks uplifted into mountains, which are separated by basins deeply filled with alluvium (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 Snake River Province began to form at the intersection of Nevada, Oregon, and Idaho approximately 14 to 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 to 6 million years ago with a series of rhyolite lava flows. More than 40 small basalt shield volcanoes erupted from 8 to 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.

Toward 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, Idaho. 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 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 River 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 and Sheep and Clover creeks and up to 1,300 feet deep along portions of the mainstem Bruneau River (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 River, 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).

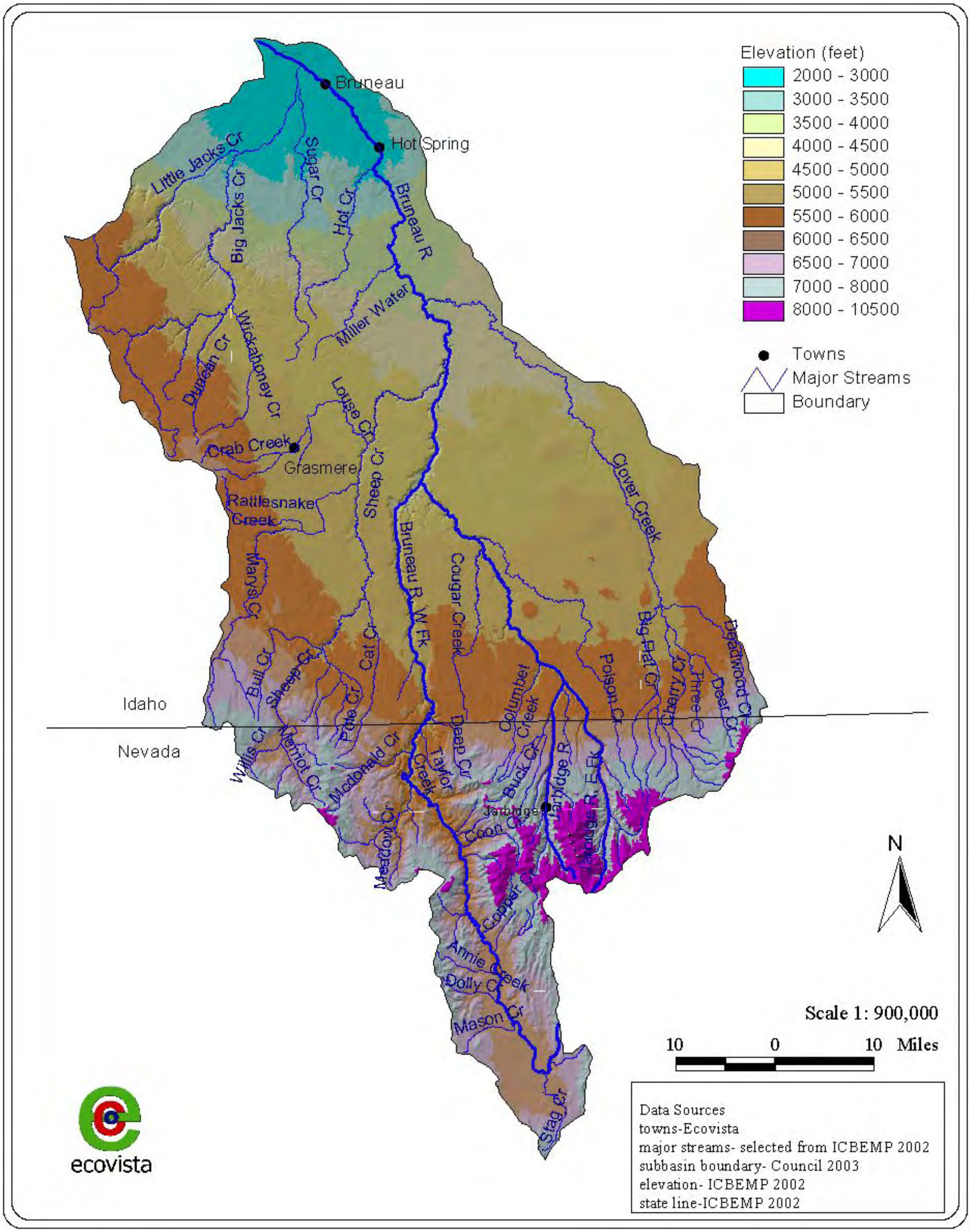


Figure 4. Topography and elevation in the Bruneau subbasin.

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).

### 1.5.5 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 potential for soil erosion and that 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 they 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, characteristics that increase the potential for slumping (McNeill et al. 1997). Despite this characteristic, sediment production in the Jarbidge watershed tends to have localized, rather than systemic, impacts as reflected by lack of significant cobble embeddedness in substrate surveys (Partridge and Warren 2000).

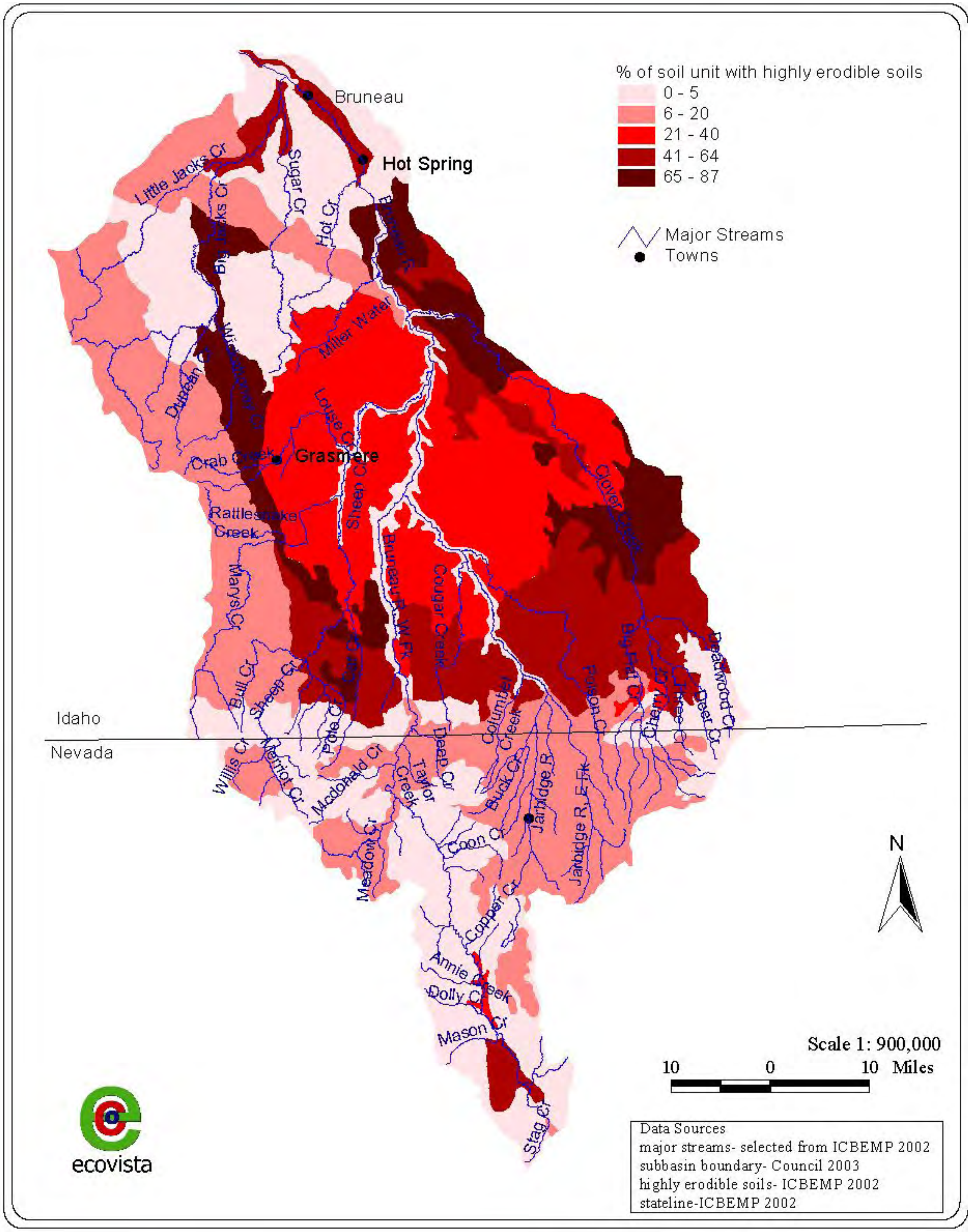


Figure 5. Soil erodibility in the Bruneau subbasin.

### 1.5.6 Water Resources

#### *1.5.6.1 Watershed Hydrography*

The Bruneau subbasin lies in the Pacific Northwest Region (U.S. Geological Survey [USGS] Region 17), which includes all of Washington and parts of California, Idaho, Montana, Nevada, Oregon, Utah, and Wyoming. It occurs in USGS subregion 1705, which encompasses a drainage area of 36,700 square miles and includes the Snake River basin below the Clover Creek basin to Hells Canyon Dam. The Bruneau River is included in USGS accounting unit 170501 (Middle Snake–Boise), which consists of the Snake River basin below the Clover Creek basin to and including the Weiser River basin (32,600 square miles). The USGS cataloging unit (4th field hydrologic unit code [HUC]) for the subbasin is 17050102 and encompasses an area of 3,290 square miles. There are a total of 44 fifth field and 107 sixth field HUCs in the Bruneau subbasin (Figure 6).

The Bruneau subbasin has approximately 3,995 miles of streams and rivers. Of this total, 986 miles of stream are perennial and 3,009 miles are intermittent. In addition, the subbasin has an estimated 47 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 (a.k.a. Clover Creek) and West Forks of the Bruneau River, the East and West Forks of the Jarbidge River, Sheep Creek, Marys Creek, and Jacks Creek (including 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.

The Jarbidge River watershed is approximately 664.1 square miles, with flows originating from snowmelt, seeps, and springs in the Jarbidge Mountains of northern Nevada at an elevation of about 10,500 feet (Zoellick et al. 1996). The East and West Forks of the Jarbidge are the two primary tributaries, which flow 22.4 and 19.9 miles, respectively, in a northerly direction to form the mainstem approximately 3.6 miles north of the Idaho–Nevada border at an elevation of 4,980 feet (Zoellick et al. 1996). From the confluence of the forks, the mainstem flows northwesterly for 28 miles before meeting the mainstem Bruneau River at an elevation of 3,700 feet.

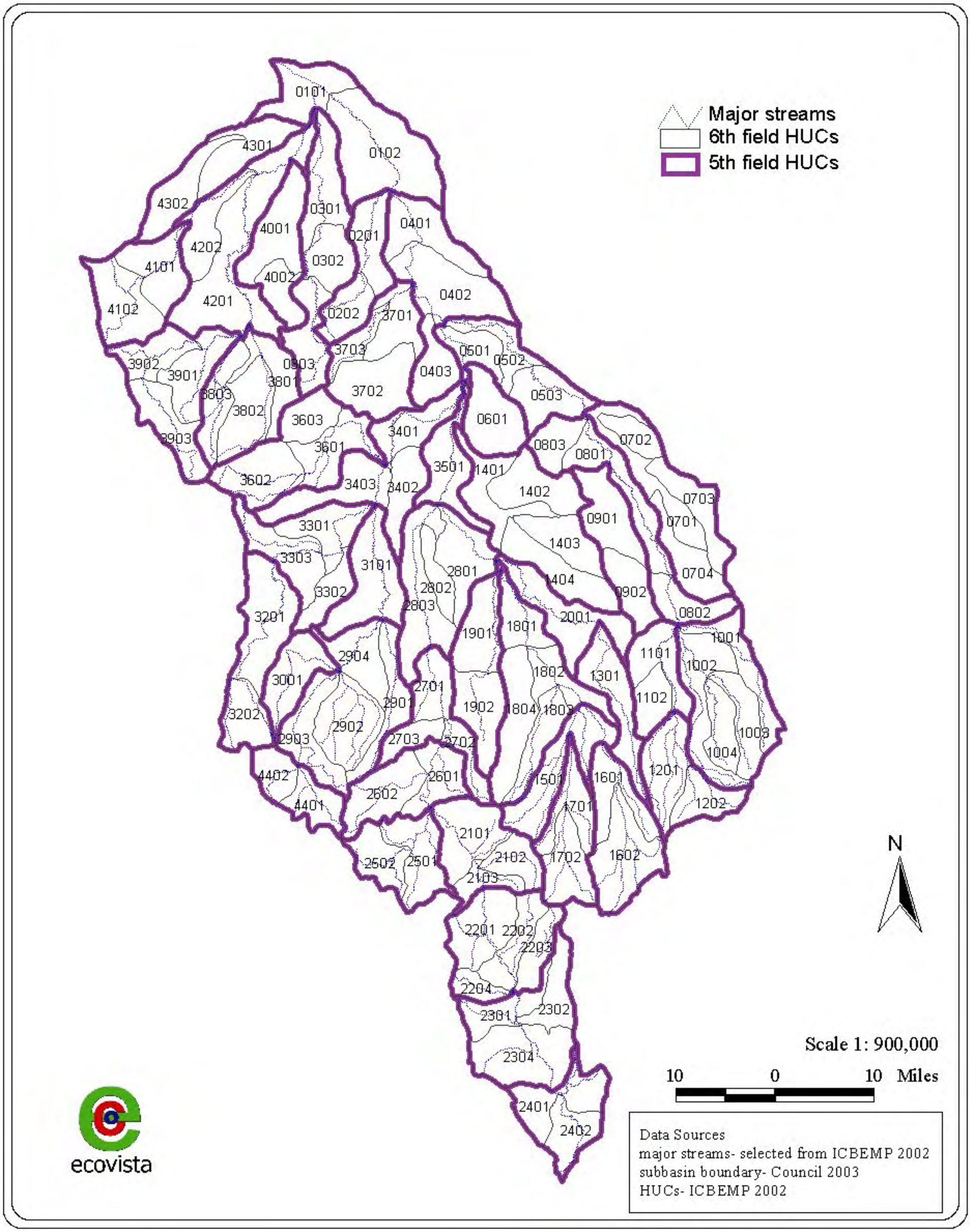


Figure 6. Fifth and sixth-field hydrologic unit codes (HUCs) in the Bruneau subbasin.

### 1.5.6.2 Hydrologic Characterization

Flow data in the Bruneau subbasin has been collected from various USGS-maintained gages, and for various periods, since 1895 (Table 5). The gage located on the mainstem Bruneau River, near Hot Springs, ID (gage 13168500), is the only currently active gage in the subbasin and has the longest period of record (count = 23,619) and second greatest contributing drainage area. The gage below Jarbidge, NV (gage 13162225), is the uppermost gage in the subbasin (and also the gage with the smallest contributing drainage area). However, flow records were collected from this gage only from 1999 through 2001.

Table 5. USGS gaging summary for the Bruneau subbasin in Idaho and Nevada.

| Gage Number | Gage Name | Latitude | Longitude | Area ($mi^2$) | Elevation (ft) | Period of Record |
|---|---|---|---|---|---|---|
| 13161500 | Bruneau River near Roland, NV | 41:56:00N | 115:40:25W | 382.0 | 4,500.0 | 1914–1918; 1967–2001 |
| 13162000 | Bruneau River near Tindall, ID | 42:08:00N | 115:41:00W | 440.0 | 4,250.0 | 1911 |
| 13162225 | Jarbidge River, below Jarbidge, NV | 41:23:56N | 115:25:40W | 30.6 | 6,050.0 | 1999–2001 |
| 13162500 | East Fork Jarbidge River near Three Creek, ID | 42:02:00N | 115:22:20W | 84.6 | 5,150.0 | 1929–1932; 1954–1971 |
| 13167500 | East Fork Bruneau River near Hot Springs, ID | 42:33:25N | 115:30:35W | 620.0 | 3,864.7 | 1911–1914; 1950–1971 |
| 13168000 | Bruneau River near Winter Camp Ranch, ID | 43:38:00N | 115:42:00W | 1,890.0 | 3,015.7 | 1946–1951 |
| 13168500 | Bruneau River near Hot Springs, ID | 42:46:16N | 115:43:10W | 2,630.0 | 2,598.5 | 1910–1914; 1944–2003 |
| 13169500 | Big Jacks Creek near Bruneau, ID | 42:47:06N | 115:59:00W | 253.0 | 2,810.0 | 1940–1949; 1966–1988 |
| 13171000 | Bruneau River near Grand View, ID | 42:56:00N | 115:57:00W | 2,650.0 | 2,372.3 | 1895–1896; 1899; 1910–1911; 1913–1915; 1945–1948 |

The average annual discharge in the mainstem Bruneau River, as recorded at the Hot Springs gage (number 13168500), is 387.7 cfs. Peak flows on the mainstem Bruneau River occur in May (average discharge = 1,248.6 cfs), while the lowest flows typically occur in September (average discharge = 79.7 cfs) (Figure 7). Average spring discharge at the Hot Springs gage is 824 cfs, while average winter discharge is 167.0 cfs. Lay and IDEQ (2000) report that, during certain times of the year, the majority of discharge in the river originates from geothermal sources, most notably near Hot Springs and other large springs farther up the Bruneau Canyon.

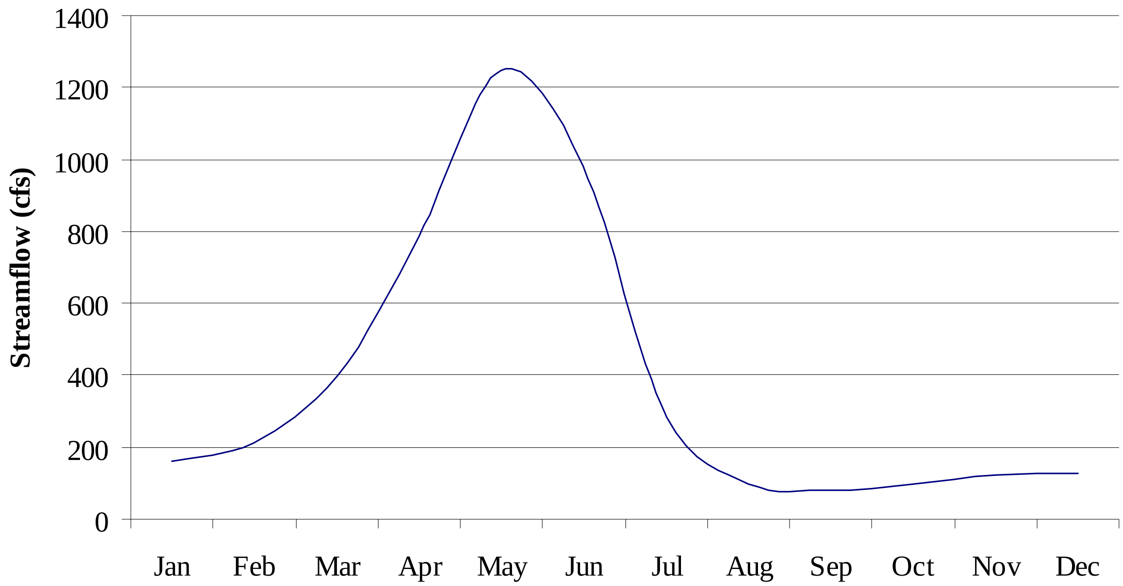


Figure 7. Monthly hydrograph for surface streamflows recorded on the mainstem Bruneau River, near Hot Springs, ID (gage 13168500). The hydrograph is based on 776 discrete monthly averages (1910–1914, 1944–2003).

Based on gage data for Big Jacks Creek, the average annual discharge for the period during which flows were recorded was 5.1 cfs. Average spring discharge was 13.0 cfs, average summer discharge was 2.1 cfs, and average winter discharge was 3.8 cfs. Baseflow conditions occur in the fall, averaging around 1.0 cfs. Big Jacks Creek is prone to extended periods of zero flow. For example, almost 60% of all daily flows recorded from 1939 to 2002 were zero cfs.

Mean annual discharge in the East Fork Jarbidge River, as recorded at gage 13162500, was 60.8 cfs (based on 22 years of data). Peak runoff occurs in June, while low flow conditions typically occur through the fall and early winter (September through December) (Figure 8). Snowmelt is the dominant contributor to streamflows in this higher elevation portion of the subbasin. On average, streamflows in the East Fork Jarbidge River are perennial: there are no zero-flow days recorded for the 21-year period of record.

Similar to the East Fork Jarbidge, the East Fork Bruneau River represents another perennial tributary to the mainstem Bruneau River. Peak runoff, as measured at gage 13167500 near Hot Springs, occurs in May (average discharge = 115 cfs), and base flows typically initiate in late July and extend through the fall (Figure 9).

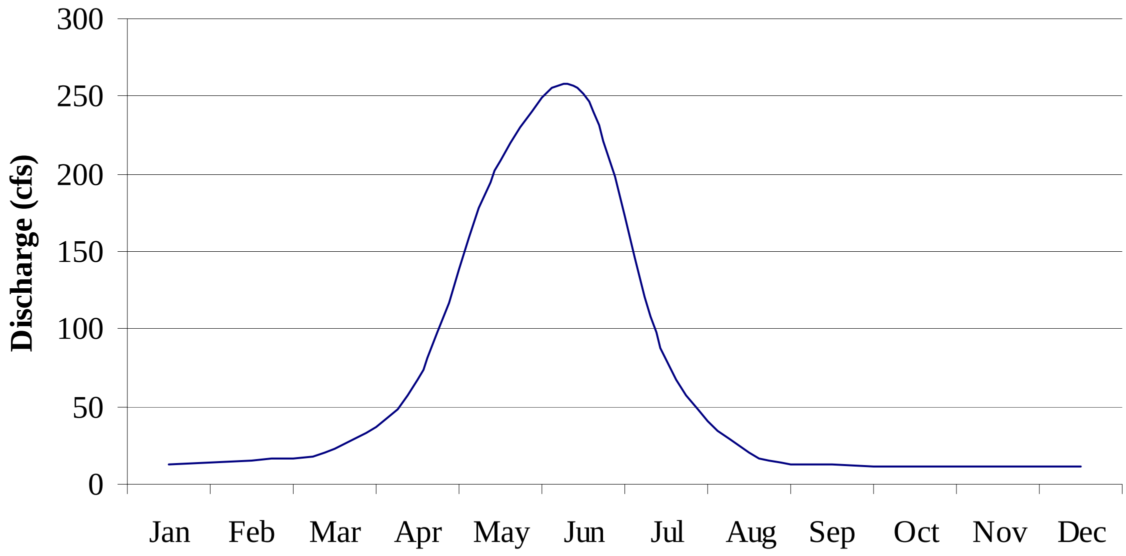


Figure 8. Monthly hydrograph for surface streamflows recorded on the East Fork Jarbidge River (gage 13162500). The hydrograph is based on 270 discrete monthly averages.

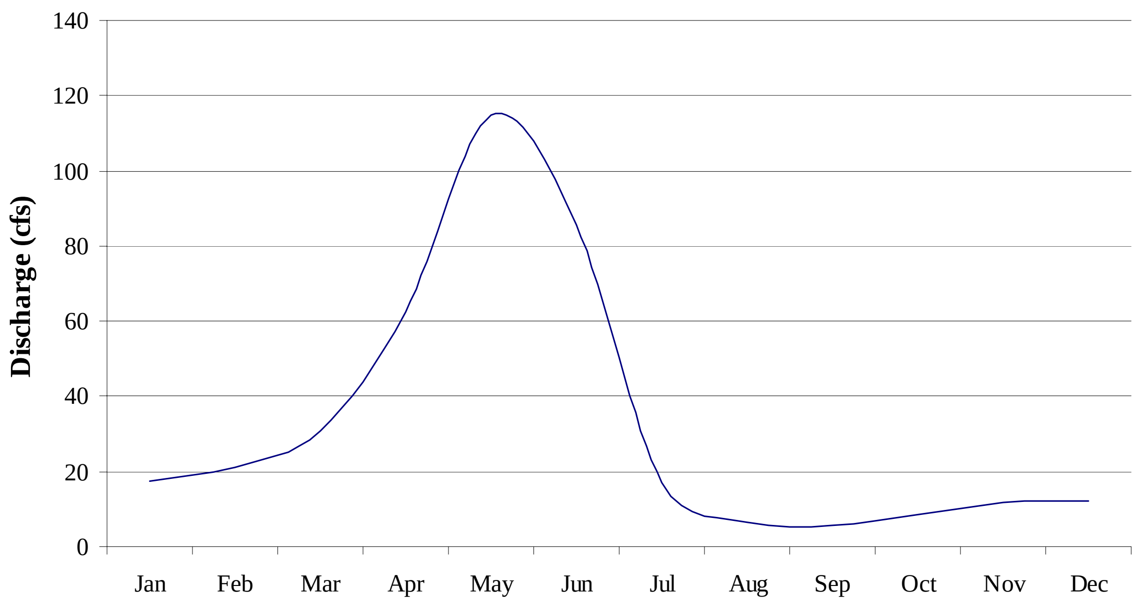


Figure 9. Monthly hydrograph for surface streamflows recorded on the East Fork Bruneau River (gage 13167500). The hydrograph is based on 327 discrete monthly averages.

### 1.5.6.3 Peak Flow Generating Processes

Streams throughout the subbasin are subject to occasional flooding (USAF 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 (USFS 1998).

### 1.5.6.4 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.

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 6 and Figure 10). It is the states' and tribes' responsibility to develop their respective 303(d) lists, to establish a total maximum daily load (TMDL) for the parameter(s) causing water body impairment (Table 7), and delist stream segments when conditions warrant (Table 8). Currently, no known point or significant nonpoint 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).

Table 6. 1998 303(d)-listed stream segments in the Bruneau subbasin (from Lay and IDEQ 2000).

| Water Body | HUC[a]/PNRS[b] | Boundaries | Pollutants and Stressors |
|---|---|---|---|
| Bruneau River | 17050102/549 | Hot Creek to C.J. Strike Reservoir | sediment, nutrients, temperature, flow alteration |
| Hot Creek | 17050102/557 | headwaters to Bruneau River | sediment, flow alteration, pathogens |
| Jacks Creek | 17050102/551 | Little Jacks Creek to C.J. Strike Reservoir | 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 |

[a] HUC = hydrologic unit code designation by the USGS for the Upper Snake Basin
[b] PNRS = Pacific Northwest River Study designation number

Table 7. Total maximum daily loads (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–total phosphorus | | | |
| Jacks Creek | nutrients–total phosphorus | dissolved oxygen–total phosphorus | bacteria | sediment–total suspended solids |
| Sugar Valley Wash | nutrients–total phosphorus | dissolved oxygen–total phosphorus | bacteria | sediment–total suspended solids |
| Clover Creek | bacteria | | | |
| Three Creek | sediment–percent fines | | | |

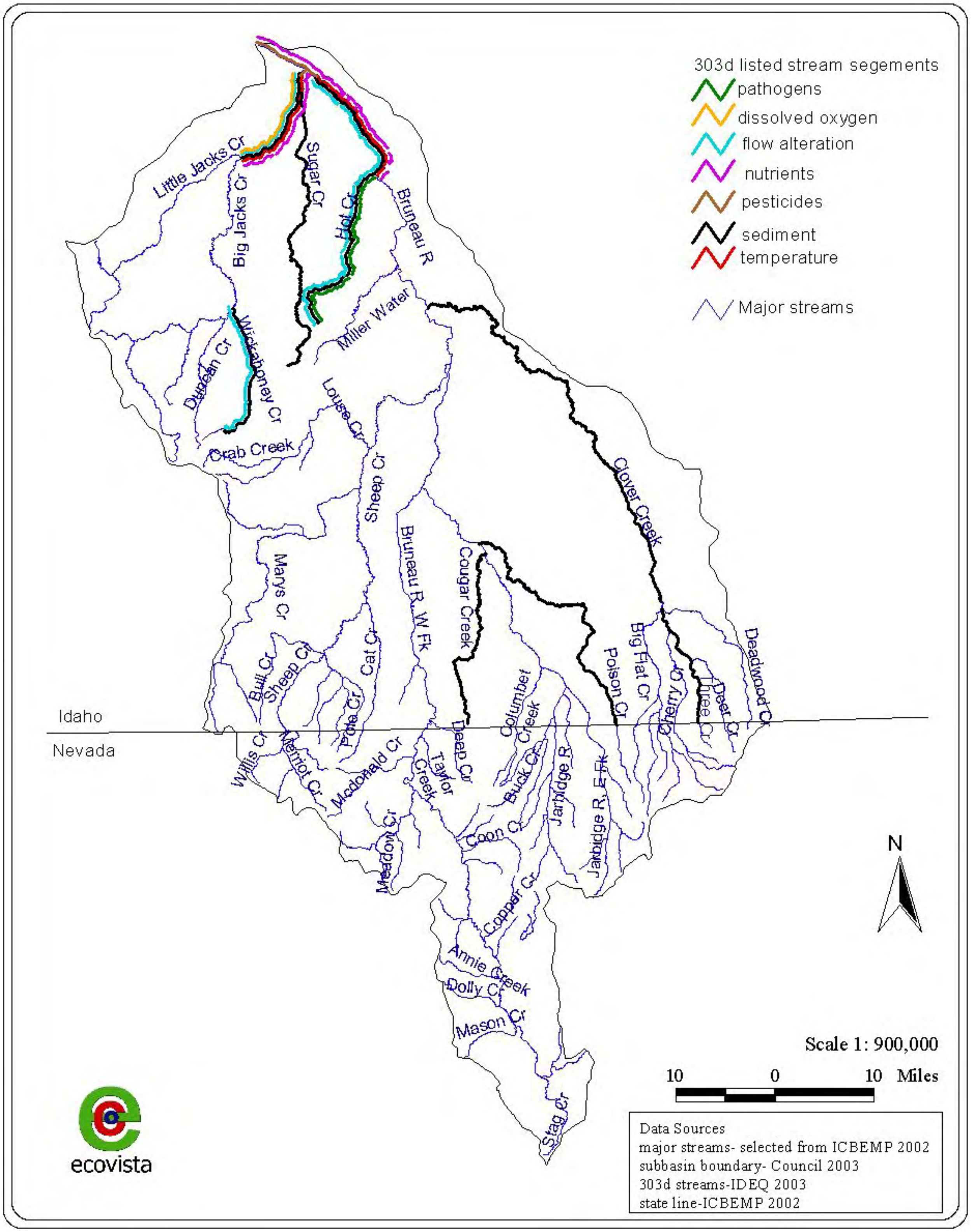


Figure 10. Location of 303(d)-listed stream segments, Bruneau subbasin.

Table 8. 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 | |

#### *1.5.6.5 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).

#### *1.5.6.6 Nutrients*

High concentrations of nutrients (TP) have been documented in Jacks Creek, a concentration that 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.

#### *1.5.6.7 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 rivers during the warmer months of the year. The Idaho Department of Fish and Game (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.

#### *1.5.6.8 Other Problems*

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

#### *1.5.6.9 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).

### 1.5.7 Vegetation and Land Cover

The Bruneau subbasin lies within the regional landform and vegetation classification of Sagebrush Province/Sagebrush Steppe Ecosystem, which spreads over much of southern Idaho, eastern Oregon, eastern Washington, and portions of Nevada, California and Utah (BLM 1999a). This ecosystem ranges from sagebrush-covered plateaus to rugged mountains covered with juniper woodlands and grasslands (USAF 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 (*Ericameria* spp.), antelope bitterbrush (*Purshia tridentata*), golden currant (*Ribes aureum*), bluebunch wheatgrass (*Pseudoroegnaria spicata*, formerly called *Agropyron spicatum*), and basin wildrye (*Leymus cinereus*, formerly *Clymus cinereus*). Wyoming big sagebrush/Idaho fescue (*Festuca idahoensis*) and Wyoming big sagebrush/bluebunch wheatgrass plant communities dominate the overall subbasin (Figure 11) (USAF 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 saltbush (*Atriplex confertifolia*) sites. 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% 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 (*Salix* spp.), cottonwood (*Populus* spp.), rose (*Rosa* spp.), and mock orange (*Philadelphus* spp.) (Lay and IDEQ 2000). Along the lower Jarbidge River, lush riparian areas are lined with western juniper (*Juniperus occidentalis*) and dense stands of rushes (*Juncus* spp.), sedges (*Carex* spp.), poison ivy (*Toxicodendron rydbergii*), 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 Jarbidge River, presumably because of less human disturbance and use in the East Fork (USFS 1997).

The river canyons support the highest biological diversity of plant communities. Plant associations within the floodplain area include meadow communities and tall shrub communities, and consist of willow, rose, or stringers of cottonwood. Basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) communities are found at the edge of sandbars, at the confluences of creeks, and around seeps. The canyon walls are dominated by Wyoming big sagebrush and low densities of shrubs such as rabbitbrush, golden currant, bitterbrush, fourwing saltbush (*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 basin wildrye (USAF 1998).

The most heavily cut areas for mine timbers were the headwater slopes near Sawmill Creek and Deer Creek drainages. Pine and fir communities occupy 21% of the West Fork Jarbidge River watershed in a random mosaic pattern. Aspen covers 29% of the surface acres in the West Fork Jarbidge River watershed and 11% in the East Fork Jarbidge watershed. Fifty-three percent of the Jarbidge River watershed is dominated by some type of tree cover type, with only 36% of the East Fork Jarbidge watershed covered with similar vegetation types (USFS 1997).

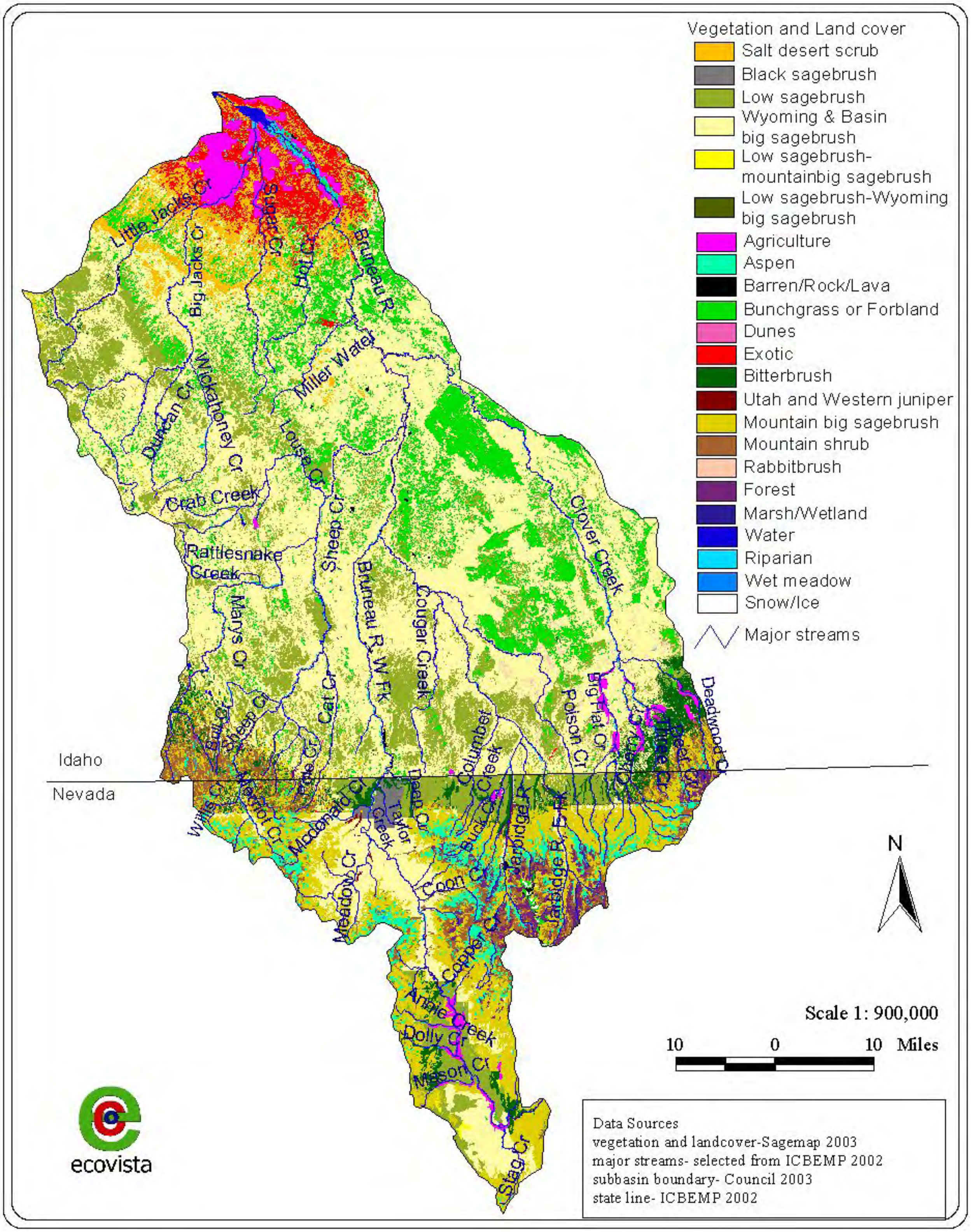


Figure 11. Vegetation and land cover in the Bruneau subbasin.

### 1.5.8 Land Management and Use

#### *1.5.8.1 Traditional Land Use by Indian Tribes*

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 Snake and Upper Snake provinces of the Columbia River, including the Bruneau Subbasin. The tribes were nomadic and 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 intertribal gatherings. Tribes met along the Snake River to trade, hunt, fish, and collect seeds, nuts, and berries. Late fall was a time of intensive preparation for winter. Meats and various plant foods were cached for later use, and winter residences along the Snake River were readied (Idaho Army National Guard 2000).

The tribes used 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*), and Pacific lamprey (*Lampetra tridentata*).

#### *1.5.8.2 Current Land Uses*

Approximately 86.2% of the land in the subbasin is federally owned and managed. The Bureau of Land Management (BLM) manages 69.8% of the land base (Figure 12). Only 8.4% of the subbasin is in private ownership (Table 9 and Figure 12).

Table 9. Land management in the Bruneau subbasin.

| Ownership | Acres | Kilometers$^2$ | Miles$^2$ | Percentage (%) |
|---|---:|---:|---:|---:|
| 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 | 88,699 | 359 | 139 | 4.2 |
| Department of Defense | 28,992 | 117 | 45 | 1.4 |
| Tribal | 22,314 | 90 | 35 | 1.1 |
| U.S. Forest Service | 318,034 | 1,287 | 497 | 15.0 |
| **Total** | **2,115,298** | **8,560** | **3,305** | **100.0** |

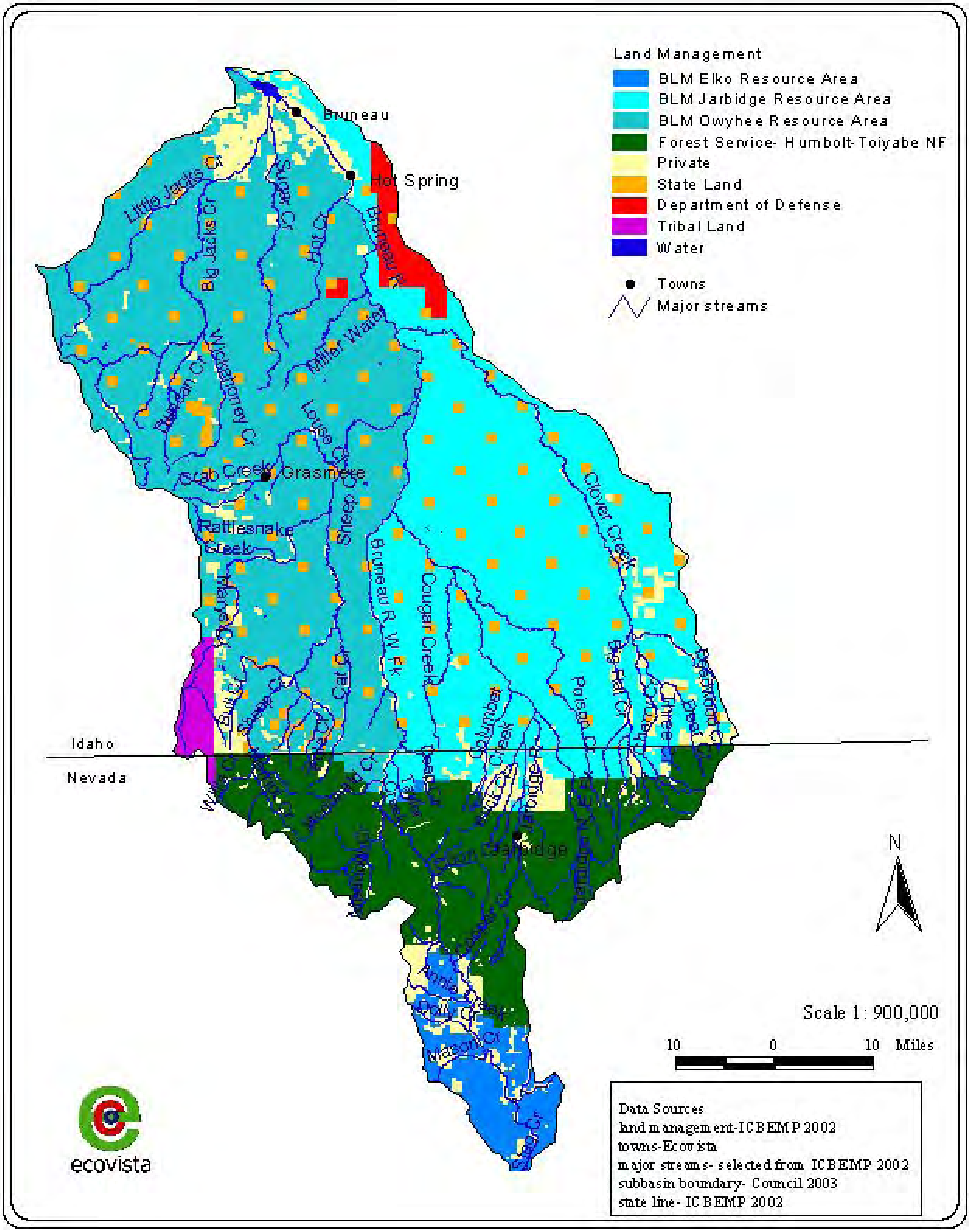


Figure 12. Land ownership and management in the Bruneau subbasin

#### 1.5.8.3 BLM Protection and Management

A number of protected or specially managed areas exist within the subbasin. These include Research Natural Areas (RNAs), the Jarbidge Wilderness, Wild and Scenic Rivers, and Areas of Critical Environmental Concern (ACECs) (Figure 13).

The BLM currently has PLO 6890 in effect for the Idaho portion of the Bruneau/Jarbidge River system. This order, which is being considered for a 10-year extension, withdrew public and private land from surface entry and mining (Figure 14). 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 (BLM 2001a). 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 option.

#### 1.5.8.4 Grazing

A majority of the Bruneau subbasin is grazed by livestock, and there are a total of 148 grazing allotments (Table 10, Figure 15). These allotments are administered by the BLM and USFS and cover 93% of the subbasin. Stocking rates for these allotments were not available for inclusion in this assessment but are based on vegetation, slope, soil type and other factors. In addition, grazing occurs on the Duck Valley Indian reservation. The largest areas of the subbasin that are not grazed include portions of the Big Jacks, Little Jacks, Bruneau and Jarbidge Canyons and the core bull trout areas of the Upper Jarbidge and East Fork Jarbidge Rivers (see Figure 15).

Table 10. Size and administrator of the grazing allotments of the Bruneau subbasin.

| Allotment Administrator | Number of Allotments | Total Acres of Allotments Administered | Average Size of Allotments |
|---|---|---|---|
| BLM Owyhee Resource Area | 29 | 865,847 | 29,857 |
| BLM Jarbidge Resource Area | 38 | 719,385 | 18,931 |
| BLM Elko Resource Area | 15 | 96,032 | 6,402 |
| USFS Humboldt-Toiyabe National Forest | 66 | 287,267 | 4,353 |
| Total in subbasin | 148 | 1,968,530 | 13,301 |

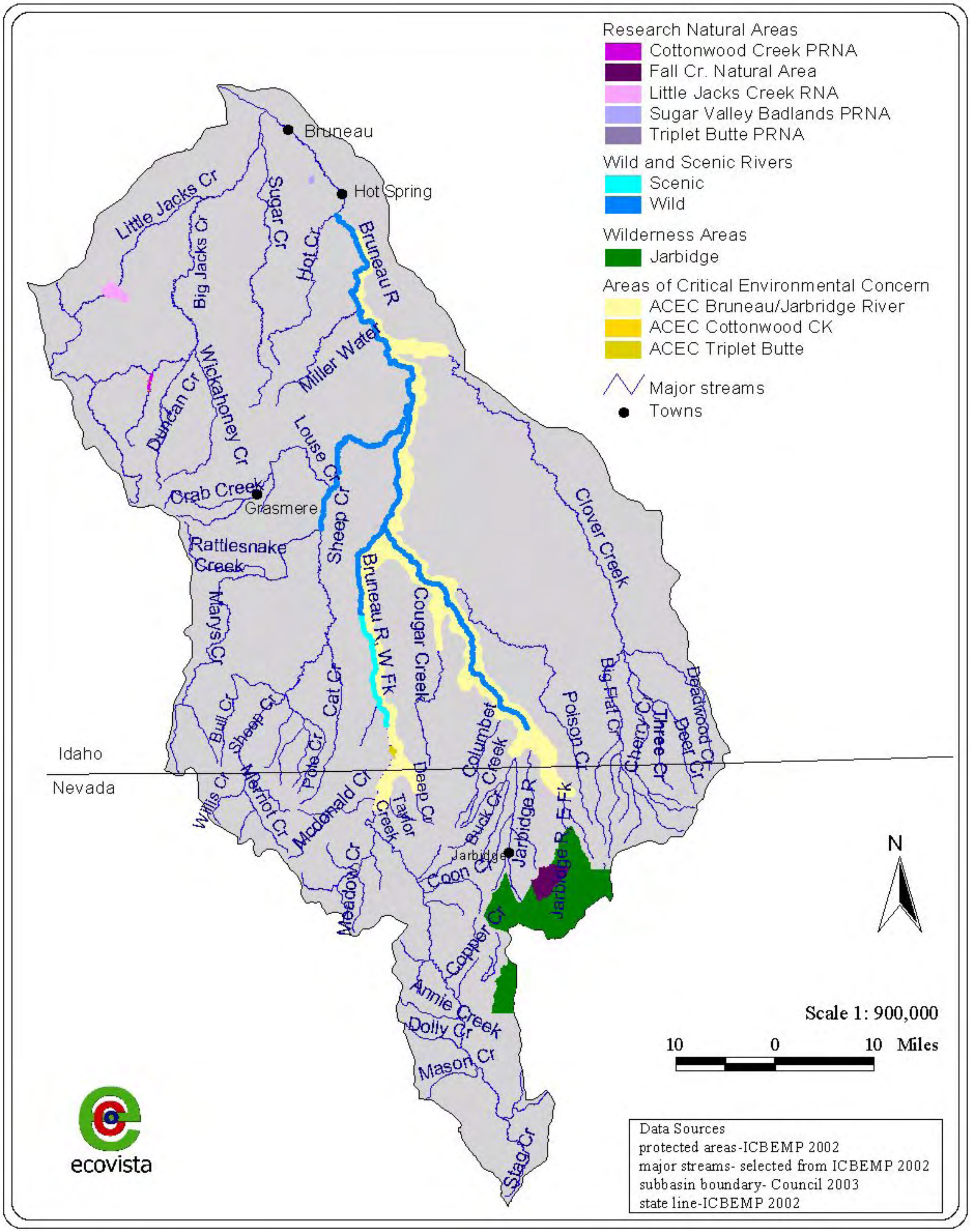


Figure 13. Areas in the Bruneau subbasin with conservation-based management or protection.

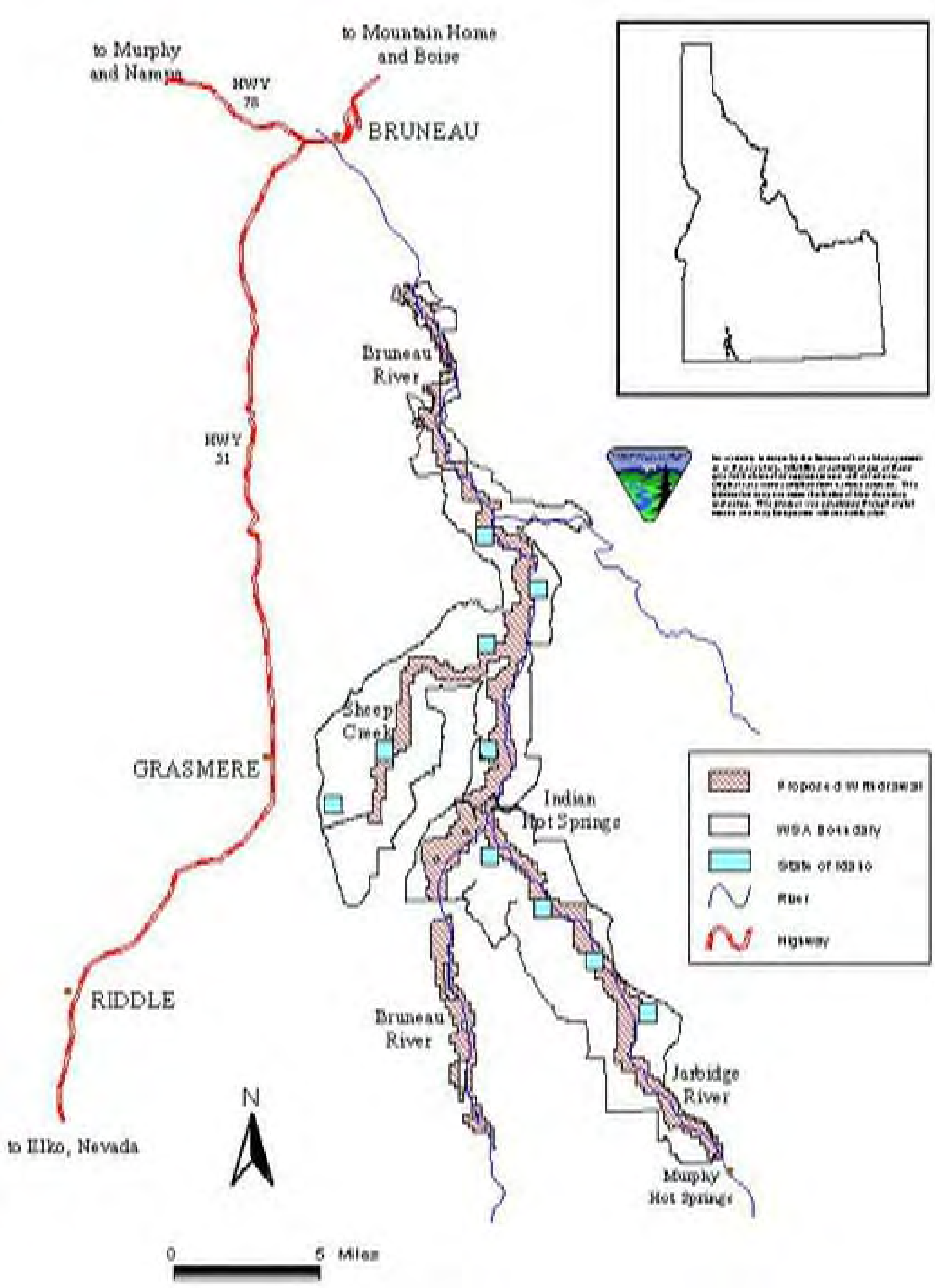


Figure 14. Area covered by State of Idaho PLO 6890 (BLM 2001a).

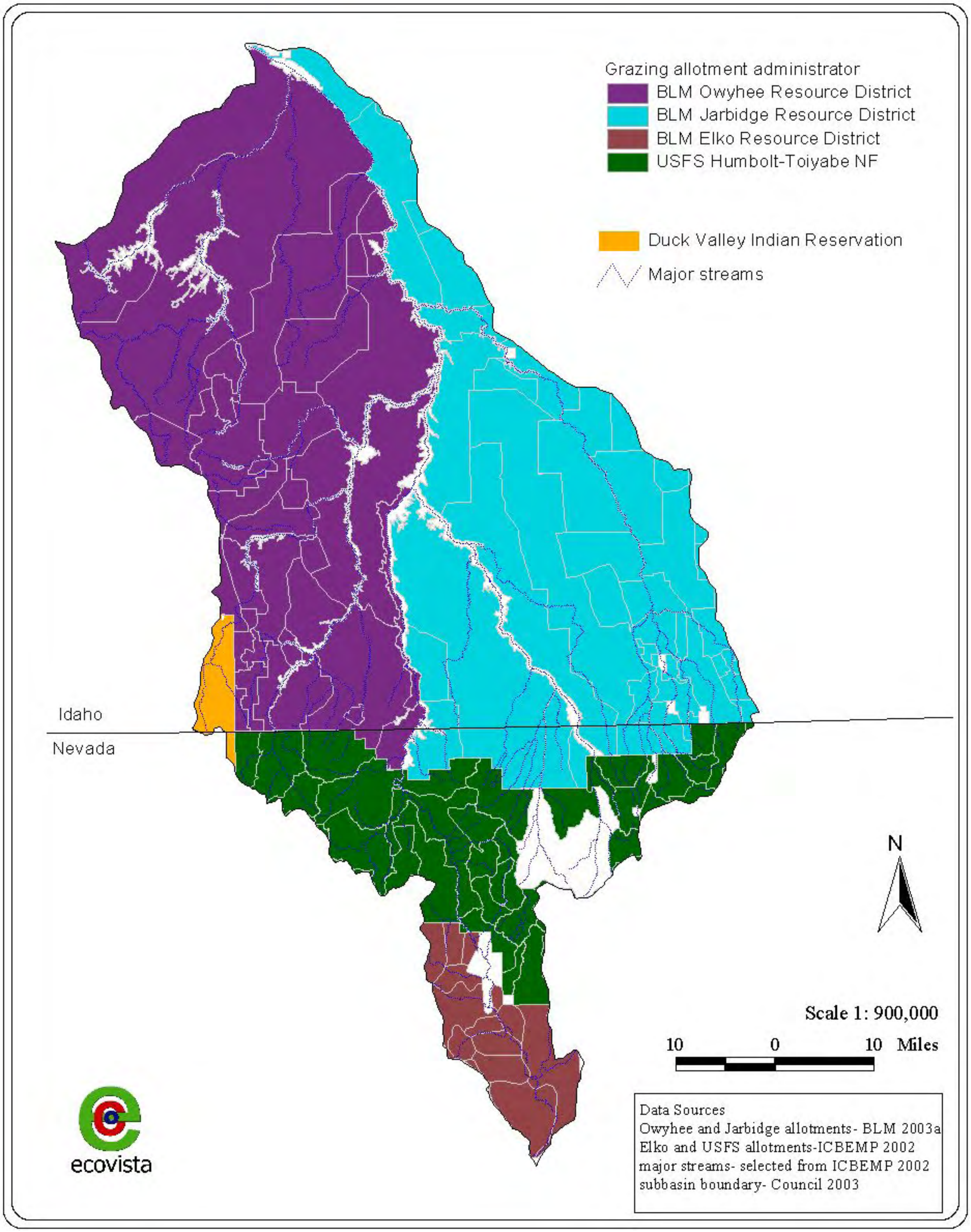


Figure 15. Grazing allotments and their administrators in the Bruneau subbasin

### 1.5.8.5 Agriculture, Irrigation, Water Diversion, and Impoundments

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.

The Bruneau River supplies irrigation water to the lands bordering the Snake River. Approximately 3.61 cfs of water 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 0.75 cfs is diverted into the South Side Canal during irrigation season (Lay and IDEQ 2000). 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. Water diversion structures and instream channelization are common in Copper, Rattlesnake, Meadow, Miller, Merritt, and McDonald creeks and in the length of the West Fork Bruneau River in the Humboldt-Toiyabe National Forest. These practices have disrupted normal stream channel processes (USFS 1995).

Nine known impoundments exist in the subbasin (Table 11). No control structures exist in the Jarbidge River system (Parrish 1998). Figure 16 shows locations for eight of the nine impoundments. 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.

Table 11. Impoundments in the Bruneau subbasin (IDFG unpublished data).

| Name | Stream | Year Complete | Crest Length (ft) | Height (ft) | Max Storage (acre-feet) | Type |
|---|---|---|---|---|---|---|
| GRASMERE MIDDLE | RATTLESNAKE CREEK | 1936 | 700 | 11.7 | 2,490 | Earth |
| GRASMERE NORTH | LOUSE CREEK | 1936 | 1,520 | 19.0 | 1,075 | Earth |
| STRICKLAND (BLACKSTONE) | LOUSE CREEK | 1927 | 950 | 29.0 | 560 | Earth |
| DIAMOND A (COWAN) | COUGAR CREEK | 1931 | 345 | 26.0 | 3,926 | Earth |
| BILLINGS (POLE CREEK) | POLE CREEK | 1992 | 575 | 14.0 | 9 | Earth |
| SNOW CREEK NORTH | SNOW CREEK | 1957 | 760 | 9.0 | 320 | Earth |
| SNOW CREEK SOUTH | | | 1,375 | 7.5 | 0 | Earth |
| TINDALL (BULL CREEK) | WEST FORK BULL CREEK | 1951 | 760 | 10.0 | 130 | Earth |
| ALDER | ALDER SP, MARYS CK | 1909 | 1,040 | 19.0 | 960 | Earth |

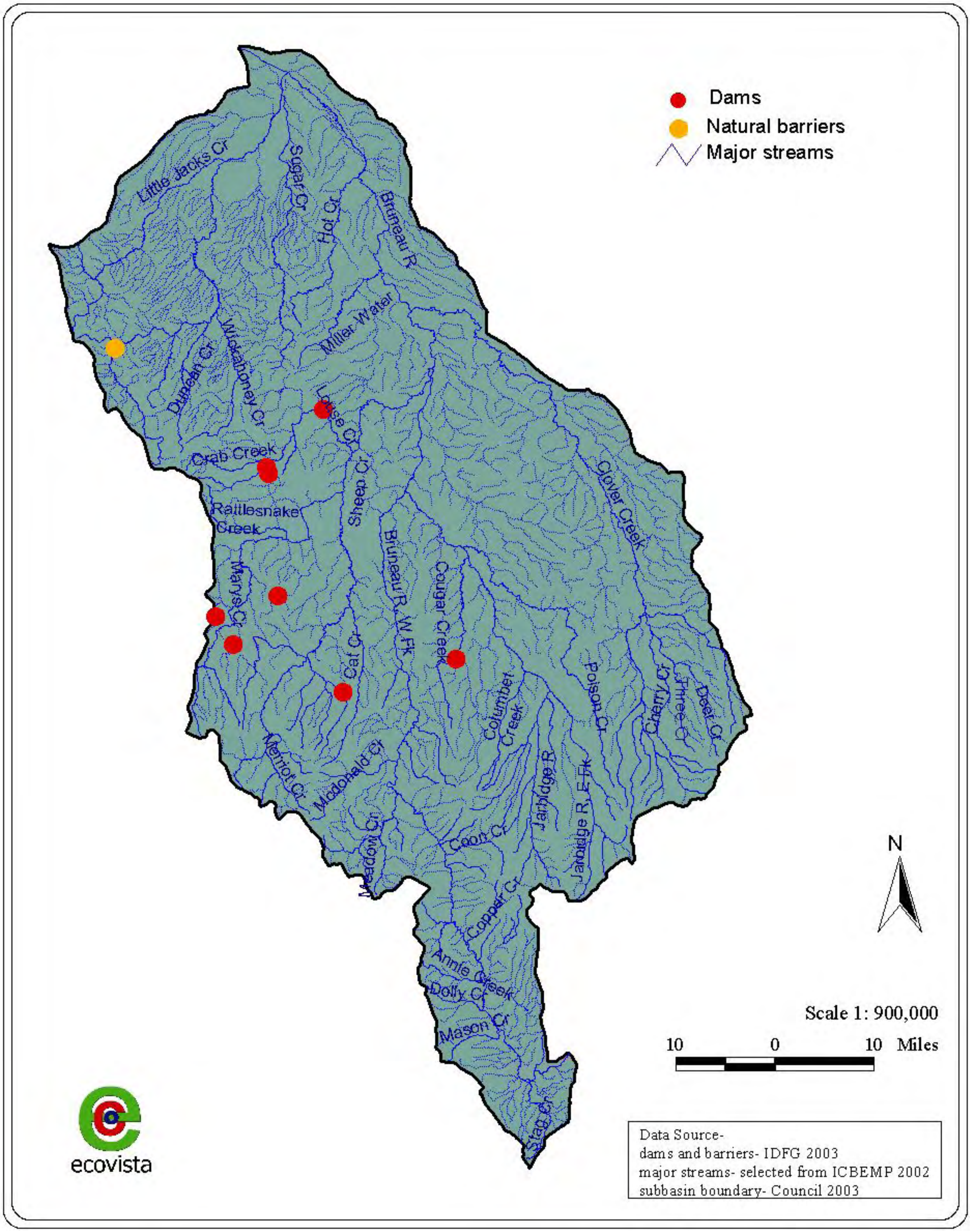


Figure 16. Dams and natural barriers within the Bruneau subbasin.

Large portions of several streams are dewatered annually, including Deadwood, Cherry, Devil, Flat, Deer, Jim Bob, House, Antelope, and Three creeks. Bear Creek, a tributary in Nevada that enters the Jarbidge River from the West at the town of Jarbidge is also dammed and diverted for domestic water for Jarbidge residents (G. Johnson, NDOW, personal communication, April, 2004). By rendering many miles of streams unsuitable for supporting aquatic species, water diversions have fragmented habitat and isolated fish populations.

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 (USAF 1998).

Prior to extensive groundwater development, about 10,100 acre-feet of water 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).

No known physical barriers to fish passage exist in the Jarbidge watershed portion of the subbasin (Parrish 1998). A culvert prevented fish passage in Jacks Creek in the upper Jarbidge watershed until it was replaced with a bridge in 1997 (Partridge and Warren 2000). On Big Jacks Creek, a barrier referred to as “The Falls” (RM 39) is a natural migration barrier. Current assessment of other instream barriers is a data need in the subbasin.

#### *1.5.8.6 Recreation*

The BLM manages areas designated for recreation, or Special Designation Management Areas (SRMAs). These areas require a recreation investment, need more intensive recreation management, and are designated in areas where recreation is a principal management objective. Three SRMAs are within the Bruneau subbasin (Bruneau–Jarbidge, Jarbidge Forks, and Jacks Creek SRMAs).

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 class 6 rapids (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 also offer anglers the opportunities to fish for trout and whitefish. Use is focused along the Jarbidge Road, Bruneau River, and Meadow Creek Road. Fishing, hunting, and nonconsumptive uses of wildlife contribute to both state and local economies.

### 1.5.8.7 Fire

The protection and management of natural resources on public lands is the responsibility of the Departments of the Interior and Agriculture, together with tribal and state governments and other jurisdictions. In 1994, the Federal Wildland Fire Management Policy and Program Review was chartered by the Secretaries of the Interior and Agriculture to ensure that federal policies are uniform and programs are cooperative and cohesive. The review was primarily conducted by the Forest Service (USFS), the Bureau of Land Management (BLM), the National Park Service, the U.S. Fish & Wildlife Service, and the Bureau of Indian Affairs. The resulting report presents fundamental principles of fire management and recommends a set of federal wildland fire policies.

Fire is used by the BLM to accomplish resource objectives in the most economical fashion possible (BLM 1987). Although mechanical treatment of fuel accumulation is often successful, prescribed fire may serve to integrate natural ecological processes of fire into the landscape (e.g. nutrient production, seed release for fire dependent species). In most of the Bruneau subbasin, full suppression of wildfire policy is enforced by the BLM and USFS. The BLM is the primary federal land manager in of the subbasin and their National Office of Fire and Aviation is headquartered at the National Interagency Fire Center, in Boise, Idaho. Fire experts of the BLM and USFS are continually developing policy, conducting wildland fire research, and coordinating with fire managers from other firefighting organizations.

### 1.5.8.8 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 watershed to shore up mine tunnels, build towns, and provide fuel for heat and cooking (Parrish 1998). No commercial harvest has occurred in the Jarbidge watershed, and impacts from historical logging are not considered a threat to the aquatic system (Parrish 1998). However, forests in the Jarbidge area were intensively harvested, and, when trees became too scarce, sagebrush was harvested by the wagonload (Northeastern Nevada Stewardship Group 2001).

The Jarbidge RMP identified 2,371 acres of commercial forestlands in the Jarbidge Field Office area. Of this, 1,086 acres (approximately 1,454 million board feet) were determined to be available for harvest when the RMP was completed in 1987. Past interest in forest products has been low in the Jarbidge resource area, but timber development will be expanded to the extent possible (BLM 1987).

### 1.5.8.9 Transportation

Road densities in the Bruneau subbasin are low when compared to subbasins of similar size (Figure 17). The highest densities (3-4 miles/mile$^2$) occur at the confluence of the Bruneau and in the Clover Creek headwaters. Snake Rivers Highway 51 is the main access road through the subbasin. The only other paved road is the Rogerson Cutoff, which 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 because of 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 some sediment to the river during minor events and vast quantities of sediment when road segments fail (Parrish 1998).  Beavers have also caused problems by damming the Jarbidge River during low flows, an activity that causes the river to back up onto roadbeds. Reintroduction of beavers in select areas of the subbasin has, however, been proposed as a way to increase baseflow conditions and improve riparian area development in some of the intermittent streams (*refer to* Subbasin Plan, Aquatics Objectives and Strategies, Section 3.2.1).

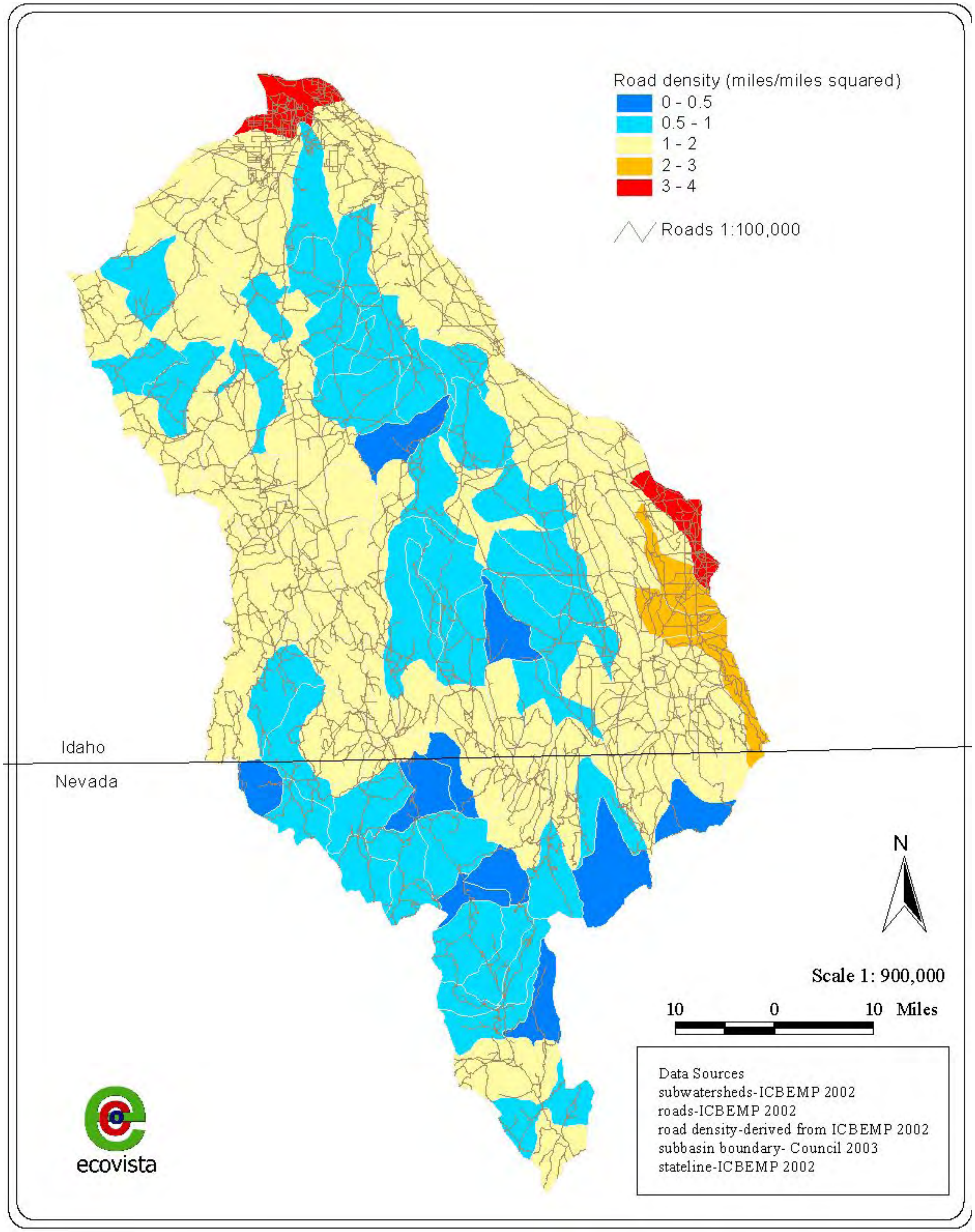


Figure 17. Road densities in the Bruneau subbasin.

#### 1.5.8.10 Mining

The Jarbidge RMP maintained 1,478,104 acres as open for mineral leasing (BLM 1987). Any restrictions of mineral development apply to proposed wilderness areas or Wild and Scenic River areas. The BLM considered that the RMP proposes no significant restraints on the availability of mineral leasing and that all existing local demands, as of 1987, should be met.

A number of active mining claims and leases occur in the subbasin (Figure 18). 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 to 40 years and annually produce several thousand pounds of jasper (USAF 1998). Eight other mining claims occur in the Indian Hot Springs area (BLM 1987). In the lower subbasin, a sand and gravel pit occurs on Three Creek Road, and guano claims exist on Clover Creek.

Gold mining activity 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 (USFS 1997). The actual volume of dumped tailings is unknown (Parrish 1998).

#### 1.5.8.11 Military Facilities and Training

Mountain Home Air Force Base lies to the north of the Bruneau subbasin, 8 miles southwest of Mountain Home, Idaho (Figure 19). Since operations began on August 7, 1942, the base has been home to several infantries and is currently occupied by the 366th Fighter Wings, also known as the Gunfighters (www.mountainhome.af.mil). The mission of the Air Force is to maintain combat readiness while training military forces, and this mission is enhanced by the use of remote training sites. Remote training sites of the Mountain Home Air Force Base form the Mountain Home Training Range Complex and are dispersed across Owyhee County (with one site in Twin Falls County). This training range complex includes the Small Arms Range, Saylor Creek Range, Juniper Butte Range, no-drop targets, emitter sites, and the Grasmere Electronic Combat Site (CH2M HILL 2003) (Figure 19). The Juniper Butte Range, 5 no-drop targets, 24 emitter sites, and the Grasmere Electronic Combat Site are within the Bruneau subbasin (Table 12) (CH2M HILL 2003). The southwest portion of the Saylor Creek Range also lies within the Bruneau subbasin.

Table 12. Mountain Home Training Range Complex sites within the Bruneau subbasin (CH2M HILL 2003).

| Site | Acres | Kilometers$^2$ | Miles$^2$ |
|---|---|---|---|
| Juniper Butte Range | 12,000 | 48.56 | 18.75 |
| No-drop targets | 660 | 2.67 | 1.03 |
| Emitter sites | 6 | 0.03 | 0.01 |
| Grasmere Electronic Combat Site | 7 | 0.03 | 0.01 |

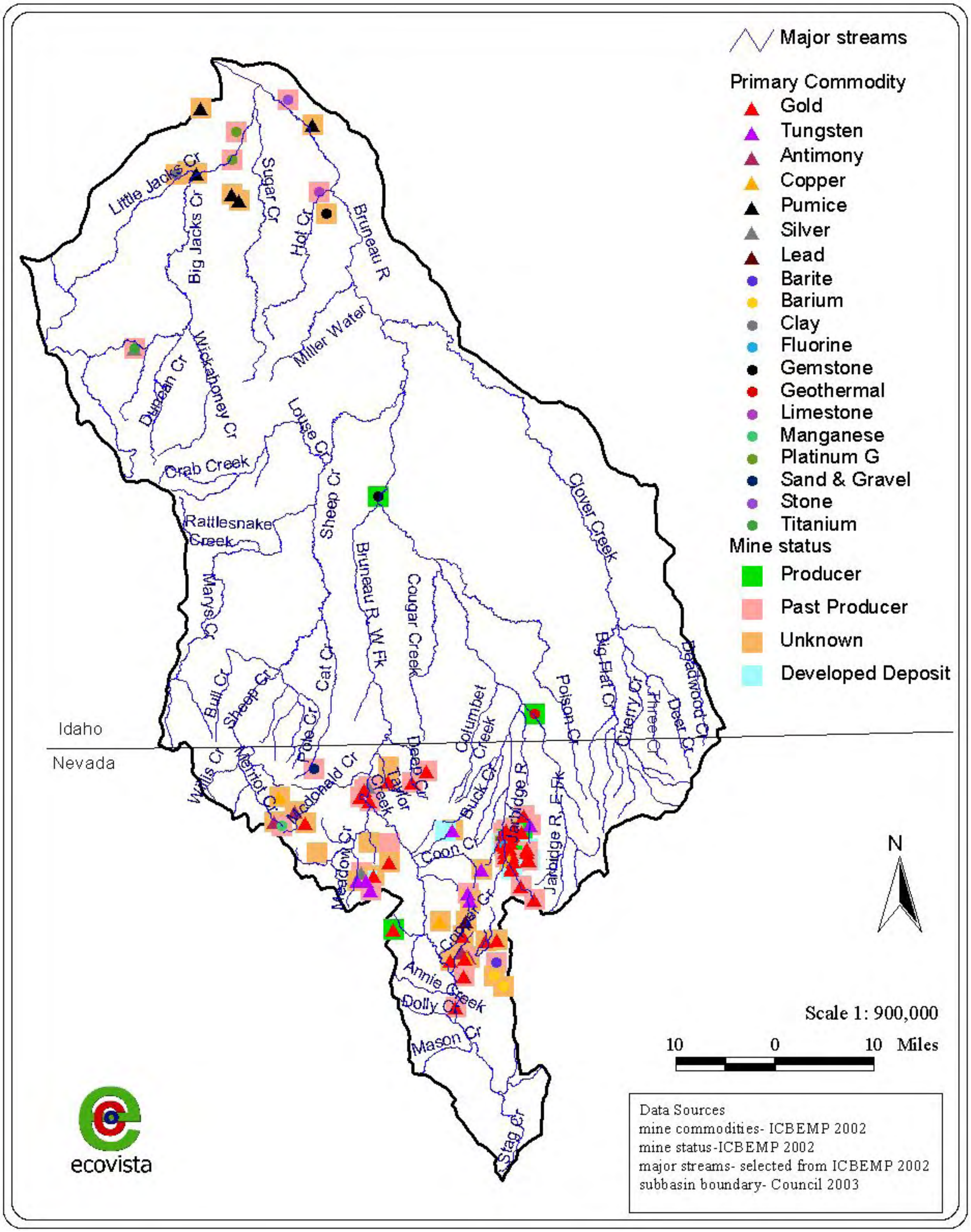


Figure 18. Historic and active mines in the Bruneau subbasin.

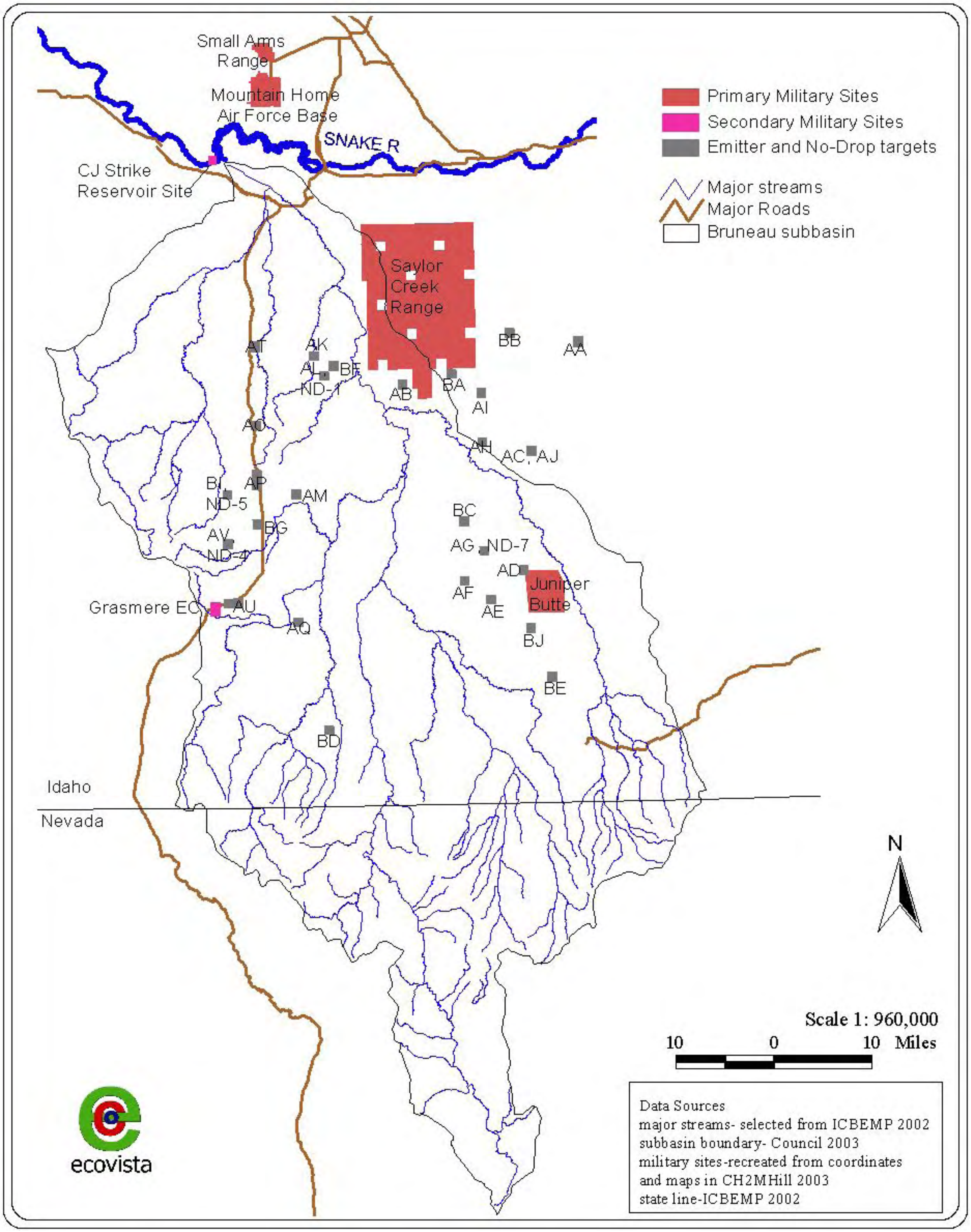


Figure 19. Location of military sites, emitters and no-drop targets in the Bruneau subbasin.

### 1.5.9 Socioeconomic and Cultural Concerns

In addition to the uses detailed above, the Bruneau subbasin also supports activities important to the social and cultural heritage and well-being of its residents and users. Because more than 80% of the subbasin is Federally owned and almost 70% of the subbasin is managed by the Bureau of Land Management, the BLM considers the effects of resource management policy upon the people that live, work and own land in the subbasin. A series of public meetings was held in 2002 to gain public comments on the important social and cultural uses of the resources of the Bruneau subbasin, and how these resources should be managed to consider impacts to these uses (BLM 2002).

#### *1.5.9.1 Shoshone-Paiute Tribal Uses*

An important goal of federal Indian policy has been to establish self-sufficient reservation communities. This has been interpreted by the Shoshone-Paiute as well as by various government agents to require development of various enterprises such as irrigated farming and cattle and horse ranching. Despite various projects and efforts by the federal government, there have been frequent failures in Duck Valley Indian Reservation history due to lack of investment and development of the reservations' water resources by the federal government. These failures have made the importance of various traditional food resources critical for survival in the domestic economy of many Shoshone-Paiute families who live in economic poverty. A principal impact on such families has been the blockading of anadromous fish passage to the Owyhee, Bruneau, as well as the Boise-Payette-Weiser and Middle and Upper Snake River drainages. These losses must be taken into account in any subbasin planning effort, especially in view of the previous failure to compensate or otherwise mitigate damages done to the Shoshone-Paiute by the loss of these important resources.

Research by Dr. Walker has established a baseline for determination of the extent of these losses. For example, Dr. Walker determined that before the blockading of the fish passage the Shoshone-Paiute of the Duck Valley Indian Reservation enjoyed three annual salmon runs of about ten days each. Dr. Walker determined from interviews of elders as well as from recorded interviews of tribal members born in the 19$^{th}$ century that these three annual salmon runs could be expected, in normal years, to last about ten days each. The research also demonstrates that the location of the Duck Valley Indian Reservation was chosen in part because of the abundant fisheries available in the region. For example, in an interview with Federal Agent Levi Gheen, the *Territorial Enterprise* (1-3-1878) quoted saying, "The country abounds in deer, grouse, prairie chickens and other wild game, while the creeks and river[s] literally swarm with excellent fish. All in all Duck Valley is a veritable Indian paradise." Again, it was at this time that Captain Sam first mentioned Duck Valley to Gheen as a "place . . . about seventy or eighty miles northeast of [Elko] where [the Indians] say there is plenty of game and fish and a good farming country as near as they can judge with plenty of timber [and in the mountains] water and grass" (Gheen 1875).

Using information gained from tribal fishermen as well as from comparative catch records from other related tribes (Walker 1967, 1992, 1993b), Dr. Walker estimates catches to have been about 200 fish per day, averaging 15 pounds each (for each of ten separate weirs), yielding a potential average annual catch of 90,000 pounds, or about 6,000 fish. As further verification of these numbers estimates have been derived for other important fisheries (the Boise-Payette-Weiser Valley and the Hagerman-Shoshone Falls sites) which the Shoshone-Paiute shared with other tribes of southern Idaho. It is estimated that this large area contained at least 25 traditional weir sites, and based on tribal accounts each site could produce significant catches for about ten days, three times per year. For 25 weirs the catches are estimated to have been 200 fish per day, per weir, averaging 15 pounds each, yielding an average annual catch of 2,250,000 pounds or about 150,000 fish. Of course, some of these fisheries were destroyed early by mining and agriculture as other were later destroyed by damming of the Columbia, Snake, and many of their tributaries. While these 19th century salmon catch estimates are large when compared to contemporary catches in the Columbia-Snake system, they are supported by the evidence discovered in Dr. Walkers research.

Beginning in the late 19th century, the destruction of these fisheries has been a significant blow for the Shoshone-Paiute. They have suffered not only economic and subsistence shortfalls because of it, but also have experienced declines in the quality of their diet which in various serious health problems such as diabetes that are becoming extremely common. The loss of this significant source of easily obtained protein and related nutrients cannot be disregarded in subbasin planning; neither can the fact that the Shoshone-Paiute have never been compensated for their losses.

#### *1.5.9.2 Other Traditional Activities*

In addition to its importance to the culture of the Shoshone-Paiute tribes, the Bruneau subbasin is also home to activities that have become important cultural components of the lives of those who moved to these lands. These activities, including hunting, fishing, backpacking, mining, and grazing livestock, have become not just economic activities, but important social and cultural activities, intimately connected to the Bruneau and its resources.

## 1.6 Regional Context

Two recent regional assessment efforts have identified portions of the Bruneau subbasin as being areas of regional conservation importance based on high biodiversity and/or the presence of rare or endemic organisms. In 1994, the Interior Columbia Basin Ecosystem Management Project (ICBEMP) mapped centers of biodiversity and endemism/rarity across the interior Columbia Basin (ICBEMP 1997). In 1999, The Nature Conservancy (TNC) used the Biodiversity Management Area Selection (BMAS) model to develop a conservation portfolio for the Columbia Plateau Ecoregion. The subbasin is recognized as supporting a particularly diverse contingent of amphibian, reptile, and bat species. The Bruneau subbasin stands out within the context of the Columbia Basin as an area of particularly high biodiversity.

### 1.6.1 ICBEMP Centers of Biodiversity and Endemism

As part of the ICBEMP, expert panels of agency and nonagency scientists were convened between October 1994 and May 1995 to identify areas of rare and endemic populations of plant, invertebrate, and vertebrate species (ICBEMP 1997). The panels of experts produced maps showing areas having unusually high biodiversity and areas containing high numbers of rare or locally or regionally endemic species (Figure 20 and Figure 21, respectively). The centers of concentration were developed at the coarse scale within a short amount of time and were mostly based on panel members' personal knowledge of areas and species locations. The map developers suggested that the areas be considered a first attempt at identifying places with particularly diverse collections of rare or endemic species, or areas with high species richness. Centers of concentration might be candidates for Research Natural Areas or other natural area designations pending further local assessment and refinement (ICBEMP 1997). Sixty-eight percent of the subbasin was identified as a center of plant biodiversity (Table 13). These areas cover the entire lower portion of the subbasin almost to the Nevada state line. Twelve percent of the Bruneau subbasin was selected as a center of animal endemism and rarity, and 1% was selected as a plant center of endemism and rarity (Table 13). These areas occur primarily in the canyon areas surrounding the lower Bruneau River.

Table 13. Areas selected as centers of biodiversity or centers of endemism and rarity in the Bruneau subbasin.

| Interior Columbia Ecosystem Management Project Designation | Area of Bruneau Subbasin Selected (acres) | Percentage (%) of Bruneau Subbasin Selected |
|---|---|---|
| Centers of biodiversity—plants | 1,432,510 | 68 |
| Centers of biodiversity—animals | 0 | 0 |
| Centers of endemism and rarity—animals | 263,664 | 12 |
| Centers of endemism and rarity—plants | 26,728 | 1 |

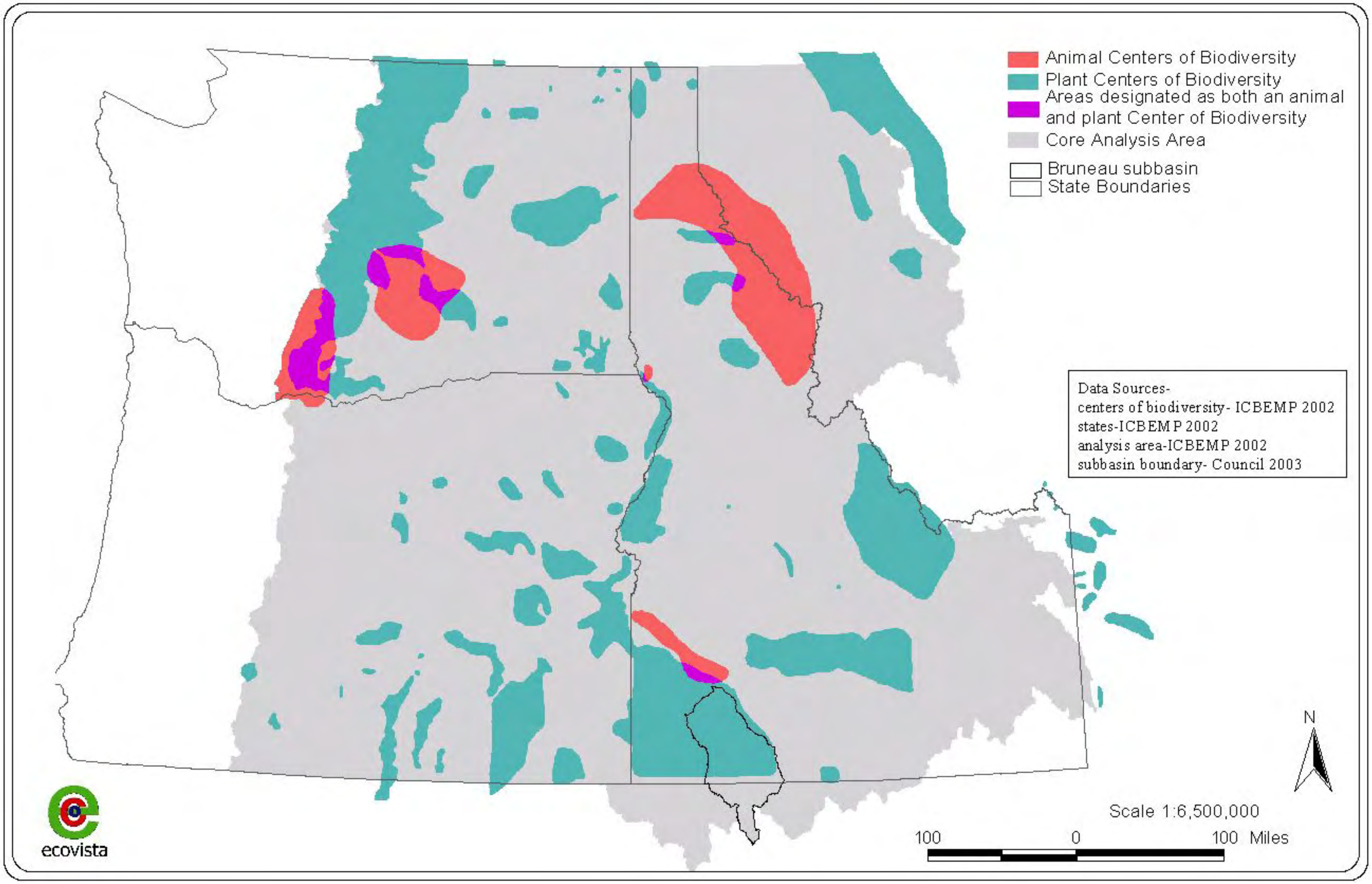


Figure 20. Centers of biodiversity in the ICBEMP analysis area and the Bruneau subbasin.

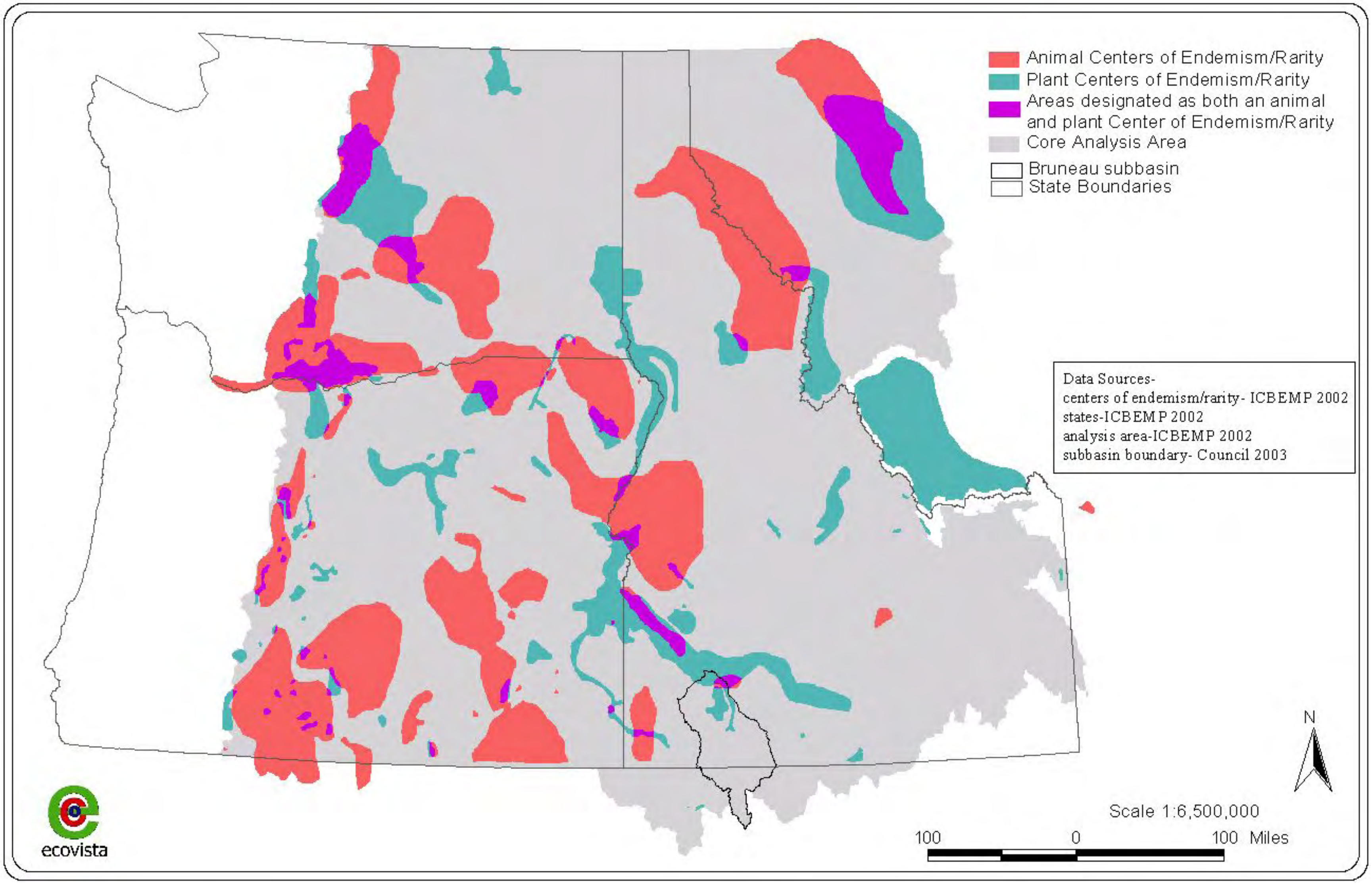


Figure 21. Centers of endemism and rarity in the ICBEMP analysis area and the Bruneau subbasin.

### 1.6.2 The Nature Conservancy's BMAS model

In 1999, TNC used the Biodiversity Management Area Selection (BMAS) model to identify a portfolio of sites that, collectively and with appropriate conservation action, would maintain all viable native species and communities in the Columbia Plateau Ecoregion, a 72,019,293-acre area covering portions of Washington, Oregon, Idaho, Nevada, California, and Utah. The Columbia Plateau Ecoregional Assessment was the first attempt at developing a selection methodology for creating a conservation portfolio. Further refinement of this methodology was employed in developing portfolios for the Middle Rockies–Blue Mountain and Canadian Rockies ecoregions (TNC 1999).

Conservation targets were selected using a coarse filter/fine filter approach. Targets representing fine filter aspects of biodiversity and comprising 154 plant species, 45 invertebrates, 49 vertebrates, 42 aquatic species, and 103 plant communities were identified for the purposes of selecting portfolio sites based on their occurrences. Coarse filter aspects of biodiversity were represented with Gap Analysis Program (GAP) cover types. An Aquatic Integrity Index developed by the ICBEMP was used to help establish aquatic targets (TNC 1999).

Conservation goals were then chosen for the targets, based on their distribution in the Columbia Plateau Ecoregion. For targets found in only one section of the ecoregion, the goal was to have all target occurrences, up to five, contained in the conservation portfolio. For targets found in more than one section, the goal was to protect all occurrences, up to three per section. Goals for coarse filter target representation were established based on percentage coverage of the cover type in the ecoregion. Element occurrence databases maintained by state Natural Heritage/Conservation Data Center programs were the main source of data. GAP provided the vegetation layer information, and other sources supplied supplementary environmental data (TNC 1999).

A GIS-driven site selection model, the BMAS model was used to select conservation sites that meet the greatest amount of biodiversity target goals while using the least amount of land. The BMAS model was a precursor to the SITES model that has been used in more recent ecoregional assessments such as those in the Middle Rockies–Blue Mountain and Canadian Rockies ecoregions. Areas identified by panels of regional biological experts as being of conservation importance were used as a starting place for the BMAS model. Sixth field HUCs were used as the site selection units. The initial portfolio developed by BMAS was then edited by TNC staff to address connectivity issues and account for differences in site quality. The final portfolio contained 139 sites that covered 20% of the ecoregion and ranged in size from 50 acres to over a million acres (Figure 22) (TNC 1999). Three of these important sites are found within the Bruneau subbasin. These areas collectively cover 27.8% of the subbasin (Table 14).

A number of conservation targets were not met by the final portfolio. However, most of these targets were at the edges of their ranges or had been poorly inventoried to date. During the next iteration of the ecoregion plan, TNC plans to focus on acquiring better information for these groups of targets (TNC 1999).

Table 14. Sites that are identified in the TNC conservation portfolio for the Columbia Plateau Ecoregional Assessment and that occur in the Bruneau subbasin.

| **Site Name** | **Size of Site (Acres)** | **Percentage (%) of Site within Bruneau Subbasin** | **Percentage (%) of Bruneau Subbasin Covered by Site** | **Reasons for Selection** |
|---|---|---|---|---|
| Bruneau–Jacks Creek | 433,169 | 75.0 | 15.30 | rare snails |
| Jarbidge | 428,100 | 62.0 | 12.50 | threatened fish habitat<br>bighorn sheep habitat<br>rare plant habitat |
| Duck Valley | 81,451 | 0.3 | 0.01 | wetlands |
| **Total** | **942,720** | | **27.80** | |

After the portfolio was developed, TNC undertook a second phase in the project: identifying the factors posing the greatest threats to the portfolio sites. The dominant threats in the ecoregion, in order by number of occurrences for each portfolio site were grazing (105), nonnative species (85), altered fire regimes (49), recreation (44), crop agriculture (42), residential development (27), diversions (26), and hydrologic alteration (19) (Table 15) (TNC 1999). The threats identified by the TNC process are similar to those identified as limiting factors through this assessment (See section 4).

Table 15. Threats identified to be impacting TNC portfolio sites in the Bruneau subbasin (TNC 1999).

| Site Name | Type of Threat | Extent of Threat | Immediacy | Reversibility | Extent of Knowledge |
|---|---|---|---|---|---|
| Bruneau–Jacks Creek | hydrologic alteration | significant | occurring now | unknown | minimal |
| Bruneau–Jacks Creek | grazing | significant | occurring now | unknown | moderate |
| Bruneau–Jacks Creek | ground water withdrawal | significant | occurring now | unknown | moderate |
| Bruneau–Jacks Creek | altered fire regime | significant | occurring now | unknown | moderate |
| Bruneau–Jacks Creek | nonnative plants | significant | occurring now | unknown | moderate |
| Bruneau–Jacks Creek | recreation | unknown | occurring now | unknown | minimal |
| Jarbidge | residential development | minor | occurring now | no | moderate |
| Jarbidge | grazing | minor | occurring now | yes | minimal |
| Jarbidge | recreation | minor | occurring now | yes | moderate |
| Jarbidge | altered fire regime | minor | occurring now | yes | minimal |
| Jarbidge | hydrologic alteration | unknown | unknown | yes | none |
| Jarbidge | roads/rights of way | minor | occurring now | yes | minimal |
| Jarbidge | mining | unknown | unknown | yes | none |
| Jarbidge | nonnative fish | unknown | occurring now | yes | minimal |
| Jarbidge | loss of habitat elsewhere | unknown | occurring now | yes | minimal |
| Jarbidge | commercial development | minor | 5–15 years | yes | minimal |
| Duck Valley | grazing | unknown | occurring now | unknown | minimal |
| Duck Valley | hydrologic alteration | unknown | occurring now | unknown | none |

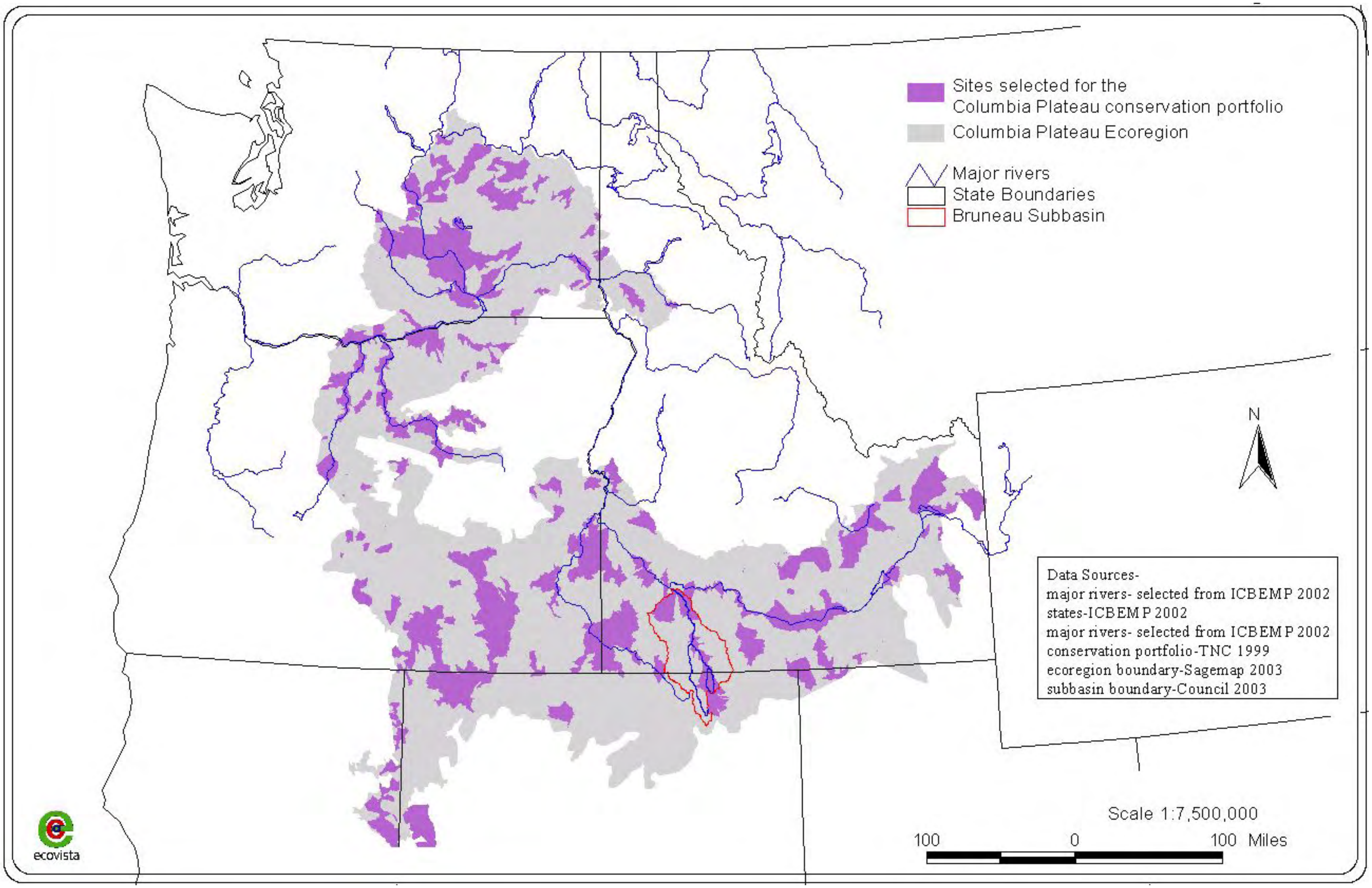


Figure 22. Sites identified in the TNC conservation portfolio for the Columbia Plateau Ecoregional Assessment.

### 1.6.3 Reptile and Amphibian Diversity

The Bruneau subbasin is recognized as an area of exceptional herptile diversity (Gerber et al. 1997) (Table 16). 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 17 species of reptiles and amphibians, 13 of which were associated with deep canyons. They also found that use of canyon bottoms and rims was highest, with little or no vertical movement of reptiles between habitat types.

Table 16. Reptiles and amphibians in Big Jacks and Little Jacks creek drainages (Gerber et al. 1997).

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

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

### 1.6.4 Bat Diversity

The canyons and uplands of the Bruneau–Jarbidge river system provide unique habitat features for a number of insectivorous bat species (Table 17). High relief, plunging cliff faces, and permanent water sources provide excellent forage and roosting habitat for bats (Schnitzspahn et al. 2000).

Table 17. Bat species identified in the Bruneau subbasin (from Doering and Keller 1998).

| Common Name | Species | Occurrence[a] |
|---|---|---|
| Pallid bat | *Antrozous pallidus* | unconfirmed |
| Townsend's big-eared bat | *Corynorhinus townsendii* | yes |
| Spotted bat | *Euderma maculatum* | yes |
| Big brown bat | *Eptesicus fuscus* | yes |
| California myotis | *Myotis Californicus* | highly likely |
| Western small-footed myotis | *Myotis cilioabrum* | yes |
| Long-eared myotis | *Myotis evotis* | yes |
| Little brown bat | *Myotis lucifugus* | yes |
| Fringed myotis | *Myotis thysanodes* | possible |
| Long-legged myotis | *Myotis volans* | highly likely |
| Yuma myotis | *Myotis yumanensis* | yes |
| Western pipistrelle | *Pipistrellus hesperus* | highly likely |
| Brazilian free-tailed bat | *Tadarida brasiliensis* | may occur |

[a] Occurrence: "yes" is based on mist net or unambiguous ANABAT results; "highly likely" is based on high confidence ANABAT results; "possible" is based on low confidence ANABAT results; "unconfirmed" means that species was predicted but not detected; "may occur" refers to an unlikely species or one that is not predicted but for which ANABAT results suggest occurrence.

# 2 Biological Characterization and Status

## 2.1 Species of Ecological Importance within the Subbasin

### 2.1.1 Species Designated as Federally Threatened or Endangered

Federal protection of native animal species in the United States was initiated by Congress in 1966 with the passage of the Endangered Species Preservation Act. In 1969, protection was extended to species worldwide by the Endangered Species Conservation Act. In 1973, international commerce of plant and animal species was restricted by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). These conservation efforts were synthesized in 1973 by the Endangered Species Act (ESA), which provided protection for U.S. and foreign species of animals, plants, and invertebrates. Amendments to the ESA were made in 1978, 1982, and 1988 but did not change the overall structure of the original act. Compliance under the ESA as amended is regulated by the Interior Department's U.S. Fish and Wildlife Service (USFWS) and Oceanic and Atmospheric Fisheries Service (NOAA Fisheries). FWS administers fish, wildlife, plants, and their habitats, while NOAA Fisheries manages marine and coastal resources.

The ESA provides a means for conserving the ecosystems upon which endangered and threatened species depend. The ESA defines an "endangered species" as "any species which is in danger of extinction throughout all or a significant portion of its range" and a "threatened species" as "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (section 3 of the act). "Candidate" species are plants and animals for which the FWS has sufficient information on their biological status and threats to propose them as endangered or threatened under the ESA, but for which development of a listing regulation is substituted by other higher priority listing activities (June 13, 2002, 67 CFR 40657). Federal agencies are required to consult with the USFWS upon any proposed action that may "jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such a species" (section 7). Conservation of endangered species at the state level is encouraged by federal financial incentives and cooperative agreements (section 6).

Two endangered snail species, one threatened fish species, three threatened wildlife species, and two wildlife candidate species for listing occur or potentially occur within the Bruneau subbasin (Table 18).

Table 18. Aquatic and terrestrial species that are listed as endangered, threatened, or candidate under the ESA and that are confirmed present or with potential habitat in the Bruneau subbasin (IBIS 2003, USFWS 2003).

| Federal Status | Common Name | Scientific Name |
|---|---|---|
| Endangered | Bruneau hot springsnail | *Pyrgulopsis bruneauensis* |
| Endangered | Idaho springsnail | *Pyrgulopsis idahoensis* |
| Threatened | Bull trout | *Salvelinus confluentus* |
| Threatened | Bald eagle | *Haliaeetus leucocephalus* |
| Threatened | Snowy plover | *Charadrius alexandrinus* |
| Threatened | Lynx | *Lynx canadensis* |
| Candidate | Yellow-billed cuckoo | *Coccyzus americanus occidentalis* |
| Candidate | Columbia spotted frog | *Rana luteiventris* |

## 2.1.2 Special Status Species

### *2.1.2.1 State*

#### Idaho

The IDFG is mandated under Idaho Code § 36-103 to "preserve, protect, perpetuate and manage all wildlife." The agency classifies wildlife into game, furbearing, migratory birds, threatened or endangered, protected nongame, or unprotected species. In addition, a species of special concern list is maintained by the state for "native species which are either low in numbers, limited in distribution, or have suffered significant habitat losses" (IDFG 2003b). The Idaho Conservation Data Center (CDC) is the central repository for information pertaining to native species status and provides the most current information on Idaho's rare, threatened, and endangered animals (ICDC 2003). In the Bruneau subbasin, there are 77 birds, 10 mammals, 3 amphibians, and 3 reptiles that are identified by the state of Idaho as protected or species of special concern (Appendix A).

The CDC maintains native plant data with major input provided by the Idaho Native Plant Society, a nonprofit organization "dedicated to promoting interest in native plants and plant communities, and collecting and sharing information on all phases of the botany of native plants in Idaho." There are 13 plant species classified as sensitive (S), which are taxa having small populations or localized distributions within Idaho but aren't presently in danger of becoming extinct or extirpated from Idaho (IDCDC 2003) (Appendix B). An additional 4 plant species have been targeted for continued monitoring (M) (Appendix B). These species are common within a limited range or uncommon without foreseeable threats (IDCDC 2003).

### Nevada

In Nevada, hunting and animal protection measures of the Department of Conservation and Natural Resources are delineated by Nevada's code of state regulations (NAC), which are defined under State law (NRS 233B.038) to outline procedure requirements of the agency. The Nevada Department of Wildlife (NDOW) is responsible for the management and restoration of Nevada's fish and wildlife resources. Animal species are classified as game, furbearing, unprotected, endangered, threatened, or protected (NAC 503). State regulations define an endangered species as one facing the threat of extinction throughout all or a significant portion of its range. A species or subspecies is considered threatened if it is likely to become an endangered species in the near future. Protected status is assigned to a species that meets any or all of the following criteria: it is found only in the state and has a limited distribution; its population may experience significant declines from human or natural causes; deterioration and loss of habitat threatens the population; the species' value (i.e., ecological, scientific, educational) justifies protection; there is inadequate data available to determine the status of a population that is suspected to be limited in habitat, distribution, or other factors; or the species is listed under the federal ESA (NAC 503.103). There is no open season on fish and wildlife classified as protected in Nevada. For protected plant species in Nevada, "no member of its kind may be removed or destroyed at any time by any means except under special permit issued by the state forester firewarden" (N.R.S. 527.270). Species that are classified by Nevada as endangered, threatened, or protected and that are present or with potential habitat in the Bruneau subbasin include 29 birds and 2 mammals (Appendix A). One plant species of the Bruneau subbasin, mud flat milkvetch (*Astragalus yoder-williamsii*), is classified by the State of Nevada as critically endangered (NNHP 2003).

## *2.1.2.2 Federal*

### Bureau of Land Management

The BLM in Idaho, in accordance with national policy (BLM Manual 6840), maintains a special status species list of plants and animals (BLM 2003b). This list is used by Idaho BLM offices for guiding priorities in conservation and management. The current list was approved by the State Director in May 2003 and will be updated in December 2005. Special status species are ranked based on rarity and endangerment and classified into one of the five following categories: Type 1 (federally threatened, endangered, proposed, and candidate species), Type 2 (rangewide/globally imperiled species), Type 3 (regional/state imperiled species), Type 4 (peripheral species), and Type 5 (watch list). Currently, there are 43 birds, 16 mammals, 2 amphibians, and 6 reptiles that are classified by the Idaho BLM as special status species, Types 2 through 5, and that are known to be present or have potential habitat in the Bruneau subbasin (Appendix A). Definitions for special status plants differ from animals only in the Type 3 (rangewide/globally imperiled plant species—moderate endangerment) and Type 4 (plant species of concern) descriptions. There are 49 plant species of the Owyhee Resource Area and 18 plant species of the Jarbidge Resource Area that are classified by the Idaho BLM as special status species, Types 2 through 5, and that occur or potentially have habitat in the Bruneau subbasin (Appendix B). Species listed as candidate, threatened, or endangered under the ESA (Type 1) were previously presented in Table 18.

### U.S. Forest Service

The threatened, endangered, and sensitive species program of the U.S. Forest Service (USFS) is guided by the ESA, National Forest Management Act (1976), and the Secretary of Agriculture's Policy on Fish and Wildlife (9500-4). In addition to compliance with conservation legislation and policy, the USFS sensitive species policy (FSM 2670.32) calls for National Forests to "assist states in achieving conservation goals; to complete biological evaluations of programs and activities; avoid and minimize impacts to species with viability concerns; analyze significance of adverse effects on populations or habitat; and coordinate with states, the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service" (NMFS). Plant and animal species identified by the Regional Forester as "sensitive" are those in which viability is of concern and adverse effects of management are avoided or mitigated to prevent federal listing. USFS (Region 4) wildlife sensitive species that are present or have potential habitat in the Bruneau subbasin include 10 birds, 3 mammals, and 1 reptile (Appendix A). There are 3 plant species classified as sensitive in Region 4 and that may occur in the Bruneau subbasin (Appendix B).

### 2.1.3 Terrestrial Species Recognized as Rare or Significant to Local Area

The Natural Heritage Network (NatureServe) consists of programs in all 50 states and extends into Canada and Latin America. The Natural Heritage Programs/Conservation Data Centers of this network adhere to high scientific standards and provide a repository of data on rare and endangered species in a standardized format. The IDCDC is part of the NatureServe network, and its mission is to "collect, analyze, maintain, and disseminate scientific information necessary for the management and conservation of Idaho's biological diversity." Nevada's Natural Heritage Program is also a contributing member of NatureServe and helps coordinate resource needs of Nevada's biological heritage.

State (S) status of animals and plants are ranked on a scale of 1 to 5. The scale and key for ranking symbols for a species is defined as follows (ICDC 2003, NNHP 2003):

**1** = Critically imperiled because of extreme rarity or because some factor of its biology makes it especially vulnerable to extinction (typically 5 or fewer occurrences)

**2** = Imperiled because of rarity or because other factors demonstrably make it very vulnerable to extinction (typically 6 to 20 occurrences)

**3** = Rare or uncommon but not imperiled (typically 21 to100 occurrences)

**4** = Not rare and apparently secure, but with cause for long-term concern (usually more than 100 occurrences)

**5** = Demonstrably widespread, abundant, and secure

**H =** Historical occurrence

**?** = Uncertainty exists about the stated rank

**B** = Breeding population (long distance migrants, *e.g.*, bats and birds)

**N** = Nonbreeding population (long distance migrants, *e.g.*, bats and birds)

**Example of use: S2S3** = Uncertainty exists as to whether the species or subspecies should be ranked S2 or S3.

The IDCDC lists 48 bird, 19 mammal, 4 amphibian, 3 reptile (Appendix C), and 45 plant species (Appendix B) that are present or with potential habitat in the Bruneau subbasin as critically imperiled (S1), imperiled (S2), or rare (S3). The Nevada Natural Heritage Program records for S1, S2, and S3 species include 25 bird, 12 mammal, 1 amphibian, and 6 plant species that occur or have potential habitat in the Bruneau subbasin (see Appendix C for animals, Appendix B for plants). Six bird, 3 mammal, 1 amphibian, and 1 plant species classified as federally listed or a focal species of the Bruneau subbasin are considered rare or significant to the local area (Table 19).

For plants, the Idaho Native Plant Society maintains a list of plants for the state, including globally rare (or global priority, GP1, GP2, GP3), state rare (or state priority, 1 and 2), and review species (IDCDC 2003). State priority 1 species are "taxa in danger of becoming extinct or extirpated from Idaho in the foreseeable future if identifiable factors contributing to their decline continue to operate; these are taxa whose populations are present only at critically low levels or whose habitats have been degraded or depleted to a significant degree". State priority 2 species will likely be classified as priority 1 if factors contributing to their decline continue to persist. The Bruneau subbasin potentially contains 1 GP1, 7 GP2, and 9 GP3, 7 state priority 1, and 5 priority 2 plant species (Appendix B).

Table 19. Terrestrial species that are recognized as rare or significant to the local area and that are federally listed (T or E)/candidate (C) species under the ESA and/or are Bruneau subbasin focal species (F) (ICDC 2003, NNHP 2003).

| Common Name | Scientific Name | ICDC | NNHP | ESA or Focal Species Status |
|---|---|---|---|---|
| **Birds** | | | | |
| Bald eagle | *Haliaeetus leucocephalus* | S3B,S4N | S1B | T |
| Northern goshawk | *Accipiter gentilis* | | S3 | F |
| Mountain willow flycatcher | *Empidonax traillii adastus* | | S2? | F |
| White-faced ibis | *Plegadis chihi* | S2B | S3B | F |
| Yellow warbler | *Dendroica petechia* | | S3B | F |
| Yellow-billed cuckoo | *Coccyzus americanus occidentalis* | S1B | S1B | C, F |
| **Mammals** | | | | |
| Pygmy rabbit | *Brachylagus idahoensis* | S3 | S3? | F |
| Spotted bat | *Euderma maculatum* | S2 | S1S2 | F |
| California bighorn sheep | *Ovis canadensis californiana* | S3 | | F |
| **Amphibian** | | | | |
| Columbia spotted frog | *Rana luteiventris* | S2S3 | S2S3 | C, F |
| **Plants** | | | | |
| Slickspot peppergrass | *Lepidium papilliferum* | S2 | | F |

### 2.1.4 Managed Wildlife Species

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 23). Five of the focal species selected for the Bruneau subbasin are managed as game species by Idaho and Nevada.

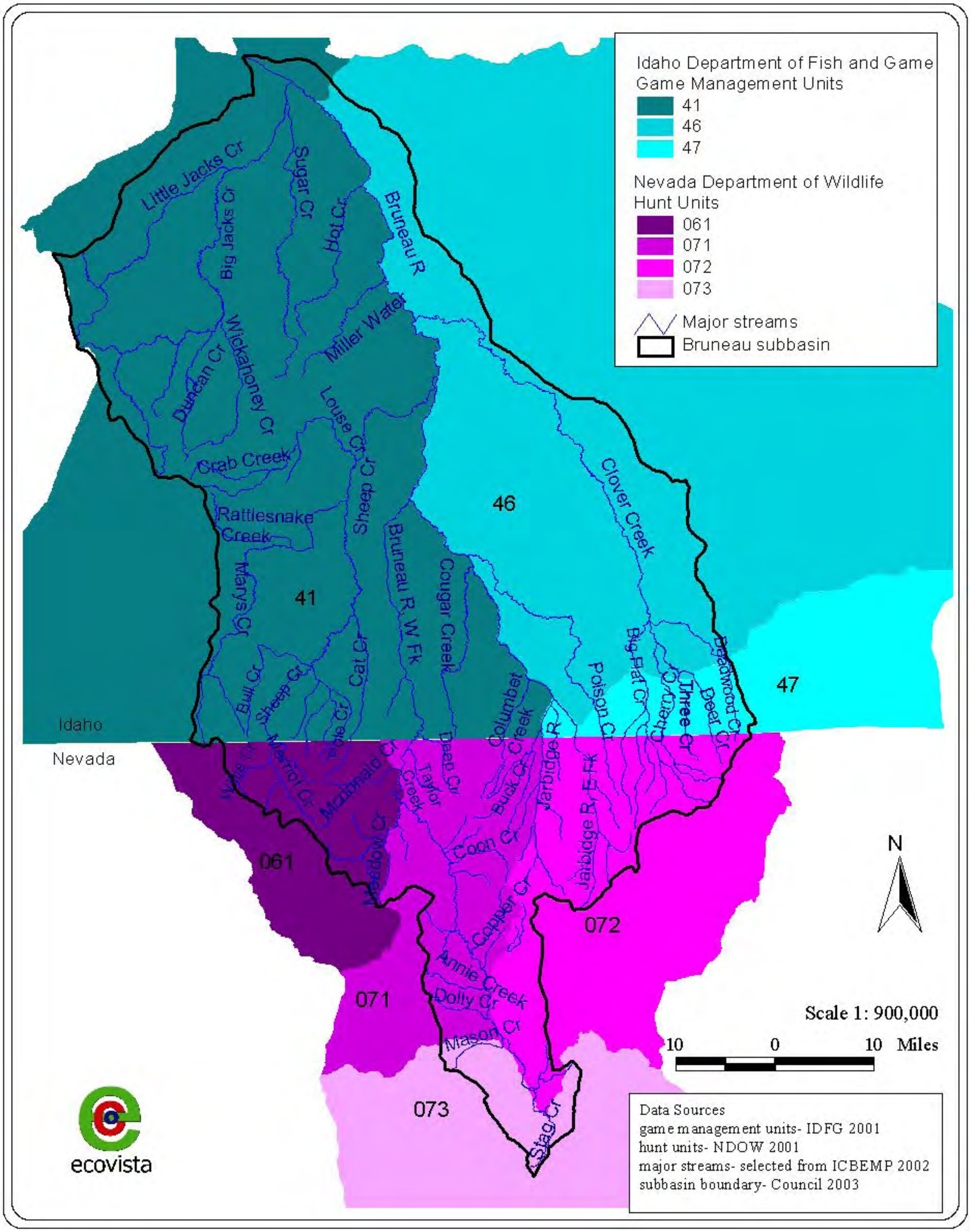


Figure 23. Idaho Department of Fish and Game GMUs and Nevada hunt units in the Bruneau subbasin.

### Idaho

Hunting, trapping, and fishing are valued activities for reasons that include recreation, pest control, and subsistence. State license sales for these activities generate funding that aids in supporting fish and wildlife programs. Idaho's Fish and Game Commission designates animal classifications for wild animals that include game and furbearing animals (Idaho statute 36-201). Game animals are managed by the state in a manner that facilitates continued supplies for hunting, fishing, and trapping (Idaho statute 36-103a). The Idaho Fish and Game Commission administers and carries out state policy in accordance with Idaho Fish and Game code (Idaho statute 36-103b). Forty birds and 16 mammals are managed as game species by Idaho in the Bruneau subbasin (Appendix D).

### Nevada

The regulatory code of the state of Nevada (NAC 503) classifies wild animals into categories that include game (birds and mammals) and furbearing species. Enforcement of laws pertaining to fish and wildlife is under the jurisdiction of the Nevada Department of Wildlife (NRS 501). Within the Department, the Game Bureau is responsible for the management, protection, research, and monitoring of game and furbearing species. Within the Bruneau subbasin, the Nevada Department of Wildlife manages 41 game birds, 11 game mammals, and 7 furbearing animals (Appendix D).

### 2.1.5 HEP Species

A Habitat Evaluation Procedure (HEP) study was conducted by CH2M HILL on behalf of Idaho Power Company as part of its relicensing process for the C.J. Strike Hydroelectric Project (Blair 1997). The procedure outlined by the USFWS (1980) was modified slightly for the C.J. Strike study (Blair 1997). The objectives of the study were to assess the current habitat conditions and values for wildlife, develop resource goals and potential future management actions (Table 20), and assess the effects of actions on future wildlife habitat values (habitat value = habitat unit = area × HIS). Habitat quality is defined by a HSI (habitat suitability index), and, for the C.J. Strike project, the index was calculated for target year zero (TY0). Results are presented in terms of existing habitat units (HU) and future average annualized habitat units (AAHU) for cover types within the analysis area as well as for the wildlife species. Evaluation species were selected to represent the resource goals and cover types present within the C.J. Strike Wildlife Management Area (WMA, Table 20).

Table 20. Evaluation species used to assess management actions, C.J. Strike HEP study (Blair 1997).

| Management Action | Evaluation Species | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Mallard | Mink | Marsh Wren | Western Grebe | Yellow Warbler | Great Blue Heron | Brewer's Sparrow | Pronghorn |
| No change | X | X | X | X | X | X | X | X |
| Reduced management funding | X | X | X | — | X | — | — | X |
| Upland planting | — | — | — | — | — | — | X | X |
| Emergent wetland development | X | X | X | — | — | — | — | — |
| Cottonwood development | — | X | — | — | — | X | — | — |
| Gold Island habitat development | X | X | X | — | X | X | X | X |
| Downstream operational impacts | X | X | X | — | X | X | — | — |
| Acquire Simplot property | X | X | X | — | X | X | — | — |
| Improved water management | — | — | X | — | — | — | — | — |
| Downstream wetland/ riparian habitat | X | X | X | — | X | X | — | — |
| Fence springs | X | — | X | — | — | — | — | — |
| Acquire Prow property | X | X | X | — | X | — | X | X |
| BLM trade | X | X | X | — | — | — | — | — |
| Island loss/ peninsula development | X | X | X | X | X | — | X | X |
| Purple loosestrife control | — | — | X | — | — | — | — | — |
| Trespass grazing | X | X | X | — | X | — | X | X |

### 2.1.6 Partners in Flight High Priority Bird Species Used for Monitoring

Partners in Flight (PIF) is a cooperative effort between federal, state, and local government agencies; philanthropic foundations; professional organizations; conservation groups; industry; the academic community; and private individuals. Its formation in 1990 was a response to growing concern about population declines in landbird species. One goal of PIF is to improve "monitoring and inventory, research, management, and education programs involving birds and their habitats" through collaborative partnerships and a combination of resources (PIF 2003).

Scientifically based bird conservation plans (BCPs) based on physiographic regions outline PIF's long-term strategy for bird conservation. For each region, the BCP outlines focal habitats and priority bird species. The Bruneau subbasin lies within the Columbia Plateau physiographic region, which contains three focal habitats and 24 priority bird species (Table 21). The states of Idaho and Nevada also have individual plans that outline priority and focal species (Appendix E).

### 2.1.7 Critical Functionally Linked Species from IBIS

Critical functionally linked species represent the only species performing a few functions or filling a critical functional role in a particular wildlife habitat. Critical functionally linked species present or with potential habitat in the Bruneau subbasin, along with the Key Ecological Function (KEF) code, KEF description, and wildlife-habitat type are listed in Appendix F (IBIS 2003).

Table 21. Partners in Flight focal habitats and priority bird populations identified for the Columbia Plateau physiographic region (* = Bruneau subbasin focal species) (PIF 2003).

| Focal Habitat | Common Name | Scientific Name |
|---|---|---|
| Shrub-steppe | Swainson's hawk | *Buteo swainsoni* |
| | Prairie falcon | *Falco mexicanus* |
| | Greater sage grouse* | *Centrocercus urophasianus* |
| | California quail | *Callipepla californica* |
| | Long-billed curlew | *Numenius americanus* |
| | Black-chinned hummingbird | *Archilochus alexandri* |
| | Gray flycatcher | *Empidonax wrightii* |
| | Sage thrasher | *Oreoscoptes montanus* |
| | Brewer's sparrow | *Spizella breweri* |
| | Sage sparrow | *Amphispiza belli* |
| Wetlands/grasslands | Western grebe | *Aechmophorus occidentalis* |
| | Trumpeter swan | *Cygnus buccinator* |
| | Sandhill crane | *Grus canadensis* |
| | Franklin's gull | *Larus pipixcan* |
| | Tricolored blackbird | *Agelaius tricolor* |
| Coniferous forest | Mountain quail | *Oreortyx pictus* |
| | Flammulated owl | *Otus flammeolus* |
| | Black swift | *Cypseloides niger* |
| | Calliope hummingbird | *Stellula calliope* |
| | Lewis's woodpecker | *Melanerpes lewis* |
| | Williamson's sapsucker | *Sphyrapicus thyroideus* |
| | White-headed woodpecker | *Picoides albolarvatus* |
| | Black-backed woodpecker | *Picoides arcticus* |
| | Hermit warbler | *Dendroica occidentalis* |

## 2.1.8 Extirpated Species

### *2.1.8.1 Aquatic*

Chinook salmon (spring and fall), possibly coho salmon, and summer steelhead (*O. mykiss* spp.) historically occupied the Bruneau subbasin, but were extirpated following construction of Swan Falls Dam in 1901 on the Snake River. The earliest documentation is qualitative and describes the Bruneau River 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 lack of distinction makes it difficult to describe species or productivity for the subbasin. Pratt (et al. 2001) provides a chronology of anadromous fish use in the Bruneau River Basin, including the following anecdotes of chinook and steelhead:

**Chinook**

| | |
|---|---|
| 1800 pre | Bruneau R, mainstem: Traditionally, fall chinook entered the lower ten miles of the Bruneau |
| 1800 pre | Jarbidge R., Deer Ck: Twenty-four bones, representing at least two chinook salmon were recovered from the site which is located on Deer Ck., a tributary of the Jarbidge River. One of the fish was probably 28 inches long and about 8 pounds. The confluence of Deer Ck. (near the cave) and the Jarbidge is at RM 38.5 on the Jarbidge |
| 1869 | Bruneau R, mainstem: Speaking of the Shoshone and Paiutes: "In the fall salmon was dried and packed away like bales of hay." |
| 1900-1901 | "Salmon and ... were plentiful in the Bruneau R and its tributaries prior to the construction of the Swan Falls Dam on the Snake River in 1901. I remember that during the annual spawning runs, Indians took these fish in traps made of willows. On occasion, my Indian friend with the broken jaw would bring our family a salmon and we'd invite him to supper. In 1990, we moved to what is now the Mink Ranch on the Bruneau R." |

**Steelhead**

| | |
|---|---|
| 1860s | Major Marshall visited the Bruneau ... and reported that the Indians ... were "nearly destitute of everything except what they obtain by fishing". [When] Governor Ballard ... [visited] in October, they [Indians] shared with him all the food they had, "salmon trout fried on a stick." [are the salmon trout steelhead or bull trout?] |
| 1897 | Bruneau R, upper: "Calenta Waters ten or twelve miles away to the north on the Bruneau the springs are in a sheltered place between mountains ... the writer saw a fish cooked there, a good sized salmon trout had strayed in from the river and lost its life ... The Bruneau is not large at that point and can be easily forded" |
| 1897 | Jarbidge R: Gold Creek News, October 1, 1897: ... the trout fishing there is the finest in the world. ... I caught one trout, exactly the length of my forearm to the end of my little finger, just seventeen inches ... I had captured a fine salmon trout [are these steelhead or bull trout?] when I returned. ... I landed two more in quick succession. ... I had caught only 17 fish but the boys thought I had 15 or 20 pounds. ... |
| 1900-1901 | "... steelhead trout were plentiful in the Bruneau R and its tributaries prior to the construction of the Swan Falls Dam on the Snake River in 1901. I remember that during the annual spawning runs, Indians took these fish in traps made of willows. On occasion, my Indian friend with the broken jaw would bring our family a salmon and we'd invite him to supper. In 1990, we moved to what is now the Mink Ranch on the Bruneau R." |

In a letter written in 1863, R.F. Maury describes the Bruneau River as having the "greatest abundance of salmon," greater than any other river entering the Snake River that he knew of (Vigg and Company 2000). In 1901, anadromous fish runs were blocked from the Bruneau River when Swan Falls Dam was built on the Snake River (Bureau of Outdoor Recreation 1977). In general, the impacts from the resulting loss of anadromous fish on the aquatic system have included a decrease in available nutrients and a loss of prey base for bull trout, large resident redband trout, raptors, and other wildlife.

#### *2.1.8.2 Terrestrial*

Several species that once occurred in the Bruneau subbasin are suspected of being extirpated. Table 18 lists these species and provides information about their current status.

Table 22. Terrestrial species extirpated from the Bruneau subbasin (IDCDC 2003).

| Common Name | Scientific Name | Status |
|---|---|---|
| American bison | *Bos bison* | Extirpated in Idaho |
| Bighorn sheep | *Ovis canadensis* | Reintroduced into subbasin |
| Gray wolf | *Canis lupus* | Reintroduced into Idaho |
| Grizzly bear | *Ursus arctos* | Present in Idaho |
| Passenger pigeon | *Ectopistes migratorius* | Extinct |

## 2.2 Method for Selecting Focal Species

### 2.2.1 Aquatic

Focal species were chosen according to guidelines provided in NWPC (2001). These guidelines suggested inclusion of species that met the following criteria in order of importance: 1) designation as a Federal endangered or threatened species; 2) ecological significance; 3) cultural significance; and, 4) local significance.

Using these guidelines, the Bruneau Aquatics Technical Team (BATT) identified a total of five focal species (Table 23), including 1) redband trout, the most widely distributed salmonid in the subbasin, 2) bull trout, the only federally listed threatened salmonid in the subbasin, 3) mountain whitefish, a culturally and ecologically important species, 4) the Bruneau hot springs snail, and 5) the Idaho springsnail, both of which are federally listed as threatened.

Ecological considerations in the selection of the focal species were largely based on the unique habitat types occupied by the respective species. The two snail species were considered to be representative of the low-elevation geothermal habitats; redband trout represented a low-elevation desert stream species adapted to extremes in temperature and flow; mountain whitefish were considered a thermally flexible species representative of mid-elevation reaches; while Jarbidge River bull trout were considered important due to their status of being the southern-most distributed population in the world, and were representative of headwater habitats.

### 2.2.2 Terrestrial

The Bruneau Subbasin Terrestrial Technical Team (BSTTT) selected focal habitats to serve as coarse filters (Hunter et al. 1988) that represent the needs of terrestrial species in the subbasin and are amenable to future monitoring efforts. Focal species (Lambeck 1997) were selected for each focal habitat to represent different attributes that must be present if the Bruneau subbasin is to meet the needs of its constituent flora and fauna.

For terrestrial species, the selection criteria included species status under the following possible designations: threatened, endangered, and state sensitive species; species listed by the PIF program; species used to model impacts from adjacent hydro-development under the USFWS Habitat Evaluation Procedure (HEP) species; managed species (i.e., game species); functional specialist and critically linked species; species with cultural significance; and species with an association to salmonids.  Susceptibility to current and historical management, data availability, and monitoring potential were also factors considered during the selection process.

Because of the rarity of some of the species listed under the Endangered Species Act that potentially occur within the Bruneau subbasin, they were reviewed in this assessment but not necessarily chosen as focal species by the BSTTT.  Monitoring programs that are currently in place for these species should contribute to the ongoing management decision processes within the Bruneau subbasin.

Five aquatic and 13 terrestrial species represented in seven habitat types were selected for the Bruneau subbasin (Table 23).

Table 23. Focal habitats and species of the Bruneau subbasin[a].

| Assessment Section | Focal Habitat | Focal Species | ESA | ID | NV | BLM | USFS |
|---|---|---|---|---|---|---|---|
| Aquatic | Hotsprings | Bruneau hot springsnail | E | | | T1 | |
| | Snake River, Bruneau River and tributaries | Idaho springsnail | E | | | T1 | |
| | | Redband trout | | G | G | T2 | |
| | | Bull trout | T | G | G | T1 | |
| | | Whitefish | | G | G | | |
| Terrestrial | Upland aspen forest | Northern goshawk | | SC | P | T3 | S |
| | Shrub-steppe | Sage grouse | | G | PG | T2 | |
| | | Pygmy rabbit | | GSC | G | T2 | |
| | | Slick spot peppergrass | PC | | | T1 | S |
| | | Spotted bat | | SC | T | T3 | S |
| | | Bighorn sheep | | G | G | T3 | |
| | Riparian and wetlands | Columbia spotted frog | C | SC | P | T1 | S |
| | | Yellow warbler | | | | | |
| | | Willow flycatcher | | P | | T3 | |
| | | White-faced ibis | | P | P | T4 | |
| | Western juniper and mountain mahogany woodlands | Mule deer | | G | G | | |
| | Desert playa and salt scrub shrublands | Pronghorn | | G | G | | |
| | | Fourwing saltbush | | | | | |

[a] Table includes corresponding federal (ESA: candidate, past candidate, threatened, endangered), state (ID: game, protected, special concern and NV: threatened, protected, game), and federal agency (BLM: Type 1 = federally threatened, endangered, proposed, and candidate species; Type 2 = rangewide/globally imperiled species; Type 3 =regional/state imperiled species; Type 4 = peripheral species; Type 5 = watch list. USFS: sensitive) status.

## 2.3 Aquatic Focal Species Population Delineation and Characterization

Distribution and status information for 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 subbasinwide distribution and status information for each species, GIS layers were obtained from the most recent updates to the ICBEMP (2002) database.

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

### 2.3.1 Redband Trout

#### *2.3.1.1 Redband Trout Population Data and Status*

Interior redband trout (*Oncorhynchus mykiss gairdneri*) 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 (one of the groups of candidates for threatened/endangered) species. Redband subgroups and other C2 species have since been dropped from the candidate list. Currently, both the USFS and BLM classify the redband trout as a sensitive species (Quigley and Arbelbide 1997).

#### Abundance

Recent redband inventories of the Bruneau subbasin were conducted by the IDFG in 2003. Upon preliminary review of the data, the highest densities of redband were 1.2 fish/meter at sample sites occurring in the upper portions of Little Jacks Creek (sample sites occurring within 6th field HUCs 4101–4102); 1.1 fish/meter in the Deer Creek HUC (sample sites occurring within 6$^{th}$ field HUC 1003) and 0.8 fish/meter in upper Big Jacks Creek (sample sites occurring within 6th field HUC 3902) (Figure 24). Fish in the 100- to 200-mm size class dominated these collections, while those measuring less than 100 mm were present but less common. Redband densities measured at other sites were <0.6 fish/meter.

Kevin Meyer and Dan Schill with IDFG will have collected fish abundance data from nearly 500 study sites in the Owyhee desert from 1999 to 2004 (work is being wrapped up in summer 2004), including much of the Bruneau drainage. Summaries of distribution and abundance from this work will be made available by winter 2004 (K. Meyer, personal communication, April 29, 2004).

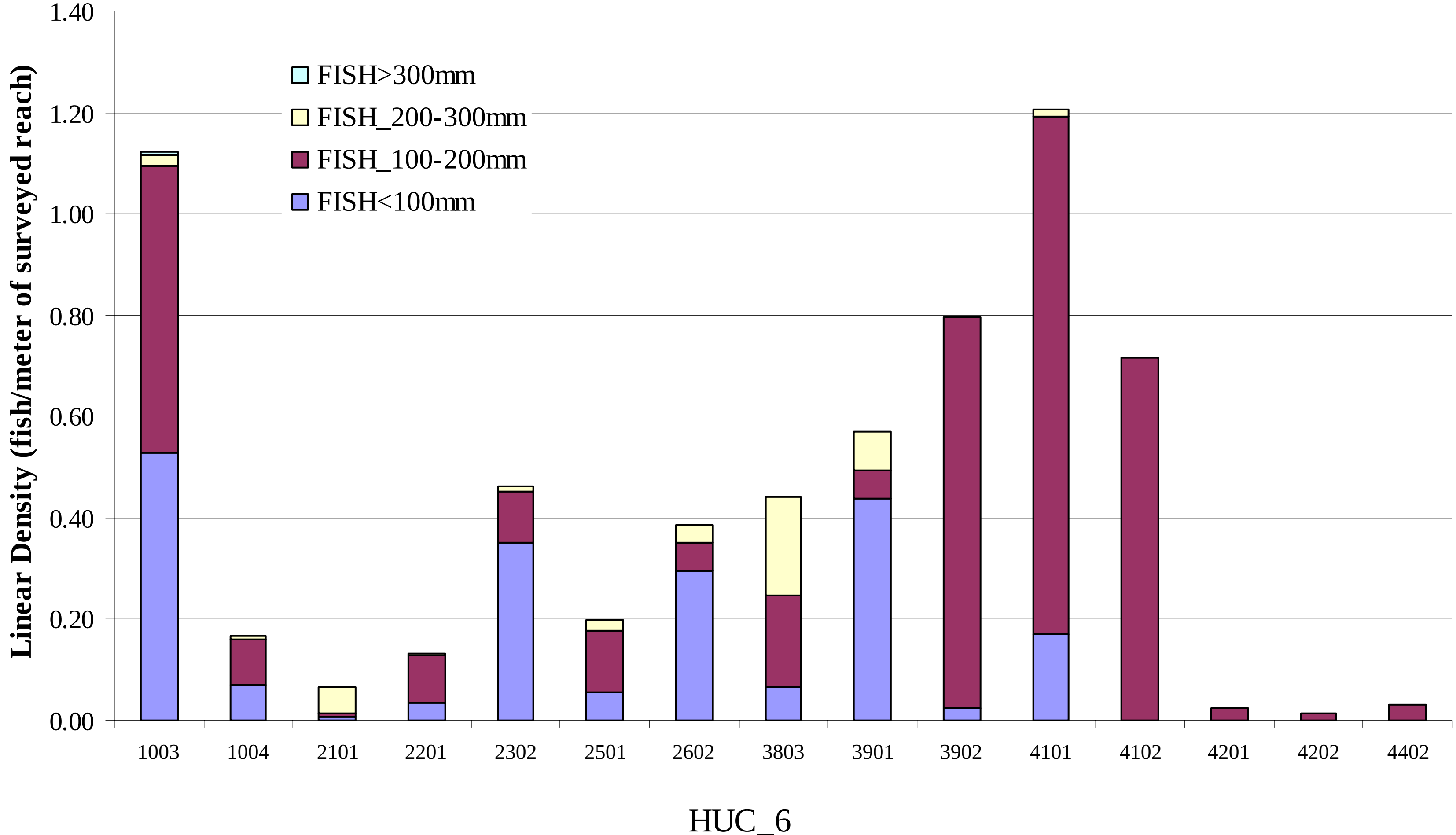


Figure 24. Estimated redband trout densities (number/meter) for sample sites throughout the Bruneau subbasin. Sampling efforts conducted by IDFG during summer 2003.

Surveys conducted in 1980 in Little Jacks Creek estimated an average density of 0.68 adult (>100 mm) fish per square meter (BLM 1999). Resurveys of the same reaches in 1995–1996 estimated average densities to be 0.76 fish per square meter, which did not differ significantly from the 1980 densities ($P$ = 0.82) (BLM 1999). 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 per 100 square meters, respectively (Figure 25).

In 1980, the estimated densities of adult and juvenile redband in upstream and downstream reaches of Big Jacks Creek were 68 and 2 fish per 100 square meters, respectively (Figure 25). Following subsequent survey efforts (1995–1998), estimates of adult redband densities in Big Jacks Creek (0.14 fish/$m^2$) did not differ significantly from densities measured in 1980 (BLM 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 (BLM 2000b).

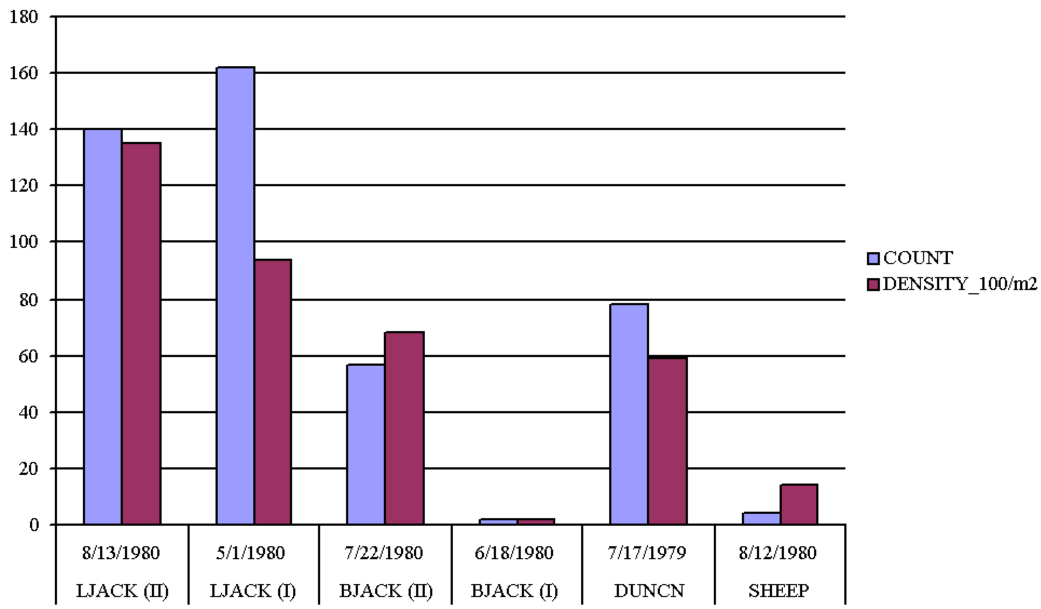


Figure 25. BLM redband survey data for streams in the Bruneau subbasin (1979–1980). Roman numerals I and II represent downstream and upstream (respectively) sample locations.

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 per square meter 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 (USFS 1995). In 2000, Idaho Department of Environmental Quality electrofishing 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.

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 electrofishing sites on the East and West Forks of the Jarbidge River and ranged from 1.7 to 16.2 trout per100 square meters. At snorkeling transects, fish densities in the East Fork Jarbidge and mainstem Jarbidge rivers ranged from 0 to 8.3 trout per100 square meters. 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 per100 square meters. 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 River increased as water temperatures dropped during the fall (Partridge and Warren 2000).

## Productivity

Quantitative estimates of redband trout productivity are not available due to incomplete data sets, sporadic inventories, and a general poor understanding of recruitment dynamics. The current status of redband trout has been mapped through the ICBEMP and inferred from agency surveys. ICBEMP data identifies redband “stronghold” areas in the Jacks Creek subwatershed, central portions of the West Fork Bruneau River, and the Jarbidge watershed (Figure 26).

Redband trout occurring in Sheep Creek are currently considered to be present but depressed (ICBEMP 2002). In the late 1980s, 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 River) above the confluence with the Jarbidge River and are commonly associated with tributary watersheds (Figure 26). Redband populations in the lower three-quarters of the subwatershed are considered present but depressed or absent during certain times of the year (Figure 26). Stronghold designations have been made in headwater tributaries to Clover Creek, which occur on Elk Mountain, including Caudle, and Flat creeks. Following surveys in 1994, NDOW was unable to document redband trout in Raker Creek, also an Elk Mountain headwater tributary (G. Johnson, NDOW, personal communication, April, 2004).

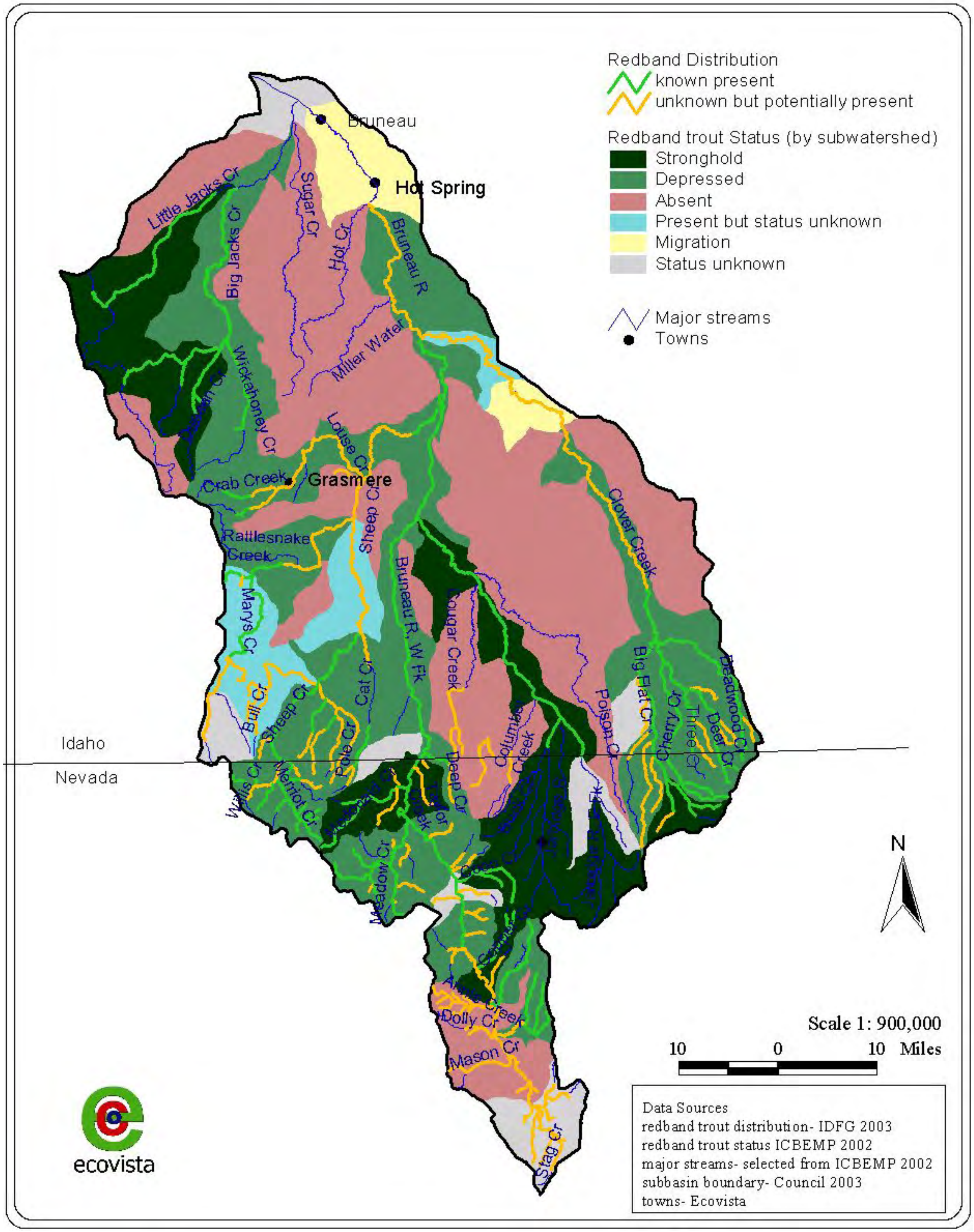


Figure 26. Redband trout distribution and status.

Redband populations occurring below the confluence with the Jarbidge River are currently listed as "present depressed" (Figure 26). Based on anecdotal evidence cited in Lay and IDEQ (2000), redband are present only 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 in either 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 River also occurs during nonirrigation 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 area includes the entire length of the mainstem and the majority of the headwater watersheds (i.e., Buck, Deer, Bear, Pine, Jack, and Rattlesnake creeks and East and West Forks of the Jarbidge River) (Figure 26).

### Life History Diversity

The *O. mykiss* is one of the most taxonomically complicated species in Idaho. Forms that have adopted, or have been forced into, a non-anadromous strategy and which occur in interior areas of the CRB such as the Bruneau subbasin are commonly referred to as inland Columbia River redband trout, *O. mykiss gairdneri* (Busby et al. 1996).

The redband trout is defined in the IDFG fish management plans (IDFG 1996, 2000) as the native rainbow trout in southwest and south-central Idaho (including the Snake River basin upstream to Shoshone Falls). Behnke (1992) identified three distinct subspecies of rainbow/redband trout, one being the native rainbow trout, including steelhead, found in the Columbia River basin east of the Cascade Range to barrier falls on the Kootenai, Spokane, and Snake rivers (to Shoshone Falls).

The *O. mykiss gairdneri* subspecies is distinct from coastal varieties (*O. 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]).

Redband trout tend to spawn in rivers and streams during the spring months of March, April and May. Cool, clean, well-oxygenated water is necessary for the eggs to survive. Redband trout fry emerge from the gravel in June and July. For the most part, they live near where they were spawned. Redband trout are three years old at maturity, with size varying depending on the productivity of individual waters.

Redband trout require four basic habitat types to accommodate life history requirements: spawning, rearing, adult and overwintering (Behnke 1992). Redband trout fry emerge from the gravel in June and July. Redband trout eggs typically hatch in four to six weeks and alevins take about three to seven days to absorb the yolk sac before emergence. Bjornn and Reiser (1991) documented rainbow trout embryo survival as it related to the proportion of substrate composed of fines less than ¼ inch: 90% embryo survival with fines at 10%, 75% embryo survival with fines at 20%, and 50% embryo survival with fines at 30%. Spawning is adversely affected when substrate fines (< ¼ inch) exceed 25% (Bjornn and Reiser 1991).

Upon emergence, redband will rear in low velocity areas associated with stream margin habitats, high cover areas and interstitial spaces. Adults require habitat for resting and feeding and thus are generally found in areas of abundant cover associated with deep pools, large organic material, undercut stream banks and overhanging vegetation. Diet consists primarily of aquatic insects, although individuals are opportunistic and will eat what is available to them. Large individuals may consume small fish of any species in addition to aquatic invertebrates.

Redband trout are adapted to fluctuations in stream flow and water temperature typical of desert streams (Behnke 1992) and are more tolerant of modifications in streamflow and temperature than other salmonids (Lay and IDEQ 2000). Zoellick (1999) identified populations in Castle, Shoofly Little Jacks, and Big Jacks creeks that tolerated temperatures above 26 °C, actively foraged at 26.2 °C, and tolerated a maximum temperature of 29 °C. Wallace (1981, cited in Schnitzspahn et al. 2000) states that redband trout "should be recognized and managed as unique populations of native trout specifically adapted to harsh desert environments."

Even though redband trout can live in naturally higher water temperatures, there is little flexibility regarding further degradation of substrate and temperature conditions. The loss of desert riparian habitat that cools stream temperatures and filters surface runoff is a factor in determining the population dynamics of the redband trout populations. Over-winter sites, characterized by low velocity areas with cover, including large woody debris, are important to all age classes (Bjornn and Reiser 1991).

### Genetic Integrity of Populations

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 in converting energy into biomass under adverse conditions. Other taxonomic and genetic analyses indicate that Bruneau River redband populations appear to be predominantly native interior rainbow, showing minimal evidence of hybridization with hatchery rainbow trout (Williams et al. 1991).

The Little Jacks Creek population (see discussion on current distribution below) 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 (BLM 1999).

Kevin Meyer and Dan Schill with IDFG collected over 500 fin clips from 33 stream locations throughout the Bruneau River drainage in 2002 and 2003, in an effort to evaluate hybridization with stocked rainbow trout, and assist in delineation of population boundaries; samples will be run in 2004 (K. Meyer, personal communication, January 22, 2004).

#### *2.3.1.2 Redband Trout Distribution*

### Current Distribution/Spatial Diversity

Currently, the redband trout is 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 26). 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.

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 Creek redband trout are thought to rely on a spring that discharges into the creek near the old Wickahoney town site. Lay and IDEQ (2000) proposed that the Wickahoney fish will disperse downstream as much as 3 to 5 km during more favorable conditions and could presumably migrate past the downstream barrier.

Kevin Meyer and Dan Schill with IDFG will have collected fish abundance data from nearly 500 study sites in the Owyhee desert from 1999 to 2004 (work is being wrapped up in summer 2004), including much of the Bruneau drainage. Summaries of distribution and abundance from this work will be made available by winter 2004 (K. Meyer, personal communication, April 29, 2004).

### Historic Distribution

Redband trout 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 and Company 2000). Their influence on redband populations is unknown; however, it is probable that their elimination from the Bruneau subbasin represented an impact to population connectivity, genetic diversity, and/or refounding capacity.

### Current In-Basin Harvest Levels

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 24).

Based on Nevada 2004-05 special regulations from the NDOW, anglers may harvest up to ten redband trout a day from the Bruneau River and five redband per day from the Jarbidge watershed (http://ndow.org/about/pubs/pdf/04fishregs/fishreg_p26_31.pdf). Historic harvest data was unavailable.

Table 24. Management history for fisheries harvest in the Jarbidge River (1945–1988).

| Year | Season | Rules |
|---|---|---|
| 1945 | May 21–November 15 | 20 trout or 15 pounds and 1 trout/day<br>not more than 5 trout less than 6 inches |
| 1946 | May 21–November 15 | 20 trout or 10 pounds and 1 trout/day<br>not more than 5 trout less than 6 inches |
| 1947–1949 | June 4–October 31 | 20 trout or 10 pounds and 1 trout/day<br>not more than 5 trout less than 6 inches |
| 1950–1954 | June 4–October 31 | 20 trout or 7 pounds and 1 trout/day<br>not more than 5 trout less than 6 inches<br>fishing hours 4 A.M. to 10 P.M. |
| 1955–1956 | June 4–October 31 | 15 trout or 7 pounds and 1 trout/day<br>not more than 5 trout less than 6 inches<br>fishing hours 4 A.M. to 10 P.M. |
| 1957–1962 | June 4–October 31 | 15 trout or 7 pounds and 1 trout/day<br>fishing hours 4 A.M. to 10 P.M. |
| 1963–1968 | Saturday near June 1–October 31 | 15 trout or 7 pounds and 1 trout/day<br>fishing hours 4 A.M. to 10 P.M. |
| 1969–1971 | Saturday near June 1–November 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<br>not more than 5 trout greater than 12 inches |
| 1977–1989 | Open year round | 6 trout<br>not more than 2 greater than 16 inches |
| 1990–1991 | Open year round | 6 trout |
| 1992–1993 | Saturday of Memorial weekend–November 30 | 2 trout |
| 1994–1998 | Saturday of Memorial weekend–November 30 | 2 trout<br>closed to the harvest of bull trout |

## 2.3.2 Bull Trout

### *2.3.2.1 Bull Trout Population Data and Status*

#### Conservation Status

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 remaining population of bull trout in the world (USFS 1998) and has been designated as a Distinct Population Segment (DPS) by the FWS (DPS Designation Rule–Federal Register, February 7, 1996).

Bull trout in the Jarbidge River DPS were proposed for listing as threatened in June 1998 (Vol. 61; Federal Register, June 10, 1998, Vol. 63, No. 111). In August 1998, this bull trout DPS was emergency listed as endangered due to river realignment and channel alterations on the West Fork Jarbidge River (Federal Register, November 1, 1999, Vol. 64, No. 210; *refer also to* Section 4.1.2.3: Habitat Simplification). The FWS published a final listing as threatened in April 1999 (Federal Register, April 8, 1999, Vol. 67, No. 67). Bull trout are considered a species of special concern in the State of Idaho (Parrish 1998). Nevada considers bull trout a coldwater game fish (Nevada Administrative Code 503.060). It is currently illegal to harvest bull trout from the Jarbidge River DPS in both Idaho and Nevada. The Inland Native Fish Strategy identified the Jarbidge River as a “priority watershed” for bull trout recovery (USFS 1998).

A Recovery Unit Team has been established to develop a recovery plan specifically for the Jarbidge River population and to identify specific delisting criteria. This local recovery team includes representatives from the States (including NDOW and Idaho Department of Fish and Game); Tribes (Duck Valley Paiute-Shoshone Tribes' Habitat, Parks, Fish and Game Division); and Federal agencies (Bureau of Land Management, U.S. Forest Service , and USFWS).

#### Abundance

Historical and recent collections of bull trout in the Bruneau subbasin have been limited. Sampling efforts have consisted of periodic presence and absence-type surveys occurring years or decades apart, each reflecting a single point-in-time (USFWS 1999). Regular, standardized, quantitative surveys designed to detect population trends of bull trout over a period of time, with statistical testing to qualify data accuracy, have not occurred (USFWS 1999).

In Idaho, 19 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). During a 1992 survey effort, no bull trout were identified in the Idaho portion of either forks of the Jarbidge River or in the mainstem of the Jarbidge River (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 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 Jarbidge River (6 bull trout) (Zoellick et al. 1996).

In Nevada, bull trout were found at all sample sites within and at 2 of 14 sample sites outside the 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. Age I, II, and IV fish were present, with the dominant year class being age II fish (57%). In nonwilderness 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 nonwilderness areas in the Nevada portion of the Jarbidge, those fish 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, personal communication, cited in Zoellick et al. 1996).

Relative abundance of bull trout has declined due to a number of factors, both environmental and human induced. Potential threats to population abundance include habitat degradation from past and ongoing activities including mining, road construction and maintenance, grazing, angling, competition with stocked fish, and unpredictable natural events.

### Productivity

Quantitative estimates of productivity are not available for bull trout in the Jarbidge DPS. Based on Interior Columbia Basin Ecosystem Management Project data (2002), bull trout core areas exist in the mainstem and East Fork Jarbidge (sixth field HUCs 1601, 1602, 1701 & 1702). These areas represent habitats that sustain multiple life history stages (*e.g.,* spawning/incubation, summer rearing, winter rearing, migration), and assumedly are those that support the highest population productivity in the subbasin. Other areas within which bull trout occur are primarily used only for migration.

### Life History Diversity

Bull trout have more specific habitat requirements than most other salmonids. Habitat components that influence bull trout distribution and abundance include water temperature, cover, channel form and stability, substrate for spawning and rearing, and migratory corridors (USFWS 2004). Strong bull trout populations are associated with a high degree of channel complexity, including woody debris and substrate with clear interstitial spaces (Batt 1996). Bull trout are found in colder streams and require colder water than most other salmonids for incubation, juvenile rearing, and spawning (USFWS 2004). Bull trout may experience considerable stress when temperatures exceed 15 °C (59 °F) (Pratt 1992; Batt 1996). Optimum temperatures for incubation and rearing have been cited between 2 and 4 °C (35.6–39.2 °F) and 7 and 8 °C (44.6–46.4 °F), respectively (Rieman and McIntyre 1993).

Spawning and rearing areas are often associated with coldwater springs, groundwater infiltration, and/or the coldest streams in a watershed. Throughout their lives, bull trout require complex forms of cover, including large woody debris, undercut banks, boulders, and pools. Alterations in channel form and reductions in channel stability result in habitat degradation and reduced survival of bull trout eggs and juveniles. Channel alterations may reduce the abundance and quality of side channels, stream margins, and pools, which are areas bull trout frequently inhabit. For spawning and early rearing, bull trout require loose, clean gravel that is relatively free of fine sediments. Because bull trout have a relatively long incubation and development period within spawning gravel (greater than 200 days), transport of bedload in unstable channels may kill young bull trout. Bull trout use migratory corridors to move from spawning and rearing habitats to foraging and overwintering habitats and back. Different habitats provide bull trout with diverse resources, and migratory corridors allow local populations to connect, which may increase the potential for gene flow and support or refounding of populations (USFWS 2004).

See Pratt 1992, Ratliff 1992, and Ratliff et al. 1996 for additional details regarding bull trout life history characteristics.

### Population Trend and Risk Assessment

The USFS (1998) determined that bull trout populations in the Jarbidge River 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 (USFS 1998). Habitat modification and mining-related pollution may have reduced bull trout numbers between 1865 and 1945 (USFS 1998).

Parrish (1998) was unable to project bull trout population viability in the Jarbidge due to insufficient data. Genetic evaluations of the Jarbidge population completed in 1998 suggested that the DPS was comprised of at least three distinct subpopulations, each of which demonstrated adequate genetic diversity and metapopulation potential to counter the threat of stochasticism (Johnson 1999), however this and other genetics information is currently being reevaluated, making it too premature to make definitive statements as to population security from threats (Selena Werdon, Nevada Department of Wildlife, personal communication, January 2004).

### Unique Population Units

As discussed above, bull trout occurring in the Jarbidge watershed currently represent a distinct population segment (DPS), as defined by the USFWS. However, recent genetic evaluations of bull trout from the Jarbidge suggest that the DPS designation should be reconsidered due to similarities with populations from the Snake River (Spruell et al. 2003). According to Spruell et al. (2003), the USFWS DPS designation of the Jarbidge population was largely based upon the watershed's unusual setting and geographical separation from populations occurring in the Snake River (USFWS 1999), rather than upon genetic differences, thereby necessitating a reevaluation of the watershed's DPS status.

### Life History Characteristics of Unique Populations

Life history forms present in the DPS included both fluvial and resident fish present in low densities in the East Fork, West Fork, and mainstem Jarbidge River, as well as six headwater tributaries (Cougar, Dave, Fall, Pine, Sawmill, and Slide creeks) (Johnson 1999). The USFWS is currently in the process of preparing a Bull Trout Recovery Plan for the Jarbidge Unit (*refer to* USFWS 2004).

### Genetic Integrity of Unique Populations

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

Subsequent genetic analysis of samples collected from bull trout in Dave Creek and the West Fork Jarbidge River are presented in Spruell et al. (2003). Results from analysis of microsatellite data and mtDNA data of Taylor et al. (1999, cited in Spruell 2003) suggest that bull trout in the Jarbidge system are not genetically distinct from other bull trout populations in the upper Snake River Basin, and therefore should not constitute a separate and unique distinct population segment from other Snake River populations.

### Estimate of Historic Status

Although accounts of bull trout in the Jarbidge River basin date to the 1930s, both sampling and actual collections of bull trout were infrequent (USFWS 1999). Therefore, historical status data are limited.

## *2.3.2.2 Bull Trout Distribution*

### Current Distribution/Spatial Diversity

The Jarbidge population is small and isolated and at the fringe of the bull trout range (USFS 1998) (Figure 27). During 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. Bull trout have been documented in Dave, Slide, Fall (Klott 1996), Jack, Pine, and Cougar (G. Johnson, NDOW, personal communication, April, 2004) creeks and headwater tributaries that are physically linked by the mainstem Jarbidge River (USFS 1998). Bull trout may overwinter in habitat downstream of the confluence of the East and West Forks of the Jarbidge River, but they have not been documented in this area during summer months (Klott 1996). Occurrence in Meadow and Telephone Creeks is unknown, but not suspected to be likely (B. Zoellick, BLM, personal communication, March, 2004).

### Historic Distribution

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 River 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 remaining Jarbidge River population is now isolated and located over 150 river miles from other bull trout populations.

Surveys conducted in 1998 indicate that bull trout have likely been extirpated from Jack Creek, a historically occupied tributary, (USFWS 1999). Migration of bull trout into Jack Creek was limited due to a impassable culvert, however, upon its removal in 1997, subsequent surveys failed to detect bull trout presence (USFWS 1999).

Pratt et al. (2003) provides an annotated chronology of resident and anadromous fish species in the Bruneau subbasin. Anecdotal evidence relating to bull trout in the Bruneau subbasin include,

| | |
|---|---|
| 1934 | August 27, 1934, while making a survey of the waters of Humboldt National Forest S.D. Durrant collected two Dolly Varden in Dave Ck, 4 miles above its junction with the East Fork of Jarbidge River T47N R9E Sec 25 ... The larger specimen (deposited at the University of Michigan) is a mature male with swollen testes and is about 169 mm in standard length, and the smaller one (at University of Utah) is an immature fish 105 mm long ... Professor Durrant of the University of Utah |
| 1951 | Three additional specimens of S. malma, all males, are in the collection of the Department of Biology, University of Nevada ... collected by Earl Dudley, a warden of the Nevada Fish and Game Commission, on July 5, 1951, on the East Fork of the Jarbidge River. Their standard lengths in mm are 168, 190, 193. |

### Harvest in the Subbasin

It is currently illegal to harvest bull trout from the Jarbidge River DPS in both Idaho and Nevada. In Idaho, all sport-fishing harvest of bull trout was eliminated in 1994.

The Jarbidge River system has been heavily fished, dating back to the 1930s. Decades of non-native trout stocking by both Idaho and Nevada encouraged increased angling pressure in bull trout habitat. Idaho stopped stocking trout in 1990, and Nevada's last stocking was in 1998 (Williams 2002). A 1990 NDOW report specifically stated concerns for the bull trout population because of angling pressure and the removal of larger bull trout (6-12 inches) from the system, possibly before they were old enough to reproduce for the first time. Angler harvest was considered by NDOW to be a likely "primary factor in the low densities of bull trout in the East and West forks of the Jarbidge River" (Williams 2002).

Harvest is considered a threat to both resident and migratory forms of bull trout. Migratory fish are at greater risk because of their lower numbers, desirable larger size and higher visibility to anglers. Anglers are known to have difficulty identifying bull trout, so unintentional harvest of bull trout is likely still occurring despite angler education efforts. Nevada bull trout fishing regulations were changed in 1998, and it is now a catch and release program (Williams 2002). Limits on other trout (native redbands and residual stocked rainbows) and mountain whitefish are now 5 and 10 fish, respectively, which still allows for substantial fishing pressure and potential repeated bull trout captures (Williams 2002). To date, bull trout monitoring has not been conducted long enough to allow for detection of improvements in the population. Idaho established a two trout limit for the Jarbidge River watershed in 1992, and prohibited harvest of bull trout entirely in 1995.

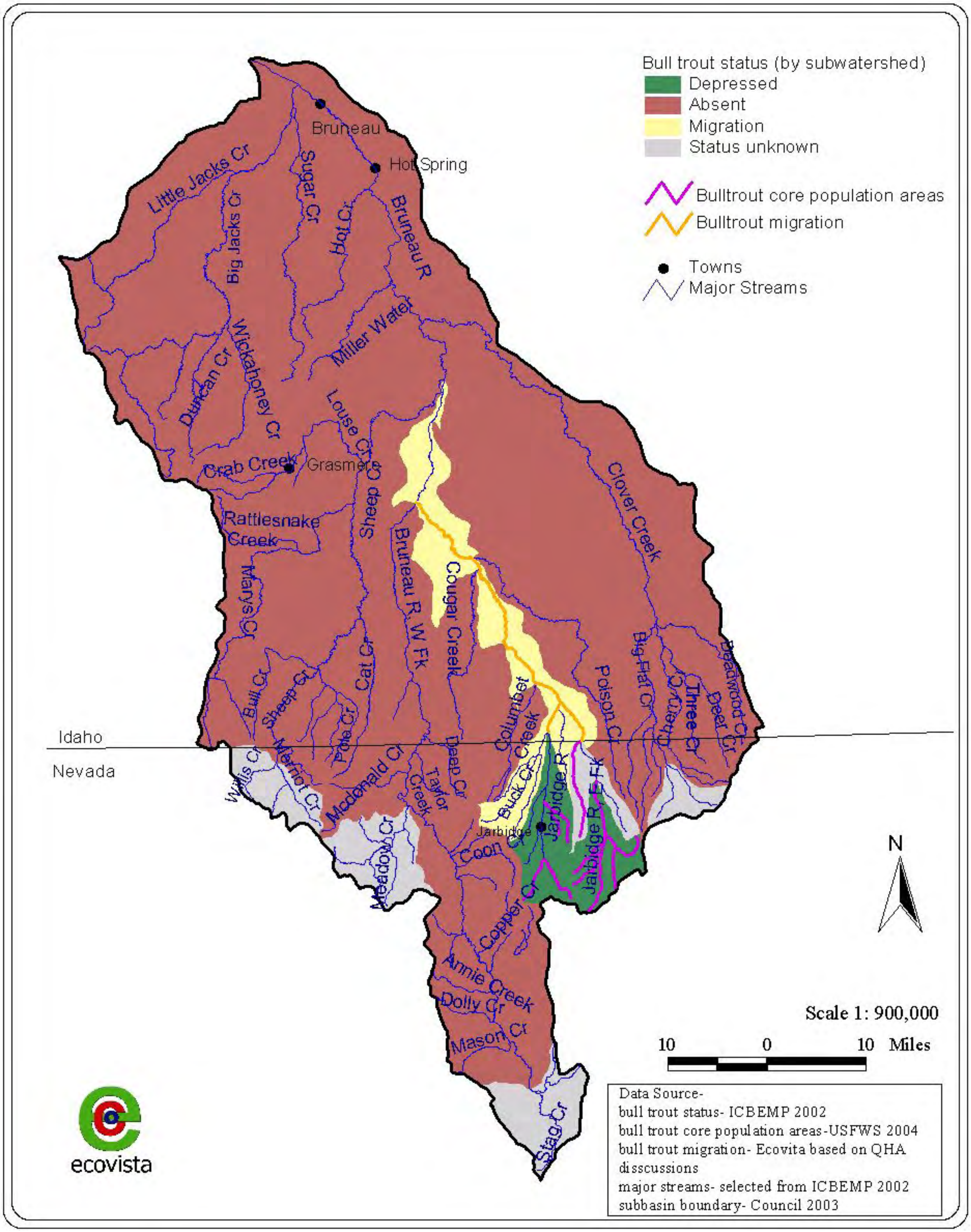


Figure 27. Distribution and status of bull trout in the Bruneau subbasin.

## 2.3.3 Mountain Whitefish

### *2.3.3.1 Mountain Whitefish Population Data and Status*

#### Relative Abundance

Besides redband and bull trout, the mountain whitefish (*Prosopium williamsoni*) is the only other native salmonid in the Bruneau subbasin. Second only to dace in numbers, the mountain whitefish was the most common fish trapped in the East and West Forks of the Jarbidge River between September and December 1999 (Partridge and Warren 2000).

Mountain whitefish have been documented at low densities in the West Fork Bruneau River within the Humboldt-Toiyabe National Forest (USFS 1995). They were detected in upper Clover Creek during IDEQ electrofishing efforts in 2000 (Lay and IDEQ 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 River appear to be more suitable than those in the West Fork Jarbidge River as Partridge and Warren (2000) found nearly 10 times more whitefish in the East Fork than in the West Fork.

During recent redband inventories of the Bruneau subbasin, IDFG collected data on the number of mountain whitefish sampled (Table 25). Density information was not available.

Table 25. Number of mountain whitefish sampled during IDFG electrofishing efforts in 2003

| Sixth Field HUC | HUC Name | Number of Fish Sampled |
|---|---|---:|
| 0402 | Bruneau 3 above Hot Creek | 2 |
| 1802 | Jarbidge 3 ( Dorsey to East Fork) | 4 |
| 2101 | Bruneau 11 (meadow to Wickiup) | 7 |
| 2801 | Jarbidge 1 (mouth to Poison) | 7 |
| 3501 | Bruneau 6 Sheep to Jarbidge | 2 |

#### Life History Diversity

The preferred habitat of the mountain whitefish is cold mountain streams (Simpson and Wallace 1982) where the species is found predominantly in riffle areas during summer and deep pools during winter (Wydoski and Whitney 1979), however the species has similarly been documented in stream reaches characterized by warm water temperatures. Mountain whitefish mature at about 3 years of age. They are fall spawners, typically spawning in riffle areas during late October or early November when water temperatures range between 40 and 45 °F; in some instances, spawning is known to occur along gravel shores in lakes or reservoirs. Eggs are adhesive and stick to the substrate following spawning. Hatching occurs in March (Simpson and Wallace 1982).

Mountain whitefish spend much of their time near the bottom of streams and feed mainly on aquatic insect larvae. Mountain whitefish will also feed on terrestrial insects on the surface and on fish eggs (Simpson and Wallace 1982). Although growth is variable, most mountain whitefish in Idaho are typically 3 to 4 inches long at the end of the first year and 6 to 7 inches after two years (Simpson and Wallace 1982).

#### *2.3.3.2 Mountain Whitefish Distribution*

### Current Distribution/Spatial Diversity

As mentioned previously, mountain whitefish are most abundant in habitats with cooler water temperatures (*e.g.,* stream reaches >7,000 ft.), but may also occur in lower elevation reaches characterized by warmer temperatures (for example, in lower Deep Creek, in the neighboring Owyhee subbasin, IDFG documented the presence of mountain whitefish and the absence of redband trout; K. Myer, IDFG, personal communication, April, 2004 ). The species are well distributed throughout the mainstem, East Fork and West Fork (below Pine Creek) Jarbidge Rivers, occur in lower densities in the West Fork Bruneau, and have been documented in headwater reaches of Clover Creek (a.k.a. East Fork Bruneau River; Figure 28).

### Historic Distribution

The historic distribution of mountain whitefish was likely similar to current distribution (Figure 28). Pratt et al. (2003) provides an annotated chronology of resident and anadromous fish species in the Bruneau subbasin. Anecdotal evidence relating to mountain whitefish in the Bruneau subbasin include,

1800s pre Pre-historically, non-migratory fishes including whitefish occurred in Jarbidge River.

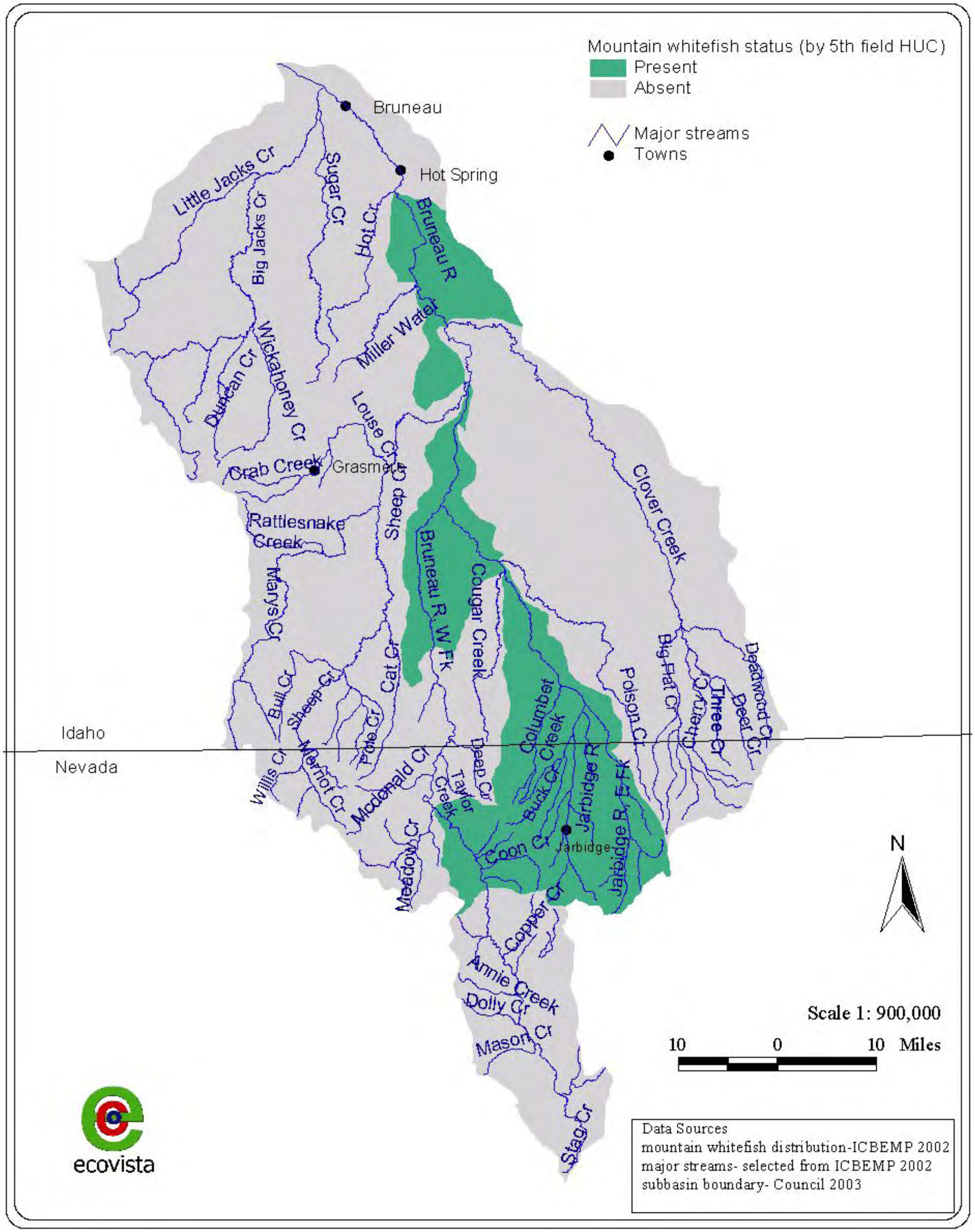


Figure 28. Mountain whitefish distribution in the Bruneau subbasin.

### 2.3.4 Bruneau Hot Springsnail

#### *2.3.4.1 Bruneau Hot Springsnail Population Data and Status*

**Conservation Status**

The Bruneau hot springsnail (*Pyrgulopsis bruneauensis*) was listed as endangered by the USFWS in 1993. The species was later taken off the list and then relisted in 1998.

**Relative Abundance**

Abundance of springsnails is thought to fluctuate seasonally and be primarily influenced by water temperature, spring discharge, food availability and food quality (Mladenka 1992, Varricchione and Minshall 1997). A survey in 1996 found the springsnail in 116 of 204 (54%) seeps and springs along the Bruneau River (Mladenka and Minshall 1996) (Table 30). 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 rangewide survey. In 2002, 68 geothermal springs were identified along a 1-kilometer stretch of Hot Creek from the confluence with the Bruneau River upstream. Of these, 38 were occupied by Bruneau hot springsnails (Lysne 2003).

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, and the springsnail population was apparently decimated (Varricchione et al. 1998). An intensive search along the length of Hot Creek found no springsnails (Varricchione et al. 1998). A rock face seep refuge located 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, all of which enabled the springsnail to recolonize the area. As of November 1999, the total springsnail population in Hot Creek was estimated at 300 to 400 individuals (Myler and Minshall 2000).

**Life History Diversity**

Bruneau hot springsnails are an endemic species inhabiting a related community of geothermal springs near the Bruneau River south of Mountain Home, Idaho (Varricchone and Minshall 1995). Adult springsnails have a small, short, wide shell measuring .22 inches long with 3.75–4.25 whorls (USFWS 2002b). Fresh shells are thin and transparent. This species occurs on exposed surfaces of various substrates including rocks, sand, gravel, and algal film. During the winter, springsnails are associated with habitats least exposed to cold-water temperatures. Distribution does not appear to be affected by water velocity as individuals have been observed across nearly the full range of flow regimes (Mladenka 1992).

Bruneau hot springsnails are grazers, taking primarily algae and diatoms (USFWS 2002b). The highest densities of springsnails appear to be associated with locations where periphyton is dominated by diatoms and the lowest densities in areas supporting algal mats (Mladenka 1992). Abundance and recruitment are thought to be affected primarily by water temperature (Mladenka 1992).

Reproduction can occur throughout the year but may be seasonal in areas affected by temperature extremes (Mladenka 1992). Sexual maturity can occur at 2 months, with offspring approximating a 1:1 sex ratio. Eggs are deposited on hard surfaces such as rocks.

### Population Trend and Risk Assessment

Annual monitoring of springsnail populations was initiated in 1990 at 3 sites (Mladenka 1992). Subsequent to the 1993 survey, a fourth site was included in future monitoring efforts (Royer and Minshall 1993). Of these 4 sites, one is located on Hot Creek at the Indian Bathtub area and the other three are located on the Bruneau River. The Hot Creek population was reduced to approximately zero individuals following a flood event in 1991 and remained absent from the site until 1999. Annual population trends at the other sites have remained fairly stable from 1990–2000 (Rugenski and Minshall 2003), although population size differs among sites and density of springsnails apparently fluctuates seasonally. Range-wide, the springsnail population may have declined by 50% from earlier estimates of abundance (Mladenka 1992).

Surveys of available and occupied spring seeps suggest geothermal spring habitat continues to decline (Lysne 2003). This decline represents a 22% decrease in the number of springs from 2000, and a 54% decrease from 1991. Furthermore, there was a 41% decrease in occupied seeps from the 2000 survey and a 65% reduction in occupied sites from the original 1991 survey (Lysne 2003).

The USFWS (2002) ranked the recovery priority of the Bruneau hot springsnail based on 4 criteria, indicating that it is: 1) taxonomically, a species; 2) facing a high degree of threat; 3) rated high in recovery potential; and 4) may be in conflict with construction, development, and other forms of economic activity. Primary threats to their conservation include groundwater withdrawal, introduced predators, and susceptibility to stochastic environmental events.

## *2.3.4.2 Bruneau Hot Springsnail Distribution*

### Current Distribution/Spatial Diversity

The springsnail occurs only in springs and seeps that arise from a thermal aquifer along a 5.5-mile reach of the lower Bruneau River (Figure 29; Klott 1996). 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 be the most suitable because it provides surfaces conducive to egg laying (Mladenka 1992).

Current distribution and population status of springsnails may be underestimated due to limited survey extent. Subsequent to 1996, surveys were restricted to the confluence of Hot Creek and the Bruneau River upstream for approximately 1 kilometer (Lysne 2003). Surveys downstream of the Hot Creek and Bruneau River confluence were discontinued due to private land concerns and lack of quality spring seeps.

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).

### Historic Distribution

The Bruneau Hot Springsnail was first collected in 1952 in upper Hot Creek, a tributary to the Bruneau River (Hershler 1990). Little is known about its historical distribution and abundance. Surveys for occupied seeps were initiated in 1991, thus distribution prior to this date is unknown. Based on documented fluctuations in population numbers due to flood events, this species historic distribution likely varied due to environmental stochasticity. Since monitoring began, the number of spring seeps as well as the number of springs occupied by springsnails has declined.

### Identification of Differences in Distribution Due to Human Disturbance

Natural recharge to the regional geothermal aquifer was estimated to be approximately 57,000 acre-feet of water annually, with approximately 10,100 acre-feet of water being discharged by spring-flow (Berenbrock 1993). Currently, there are more than 50 private wells within 12 kilometers of the Hot Creek/Indian Bathtub site using geothermal groundwater for irrigation (USFWS 2002b). Well withdrawals have increased form zero to a high of approximately 66,200 acre-feet of water per year from 1890 to 1999 (Berenbrock 1993). Based on measurements from several monitoring wells, geothermal groundwater levels have declined by approximately 4 feet from 1991 to 2000; groundwater levels are approximately 5 feet below the level identified necessary for recovery (USFWS 2002b). In accord with declining water levels, discharge from many of the geothermal springs along Hot Creek and the Bruneau River has decreased greatly or ceased flowing during the last 40 years (Mladenka 1992, USFWS 2002b). For example, discharge from Hot Creek/Indian Bathtub spring declined from an estimated 9,300 liters per minute in 1964 to zero in 1990 (Berenbrock 1993). Today, water from the spring continues below the surface and emerges about 450 meters below the traditional outlet (Rugenski and Minshall 2002). Reductions in spring flow restrict and degrade springsnail habitat by limiting the extent and quality of wetted surface areas (Mladenka 1992, USFWS 2002b, Lysne 2003).

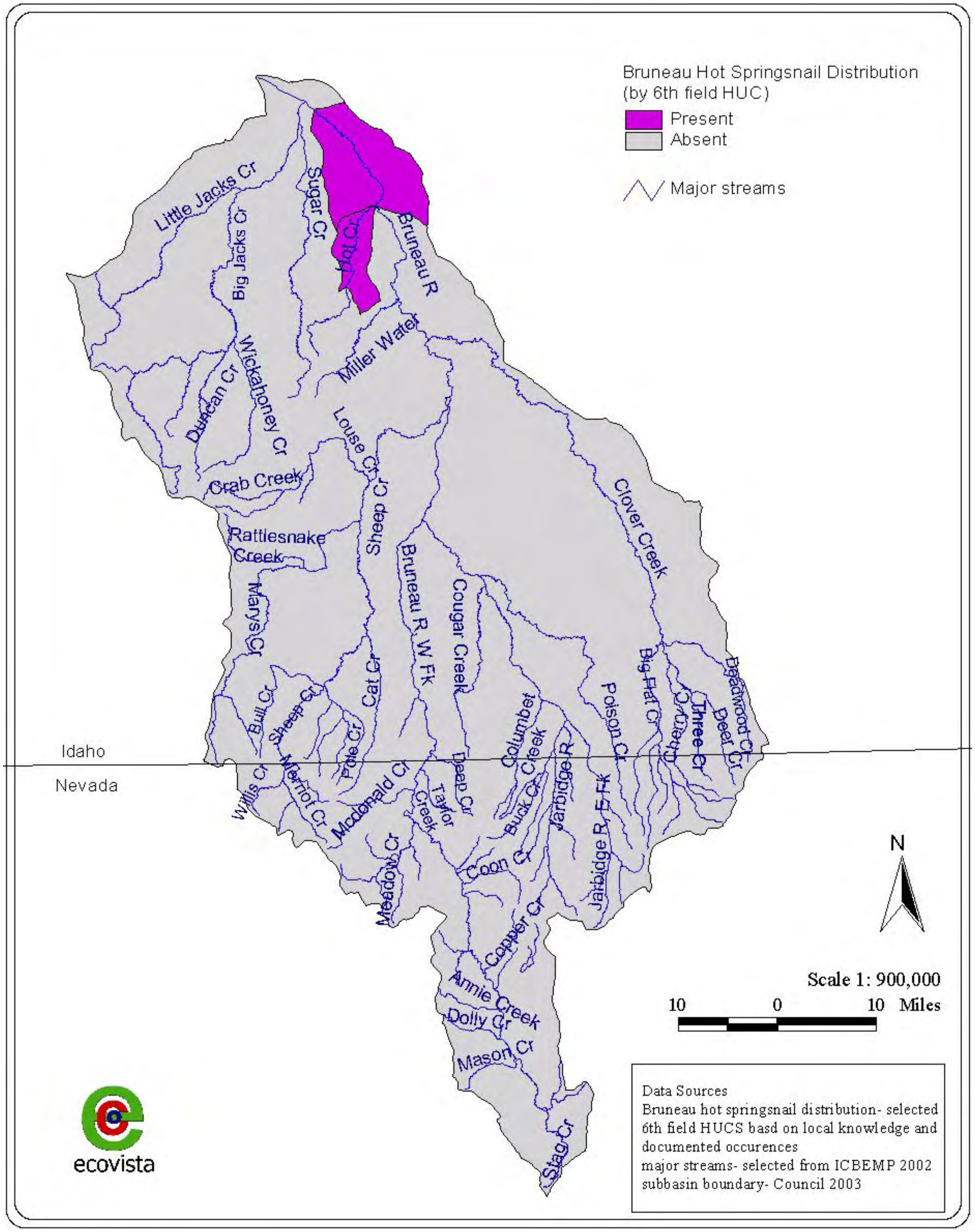


Figure 29. Bruneau hot springsnail distribution.

Bruneau hot springsnails are vulnerable to several introduced predators (Mladenka 1992). The presence of two introduced predator fish species may restrict the springsnails ability to repopulate currently unoccupied spring sites (USFWS 2002b). Both fish species are currently present in Hot Creek and are known to move in to the Bruneau River during warm summer months. This facilitates access to other spring sites as well as influences the springsnails ability to successfully disperse. As quality habitat continues to be reduced in extent, springsnails may be vulnerable to greater predation pressure.

### 2.3.5 Idaho Springsnail

#### Conservation Status

The Idaho springsnail (*Pyrgulopsis idahoensis*) was listed as endangered under the Endangered Species Act by the USFWS in 1992. Suggested causes of decline stem from alterations to the free-flowing, cold-water environment required by the snail in the form of hydropower development and operation, water withdrawal and diversion, water pollution, and competition from introduced, nonnative species. A recent study of taxonomy based on morphological and genetic data suggests *P. idahoensis* should not be recognized as a unique species (Hershler and Liu 2004).

#### Relative Abundance

Little data are available to assess density or abundance of Idaho springsnails. Distribution is patchy and occurrence is limited to small portion of mainstem Snake River (USFWS 1995a). In 2003, 165 locations were surveyed along a 3.5-mile stretch of the mainstem Snake River upstream of C.J. Strike reservoir (Steve Lysne, U. S. Fish and Wildlife Service, personal communication April 2004). Relative abundance of snails was reported as high at one site, medium at 37 sites, low at 77 sites and absent from 50 sites.

#### Life History Diversity

Little information is available on specific life history requirements of Idaho springsnails. Adult springsnails have slender, elongate shells (height 5–7 millimeters, length .2–.25 inches) with up to 6 whorls. In the mainstem Snake River, this species is readily distinguishable from other snails based on external anatomy (Lysne 2003). However, morphological characteristics may offer a potentially misleading identification tool when comparing species occurring outside the Middle Snake drainage (Hershler and Liu 2004).

The life span of *P. idahoensis* is assumed to be 1 year, although maximum life span estimated at 717 days in captivity (Lysne 2003). Idaho springsnails lay round or oval egg masses containing one offspring on vegetation, smooth, hard surfaces, and shells of other snails. Based on limited observational study, Idaho springsnails are suggested to feed nocturnally as well as hibernate during the winter months (Lysne 2003).

The Idaho springsnail is found in free-flowing reaches of the mainstem Snake River, excluding tributaries and coldwater springs (USFWS 1995a). This species is thought to require cold, clear, well oxygenated and rapidly flowing water. Springsnails occur on sand or mud between gravel to boulder-sized substrate (USFWS 1995a). Deterioration of water quality due to pollution, oxygen depletion, siltation, and increased water temperature would likely extirpate these snails from affected sites.

Laboratory examination of thermal thresholds suggests minimum and maximum temperature limits are 9º C and 33º C, respectively (Lysne 2003). Unfortunately, an attempt to identify optimal temperature range for growth and survival proved inconclusive. Idaho springsnails are suggested to have low tolerance to desiccation and pollutants (i.e. organic enrichment, metal exposure) as well as limited dispersal ability (Lysne 2003). While this makes them a useful indicator of environmental quality, it also predisposes the species to stochastic events.

### Population Trend and Risk Assessment

Although available data are limited, this species has reportedly declined in numbers and remaining populations are small and isolated (USFWS 1995a). Population surveys are limited to occurrence and lack adequate replication (Lysne 2003). Estimates of abundance and density are limited. Furthermore, there are no data available to assess productivity or estimate demographic parameters. Thus, a determination of population stability would be speculative.

### *2.3.5.1 Idaho Springsnail Distribution*

### Current Distribution/Spatial Diversity

Currently, occurrence is limited to a few locations near C. J. Strike Reservoir (RM 518) upstream to Bancroft Springs (RM 553), representing a reduction of approximately 80% from its historic distribution (Figure 30; USFWS 1995a). Current populations are small and thought to be isolated.

### Historic Distribution

Based on fossil records, the springsnail was endemic to Pliocene Lake Idaho (c.a. 3.5 m.y.a.) being found from Homedale (RM 416) to Bancroft Springs (RM 553) on the mainstem of the Snake River (USFWS 1995a). Historic distribution is thought to be contiguous.

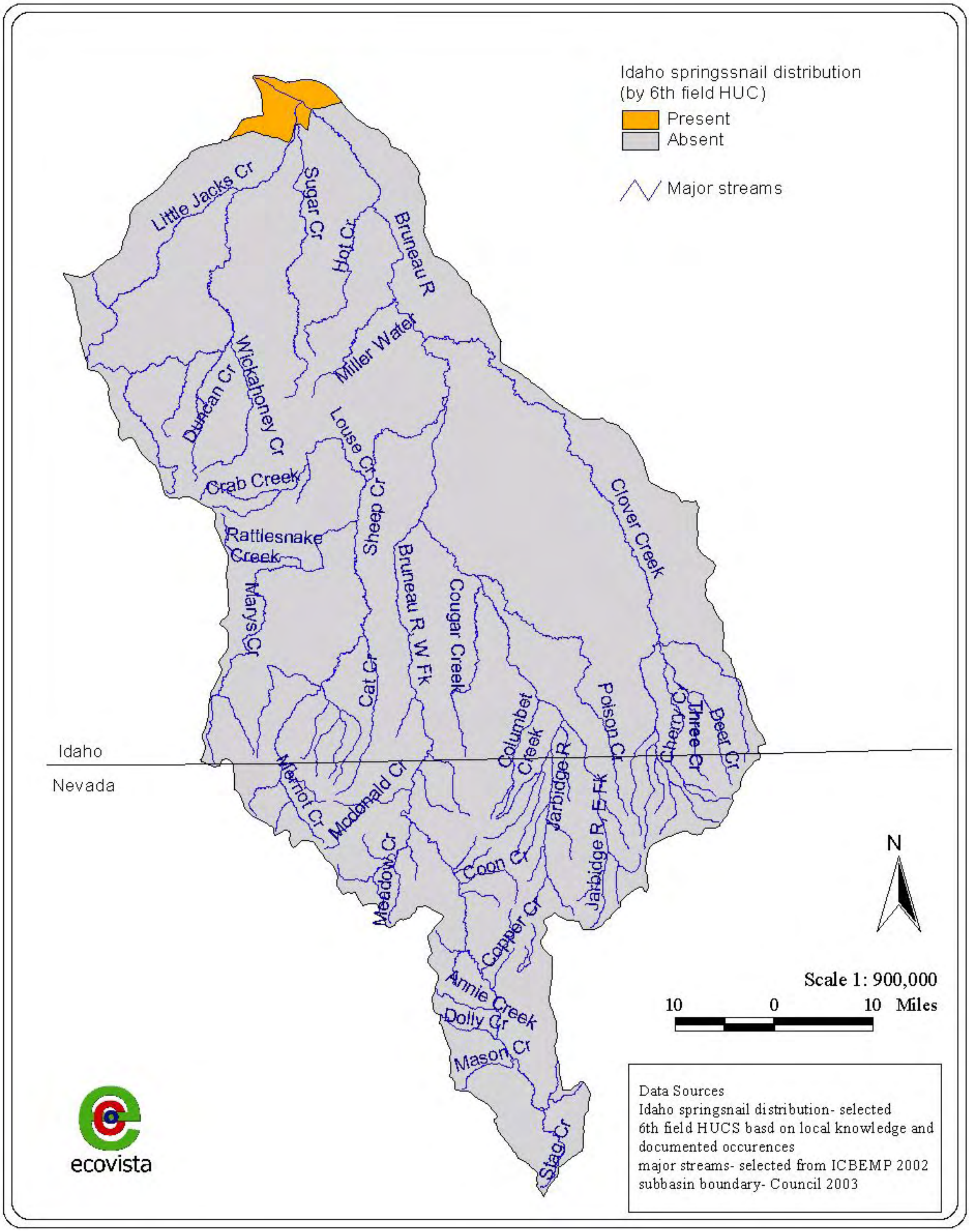


Figure 30. Idaho springsnail distribution in the Bruneau subbasin

## 2.4 Terrestrial Focal Habitats and Focal Species Characterization

### 2.4.1 Terrestrial Focal Habitats

Terrestrial focal habitats of the Bruneau subbasin are based upon the current wildlife habitat types (WHTs) delineated in the subbasin (Table 26) (Figure 31). Wildlife habitat types are groupings of vegetative cover types, based on similarity of wildlife use, that have been delineated across the Columbia Basin by the Northwest Habitat Institute (2003). Johnson and O'Neil define a wildlife habitat as "an area with the combination of the necessary resources (e.g., food, cover, water) and environmental conditions (temperature, precipitation, presence or absence of predators and competitors) that promotes occupancy by individuals of a given species (or population) and allows those individuals to survive and reproduce" (2001). Wildlife habitats are viewed as hierarchical in nature with vegetative type being the coarsest element selected for by a species, vegetative structure the next, and unique habitat elements (e.g., snags) the finest (Johnson and O'Neil 2001).

Shrub-steppe and dwarf shrub steppe were combined as a focal habitat group as well as all riparian and wetland wildlife habitat types. The resulting terrestrial focal habitats in the Bruneau subbasin are upland aspen forest, shrub-steppe/dwarf shrub-steppe, riparian/wetland, western juniper/mountain mahogany, and desert playa/salt desert scrub.

Table 26. Acres of current wildlife habitat types in the Bruneau subbasin (NHI 2003).

| Habitat Type | Acres in Bruneau |
|---|---|
| Shrub-steppe | 1,517,336 |
| Agriculture, pasture, and mixed environs | 228,010 |
| Dwarf shrub-steppe | 198,330 |
| Desert playa and salt scrub | 79,026 |
| Upland aspen forest | 57,051 |
| Montane mixed conifer forest | 15,056 |
| Western juniper and mountain mahogany woodlands | 7,666 |
| Herbaceous wetlands | 6,297 |
| Alpine grasslands and shrublands | 3,483 |
| Lakes, rivers, ponds, and reservoirs | 2,664 |
| Eastside (interior) riparian wetlands | 2,001 |
| Eastside (interior) grasslands | 1,052 |
| Eastside (interior) mixed conifer forest | 455 |
| Montane coniferous wetlands | 319 |
| Urban and mixed environs | 121 |

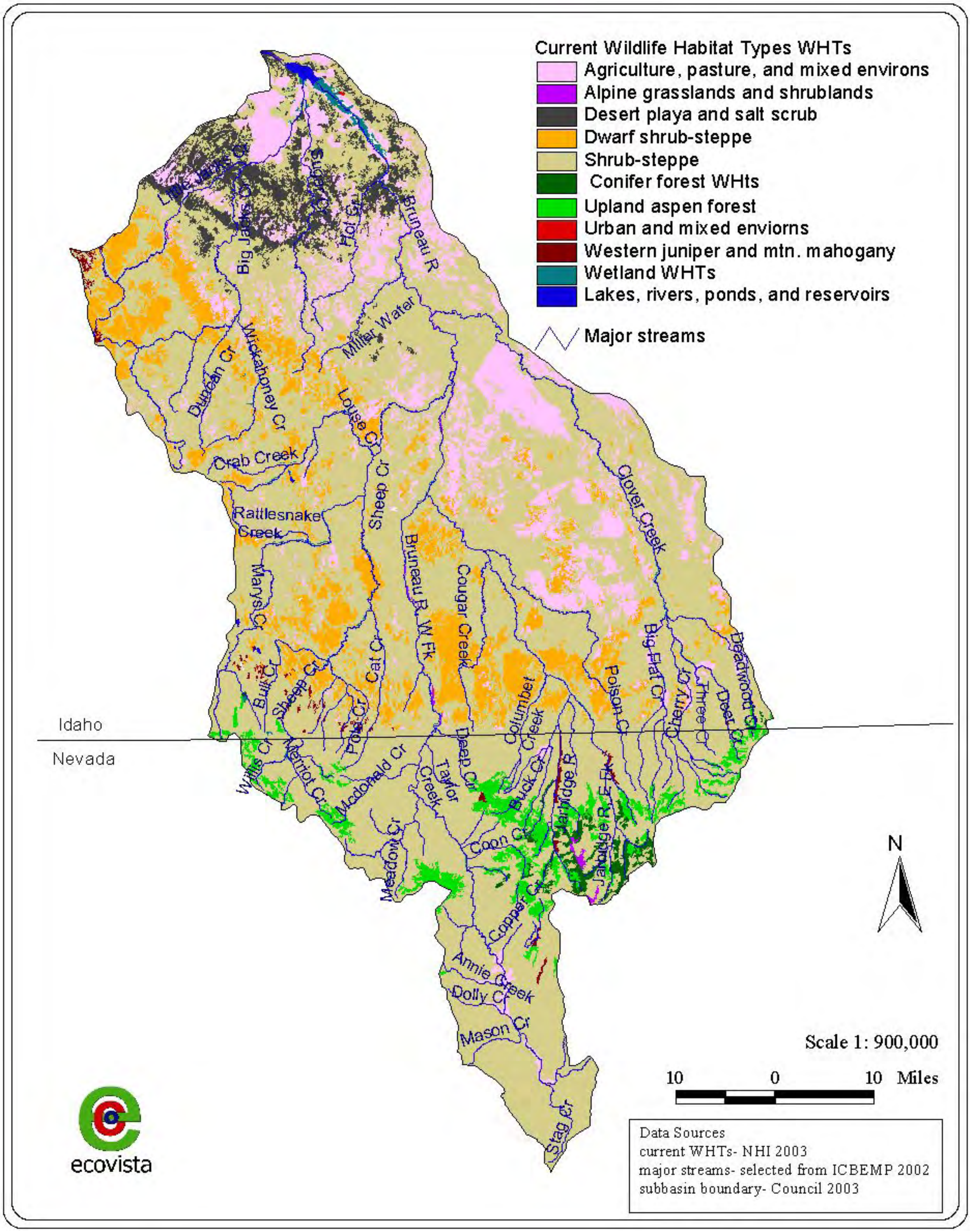


Figure 31. Current wildlife habitat types in the Bruneau subbasin.

### 2.4.1.1 Upland Aspen Forest

Aspen habitat usually occurs on well-drained mountain slopes or canyon walls that retain some moisture and can be found from 2,000 to 9,500 feet (210 to 2,896 m). Deciduous, shade-intolerant aspen trees dominate the forest type and grow over a forb-, grass-, or low shrub-dominated undergrowth, and relatively simple two-tiered stands typify the vertical structure of this habitat. Fire is an important process for the maintenance of aspen habitat, with rapid recolonization of sites occurring after fires. Aspen groves are widespread across North America but are a minor type in the Bruneau subbasin, found in the uplands in the Humboldt-Toiyabe National Forest in Nevada (Figure 11; Figure 31; Crawford and Kagan 2001a). Approximately 2% of the land cover of the Bruneau subbasin is represented by upland aspen forest (Reid et al. 2002). The primary land use for aspen stands is livestock grazing (Crawford and Kagan 2001a). Although the cover type produces wood fiber in abundance, it has been underutilized for this resource. Aspen stands are ecologically important because they provide food and cover for wildlife species, as well as high-quality water. Aspen stands can act as living firebreaks for the more flammable coniferous types and provide fire protection for the surrounding landscape (DeByle and Winokur 1985).

Growth and regeneration of aspen stands can be negatively impacted by heavy livestock browsing, and domestic sheep have been reported to consume four times more of this type than cattle do. Regeneration of aspen stands has been greatly reduced since about 1900 due to fire suppression and alteration of fine fuel levels. Conifer encroachment and dominance of aspen stands are widespread, and extensive stands of young aspen are uncommon (Crawford and Kagan 2001a).

### 2.4.1.2 Shrub-steppe

Shrub-steppe habitat is characteristically associated with dry, hot environments and found across the Columbia Plateau of Washington, Oregon, Idaho, and adjacent Wyoming, Utah, and Nevada. Most shrub-steppe habitat occurs between 2,000 and 6,000 feet (610–1,830 m) on deep alluvial, loess, silty or sandy-silty soils, stony flats, ridges, mountain slopes, and slopes of lake beds having ash or pumice soils. Shrub-steppe habitat in good ecological condition will contain a bunchgrass steppe layer, and forbs may be present in some areas depending on site potential and disturbance history. Prior to European settlement, shrub-steppe habitat lacked extensive herds of large grazing and browsing animals, and burrowing animals likely played important roles in the habitat patch dynamics. Land uses of shrub-steppe habitat include livestock grazing, irrigation, and dry land agriculture (Crawford and Kagan 2001b).

Shrub-steppe habitat is widely variable across the Bruneau subbasin. Remnant high-quality patches occur in 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 Bruneau subbasin sits below western juniper and mountain mahogany woodland habitats and forms a mosaic across the landscape with grasslands, dwarf shrub-steppe, and desert playa and salt scrub habitats (Reid et al. 2002, IBIS 2003). Shrub-steppe habitat covers approximately 78% of the land in the subbasin and is comprised primarily of Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and basin big sagebrush (*A. tridentata* ssp. *tridentata*) (Reid et al. 2002; Figure 11).

Shrub-steppe habitat in the Big Jacks and Little Jacks creeks areas is used year around by pronghorn and provides important winter/spring habitat. 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 that are rated in excellent condition and 1,000 acres (Jacks Creek Research Natural Area) in near-pristine condition. The Sheep Creek area has some of the best summer habitat in the region in the Bruneau Wilderness Study Area west of the mainstem Bruneau River. This area has the highest diversity of plant communities in the BLM's Boise District. In the upper West Fork of the Bruneau River, mule deer use the low-elevation sagebrush communities for winter habitat (BLM 1989). Approximately 24,000 acres of the Humboldt-Toiyabe National Forest Study Area provide critical mule deer winter range.

Biological soil crusts are an important component of the shrub-steppe and grassland ecosystems because they moderate surface temperature extremes, enhance seedling establishment, and improve soil stability, productivity, and moisture retention (Wisdom et al. 2000). 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]).

Altered fire regimes, habitat fragmentation, exotic plant species, and livestock grazing all modify shrub-steppe habitat. Extensive livestock use results in a decrease in the bunchgrass layer and an increase in both shrub density and cover of annual species. When there is repeated or intense disturbance, cheatgrass replaces and dominates native bunchgrasses (Crawford and Kagan 2001b).

#### *2.4.1.3 Riparian and Wetlands*

Riparian habitats occur along perennial and intermittent rivers and streams that flow from high to low gradients. Riparian and wetland habitats contain shrublands, woodlands, and forests, or, classically, a mosaic of these communities. Riparian and wetland habitats follow a corridor along montane or valley streams and usually do not extend 100 to 200 feet (31–61 m) beyond the stream. These habitats are strongly associated with stream dynamics and hydrology, and flood cycles occur within 20 to 30 years in most riparian shrublands. Habitat structure can be influenced by flood, fire, beavers, grazing, and trampling (Crawford and Kagan 2001c).

Although not documented throughout the entire subbasin, 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 to be in "excellent" or "good" condition. The majority of uplands was considered to be in "fair" or "poor" condition (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 (USFS 1995).

Vegetation removal in riparian and wetland habitats for dam construction, roads, and logging are conspicuous human influences in riparian and wetland habitats. Other activities that may adversely affect these habitats include interference with natural processes (*e.g.,* elimination of beavers, removal of large woody debris). Excessive use livestock and native ungulates may lead to a decrease in woody cover and an increase in undesirable forb species (Crawford and Kagan 2001c).

#### *2.4.1.4 Western Juniper and Mountain Mahogany Woodlands*

Western juniper and mountain mahogany woodlands are widespread, variable habitats that can be found on high topography adjacent to shrub communities common to depressions and steep slopes. Savannahs, woodlands, and open forests can characterize these habitats, with canopy cover ranging from 10 to 60%. Western juniper and/or mountain mahogany woodlands may have bunchgrass or shrub-steppe undergrowth, but some areas lacking the shrub layer may be dominated by native bunchgrasses. Cheatgrass is common in disturbed sites. Because of the fire intolerance of juniper and mountain mahogany woodlands, the amount of this habitat type has increased over the past 100 years. However, the benefits of the type's increase may be offset by degraded habitat condition due to exotic plants outnumbering native bunchgrasses (Crawford and Kagan 2001d). Western juniper and mountain mahogany woodlands are found around the Idaho–Nevada border in the Bruneau subbasin (Figure 31) but make up a relatively small portion (<1%) of the Bruneau subbasin (Reid et al. 2002). The primary land use of this habitat type is livestock grazing (Crawford and Kagan 2001d).

Fire suppression and overgrazing are the primary threats to the western juniper and mountain mahogany habitat type. Increased juniper densities coupled with a decrease in fine fuels through shading and grazing can result in high-severity fires altering habitat structure. A decrease in native bunchgrasses through overgrazing facilitates encroachment of exotic annual grasses and forbs. Shade-seeking animals can also contribute to the increase of cheatgrass cover (Crawford and Kagan 2001d).

#### *2.4.1.5 Desert Playa and Salt Scrub Shrublands*

Desert playa and salt scrub shrubland habitats center on the Great Basin of Nevada and Utah and are represented in low-elevation basins in the driest regions of the Pacific Northwest, Columbia Plateau, Basin and Range, and Owyhee provinces. Changes in salinity and fluctuations in the water table influence structural and compositional variation of these habitats. The desert playa and salt scrub shrublands are typically surrounded by shrub-steppe habitat forming a mosaic of playas, salt grass meadows, salt desert shrublands, and sagebrush shrublands (Crawford and Kagan 2001e). Less than 5% of the landcover of the Bruneau subbasin is represented by desert playa and salt scrub shrublands (Reid et al. 2002). These habitats provide rangeland for livestock, particularly in winter. Because of sparse vegetation and lack of fuel, fire plays a minor role in the natural disturbance regime (Crawford and Kagan 2001e).

Grazing facilitates the invasion of toxic and nontoxic exotic plant species into these areas, changing the structure of the native habitat. Because agricultural development is generally not feasible in these habitats, little of this habitat has been subjected to land use conversion (Crawford and Kagan 2001e).

## 2.4.2 Terrestrial ESA Listed and Focal Species Population Data and Status

### *2.4.2.1 Federal Endangered, Threatened, or Candidate Terrestrial Species*

#### Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*) is the second largest North American bird of prey, next to the California condor (*Gymnogyps californianus*). Two subspecies are tentatively recognized: a larger, northern subspecies (*H. leucocephalus alascanus*) and a smaller, southern subspecies (*H. leucocephalus leucocephalus*). The adult has a distinctive white head and tail, which contrast with dark brown body and wings. The bald eagle breeding range extends across Alaska, Canada, and all contiguous states of the United States, except for Rhode Island and Vermont. Winter range in the lower 48 states is typically associated with aquatic areas having some open water for foraging. Migration patterns are complex and depend on the age of the individual, location of breeding site, severity of climate at the breeding site, and year-round food availability. Northern birds leave the breeding areas between August and October and usually return between January and March, depending on weather conditions and food availability. High-quality winter habitat is defined by adequate food availability, presence of roost sites that provide protection from inclement weather, and absence of human disturbance. Native Americans valued bald eagles and used their feathers for ceremonial purposes. For the people of the United States, the bald eagle serves as a symbol of freedom associated with democracy, wilderness, and the environmental ethic (Buehler 2000).

Bald eagles typically nest in forested areas adjacent to large bodies of water. Nests are usually in mature forests with some habitat edge (eases nest access) in close proximity to water (usually < 2 km) with suitable foraging opportunities. The nest tree is usually one of the largest trees available, with accessible limbs capable of holding a nest, and the nest is placed in the tree's top quarter, just below the crown. Only one brood per season is produced unless eggs are taken or destroyed during incubation, in which case, a second brood might be attempted. Incubation is long, approximately 35 days. Clutches are generally one to three, with two being the most common. Nest success and reproduction data are variable across different regions, and no data are available that would be pertinent to birds nesting in the Bruneau subbasin vicinity (no nests occur within or near the subbasin). Lifetime reproductive success has been documented for one female that produced a total of 23 fledged young in 13 years of nesting (Buehler 2000).

Eggs, nestlings, and fledglings are the life stages most susceptible to predation. Potential predators include the black-billed magpies (*Pica pica*), gulls, ravens (*Corvu* spp.), crows (*Corvus* spp.), black bears (*Ursus americanus*), raccoons, hawks and owls, bobcats, and wolverines (*Gulo gulo*). The maximum recorded age for a wild bald eagle is 28 years, but good survival data are still lacking for most populations. It is speculated that bald eagles may have similar survival patterns of other raptors, with first-year survival being the lowest, followed by increasing survival with age. Because bald eagles have low reproductive rates, factors affecting survival likely regulate populations. Bald eagles are optimal foragers, and food is obtained by direct capture, scavenging, and usurping from other bald eagles, birds, and mammals. Diet composition varies by site and prey species availability. Bald eagles eat a wide variety of fish, birds, mammals, reptiles, amphibians, and crustaceans. Food is obtained by direct capture, scavenging, and usurping from other bald eagles, birds, and mammals. Fish typically comprise a greater proportion of the diet, followed by birds, mammals, and other food items (Buehler 2000).

There are no known bald eagle nests within 15 miles of the Bruneau area, but bald eagles are known to winter in the C.J. Strike area along the Snake River. Most wintering birds are single or pairs of adults, and there is no known communal roost in the area. Fish and waterfowl are more abundant along the Snake River than they are inland in the Jarbidge Resource Area. Other potential prey within the subbasin are either hibernating in the winter (ground squirrels and other rodents) or low in numbers due to the loss of range habitat (jackrabbits). Since numbers of big game, mule deer, and antelope in this area are low, these animals would not be major food sources for wintering eagles (Klott 1996).

The bald eagle is listed as threatened under the ESA. It is classified by the BLM as a Type 1 sensitive species and by Idaho as endangered (IDCDC 2003). The species is considered globally secure (G4); in Idaho, it is rare as a breeder, but the nonbreeding population is apparently secure (S3BS4) (IDCDC 2003). No bald eagle data are available from the Bruneau subbasin Breeding Bird Survey (BBS) routes, but in Idaho and the western BBS region, increasing trends (1966–2002) of 1.3% ($n$ = 5 routes, $P$ = 0.65) and 5.4% ($n$ = 88 routes, $P < 0.001$) per year are promising for these populations (Sauer et al. 2003). The USGS Forest and Rangeland Ecosystem Science Center's Snake River Field Station coordinates the Midwinter Bald Eagle Survey, in which standard, nonoverlapping routes are surveyed by several hundred individuals (http://ocid.nacse.org/qml/nbii/eagles/). No midwinter count routes occur within the Bruneau subbasin, and the closest routes are approximately 15 km northwest of the subbasin in Grand View (Middle Snake subbasin) and approximately 50 km east in King Hill (Middle Snake subbasin). Data from 1986 through 2000 from survey routes in both of these areas show annual increases in wintering bald eagles.

The greatest threats to bald eagles are from human activities. Direct threats are shooting, trapping, or poisoning; indirect threats include developments of powerlines and other structures. In addition, environmental contaminants are a significant source of mortality (Buehler 2000).

### Snowy Plover

The snowy plover (*Charadrius alexandrinus*) is a small shorebird with a breast band restricted to lateral patches, pale brown upperparts, and dark gray to black. At least three races are recognized outside of the Americas, and up to three subspecies have been reported for the Americas: *C. a. occidentalis*, *C. a. tenuirostris*, and *C. a. nivosus*. Pacific Coast, Atlantic Coast, and inland birds all are classified as *C. a. nivosus*. In North America, snowy plovers breed inland and along the Pacific, Gulf, and Atlantic coasts. The Bruneau subbasin does not lie within the known breeding range of inland plovers, but breeding is known to occur in western and central Nevada and south-central Oregon. The extent of the inland breeding range west of the Rocky Mountains has only been documented since the late 1970s, and it's plausible that the breeding range has contracted in some areas with the loss of lakes used as breeding areas. Inland populations migrate to wintering grounds in coastal California and on the west coast of Baja California. They also reportedly winter in interior Mexico south to the central volcanic belt. Snowy plovers in the western Great Basin arrive on the breeding grounds in April and may leave as soon as early July, with most birds leaving by the beginning of September. Snowy plovers winter primarily in coastal areas at beaches, tidal flats, lagoon margins, and salt-evaporation ponds. They exhibit fidelity to breeding sites and winter ranges, although some dispersal has been seen among breeding sites within and between years (Page et al. 1995).

Inland snowy plovers breed on barren to sparsely vegetated ground at alkaline or saline lakes, reservoirs, and ponds; on riverine sand bars; and occasionally at sewage, salt-evaporation, and agricultural wastewater ponds. Nesting has not been documented on salt flats lacking water, but it can occur where the only apparent surface water is a distant small seep. Snowy plovers are facultatively polyandrous and polygynous, particularly in areas with long breeding seasons and a surplus of males. Males rear broods, while females obtain new mates and initiate new nests. Nests are scrapes on the ground, usually located near objects but still often exposed to environmental conditions. Clutches are usually three eggs, and for 70 interior Oregon and Nevada nests, the average was 2.92 (SD = 0.27, range = 2–3). Single-egg clutches are usually deserted by the adults, who probably initiate a new nesting attempt. The young are precocial and first leave the nest within one to three hours of hatching. Most young breed during the first nesting season following their birth. In snowy plover populations for which the breeding season is long and the clutch loss is high, birds have been documented attempting six clutches in a season. Birds that successfully produce clutches generally produce two to three in a breeding season. The proportion of broods producing at least one flying young (data from four studies) averaged 61% (SD = 10.9, range 48–71%). Other studies have estimated the number of flying young per successful brood (producing at least one flying young) at 1.6 (SD = 0.21, range 1.4–1.9). At a coastal and an interior California site, the number of young reaching flying age per female was 0.8 to 0.9 and 0.5, respectively (Page et al. 1995).

Adults, chicks, and eggs of snowy plovers are subject to predation by a number of avian and mammalian predators. The maximum age for a male snowy plover in the wild is at least 15 years, which is considered out of the ordinary. One estimate of life span is 2.7 years for adults. Survival analysis of birds at Great Salt Lake, Utah, resulted in annual survival rates from 0.578 to 0.880, with no significant differences detected between sexes.

Snowy plovers feed on terrestrial and aquatic invertebrates. Most feeding at inland habitats is in shallow (1–2 cm deep) water or on wet mud or sand. Some foraging occurs on dry flats on playas. In osmotically stressful environments, water intake may be reduced to insectivorous diet (Page et al. 1995).

The breeding population of snowy plovers along the Pacific Coast of the United States as well as Baja California is listed as threatened under the ESA. Current estimates of U.S. breeding populations are about 21,000 snowy plovers, with most (87%) occurring west of the Rocky Mountains and more than half (50%) concentrated at Great Salt Lake, Utah. A 20% decline in size of the breeding population between the late 1970s and 1980s was observed for California, Oregon, Washington, and Nevada combined (Page et al. 1995). Nevada's Natural Heritage Program lists the snowy plover as globally secure (G4) but extremely rare and critically imperiled as a breeder in Nevada (S1B) (NNHP 2003). The Lahontan Valley, northwest of Fallon, Nevada, has been identified as the single most important area for snowy plovers in that state (Herman et al. 1988). No BBS data for snowy plovers are available in the database for Idaho or the western region (Sauer et al. 2003).

Limiting factors for snowy plover habitat are diversions for irrigation, high water conditions, and lowered water tables (Herman et al. 1988). Major threats to snowy plovers include disturbance or destruction of nests by cattle (Herman et al. 1988), clutch destruction by predators, reduction in suitable breeding habitat, and human disturbance at nests (Page et al. 1995).

## Lynx

A medium-sized forest carnivore, the lynx (*Lynx canadensis*) is characterized by long black ear tufts, large feet, and a black tip that completely encircles the tail. The range of lynx in North America extends across the boreal forests of Canada and Alaska to tree line, northern New England, portions of the Lake States, the Pacific Northwest, and the Rocky Mountains (Tumlison 1987). The primary habitats include boreal and sub-boreal forests with openings, rugged outcrops, bogs, and thickets (Tumlison 1987, Aubry et al. 2000). In the western mountains, lynx are associated with coniferous forests and upper elevations but mixed coniferous-deciduous forests comprise lynx habitat in the Northeast. Lynx utilize early successional forest stands for foraging and mature forest stands containing large woody debris for denning. Southern populations of lynx have large home ranges and are found in lower densities than their northern counterparts (Aubry et al. 2000). Because of the value of lynx as a furbearer, there are over 200 years of trapping records from the Hudson Bay Company. These records show approximately 10-year fluctuations in lynx harvests that are synchronized with the populations of the lynx's primary prey, snowshoe hares (*Lepus americanus*) (Tumlison 1987).

Female lynx are capable of breeding at 10 months but may wait until their second breeding season (22–23 months) if sexual maturity is delayed. Males typically do not breed until their second year. Reduced prey may affect reproductive success, particularly in yearling females, and lynx may reproduce in alternate years if limited by food availability. Litter size ranges from one to six but is usually three to four in North America. Twenty-two years is the maximum life span in captivity, but lynx will seldom live beyond 15 years in the wild. The main sources of mortality are starvation and human harvest (Tumlison 1987), but recently introduced lynx in Colorado have also suffered from plague (Tanya Shenk, Colorado Division of Wildlife, personal communication).

Snowshoe hares can comprise up to 83% of the lynx diet, which may also include alternate prey such as squirrels, small mammals, beaver, deer, moose, muskrats, and birds (Tumlison 1987). Alternate prey are believed to be important constituents of lynx diets in southern boreal forests (Aubry et al. 2000).

On March 24, 2000, lynx were listed as threatened under the ESA. Although the USFWS considers Idaho a state where lynx are known to occur, viable populations have not been documented in the Bruneau subbasin. Therefore, there can be no discussion of trends for this species within the subbasin. Historical records indicate that this area may be regarded as dispersal habitat for lynx. Two museum specimens collected in 1916 in Elko County, Nevada (north-central Nevada near the Oregon border) are the southernmost records of lynx occurrence west of the Rocky Mountains and the only verified records of lynx in Nevada. Because of records collected in other southern locales and high pelt returns from British Columbia and southern Alberta, it is thought that lynx in 1916 were dispersing south of their primary range (McKelvey 2000).

Primary threats to lynx include prey scarcity and lynx harvest (Tumlison 1987). It is also speculated that habitat fragmentation facilitating access by interspecific competitors may affect the structure and function of lynx populations (Buskirk et al. 2000).

## Yellow-billed Cuckoo

A slender, long-tailed bird, the yellow-billed cuckoo (*Coccyzus americanus*) migrates from its winter range in South America to breed throughout temperate North America south to Mexico and Greater Antilles. It has been nicknamed the “raincrow” because it appears to call more often on cloudy days (Hughes 1999). Currently, with some debate, two subspecies are recognized, *C. a. occidentalis* (western) and *C. a. americanus* (eastern). Pecos River, Texas, is the dividing line between the two subspecies, although there appears to be an intergrade along that boundary (AOU 1957).

Western cuckoos arrive on the breeding grounds in mid- to late May, which is one to two months later than their eastern counterparts do at the same latitude. By early to mid-June, considerable numbers may be present, but transients continue to be recorded in late June to mid-July. Western cuckoos depart in the fall, starting in late August, two to three weeks earlier than eastern cuckoos do, with most birds departing by mid-September. Breeding habitat is typically open woodland with clearings and low, dense scrubby vegetation. In arid environments of the West, the birds are often associated with riparian areas. Yellow-billed cuckoos are usually absent from heavily forested areas and large urban centers. Two to three weeks prior to breeding, yellow-billed cuckoos may occupy upland areas before moving into riparian areas to breed. Habitat on their winter range is similar to that of breeding areas; they prefer woody vegetation bordering fresh water, lowlands to 1,500 meters, dense scrub, deciduous broad-leaf forest, gallery forest, and secondary forest. Western populations nest in willow, Fremont cottonwood, and mesquite; they may also nest in hackberry, soapberry, alder, and cultivated fruit trees. The nest is typically placed 0.3 to 1.0 meter from the end of a horizontal branch or in a vertical fork of a tree or large shrub, usually 1 to 6 meters above the ground. The nest may be 2 to 4 meters from the main tree trunk and is well concealed, particularly from above, by surrounding foliage. Because of the shortened breeding season, only a single brood is thought to be produced by western cuckoos, with the onset of breeding determined by food availability. Clutch size can be one to five eggs but is usually two or three. Large clutches (*e.g.,* >6) are attributed to more than one female laying eggs in a single nest (Hughes 1999). No data of nest success or young survival are available for Idaho. In the Sacramento Valley, California, the mean number of eggs per nest was 3.5 (± 1.0 SD), with 1.5 (± 0.56 SD) young surviving per nest (Laymon 1980). No information is available about lifetime reproductive success. Four years is the maximum recorded lifespan (Hughes 1999).

In addition to being an intraspecific brood parasite, the yellow-billed cuckoo is known to parasitize at least 11 other bird species. Evidence suggests that the yellow-billed cuckoo selects hosts that have similarly colored eggs. Brown-headed cowbirds may parasitize yellow-billed cuckoo nests but are probably rarely successful due to longer nesting requirements (11 days versus 7–9 days, respectively). Fatigued, migrating adult yellow-billed cuckoos are susceptible to predation by raptors. Nestlings may be taken by avian predators, snakes, and mammals. Yellow-billed cuckoos feed primarily on large insects, including caterpillars, katydids, cicadas, grasshoppers, and crickets. Other occasional food items are small frogs, arboreal lizards, eggs and young of birds, or fruits and seeds. Yellow-billed cuckoos most frequently forage by gleaning insects from leaves and stems while perching in open areas, woodlands, orchards, or adjacent streams (Hughes 1999).

Abundance of yellow-billed cuckoos can be highly variable, with large localized influxes occurring during times of insect abundance or outbreaks. It is difficult to determine population trends from conventional observation, mist netting, or listening-post techniques due to the quiet demeanor and skulking behavior of yellow-billed cuckoos. These methods should be considered inadequate for determining densities. The preferred and recommended method is counting responses to playback (Hughes 1999). Because of these limitations, interpretation of BBS data should be made with caution. No yellow-billed cuckoo BBS data are available for Idaho, but trend estimates for the western region indicate declines from 1966 through 2002 but not at a statistically significant level (–2.6% per year, $P = 0.31$, $n = 20$) (Sauer et al. 2003). In 2003, a survey was conducted for yellow-billed cuckoo in recorded historic and other likely locations in Idaho. The purpose of this study was to compile historic records for yellow-billed cuckoos in the state, develop and implement sampling methodology, and establish a long-term monitoring protocol that could be used to monitor this species. Fifty-five percent (35 of 64 total historic sightings) of the historical yellow-billed cuckoo records in Idaho are from southeast Idaho, with most being from the Snake River corridor. No yellow-billed cuckoos were detected in southwest Idaho during the 2003 surveys, and one verified sighting in 2002 is on record at 26 km northwest of the town of Bruneau, near the confluence of the Snake River and Bennet Creek (TREC, Inc. 2003).

Yellow-billed cuckoos are extremely rare in the western United States and western Canada. Western yellow-billed cuckoos were given candidate status for listing under the ESA in July 2001 (Federal Register, Vol. 66, No. 143). The yellow-billed cuckoo is also listed for the Great Basin in *Birds of Conservation Concern 2002* (USFWS 2002) and deemed a priority for conservation actions. The IDCDC (2003) reports that the yellow-billed cuckoo is globally secure (G5) but ranks it as critically imperiled as a breeder in Idaho because of its rarity and vulnerability to extinction (S1B). The bird has the same state status (S1B) in Nevada (NNHP 2003).

Limiting factors for yellow-billed cuckoos include habitat loss and fragmentation, inundation from water management projects, lowering of water tables, land clearing, cattle grazing, and pesticide use (Hughes 1999).

### Columbia Spotted Frog

The Columbia spotted frog (*Rana luteiventris*) belongs to the Class Amphibia and Family Ranidae (True Frogs). It was long considered the same species as the Oregon spotted frog (*R. pretiosa*), but genetic studies have differentiated the two as separate species. The two species are morphologically indistinguishable but have nonoverlapping ranges, a characteristic that facilitates field identification (Green et al. 1997). Oregon spotted frogs are found in south-central Washington, the Cascade Mountains of Oregon, and extreme southwestern British Columbia (Reaser 2000). The range of Columbia spotted frogs extends northward from scattered, isolated populations in Nevada and Utah through parts of eastern Oregon, central and northern Idaho, northwestern Wyoming, eastern Washington, western Montana, and much of British Columbia to its northernmost extent in southwestern Yukon (Green et al. 1997, Reaser 2000). Spotted frogs have been delineated into four “populations” (Bos and Sites 2001), and the Bruneau subbasin is within the Great Basin population, comprised of eastern Oregon, southwestern Idaho, and Nevada.

Spotted frogs were detected on the BLM's Bruneau Resource Area (Upper Owyhee subbasin) during surveys in 1993. These surveys were conducted to assess the abundance and distribution of spotted frogs in the southern portion of the resource area (Munger et al. 1994). Spotted frog surveys were conducted on the BLM Jarbidge Resource Area in 1994 (McDonald and Marsh 1995) and both the Jarbidge and Snake River Resource Areas in 1995 (McDonald 1996). Only one site of seven surveyed during 1994 was located in the Bruneau subbasin, at the East Fork Jarbidge River at Murphy Hot Springs (McDonald and Marsh 1995). The survey site included two 1-km stretches of river and adjacent wetlands above and below the town. The three sites of the Jarbidge Resource Area were east of the Bruneau subbasin (Middle Snake subbasin). Despite sightings in northeastern Nevada around the same time of the surveys, no spotted frogs were detected in these survey efforts. For the Bruneau subbasin, the IDCDC has one record of a Columbia spotted frog occurrence in the headwaters of Marys Creek (IDCDC 2001). Surveys conducted by the BLM in Nevada documented the species in the headwaters of Sheep, Meadow, Corral, and Copper creeks (Figure 32) (BLM, Elko Resource Area unpublished GIS data).

Two adult Columbia spotted frogs were present in Salmon Falls Creek in 1994, and other observations of spotted frog in Idaho south of the Snake River were from southwestern Owyhee County. Habitat of the Owyhee Mountain subpopulation tends to be near permanent, slow-moving water that has little vegetation and that has warmer water temperatures than non-frog sites do (Munger et al. 1997). During this investigation, a modest negative association was detected between recent grazing and spotted frog presence. Movement between habitats during spring breeding, summer foraging, or winter hibernation is likely along riparian corridors (Engle and Munger 1998). Although spotted frogs are capable of long movements (*e.g.,* 676 m), most resightings of a population in the Owyhee Mountains were within 10 meters of the original capture site (Engle and Munger 1998). Females have exhibited site fidelity to their natal ponds in the Owyhee Mountains (Engle and Munger 2003). Survival is largely influenced by environmental factors, predators (*e.g.,* exotic trout), and cattle (Reaser 2000). Heavy fall grazing resulted in decreased survival for migrating subadult and female spotted frogs in the Owyhee Mountains due to the lack of vegetative cover and the reduced water corridor (Engle and Munger 2003). Numerous researchers have asserted that amphibian populations worldwide are undergoing population declines (see Munger et al. 1996). No long-term data are available on population numbers of spotted frogs in the Bruneau subbasin, but studies and field surveys have been underway to establish presence or absence and long-term monitoring of spotted frogs in the Owyhee Mountains (Gerber et al. 1997, Engle and Munger 2003). An assessment of population structure of spotted frogs in the Owyhee Mountains revealed a downward trend in population numbers from 1997 through 1999 (Engle and Munger 2003). In Nevada, surveys from 1994 through 1996 indicated that 54% of the sites known to have spotted frogs before 1993 no longer supported spotted frogs (Reaser 1997).

The Great Basin population of the Columbia spotted frog is a candidate for listing under the ESA. As of February 2002, publication of a proposal to list had been precluded by other higher-priority listing actions. The CDC has classified the spotted frog as S2S3, because it is considered rare or uncommon in the state and uncertainty exists concerning its imperilment (IDCDC 2003). A conservation agreement between multiple partners has been signed in Nevada and covers this northeast Nevada (Elko County) subpopulation of Columbia spotted frogs (September 2003).

Threats to Columbia spotted frogs include grazing, spring development, road and trail construction, water diversion, fire in riparian corridors, pesticides, disease, and non-native fish.

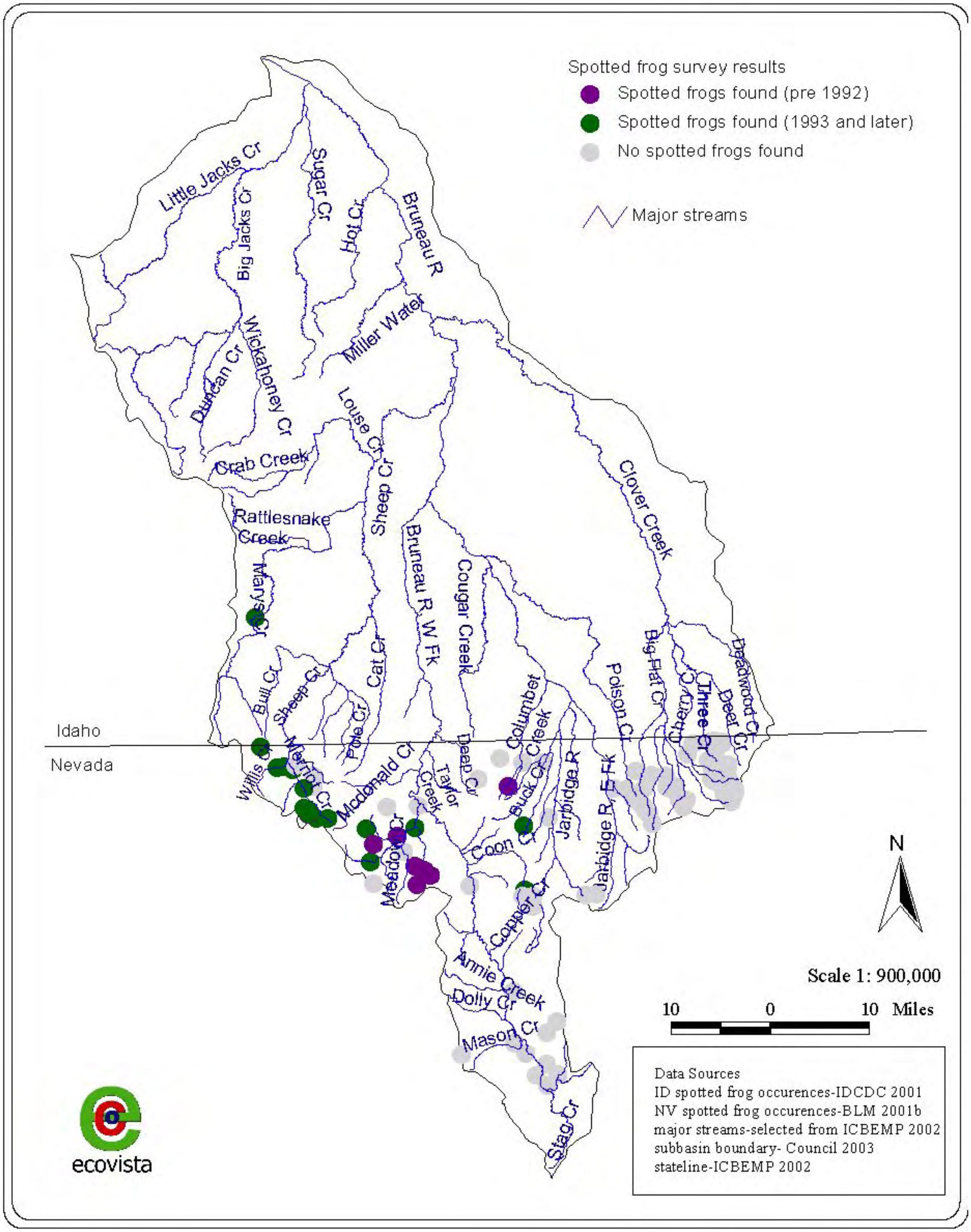


Figure 32. Spotted frog survey records for the southern portion of the Bruneau subbasin.

### *2.4.2.2 Terrestrial Focal Species by Habitat Type*

## Upland Aspen Forest

### *Northern Goshawk*

The northern goshawk is a forest raptor found in boreal and temperate habitats of North America. Although southwest Idaho is not included in the bird's western United States breeding range, the goshawk does occupy insular mountain ranges of Nevada (Squires and Reynolds 1997). Populations have also been documented on the Sawtooth National Forest just east of the Bruneau River vicinity (Marilyn Hemker, USFWS, personal communication, January 2004). Some birds will remain residents in their breeding range throughout the winter, but others have been documented moving outside of these areas. Wintering habitat preferences may be dictated by prey abundance (Squires and Reynolds 1997). Two subspecies, *A. g. atricapillus* and *A. g. laingi*, are recognized in North America by the American Ornithologists' Union (1957), with *A. g. atricapillus* breeding in Idaho and Nevada. Interest in falconry has spread across North America since World War II, and goshawks are valued by modern-day falconers because they are aggressive and will hunt a variety of prey (Squires and Reynolds 1997).

Goshawks nest in most forest types found throughout their geographic range, and habitat characteristics vary from territory to territory, depending on availability. At large spatial scales, the goshawk is considered a habitat generalist, but nest structures are usually found in mature forest stands having high (60–90%) canopy closure near the bottom of moderate hill slopes with sparse ground cover (Squires and Reynolds 1997). In Nevada, goshawks nest in high-elevation, shrub-steppe habitat in small, scattered mature aspen stands along drainages (Younk and Bechard 1994). The mean elevation of nest stands was 2119 m (range 1975–2386 m) and averaged 60 years of age based on core samples. Nests in this area are usually in large forked aspen trees (mean dbh = 29 ± 3.8 [SE] cm) (Younk and Bechard 1994) and constructed at the lower one-third of the tree or just below the forest canopy (Squires and Reynolds 1997). The proportion of subadult and young adult nesting females varies among populations, but a high frequency of nesting subadults is believed to indicate an increasing population and vice versa (Squires and Reynolds 1997). Egg laying usually begins by early May (Younk and Bechard 1994), and typically only one brood per season is produced (Squires and Reynolds 1997). Replacement clutches for lost eggs have been documented but are considered uncommon. Clutches are usually two to four eggs, rarely one or five. The average clutch size for North America is 2.7 eggs (± 0.88 SD). Nest success is variable (usually between 80 and 94%), and most populations usually produce between 2.0 and 2.8 fledglings per successful nest. Lifetime reproductive success is unknown and difficult to estimate due to the secretive nature of adults and their sometimes extensive movements to alternate nests (Squires and Reynolds 1997).

Goshawks have few natural predators, and the maximum documented lifespan is 11 years. Mortality risk is believed to be highest during the first year after dispersal. Exposure to cold and rain contributes to egg and chick mortality. Goshawks will feed on a variety of prey and are considered opportunists. Prey items include squirrels, rabbits and hares, large passerines, woodpeckers, game birds, and corvids, along with occasional reptiles and insects. Prey selection and switching may be influenced by season and availability (Squires and Reynolds 1997). For instance, in Nevada, more birds were consumed when Belding's ground squirrels began estivation. Foraging habitat ranges from open sagebrush-steppe to dense forests. Goshawks in

Nevada were documented foraging in open sagebrush and perching along edges of aspen groves (Younk and Bechard 1994).

Densities of breeding pairs are low because goshawks are top-level predators, and extensive nest searching hampers the ability to calculate accurate population estimates (Squires and Reynolds 1997). Goshawks have been observed in the southern portion of the Jarbidge Resource Area in stands of aspen (Klott 1996). Nesting goshawks have been found in small isolated aspen/conifer stands throughout the West Fork Bruneau River in the Humboldt-Toiyabe National Forest (USFS 1995). Geographic and temporal trends are poorly understood, but interpretations are probably confounded by prey availability and severe weather. No BBS trend data are available for goshawks in Idaho or Nevada (Sauer et al. 2003). BBS western regional data show a population change of 1.5% per year ($P = 0.5$, $n = 44$ routes) from 1966 to 2002. Goshawks are classified as a species of special concern in Idaho, protected in Nevada, sensitive type 3 by the BLM, and sensitive by the USFS Region 4 (IDCDC 2003). The Natural Heritage Network ranking of G5S4 for the species indicates that populations are secure rangewide but that there is cause for concern over the long term in Idaho.

Timber harvest is a primary threat to nesting populations, but responses of goshawks to these practices are unknown (Squires and Reynolds 1997). Understory cover is decreased through grazing and shading by livestock during the hot summer months (Younk and Bechard 1994). Furthermore, grazing has been identified as a factor jeopardizing the northern goshawk in the Southwest (Fleischner 1994).

## Shrub-steppe

### *Sage Grouse*

The sage grouse (*Centrocercus urophasianus*) was originally distributed across 16 western states in the United States and 3 provinces in southwestern Canada. Reductions of populations have occurred throughout the bird’s range, and it is currently found in 2 Canadian provinces and 11 western states (Storch 2000). Sage grouse populations are sympatric with sagebrush (*Artemisia* spp.) habitats (Connelly et al. 2000). In Idaho, sage grouse are present in the southern half of the state. Sage grouse habitat and potential restoration areas have been identified in the Bruneau subbasin (Figure 33). The sage grouse was an important game species for Native Americans and European settlers and continues to be valued for hunting and food. Because of the stunning display of sage grouse on their strutting grounds, they have become popular with naturalists and bird watchers (Storch 2000).

Sage grouse populations may display differing annual migratory patterns that range from moving seasonally between distinct areas to being completely nonmigratory. There is large variability in seasonal and annual movements, depending on the migratory patterns of the population, but all sage grouse have high fidelity to seasonal ranges, with females being philopatric or reproducing at the site of their birth. Sage grouse feed exclusively on sagebrush during the winter and also forage on insects and herbs in the summer (Connelly et al. 2000). Insects are an important dietary component for young chicks. Compared with other grouse species, sage grouse typically have higher survival rates and lower productivity. Sage grouse perform breeding behavior displays on traditional grounds, or leks, which are open but adjacent to sagebrush habitats

(Storch 2000). Characteristics of sagebrush rangeland needed for productive sage grouse populations were outlined by Connelly et al. (2000) (Table 27).

Table 27. Vegetation characteristics required for productive sage grouse populations.

| | **Breeding** | | **Brood rearing** | | **Winter** | |
|---|---|---|---|---|---|---|
| | **Height (cm)** | **Canopy (%)** | **Height (cm)** | **Canopy (%)** | **Height (cm)** | **Canopy (%)** |
| Mesic sites[a] | | | | | | |
| Sagebrush | 40-80 | 15-25 | 40-80 | 10-25 | 25-35 | 10-30 |
| Grass-forb | >18[c] | ≥25[d] | variable | >15 | N/A | N/A |
| Arid sites[a] | | | | | | |
| Sagebrush | 30-80 | 15-25 | 40-80 | 10-25 | 25-35 | 10-30 |
| Grass-forb | >18[c] | ≥15 | variable | >15 | N/A | N/A |
| Area[b] | >80 | | >40 | | >80 | |

[a] Mesic and arid sites should be defined on a local basis; annual precipitation, herbaceous understory, and soils should be considered

[b] Percentage of seasonal habitat needed with indicated conditions

[c] Measured as “droop height”; the highest naturally growing portion of the plant

[d] Coverage should exceed 15% for perennial grasses and 10% for forbs; values should be substantially greater if most sagebrush has a growth form that provides little lateral cover

[e] Values for height and canopy coverage are for shrubs exposed above snow

Sage grouse numbers have been declining throughout the 20th century. Between 1985 and 1994, populations declined by an average of 33%. Annual harvests during the late 1970s were reported at approximately 280,000 birds, and by 1998, the rangewide breeding population was estimated at 140,000 birds (Storch 2000). In Idaho, BBS data show populations declining at 28.3% per year ($P$ = 0.01, $n$ = 4 routes) from 1980 to 2002 (Sauer et al. 2003). Lek counts have been conducted in the Bruneau subbasin and documented active leks (1995–2003) are presented in Figure 34. Counts in the Jarbidge Resource Area indicate a decline in the number of males per lek since 1980 (JSGWG 2002). By 1997, fewer than one-third of the recorded lek locations ($n$ = 120) were still active, and harvest records from a check station near Salmon Falls Creek Dam showed a decline in harvest by more than 80% since the 1950s (Klott 1997). A radio-telemetry study conducted in south-central Owyhee County and extreme north-central Elko County from 1999 through 2001 assessed sage grouse survival, productivity, habitat use, and the efficacy of population monitoring by utilizing fecal dropping counts. The 300,000-ha study area was mostly within the Bruneau subbasin (Wik 2002). Annual survival rates of males (0.54, 1999–2000; 0.67, 2000–2001) (Wik 2002) were similar to those of previous studies in Idaho (0.60, Connelly et al. 1994). Seasonal rates of male survival did not differ between seasons, indicating that lek displays and hunting didn’t increase mortality pressure for males during the study. Adult female annual survival (0.58, 1999–2000; 0.42, 2000–2001) (Wik 2002) was within the range previously reported by Connelly et al. (1994). Many of the adult females and juveniles concentrated their habitat use near moist meadows and springs or irrigated croplands, which is where many hunters focused their efforts. As a result, 2.1 to 3.8 times more adult females than adult males were harvested during this study (Wik 2002). Connelly et al. (2000) recommended that no more than 10% of the fall population be hunted and that no hunting should occur in populations with a breeding population of less than or equal to 300. Although no population estimates were calculated in the Owyhee County study, harvest estimates ranged from 2 to 16%. Mean clutch size was 6.5 (Wik 2002), which was at the low end of averages (6.6–9.1) reported from other studies of sage grouse (Schroeder et al. 1999).

Productivity at seven weeks was measured in the Owyhee County study by visual and flush counts (0.43 chicks/hen, 2000; 0.66 chicks/hen, 2001) (Wik 2002) and wing barrel counts from hunter returns (0.91 juveniles/hen, 2000; 1.12 juveniles/hen, 2001) (IDFG unpublished data from Wik [2002]). Long-term harvest data on the Jarbidge Resource Area provided an average of 1.96 chicks/hen from 1961 through 2000 (JSGWG 2002). Estimates from both areas and methodologies are below the 2.25 chicks/hen considered necessary to maintain a stable or increasing population (Connelly et al. 2000). Intensive winter habitat use by sage grouse during the Owyhee County study was not evaluated, but birds were observed moving between distinct spring and summer ranges, and a few birds exhibited nonmigratory behavior or remained in the same area during both spring and summer (Wik 2002). 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 is expected to be complete in 2004 (Commons 2001).

Currently, the sage grouse is managed as a game species and is not afforded federal protection under the ESA, but seven petitions have been submitted to the USFWS requesting listing of distinct populations and of the entire species collectively (NDOW 2003b). Because research has concluded that there is no genetic evidence to support the delineation of “eastern” and “western” subspecies of sage grouse (Benedict et al. 2003), the “eastern” subspecies was not eligible for listing as endangered under the ESA (January 5, 2004). In a recent 90-day finding for petitions to list the sage grouse as threatened or endangered, the U. S. Fish and Wildlife Service found that the petitions and additional information they have in their files suggest the listing of sage grouse may be warranted (Federal Register Vol. 69, No. 77, April 21, 2004), and a status review is being initiated. Great Basin populations of sage grouse are included in *Birds of Conservation Concern 2002* (USFWS 2002) as a priority for conservation actions. The Idaho BLM classifies sage grouse as a type 2 sensitive species (BLM 2002).

Principle threats to sage grouse include small population size, lack of genetic diversity, habitat degradation, habitat loss, weather, and pesticides and herbicides (Connelly et al. 2000, Storch 2000).

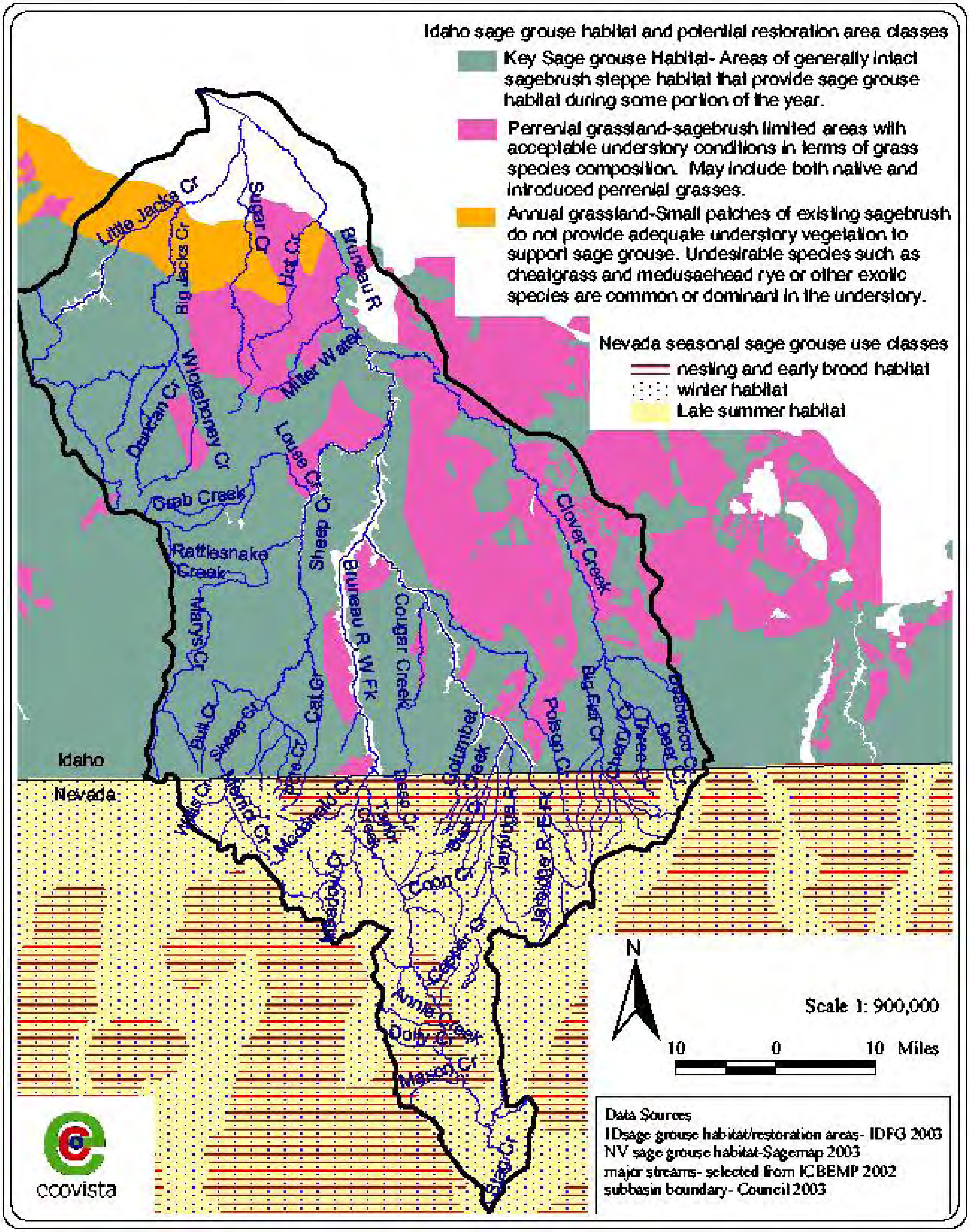


Figure 33. Idaho sage grouse habitat and potential restoration classes.

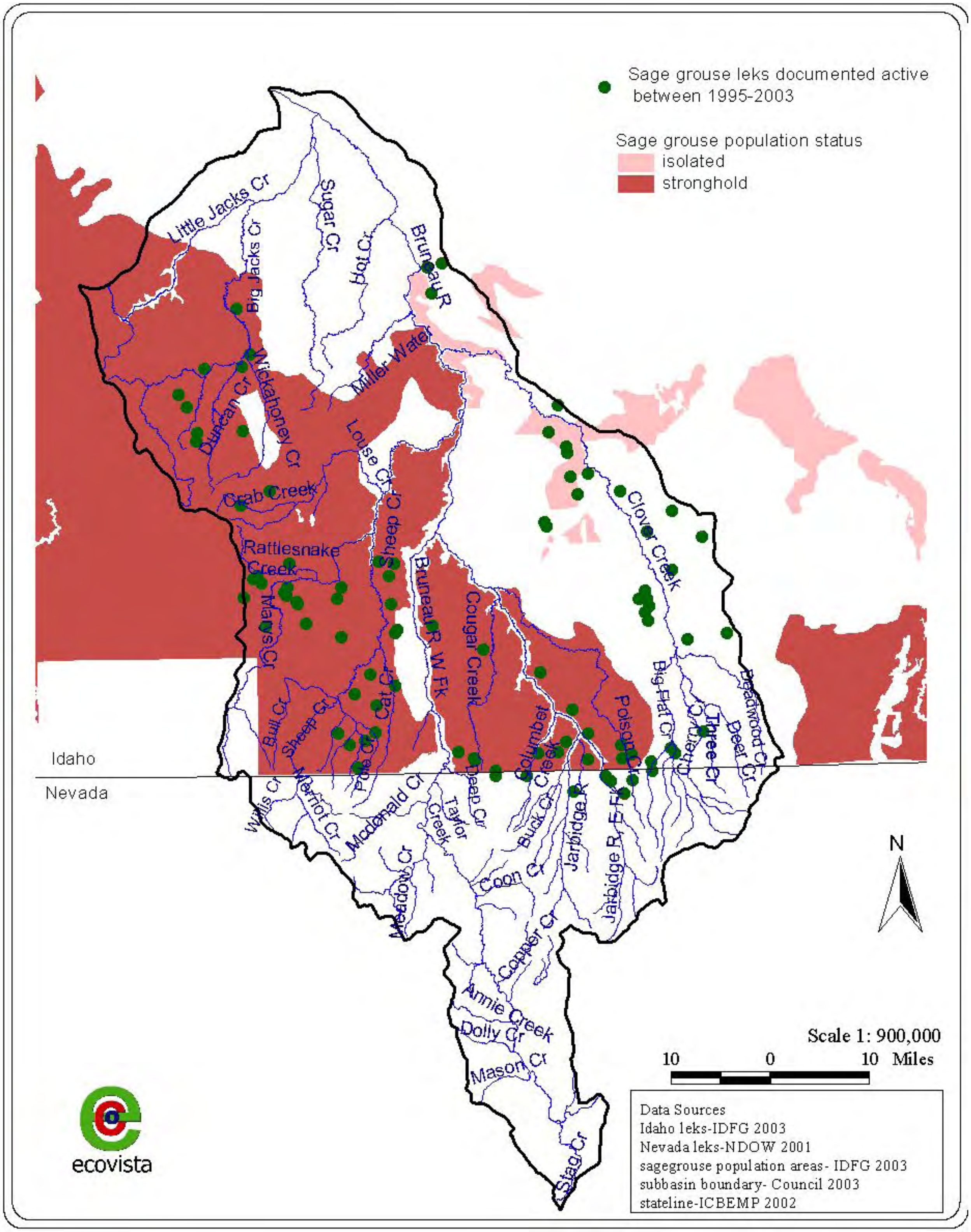


Figure 34. Documented active sage grouse leks in Idaho from 1995–2003.

### *Pygmy Rabbit*

The pygmy rabbit (*Brachylagus idahoensis*) is in the order Lagomorpha and with jackrabbits and hares (*Lepus* spp.) plus nine other rabbit genera forms the family Leporidae. Lagomorphs serve as the base of many predator–prey systems and can support communities of small to medium-sized predators (Chapman and Flux 1990). The pygmy rabbit has the smallest body size of any North American rabbit species (Dobler and Dixon 1990). The range of the pygmy rabbit includes most of the Great Basin and some adjacent intermountain areas of the western United States, plus an isolated population in southeastern Washington. Within the outlined range, the rabbit is found primarily on plains dominated by big sagebrush (*Artemisia tridentata*) and on alluvial fans with tall, dense clumps of plants (Green and Flinders 1980). Green and Flinders (1980) speculated that dense stands of big sagebrush along riparian areas, fence lines, and borrow ditches next to roadways might serve as dispersal corridors for the rabbits. Klott (1996) reported that, for the Jarbidge Resource Area, the pygmy rabbit had been observed only northwest of Signal Butte and added that much of the suitable habitat has been lost to land conversion to crested wheatgrass or annual grassland resulting from wildfire.

Pygmy rabbits are unique among North American rabbits for constructing and using extensive burrow systems (Green and Flinders 1980). Burrows are usually located under big sagebrush and may have multiple entrances (Green and Flinders 1980, Dobler and Dixon 1990). Soil structure and topography are thought to be key components of burrow site selection. Rabbit movements as far as 2.6 km have been documented, but it is thought that pygmy rabbits retract their movements and stay closer to their burrow system during the winter. Pygmy rabbits feed primarily on big sagebrush, which may make up to 99% of their winter diet (Dobler and Dixon 1990). Grasses become a larger part (30–40%) of the diet in mid to late summer (Green and Flinders 1980). A study in eastern Idaho found that annual mortality for adults was as high as 88% (Wilde 1978). Predators of pygmy rabbits include weasels (*Mustela spp.*), coyotes (*Canis latrans*), red foxes (*Vulpes vulpes*), owls (*Bubo spp.*), northern harriers (*Circus cyaneus*), bobcats (*Felis rufus*), and badgers (*Taxidea taxus*) (Green and Flinders 1980). In 2002, Roberts (2003) included the BLM's Owyhee and Jarbidge FO areas in an extensive survey for pygmy rabbits. Prior to this study, the IDCDC database contained seven old pygmy rabbit records from the Owyhee and Jarbidge FO areas. Roberts (2003) found three additional burrow sites in the Bruneau River drainage, Owyhee FO, and one near Salmon Falls Reservoir, Jarbidge FO, and stated that the most likely place to find more rabbits of this "subpopulation" is in the remote areas adjacent to the Nevada border. An additional site that was recently active within the last year or two was located within the Owyhee FO area. Roberts contends that the Owyhee and Jarbidge FO areas still contain suitable pygmy rabbit habitat and connectivity is still rated as fair to good. This area should be considered the second major subpopulation of Idaho pygmy rabbits (Roberts 2003). In a habitat modeling exercise (Figure 35), much of the southern two-thirds of the BLM Jarbidge FO area contained habitat mapped as higher priority for surveys, with some of the largest tracts of highest priority habitat in the southern region being along the Nevada border. Several high priority areas were also identified in the southwest portion of the BLM Owyhee FO area, and areas west of the Bruneau River, southeast of Grasmere Reservoir, and along the Nevada and Oregon borders were included in the survey recommendations for this area (Rachlow and Svancara 2003). This model is coarse grain and since pygmy rabbits likely select habitat on a finer scale, it over-predicts potential habitat (Janet Rachlow, UI, personal communication February 2004). With this caveat in mind, this model should serve as a guide in survey efforts but not as an explicit source of pygmy rabbit habitat in the Bruneau subbasin. Pygmy rabbits appear to have a very patchy distribution across their remaining range (Janet Rachlow, UI, personal communication February 2004), and will probably exhibit the same pattern of distribution across the Bruneau subbasin.

The isolated population of pygmy rabbits in Washington is considered a DPS by the USFWS. It is federally protected under the ESA and was designated as endangered on March 5, 2003 (USFWS 2003). On April 1, 2003, there was a petition filed to list the remaining pygmy rabbit populations that occur in the coterminous Intermountain and Great Basin region as threatened or endangered under the ESA. As of December 2003, no determination has been made by the USFWS. Nevada classifies the pygmy rabbit as a game species (NDOW 2003b), and Idaho has managed the pygmy rabbit as a game species but also classifies it as a species of concern (IDCDC 2003). The rabbit is considered globally secure but with cause for concern over the long term (G4); it is uncommon but not imperiled in Idaho (S3) (IDCDC 2003).

Threats to pygmy rabbits include overgrazing and habitat fragmentation, resulting in small populations. Pygmy rabbits were believed to have a continuous distribution in the past, but many populations have now been isolated as a result of human activities (Dobler and Dixon 1990).

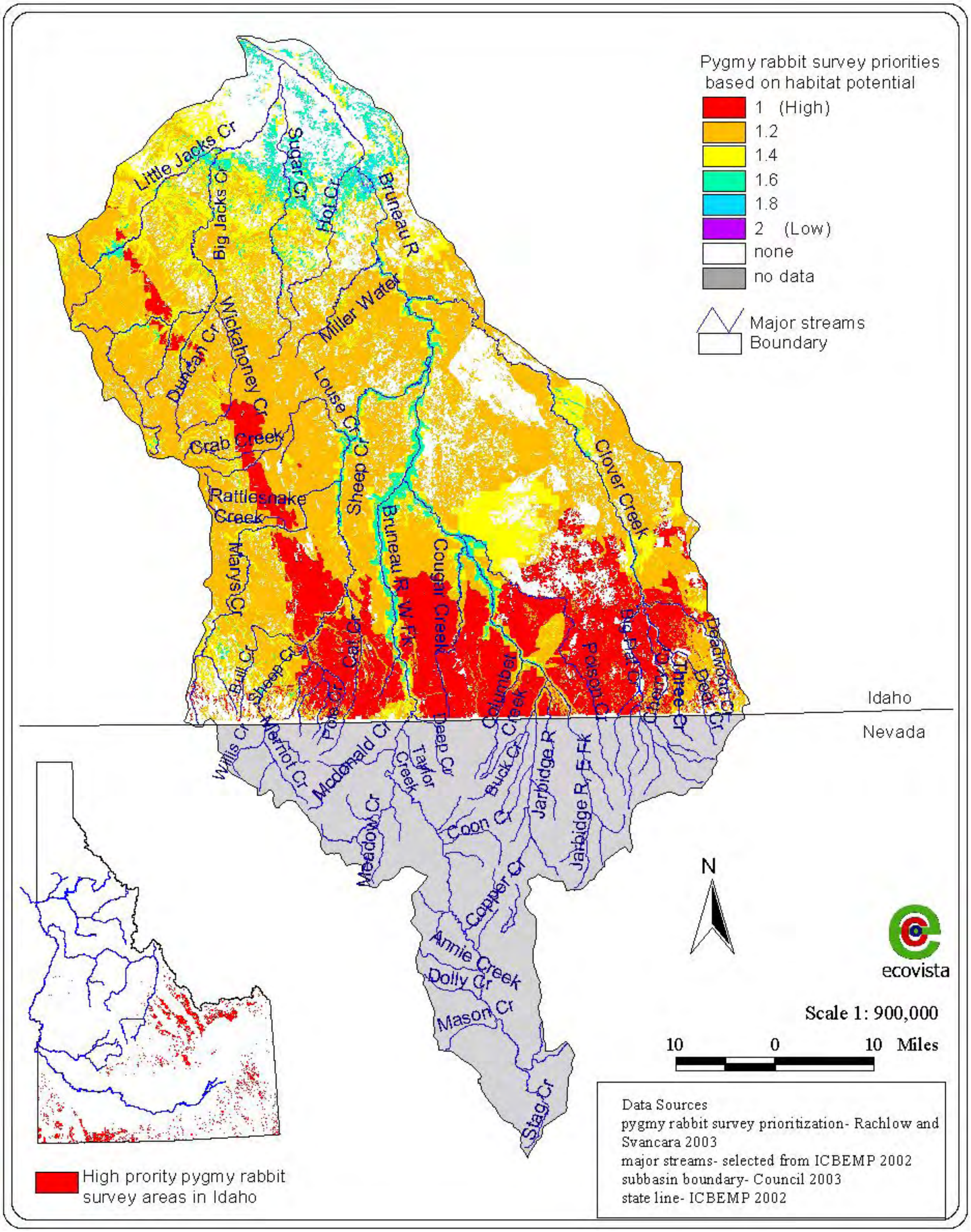


Figure 35. High priority survey areas for pygmy rabbits in the Bruneau subbasin.

### *Spotted Bat*

The spotted bat (*Euderma maculatum*) belongs to the family Vespertilionidae and is the single species of the genus *Euderma*, which is known only from western North America. Spotted bats have been recorded in a variety of habitats, but most collections have been in desert terrain. Spotted bats are distributed across central western North America from southern British Columbia to northern Mexico (Watkins 1977). The spotted bat is a rare bat species in the United States (Barbour and Davis 1969), and populations are believed to be concentrated in a few areas across the bat's range, including the Big Bend area of Texas, northern New Mexico, southwestern Utah, and southern British Columbia (Fenton et al. 1987).

Analyses of spotted bat stomachs and scats revealed noctuid moths as the primary food source, and some researchers have found evidence that spotted bats will take June beetles. Avian predators include kestrels, peregrine falcons, and red-tailed hawks. Typically, spotted bats seek refuge in crevices along cliffs, loose rocks, or boulders. Spotted bats are notoriously difficult to capture because they roost solitarily within cracks high on cliff faces and forage high in the air column (usually > 10 m) (Watkins 1977). Spotted bats will travel long distances, if necessary, between high-cliff roost sites to meadows to forage. On several occasions, a radio-marked lactating female on the North Kaibab Ranger District in Arizona was documented traveling 38.5 km (each way) from her day roost site to a meadow in which she foraged (Rabe et al. 1998).

A survey of bat species of the Bruneau/Jarbidge river area recorded spotted bats throughout the study area, with the highest numbers detected in the Marys Creek vicinity, which is west-centrally located within the Bruneau subbasin. This study found spotted bats flying over all habitat types, with heavy foraging over sagebrush uplands adjacent to riparian areas (Doering and Keller 1998). Although the study did not address population demographics, the results point to the Bruneau/Jarbidge river area as another important population center for the species; Doering and Keller detected spotted bats at 5 of their 11 sampling localities (1998), a site percentage comparable to the highest detection rates reported elsewhere in the literature (Fenton et al. 1987). Perkins and Peterson (1997) conducted other surveys for bats in southwest Idaho in the juniper forests of the Owyhee uplands, northwest of the Bruneau subbasin. The study area was on BLM lands in Owyhee County, and efforts concentrated on the water sources of the Owyhee Uplands Byway. Perkins and Peterson concluded that bat populations in general in the areas surveyed were not numerous and species diversity was low. They detected no spotted bats during their sampling efforts (1997), a result that may reemphasize the importance of the Bruneau/Jarbidge river area as a population center for spotted bats.

The spotted bat is ranked as apparently secure but with cause for concern over the long term (G4); it is classified as imperiled in Idaho because of its rarity (S2), as sensitive by the USFS Region 4, and as moderately endangered by the BLM (IDCDC 2003). Although little is known about the spotted bat, some researchers believe that this situation more likely reflects the bat's elusive nature than the bat's actual status (Bat Conservation International, Inc. 2003).

Limiting factors for spotted bats are probably availability of prey (large moths) and roosting habitats (cliffs).

### *Bighorn Sheep*

There are two recognized species of North American mountain sheep: the bighorn (*Ovis canadensis*) and the thinhorn (*Ovis dalli*). The bighorn sheep comprises six extant subspecies that include four desert races (*O. c. nelsoni, O. c. mexicana, O. c. weemsi,* and *O. c. cremnobates*), the Rocky Mountain bighorn (*O. c. canadensis*), and the California bighorn (*O. c. californiana*) (Shackleton 1985, Valdez and Krausman 1999). Bighorns inhabit grasslands (Cowan 1940) having accessible cliffs and rock bluffs, and these areas are typically associated with mountains, foothills, or major river canyons (Shackleton 1985). Native Americans valued bighorn sheep for food and clothing; early settlers valued them for food. Today they are considered a major big game trophy species (Shackleton 1985). Bighorn sheep hunting permits are coveted as the most desirable permits offered by the state (Crenshaw et al. 2003).

The range of California bighorns was originally from British Columbia to California and extended eastward into Idaho and Nevada (Cowan 1940, Hall 1946). By the early 20th centuray, they were considered extirpated from Oregon, Nevada, and Idaho (Bailey 1936, Cowan 1940, Hall 1946). The last confirmed sighting of a native bighorn sheep in Owyhee County was in 1927 (Hanna and Rath 1976). The Bruneau subbasin now supports a reintroduced population of the California bighorn subspecies, with sheep distributed throughout the Jarbidge and West Fork Bruneau river canyons upstream from their confluence. Observations of sheep have been made as far north in the Bruneau Canyon as Cave Draw, with occasional sightings in Sheep Creek and Marys Creek drainages. The IDFG initiated a program to reestablish bighorn sheep populations in Owyhee County in 1963 (Crenshaw et al. 2003). Twelve sheep from British Columbia were released into Rattlesnake Creek, a tributary of Little Jacks Creek in 1967 (Hanna and Rath 1976). A second release occurred in 1988 into Big Jacks Creek (Bodie et al. 1990), and transplants have continued since these initial efforts (Toweill 2001). From 1982 through 1993, Nevada (NDOW) and Idaho (IDFG) released 93 bighorn sheep into portions of the Jarbidge and Bruneau river drainages. The sheep released by Nevada in 1982 and 1984 dispersed north to the Jarbidge River canyon in Idaho. Other IDFG release sites include near the confluence of the Jarbidge and West Fork Bruneau rivers, Dorsey Creek, and near Black Rock Pocket on the West Fork Bruneau River (Crenshaw et al. 2003).

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 river confluence, areas that separately did not score well for quality sheep habitat but that together complemented each other to provide necessary habitat components. Together, habitat blocks at the confluence of the Bruneau and Jarbidge rivers, Long Draw Creek, Cedar Tree Creek, Lookout Creek, and Cougar/Poison creeks make up approximately 24,000 acres of suitable habitat, enough to support a population of 400 bighorn sheep.

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 in habitat by the adjacent Shoofly drainage. Human disturbance limits the use of the northern portion of the Little Jacks Creek Wilderness Study Area. 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 vegetation.

Sheep may move between seasonal ranges, using lower elevations in the fall or winter and higher areas during spring and summer. Yearly habitat use and movements may vary between populations, with distances up to 48 km reported in the literature (Shackleton 1985). California bighorns in Owyhee County were documented consuming shrubs and grasses during the winter and adding forbs to the diet in summer (Drewek 1970). Although California bighorns live in groups, ewes and rams are typically segregated and interact only during the breeding season (Valdez and Krausman 1999). Predators of bighorns include coyotes (*C. latrans*), eagles (*Aquila chrysaetos*), bobcats (*Felis canadensis*), cougars (*F. concolor*), and wolverines (*Gulo gulo*) (Shackleton 1985). The main predator of bighorn sheep documented in the Bruneau subbasin has been the cougar (Crenshaw et al. 2003; Regan Berkely, University of Idaho, personal communication, September 2003).

The California bighorn sheep is managed as a game species, and permits to hunt bighorn in the Idaho portion of the subbasin were first issued in 1975. The Heritage Network ranks the California bighorn sheep as globally secure but with cause for long-term concern because this subspecies may be vulnerable to extinction (G4T1). In Idaho, California bighorns are rare but not considered imperiled (S3) (IDCDC 2003). From 1980 through 1992, Idaho's California bighorn sheep populations provided a source for numerous reintroduction projects, with 413 sheep being trapped and relocated to other locations in Idaho, Nevada, Oregon, and North Dakota. Due to precipitous declines of the populations in the East Fork Owyhee River and Jacks Creek drainages, annual trapping and transplanting operations were discontinued in 1994. Surveys from 1996 through 2002 indicated that sheep numbers have not increased to pre-1994 levels. Surveys in 1998 and 2000 indicated a downturn in the Jarbidge/Bruneau river population, and the hunting season was thereafter closed for 2001 and 2002. In 2002 and 2003, aerial surveys indicated a promising upward trend, resulting in the authorization of two permits for 2003 and 2004 (Crenshaw et al. 2003).

Limiting factors for bighorn sheep include habitat degredation, disease, predation, and competition with domestic sheep (Klott 1996).

### *Slickspot Peppergrass*

A member of the mustard family, slickspot peppergrass (*Lepidium papilliferum*) is endemic to the lower Snake River Plain and the foothill ridges adjacent to the plain in southern Idaho. It is a small herbaceous plant that produces white flowers and has two life cycle morphs: annuals and biennials (Moseley 1994). Slickspot peppergrass grows in low-lying patches of big sagebrush habitats with native bunchgrasses, several kinds of wildflowers, soil mosses, and lichens in the surrounding habitat. Typically, nonnative weeds are uncommon in slickspot peppergrass habitat that is considered to be in good condition. Soils on slickspot peppergrass microsites have higher salt and clay concentrations (natric) than surrounding sagebrush habitat, a characteristic that facilitates moisture retention (Quinney 1998). Slickspot peppergrass plants are restricted to these "slick spot" habitats, suggesting that soil edaphic factors determine the species' distribution on the landscape (Fisher et al. 1996).

Spring precipitation is an important factor determining how many slickspot peppergrass plants are present in an area. Because the seeds can remain "dormant," but viable, in the soil for years (≥ 4), protection of known sites is important for maintaining populations, even if individuals are not present at the time of survey or planned activity (Quinney 1998). A study of three geographically distinct populations of slickspot peppergrass determined that several soil series found in the plant's habitat were natric or occurred near to natric soil series. Because slick spots are too small to be delineated on soil survey maps, mapped natric areas can be used to delineate potential slickspot peppergrass habitat (Fisher et al. 1996).

The IDCDC collaborated with the Idaho Army National Guard to develop a Habitat Integrity Index (HII) to facilite assessment and long-term monitoring of slickspot peppergrass across its range (Mancuso et al. 1998). This program was designed to monitor transects of known occurrences. The Inside Desert area is considered to be part of the Juniper Butte metapopulation and, by the end of the field season in 1999, contained six land unit areas being monitored for HII (Mancuso 2000). Rangewide, most known locations and unsurveyed suitable habitat of slickspot peppergrass are on BLM lands. Surveys by the BLM within the Bruneau subbasin include an effort between the BLM's Lower Snake River District and the IDCDC to conduct a systematic field investigation for slickspot peppergrass in the Bruneau Desert area (Mancuso and Cooke 2001) (Figure 36). Survey routes covered approximately 1,945 acres (54% of total effort) within the northeast portion of the subbasin. Although many of the areas surveyed in 2001 contained suitable-appearing habitat for slickspot peppergrass, none was found during the survey. Mancuso and Cooke recommended that remnant stands of sagebrush-steppe habitat deserve consideration as conservation targets. To facilitate management of slickspot peppergrass across its range, 12 management areas were outlined in a Candidate Conservation Agreement. Conservation measures for each management area were designated to "eliminate, reduce or mitigate the impacts of site specific activities and threats and to maintain or restore the sagebrush-steppe habitat" (Caswell et al. 2003). The Bruneau subbasin contains two of these areas: the Jarbidge Management Area and Jarbidge/Juniper Butte Management Area.

The rate of population loss for slickspot peppergrass is highest of any plant species in Idaho (Moseley 1994). Moseley (1994) estimated a minimum rate of extirpation of two populations per decade from when it was first discovererd in 1892 but speculates that the undocumented rate has probably been much higher during the past century. Slickspot peppergrass is considered imperiled and vulnerable to extinction because of its rarity (INPS rank of GP2) (IDCDC 2003). It was proposed for listing as endangered under the ESA, but the U. S. Fish and Wildlife Service concluded there was a lack of strong evidence of negative population trend and that current conservation efforts will be effective in reducing threats below those required for listing under the Endangered Species Act (Federal Register, Vol. 69, No. 14, January 22, 2004). The Candidate Conservation Agreement between the BLM, the State of Idaho, and nongovernmental cooperators will contribute to the implementation of conservation measures for slickspot peppergrass in Idaho.

Threats to slickspot peppergrass include wildfire, wildfire management, wildfire rehabilitation, grazing and trampling by livestock, nonnative plants, land development, military training, mining, motorized vehicles, predation, fragmentation/isolation, and recreation (Quinney 1998, Caswell et al. 2003).

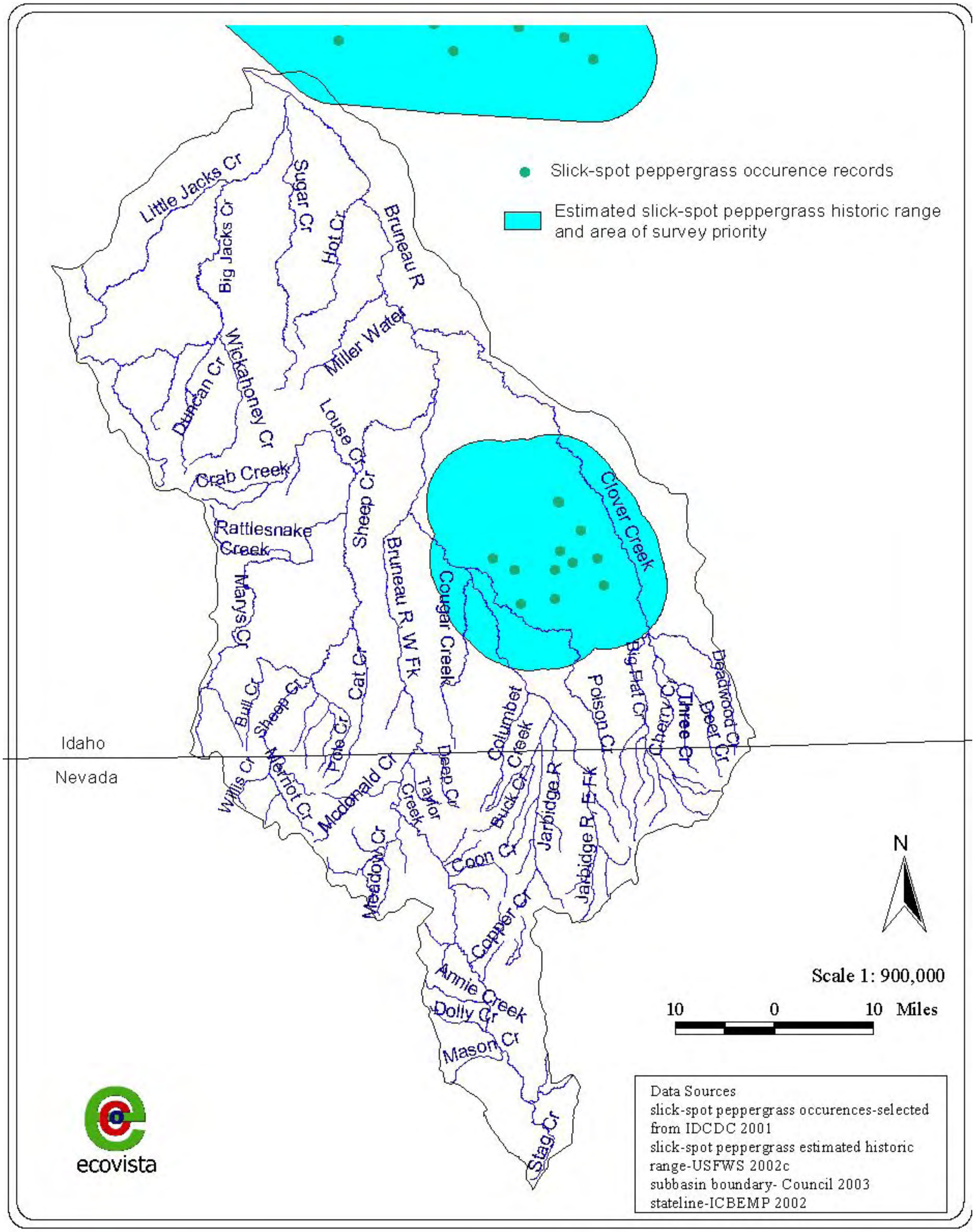


Figure 36. Area of survey priority and known occurrences of slickspot peppergrass in the Bruneau subbasin.

## Riparian and Wetlands

### *Yellow Warbler*

A medium-sized migratory wood warbler, the yellow warbler (*Dendroica petechia*) has the broadest distribution of any *Dendroica* species, making it amenable to survey and study. It is one of three groups of *Dendroica* subspecies: the yellow warbler (*aestiva* group), golden warbler (*petechia* group), and mangrove warbler (*erithachorides* group). Within the yellow warbler group, there are nine subspecies, including *D. p. morcomi*, the subspecies whose range includes the Bruneau subbasin. This subspecies breeds from the southern Yukon through interior British Columbia through eastern Washington, eastern Oregon, eastern California to western Montana, southern Wyoming, western Colorado, and northern Texas. Yellow warblers breed in North America in, roughly, the upper two-thirds of the United States from coast to coast north to the limits of shrub vegetation south of tundra in Alaska and Canada. They winter from northern Mexico to South America (mostly east of the Andes) to Amazon lowlands of northern Bolivia and Amazonian Brazil. There are some sparse winter records of yellow warblers in the United States (Lowther et al. 1999).

Yellow warblers are long-distance migrants and travel primarily at night (Lowther et al. 1999). In Oregon, birds usually begin arriving in late April, with arrivals peaking in late May (Gilligan et al. 1994). In northern Idaho, first arrivals were documented in early May (Burleigh 1972). Western populations typically begin their fall migration by late July. Spring and fall migrants are usually found in habitats most frequently used for breeding. Typical breeding habitat is willow-dominated wet, deciduous thickets. Yellow warblers are also found breeding in disturbed and early successional habitats. Winter range habitat consists of a variety of types from wooded and scrubby habitats to town plazas. Yellow warblers are primarily monogamous, with occasional polygynous matings. Because of the short time on the breeding range, only one brood is normally reared, with second broods rarely attempted. Nests are built in an upright fork of a bush, sapling, or tree, usually within a couple of meters of the ground but documented as high as 15 meters (Lowther et al. 1999). Clutches are four to five eggs. Lowther et al. (1999) reported nest success rates from British Columbia and the southwest coast of James Bay of 42% and 72%, respectively.

The yellow warbler is frequently reported as a host of the brown-headed cowbird. This situation is probably attributable to the warbler's abundance and shared range with the cowbird. Other sources of mortality may include exposure and predation. Yellow warblers may live as long as nine years in the wild (maximum reported), and an estimate of annual adult survival, based on band returns to the breeding area, is 0.53 (± 0.077 SE). Because this estimate does not account for dispersal, it is potentially biased low. Long-tailed weasels are known to prey on adults, and nest predators may include a variety of snakes, mammals, and avian species. The yellow warbler diet consists primarily of insects and other arthropods, with wild fruits taken occasionally. Food is captured by gleaning, sallying, or hovering (Lowther et al. 1999).

Yellow warblers have been documented in the BLM's Jarbidge Resource Area at Salmon Falls, Cedar, Deer, Flat, Clover, and Devil creeks and the East Fork Jarbidge River (Klott 1997). Although yellow warblers are considered "abundant and widespread" (Lowther et al. 1999), BBS results from 1966 to 2002 (Sauer et al. 2003) show a decreasing trend for Idaho (–1.6% per year, $P = 0.01$). There are three BBS routes within the Bruneau subbasin, but data are available for only two of the sites. Trends from individual routes are presented by the BBS, but variance estimates are suspect because it is a single site analysis. The Hot Springs route (IDA-224) indicated a declining trend (–3.19% per year, $P = 0.90$), based on 11 years of data. The Humboldt National Forest route (NEV-902) estimated an increasing trend (42.9% per year, $P = 0.54$), but this percentage should be interpreted with caution because it is based on only two years of data.

The C.J. Strike HEP study results for the yellow warbler indicate that the existing scrub-shrub wetland cover type was rated as relatively good quality habitat (HSI = 0.67) (Blair 1997). Shrub canopy cover was less than what is preferred by yellow warblers, contributing to the decrease in value of the HSI from the optimal 1.0. Additionally, the shrub canopy was comprised of only 37% hydrophytic species, a factor that further reduced the HSI. The results indicate that trespass grazing is the most influential of the management actions analyzed in the HEP study (Table 28).

Table 28. Projected net changes in future average annual habitat units by cover type for the yellow warbler in Scrub-Shrub Wetland, C.J. Strike HEP study (Blair 1997). Approximately 290 HUs were present on the entire study area.

| **Management Action** | **Reach** | **Scrub-Shrub Wetland** |
|---|---|---|
| | | **Net Change[a] (AAHU)** |
| No change | | |
| Reduced management funding | 1 | –11.60 |
| Downstream operational impacts | 4 | |
| —Wetland cover type (28.3 acres) | 4 | –7.70 |
| —Wetland cover type (40.75 acres) | 4 | –10.9 |
| Acquire Simplot property | 5 | 23.5 |
| Downstream wetland/riparian habitat | 4 | 18.3 |
| Fence springs | 1 | 0.40 |
| Island loss/peninsula development | | |
| —Island loss | 1 | –1.20 |
| —Peninsula development | 1 | 0.52 |
| Trespass grazing | | |
| —Increased trespass grazing | All | –201.93 |
| —Reduced trespass grazing | All | 92.34 |

[a] The “Net Change” results from the comparison of AAHUs for the subject action to the “No Change” action

Limiting factors include reduction or removal of willow habitat along riparian habitat from grazing as well as brown-headed cowbird parasitism (Lowther et al. 1999). Populations have benefited from grazing practices designed to maintain willow habitat in riparian areas. In a study on the Malheur National Wildlife Refuge in Oregon, yellow warblers were more numerous on transects having abundant willow and little or no cattle than they were on transects having low shrub volume and heavy cattle use (Taylor and Littlefield 1986).

### *White-faced Ibis*

The white-faced ibis (*Plegadis chihi*) is a highly mobile, long-legged wading bird with a distinctively long, decurved bill. The bird is a highly gregarious colony nester that can also be found foraging in flocks. White-faced ibises have been identified by some ranchers as detrimental to alfalfa crops due to trampling and soil compaction. The majority of recent North American works consider the white-faced ibis a full species and do not recognize subspecies. During breeding and migration, white-faced ibises are associated with wetland areas such as reservoirs and irrigated fields. During the breeding season, birds are usually found at inland, shallow marshes with "islands" of emergent vegetation. If regular nesting areas are dry from drought or drainage from human activities, white-faced ibis will find new areas for nesting. During the nesting period, birds may forage 3 to 6 km from the breeding colony but have been documented traveling as far as 18 km. Toward the end of the breeding season, adults in Idaho were documented traveling 40 to 48 km between daytime feeding areas and nighttime roosts in tall emergents (Ryder and Manry 1994).

The breeding range of U.S. populations includes northern California, eastern Oregon, southern Idaho, southern Alberta, Montana, eastern North and South Dakota, and northwest Iowa south to the Mexican states of Durango and Jalisco. Coastal Texas and Louisiana also support breeding white-faced ibis. Northernmost populations regularly migrate north–south to coastal Texas and Louisiana and Mexico. Birds may also be found wintering in southern California and the lower Colorado River valley of Arizona. Birds in Idaho usually arrive on the breeding grounds in April and leave between September and October. In the Great Basin, the largest nesting colonies are usually in stands of hardstem bulrush (*Scirpus acutus*), Olney's bulrush (*S. olneyi*), and alkali bulrush (*S. paludosus*). Nests have been observed at Carson Lake, Nevada, and Malheur National Wildlife Refuge, Oregon, in hardstem bulrush. Although data are lacking, the white-faced ibises is presumed to be monogamous and produces one clutch a year. Nests are usually constructed in emergent vegetation or low trees and shrubs over shallow water, although they may be found on the ground on small islands. Nesting may be delayed by high water or habitat degredation (i.e., vegetation damaged by fire or herbivorous mammals). If an early nesting attempt fails, the white-faced ibis may attempt to renest, but second clutches have been documented as less successful (Ryder and Manry 1994). Birds lay two to five eggs per clutch, and in Nevada, a mean clutch size of 3.21 ($n = 140$) was calculated. Eighty-three percent ($n = 42$) of nests in the same area produced one or more 7-day-old chicks. Annual reproductive success was 2.54 per successful nest ($n = 150$), but lifetime reproductive success is unknown (Henny and Herron 1989). The oldest bird known in the wild was 14.5 years old, but band recoveries in Utah ($n = 111$) documented all birds dying by 9 years of age (Ryder and Manry 1994).

Threats to survival include exposure (particularly for small nestlings) and predation. Predation on adults is probably negligible, but on the feeding grounds, large raptors (*e.g.*, peregrine falcons or red-tailed hawks) occasionally take them. Eggs and small nestlings are at risk from avian and terrestrial nest predators. The main foods consumed by the white-faced ibis include aquatic and moist-soil insects, crustaceans, and earthworms. Feeding sites are typically shallowly flooded pond margins, reservoirs, marshes, or flooded agricultural fields where vegetation is less than 5 to 90 cm high. Plant materials and seeds that have been consumed by white-faced ibises are believed to have been incidentally ingested (Ryder and Manry 1994). Taylor et al. (1989) stressed that, in Idaho, mudflats are important sources of high concentrations of earthworms and chironomid larvae. These areas enable ibises to increase fat reserves prior to fall migration.

White-faced ibises are highly mobile and will shift breeding areas between years, making population census efforts difficult in the absence of coordinated surveys with standardized techniques repeated at regular intervals. Annual or biannual censusing of breeding colonies occurs in Nevada, Oregon, and Texas but is sporadic and incomplete in Idaho and other states. Population surveys and status assessments require coordinated efforts between states, agencies, and other relevant parties (Ryder and Manry 1994). White-faced ibis have not been detected along BBS routes in the Bruneau subbasin, but BBS trend estimates for Idaho (+13.4%, $P = 0.9$, $n = 5$) and the western region (+22.3%, $P < 0.001$, $n = 36$) indicate that populations have been increasing between 1966 and 2002 (Sauer et al. 2003). In 1996, a pair of white-faced ibises was observed near the U.S. Air Force Grasmere Study Area. Potential breeding habitat exists in Wickahoney and China ponds near Grasmere (USAF 1998). The Donabahba Yogee marsh on the Duck Valley Indian Reservation (Owyhee subbasin) has a large colony of nesting white-faced ibis (>2000 birds in 1993). Birds that were presumed to be from this colony have been observed feeding at reservoirs and ponds in the Bruneau River basin. Ibises also can be found in irrigated fields in Little Valley (Jack Creek tributaries to the Bruneau River) and the Bruneau River valley during spring and fall migration. Ten to 50 ibises have been observed in the Bruneau and Little valleys during the summer, but these sightings were considered uncommon occurrences (John Doremus, BLM, personal communication, December 2003). White-faced ibises have been observed in Cedar Mesa Reservoir, Heil Reservoir, and Camas Slough in the spring (BLM Jarbidge FO) (Klott 1996). Suitable nesting habitat is not present at Cedar Mesa and Heil reservoirs, and Camas Slough typically lacks late-season water. The white-faced ibis is protected by Idaho and Nevada and is classified as a type 4 sensitive species by the Idaho BLM (IDCDC 2003). The Heritage Network ranking of G5S2B indicates that the white-faced ibis is globally secure but a rare breeder in Idaho (IDCDC 2003).

Limiting factors for white-faced ibis include pesticides and habitat deterioration. DDT continues to be used on the wintering grounds in Mexico, and contaminant concentrations (DDE) remain high in Great Basin white-faced ibis populations, a factor that can contribute to a decrease in productivity. Cattle grazing and trampling of nesting habitat, prescribed burning of emergent vegetation to enhance habitat for waterfowl, drought, and human disturbance to nesting colonies can all negatively impact nesting success (Ryder and Manry 1994). Drought has been successfully mitigated by allocating limited water resources to prioritized breeding areas (Ryder and Manry 1994).

### *Willow Flycatcher*

The willow flycatcher (*Empidonax traillii*) is a migratory bird species with a convoluted taxonomic history. Until 1973, it shared species status with the alder flycatcher (*Empidonax alnorum*). Authors recognize four and sometimes five subspecies of willow flycatcher that include *E. t. traillii, E. t. adastus*, *E. t. brewsteri*, *E. t. extimus*, and sometimes, *E. t. campestris*. Willow flycatcher subspecies can be defined by plumage coloration and wing morphology, but subspecific range boundaries are difficult to define due to overlap of these characteristics. Western subspecies include *extimus, adastus*, and *brewsteri*. The Bruneau subbasin is within the range of *E. t. adastus*, which breeds from southern British Columbia to eastern California (east-side Cascades and Sierras) and in the Great Basin to the Rocky Mountains, north of southern Utah. Habitat is generally considered to be in moist, shrubby areas that may have standing or running water (Sedgwick 2000). Although frequently associated with stands of willow (*Salix* spp.), willow flycatchers in the West have been documented in a range of habitats from beaver meadows (Sedgwick 2000) to early-growth clearcuts in Oregon (Morrison and Meslow 1983).

Willow flycatchers are long-distance migrants that breed in the United States and southern Canada and winter in southern Mexico, Central America, and northern South America. They arrive on their breeding grounds in the late spring and have a short breeding season (Sedgwick 2000). The average spring arrival of willow flycatchers to Malheur National Wildlife Refuge in southeast Oregon was reported as May 12 (Littlefield 1990), and fall migration usually peaks by late August east of the Cascades (Gilligan et al. 1994). Birds from a southeast Oregon study (1988–1997) exhibited site fidelity for breeding with over half of the breeding adults returning to the same general area and breeding again in subsequent years (Sedgwick and Iko 1999). Willows are commonly selected for nesting substrate, and nests are usually low (1–3 m off ground, on average) in the crotch of a bush or small tree. Clutches are usually three to four eggs but occasionally five may be laid. In southeast Oregon, mean first nest (unparasitized) clutch size was $3.69 \pm 0.03$ (SE) (Sedgwick 2000). Mean lifetime reproductive success for the birds in the southeast Oregon population was estimated as $3.59 \pm 0.17$ (Sedgwick and Iko 1999). Only one brood per season is produced although renesting attempts may occur after nest loss or predation (Sedgwick 2000).

A variety of avian and mammalian predators have been identified for willow flycatcher nests. Most predation in the southeast Oregon population was attributed to mammalian predators, primarily long-tailed weasel and mink (Sedgwick 2000). Seasonal fecundity losses are primarily by predation, which is greater at the egg stage than the nestling stage (Sedgwick and Iko 1999). Willow flycatchers primarily forage aerially for insects, but will occasionally feed on fruit. Drinking has not been reported, and water needs are presumably met from their insect diet (Sedgwick 2000).

Although willow flycatchers may reside in very high densities (Sedgwick 2000), Breeding Bird Surveys (BBS) (Sauer et al. 2003) from 1966 to 2002 show a decreasing trend for both Idaho (–3.65% per year, $P = 0.02$) and the western BBS region (–1.3% per year, $P < 0.001$). There are three BBS routes within the Bruneau subbasin, but data is only accessible for two of the sites. Although willow flycatchers have been documented in the Bruneau subbasin (Deer Creek) (Klott 1997), they were not detected along Bruneau subbasin BBS routes, precluding trend analysis for the subbasin utilizing this database.

*E. t. extimus* subspecies was listed as Endangered under the ESA (USFWS 1995b) and critical habitat identified for this subspecies was designated in New Mexico, Arizona, and California, where the largest populations are known to occur (USFWS 1997). Willow flycatchers are a protected nongame species in Idaho and a BLM sensitive species type 3 (IDCDC 2003).

Limiting factors for willow flycatchers may include predation, brood parasitism, and weather (Sedgwick 2000). Additional anthropogenic impacts to willow flycatchers are structures (*e.g.,* towers) encountered by nocturnal migrants, alteration of riparian zones, and habitat degredation. Grazing can induce soil compaction and gullying, reduction of willows, and alteration of willow height and volume (Harris et al. 1987). Reduction of cattle grazing and elimination of willow cutting and spraying resulted in increases in willow flycatcher densities in Oregon (Taylor and Littlefield 1986) and abundance was greater in areas that were relatively undisturbed (Taylor l986).

#### *Columbia Spotted Frog*

See discussion in above section on federally listed and candidate species (section 2.4.2.1).

### Western Juniper and Mountain Mahogany Woodlands

#### *Mule Deer*

Mule deer (*Odocoileus hemionus*) are medium-sized cervids distributed across most of the western half of North America. The genus *Odocoileus* contains two extant species, *O. hemionus* and *O. virginianus*. *O. hemionus* has a tail that is white to black above and tipped with black. Mule deer occur in almost all of the biomes of western North America north of central Mexico with exceptions including the arctic tundra, southwestern U.S. desert regions, Central Valley of California, and probably the Great Salt Lake desert region (Anderson and Wallmo 1984). In Idaho, mule deer densities are highest south of the Salmon River. Because mule deer are Idaho’s most abundant and widely-distributed big game animal, they provide more recreational hunting opportunities than any other big game species (Hayden et al. 2003).

Mule deer females will typically conceive during their second year and rarely the first. From 25 studies that examined a total of 1,795 females, the average number of fetuses per doe ranged from 1.14 to 1.85. Common litter sizes are two, particularly for females in their third or greater breeding year. Most populations have a male biases ratio of fetuses. Annual rates of postnatal mortality among five populations of mule deer ranged from 22 to 55% for males, 17 to 25% for females, and 45 to 69% for fawns of each sex. Average life span is unknown, but the maximum longevity of males and females recorded in the wild are 19 and 20 years, respectively (Anderson and Wallmo 1984).

Mule deer need highly digestible, succulent forage in addition to woody vegetation for maintenance requirements although a common misconception is that mule deer are “browsers” and could subsist on woody browse alone (Anderson and Wallmo 1984). The quality and quantity of spring food resources has a major effect on production and survival of fawns (Hayden et al. 2003). Mule deer capitalize on high quality food resources in the summer and are able to lower their energy demands to adjust to poorer forage availability through the winter. Seasonal movements are common, but most deer with established home ranges will use the same summer and winter areas in consecutive years. The chronology of movement from lower (winter ranges) to higher (summer ranges) elevations is thought to coincide with plant phenology and rate of snow melt (Anderson and Wallmo 1984). Although winter range is considered a critical component of mule deer habitat, survival is largely influenced by the condition of a deer at the start of winter, and that condition depends on the quality of habitat that the animal occupies during the rest of the year. A winter range with good thermal cover will minimize energy loss (Hayden et al. 2003).

Populations of mule deer in Idaho have declined since the 1950s and 1960s and will likely never increase to the previous levels because habitat continues to diminish in quantity and quality over time. Idaho manages mule deer harvest by monitoring populations annually and responding to population changes. Mule deer seasonal habitats are delineated in the Bruneau subbasin (Figure 37), but refinement of these designations is an information need (Mike McDonald, IDFG, February 2004). Twenty-two trend analysis areas (Game Management Units) have been delineated across the state, and the Bruneau subbasin is within Analysis Area 12 (Units 41, 46, and 47) (Figure 23). The lack of trend area surveys in Analysis Area 12 has made setting populations objectives difficult for this area. Traditionally, Units 41 and 47 have supported substantial deer herds that provide hunting opportunities for southern Idaho hunters. Unit 46 has provided important general hunting opportunities but has never supported a large resident deer herd. Until and area-wide decline in the early 1970s, liberal hunting seasons were in place across the subbasin. A large number of deer on the eastern side of Owyhee County migrate between Nevada (summer) and Idaho (winter) seasonal ranges which makes a population census difficult for Idaho managers (Hayden et al. 2003). Very little mule deer aerial survey data exists for this area (Idaho portion of Bruneau subbasin), and population information is identified by Hayden et al. (2003) as a primary data need. Two analysis areas summarized by the NDOW contain portions of the Bruneau subbasin. The 061 Unit Group (061-064, 067-068) is exhibiting a decreasing population trend, and the 2002 population estimate was the second lowest ever calculated for this group. Poor winter range in this area is believed to dictate long-term population levels and proper management is necessary that facilitates increase in winter habitat capacity for deer. Units 071, 072, and 073 fell within a second analysis area (Unit 071-079 herd). Tag quotas for this herd have been reduced due to population declines resulting from four years of drought, wildfires, and the severe winter of 2001–2002 (Cox et al. 2003).

Human encroachment has eliminated much of the historic mule deer winter range with the development of ranches, farms, subdivisions, and industry located in the foothills and lower elevation areas. Livestock grazing has dominated land use in the area, and serious conflicts between mule deer and livestock are localized on the winter ranges and riparian areas. Fires have destroyed a large portion of winter habitat in Units 41 and 46 (Idaho), and these areas provide little browse to support deer (Hayden et al. 2003). Predators of mule deer include cougars, coyotes, bobcats, golden eagles, domestic and feral dogs, and black bears (Anderson and Wallmo 1984). No black bears are present in the Bruneau subbasin, and the impact of predators on mule deer populations is poorly understood (Anderson and Wallmo 1984, Hayden et al. 2003). Because mule deer are a popular game species, hunting mortalities may contribute to population regulation. Consistent records of hunting efforts and success facilitate estimating the impact of hunting on populations (Anderson and Wallmo 1984), which is thought to be minimal in Idaho (Hayden et al. 2003). Disease, parasites, and competition with other herbivores (wild and domestic) may also pose threats to mule deer populations (Anderson and Wallmo 1984), although elk are not a significant management concern for this area (Hayden et al. 2003).

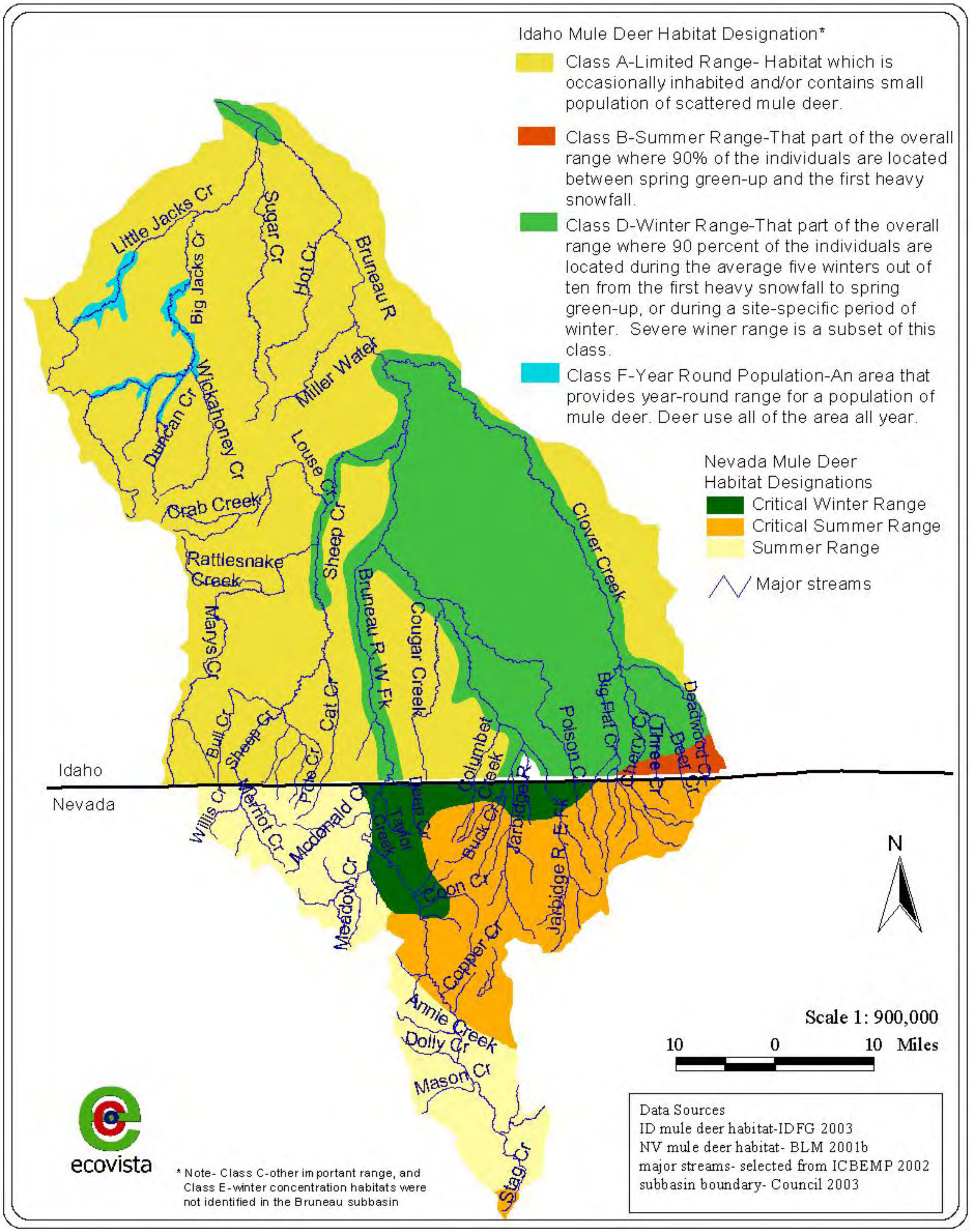


Figure 37. Mule deer habitat designations in the Bruneau subbasin.

## Desert Playa and Salt Scrub Shrublands

### *Pronghorn*

Pronghorn (*Antilocapra americana*) are large game mammals characterized by a robust build and long, slender legs and feet (O'Gara 1978). They are white on underside and rump and brown on their back with black and dark brown markings about the head and neck. The genus includes only one species which has been divided into five subspecies. *A. a. americana* comprise a vast majority of pronghorns today, likely including the Bruneau subbasin populations. Lines of subspecies delineation are somewhat uncertain between A. a. americana, A. a. oregona, and A. a. mexicana partly because there have been numerous transplants and mixing between subspecies. Pronghorn habitat consists of grasslands, grassland-brushlands, and deserts. Pronghorn are polygamous and have a territorial mating system, a system that ensures most mating is done by the largest and most aggressive bucks. Before European settlement in the United States, approximately 35 million pronghorns inhabited North America. By 1924, this estimate decreased to less than 20,000 animals (O'Gara 1978). Pronghorns are very important game animals in North America and valuable assets to the range because of their willingness to consume noxious weeds.

Northern populations of pronghorn depend heavily on browse, particularly in the winter when it can make up 80% or more of the diet (O'Gara 1978). Sagebrush may be an important winter dietary item and animals may switch to forbs during the summer. Pronghorn will move between winter and summer areas, and ranges of equal proportion of browse and forb species should meet yearlong dietary requirements of pronghorn populations. Pronghorn water requirements are related to the succulence and quantity of preferred forage. In the presence of forbs with high moisture content, water consumption decreases.

Nevada management units for pronghorn in the Bruneau subbasin include Units 61 (Area 6), 71 (Area 7), 72 (Area 7), and 73 (Area 7) (Figure 23). Pronghorn management units are divided into five groups in Idaho with each group comprised of management units with similar attributes and hunting opportunities (Rachael et al. 2003). Idaho management units in the Bruneau subbasin (Figure 23) include Units 41 (Group 1), 46 (Group 2), and 47 (Group 2). Hunting pressure is light or dispersed in Group 1 and usually occurs away from major population centers in aesthetically appealing areas. Group 2 supports high hunter densities, high harvest, and high success rates in many units. Population control hunts of doe/fawn pronghorn are often in these units. Management objectives for both groups are to maintain an average horn length of 12.0 inches in the firearm buck harvest and maintain a preseason buck:doe ratio of greater than 50:100 and 40:100 in Groups 1 and 2, respectively. Pronghorn population numbers in Idaho are low to moderate in comparison to high-quality habitats in Wyoming and Montana. This is considered attributable to low annual precipitation, poor range conditions, and conflicts with private landowners (Rachael et al. 2003).

Ground surveys for pronghorn are conducted by the NDOW in the North Central Elko County units (Units 061, 062, 064, 071, and 073) (Cox et al. 2003). Units 061, 071, and 073 are located in the southern region of the Bruneau subbasin (see Figure 23). From 1994 through 2002, pronghorn population estimates were following an increasing trend, but the numbers dropped by 2003. Because pronghorn populations are declining, the antlerless quota was lowered. The NDOW believes the herd is about 200 to 300 animals below the estimated winter range carrying capacity and hopes numbers will increase within three to four years. The 1992–2001 average fawn ratio was 57 fawns per 100 does, and 43 fawns per 100 does and 49 fawns per 100 does were recorded in 2002 and 2003, respectively. The 2002 fawn ratio was the second lowest ever observed in this unit group. The surveys revealed buck ratios similar to the 1992–2001 average (36 bucks/100 does) in 2002 (38 bucks/100 does) and 2003 (37 bucks/100 does) (Cox et al. 2003). The IDFG conducted a fixed-wing line transect survey in 2002 in Unit 41. Results have not been released but incidental observations of pronghorn during bighorn sheep surveys and other opportunistic sightings indicate a static population. Population numbers in the Group 2 units have fluctuated widely the past 25 years. Declines to low levels were observed in the early 1980s with increases to 1992. At this point, the combination of drought and severe winter conditions in 1992–1993 are thought to contribute to the 30 to 50% decline. Pronghorn numbers in Units 46 and 47 appear to have declined, even with a substantial curtailing of harvest since 1994. Reproductive average in Unit 46 (0.82 fawns:doe) was based on a small sample but was above the long-term average of 0.50 fawns per doe from 1982 through 2002. The observed buck:doe ratio from 1991 to 2002 in Unit 46 has averaged 3% below the management objective at 0.37 (Rachael et al. 2003).

The C.J. Strike HEP Study results for pronghorn rated the shrub savanna cover type as very good quality habitat (HSI = 0.94). The slight lowering of the HSI value was influenced by taller than preferred shrubs. The remaining evaluated habitats (HSI values at TY0) for pronghorn included shrubland (0.73), desertic shrubland (0.78), desertic herbland (0.84), grassland (0.50), and forbland (0.50). Upland planting and trespass grazing would result in the greatest absolute change in AAHUs (Table 29) (Blair 1997).

Table 29. Projected changes in future average annual habitat units by cover type for the pronghorn, C.J. Strike HEP Study (Blair 1997).

| **Action** | **Cover Type (acres)** | | | | | | **Total (AAHU)** | **Net Δ[a]** |
|---|---|---|---|---|---|---|---|---|
| | **Desertic Herbland** | **Shrub-land** | **Desertic Shrub-land** | **Shrub Savanna** | **Forb-land** | **Grass-land** | | |
| No change | 1340.51 | 578.92 | 1644.17 | 4451.84 | 6339.15 | 1476.85 | 15831.44 | 0.00 |
| Upland planting | | | | | | | | |
| —Native | 1168.37 | 552.41 | 1456.99 | 3923.15 | 7727.08 | 1496.74 | 16324.74 | 493.30 |
| —Silver sage | 1202.29 | 566.81 | 1487.86 | 4006.95 | 8779.42 | 1568.71 | 17612.04 | 1780.60 |
| Gold Island habitat development | — | 54.24 | — | — | — | — | 54.24 | 54.24 |
| Peninsula development | — | — | 92.43 | — | — | — | 92.43 | 92.43 |
| Trespass grazing | | | | | | | | |
| —Increased | 1244.72 | 528.14 | 1433.37 | 3792.75 | 6339.15 | 1476.85 | 14814.98 | –1016.5 |
| —Reduced | 1293.66 | 567.79 | 1472.02 | 4070.59 | 6339.15 | 1476.85 | 15220.06 | –611.38 |

[a]The "Net Change" results from the comparison of AAHUs for the subject action to the "No Change" management action

Threats to pronghorn include fences, interstate highways, railways, and other barriers to movement. Domestic sheep pose competitive threats to pronghorns because they consume palatable forbs and sheep-proof fences restrict pronghorn movements. Cattle may also share resources with pronghorns, with one report stating that one cow utilized as much food as did 38 pronghorns (O'Gara 1978).

### *Fourwing Saltbush*

Fourwing saltbush (*Atriplex canescens*) is a perennial shrub with many branches that ranges from two to six feet tall. It is a native of Idaho and also distributed throughout the western United States. Fourwing saltbush will grow on a wide range of soils and is mostly found in moderately deep to deep soils. It is an important species of the northern salt desert shrub association which is characterized by hot, dry summers and cold winters. Areas where the plant can be found include desert flats, gravelly washes, mesas, ridges, slopes, and sand dunes. The active growth period for fourwing saltbush is spring and summer. Its National Wetland Indicator status is facultative to obligate upland (UPL, FACU) species (NRCS 2003).

Fourwing saltbush can be used for beautification (ornamental), erosion control, livestock, and wildlife. Due to its extensive and deep root system (20–40 feet deep), it can effectively be used for erosion control, particularly where native plants are intact. It is considered nutritious for livestock. For cattle, the nutritive value is rated fair to good during the winter. Fourwing saltbush is favored by deer and is an important winter food source. Quail will use the plant for cover, roosting, and food (NRCS 2003). Other species, including pronghorn, elk, porcupine, ground squirrel, and jack rabbit, have been observed using this plant as well (Bowens et al. 2003, NRCS 2003). Native Americans ground the seeds to make flour for bread (Bowens et al. 2003).

There are no serious pests of fourwing saltbush, but small seedlings can be damaged by rabbits and other small rodents. Plants can be destroyed if in areas of heavy foot, horseback, or vehicle travel. In heavy winter deer concentration areas, overgrazing may be a threat if other food sources are unavailable. Grazing by livestock should not exceed 40% of the total annual growth during the growing period and 50% during the plant dormancy period (NRCS 2003). Others recommend that maximum plant performance can be obtained by allowing grazing by livestock only during the winter (Smoliak et al. 2003).

# 3 Environmental Conditions

## 3.1 Characterization of Aquatic Habitat Conditions

### 3.1.1 Subbasin Scale

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, nonsalmonid species.

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 (see BLM 1997, 2000; NRCS 2000 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 nonfunctioning 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 38). Stream segments considered as NF occurred in the Clover Creek (East Fork Bruneau) subwatershed and include Cedar, Cherry, House, Pole, Shack, and Three creeks. Upward and downward trends of streams classified as FAR were similar, as were those FAR segments that showed little or no change.

### 3.1.2 Watershed Scale

The same BLM protocols were applied to assess riparian conditions in the Jarbidge Resource Area (JRA) for the 1998, 1999, and 2002 fiscal years (Figure 39). Although the “FAR u” classifications have increased over the assessment period, the percentages of riparian areas classified as “NF” have decreased.

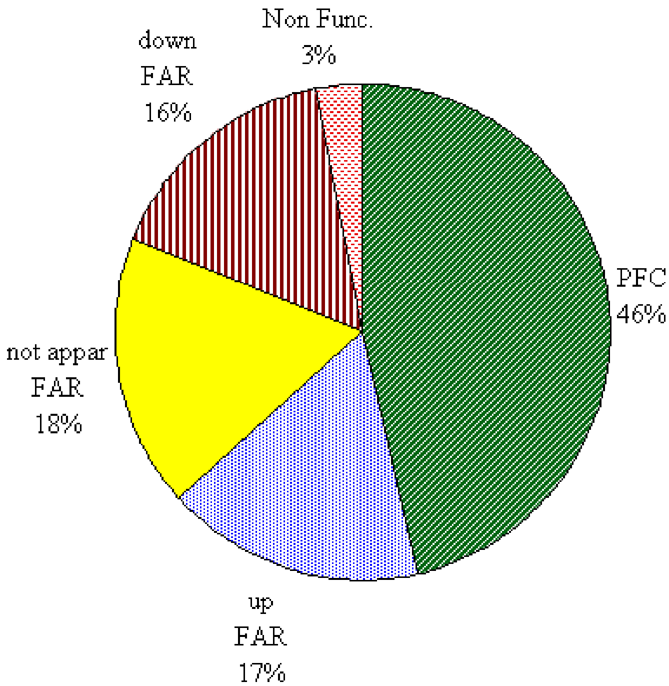


Figure 38. Known conditions of streams in the Bruneau subbasin (BLM unpublished data). PFC = properly functioning condition, FAR = functioning at risk, and NF = not functioning

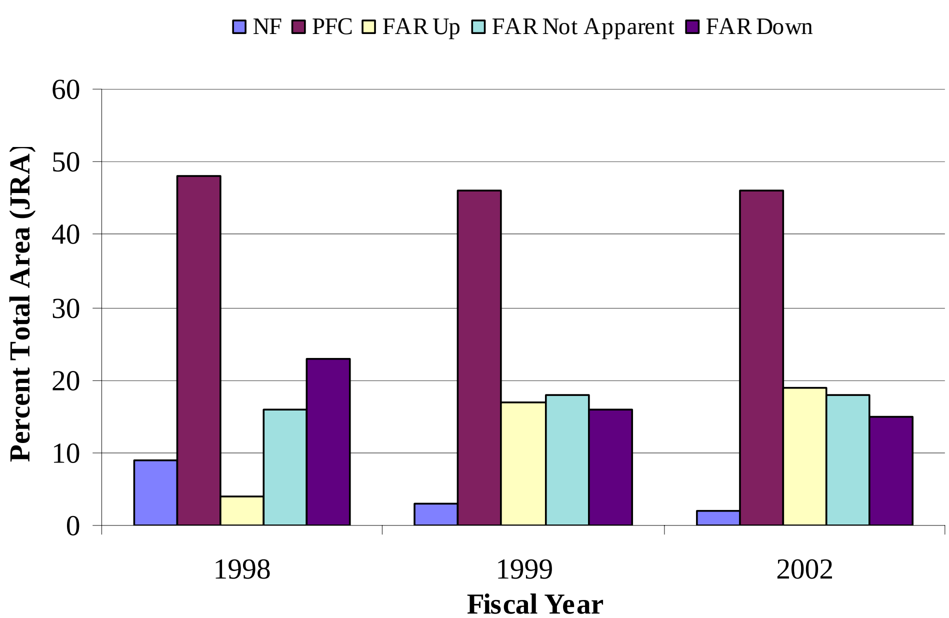


Figure 39. Riparian condition in the Jarbidge Resource Area for fiscal years 1998, 1999, and 2002 (BLM unpublished data).

### 3.1.2.1 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%. 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).

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 (USFS 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 (USFS 1998). Habitat conditions reflect the channel modifications. A 1985 GAWS survey found that 35% of quality pools in the Jarbidge River fell between RM 16.8 and RM 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 (USFS 1998). A survey for LWD 1996 (USFS 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 (USFS 1998).

Dave Creek (NV), a headwater tributary to the East Fork Jarbidge, is unique from other Jarbidge tributaries in that it is a lower gradient system and is less confined and therefore contains comparatively higher amounts of spawning gravels (Burton et al. 2001). Because of its lower gradient, Dave Creek contains, making it some of the most critical habitat for bull trout spawning and rearing (G. Johnson, NDOW, personal communication, April, 2004). Dave Creek has been impacted by roading, grazing, and other land use activities, which has resulted in elevated amounts of fine sediment, excessive width:depth ratios, and limited riparian coverage (Burton et al. 2001).

The Nevada Department of Wildlife has expressed interest in assuming management responsibilities in Dave Creek, either through land acquisition or through conservation easements. There are currently discussions between NDOW and the Rocky Mountain Elk Foundation to acquire a 4-mile reach of privately owned land to further bull trout protection and restoration objectives (B. Zoellick, BLM, personal communication, April, 2004). If outright purchase does not occur, NDOW and Rocky Mountain Elk Foundation would consider the acquisition of a conservation easement for a 1000 acre private grazing allotment on Dave Creek (for a period of 4 years or less depending on how long it will take BLM to work out a land exchange with the landowner), and fencing 4 miles along the creek, placing large woody debris into the stream channel, and restoring of bull trout habitat at one road crossing.

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 °C within a 12-hour period (McNeill et al. 1997). These temperatures affect bull trout. Zoellick et al. (1996) 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 (McNeill 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 (McNeill 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 gulches 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 unforested 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.

### *3.1.2.2 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 (BLM 1999) 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 26).

Sheep Creek and Marys 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 (BLM 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 (USFS 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 (USFS 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.

#### 3.1.2.3 Aquatic Habitat Condition of Hot Springs and Seeps

A USFWS survey conducted in 1996 located Bruneau hot springsnail in 116of 204 (54 %) seeps and hot springs along the Bruneau River (Table 30) (Mladenka and Minshall 1996). Wood (2000) reduced this estimate of occupied habitat to 89 of 155 based on 1998 habitat surveys. This habitat has been considerably reduced in quantity and quality by groundwater pumping for agricultural uses (Varricchione and Minshall 1995b).

Table 30. Total number of springs and total number of springs occupied by Bruneau hot springsnail and the water levels of two wells near Indian Bathtub spring (table from Wood 2000).

| Date | Total Number of Springs | Number of Occupied Springs | October Elevation (ft) of Well 03BDC1 | October Elevation (ft) of Well 03BDC2 |
|---|---|---|---|---|
| 1991 | 211 | 131 | 2672.74 | 2672.56 |
| 1993 | 201 | 128 | 2671.65 | 2671.45 |
| 1996 | 204 | 116 | 2671.65 | 2671.39 |
| 1998 | 155 | 89 | 2671.57 | 2671.23 |

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 et al. 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 et al. 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 et al. 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.

#### 3.1.2.4 Geomorphologic Conditions of Stream Channels

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 (Parrish 1998, USFS 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 (USFS 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 (USFS 1998).

## 3.2 Terrestrial

The Northwest Habitat Institute (2003) modeled current (Figure 31) and historic (Figure 40) wildlife habitat types of the Bruneau subbasin. Although this is a course analysis, it provides some insight into the magnitude of habitat changes (Table 31) encountered by terrestrial species over time in the subbasin. Although shrub-steppe has undergone a relatively small decrease in quantity (-3%), the degradation of habitat condition by altered fire regime, invasive exotics, and grazing are the currently threaten this environment. The most extensive loss of habitat is interior riparian wetlands which have decreased by 1,965% from historic estimates. Aspen (76%) and desert playa (43%) have increased while focal habitats that have undergone a decrease include western juniper and mountain mahogany (-474%) and dwarf shrub-steppe (-39%).

Terrestrial environmental conditions are discussed in further detail in section 1.5.7 (about vegetation and land cover), section 2.4.1 (about terrestrial focal habitats), and section 5.1.2 (with the interpretation and synthesis of terrestrial conditions).

Table 31. Current and historic projected quantities of wildlife habitats (WHTs) in the Bruneau subbasin (NHI 2003).

| Habitat | Current # Acres | Historic # Acres | %change |
|---|---|---|---|
| Montane Mixed Conifer Forest | 15,051 | 0 | 100 |
| Interior Mixed Conifer Forest | 455 | 1,894 | -316 |
| Lodgepole Pine Forest and Woodlands | 0 | 1,483 | 100 |
| Ponderosa Pine & Interior White Oak Forest and Woodlands | 0 | 34,068 | 100 |
| Upland Aspen Forest | 56,974 | 13,647 | 76 |
| Alpine Grasslands and Shrublands | 3,480 | 8,936 | -157 |
| Western Juniper and Mountain Mahogany Woodlands | 7,670 | 44,005 | -474 |
| Interior Grasslands | 1,052 | 96,058 | -9031 |
| Shrub-steppe | 1,515,534 | 1,553,829 | -3 |
| Dwarf Shrub-steppe | 198,082 | 274,938 | -39 |
| Desert Playa and Salt Scrub Shrublands | 78,940 | 44,637 | 43 |
| Agriculture, Pastures, and Mixed Environs | 227,770 | 0 | 100 |
| Urban and Mixed Environs | 121 | 0 | 100 |
| Open Water–Lakes, Rivers, and Streams | 2,658 | 1,652 | 38 |
| Herbaceous Wetlands | 6,287 | 0 | 100 |
| Montane Coniferous Wetlands | 318 | 0 | 100 |
| Interior Riparian-Wetlands | 1,997 | 41,245 | -1965 |

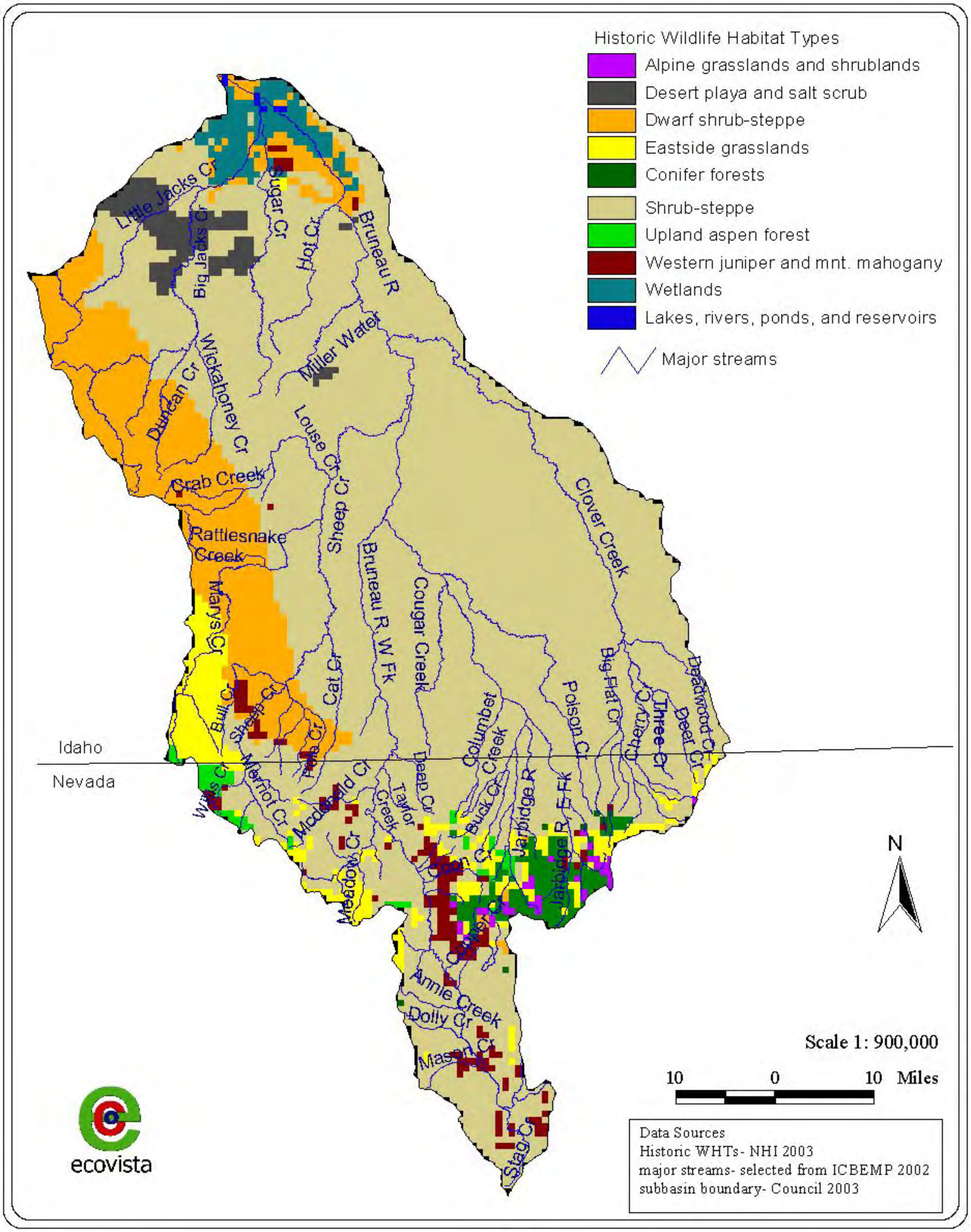


Figure 40. Projected historic wildlife habitat types of the Bruneau subbasin.

## 3.3 Out-of-Subbasin Effects

### 3.3.1 Effects on Aquatic Focal Species

Historic out of subbasin activities significantly affected the current aquatic fauna of the Bruneau subbasin. Anadromous fish were first blocked from entering the Bruneau subbasin in 1860 following construction of an irrigation storage reservoir on the lower 1.5 miles of the Bruneau. Although it is unknown whether the structure blocked all anadromous salmonids, the construction of Swan Falls Dam on the Snake River in 1901 soon became the terminus for all Snake River Salmon, and, to a large extent, the dam was a barrier to steelhead (Chandler 2001). Although a fish ladder was installed at Swan Falls Dam during the initial construction, it was not functional for salmon and was probably not functional for steelhead (Chandler 2001). Any hope of anadromous fish passage into the Bruneau subbasin was eliminated in 1952 following construction of C.J. Strike Dam, which posed a complete migration barrier.

The loss of anadromous fish in the Bruneau subbasin was significant. Chandler (2001) estimates that during the pre-development era (pre-1860), the area above Hells Canyon Dam produced between 1 and 1.7 million adult Pacific salmon (*Oncorhynchus* spp.) and steelhead (*Oncoryhynchus mykiss*). This estimate includes an estimated 0.76 to 1.19 million spring/summer chinook salmon, 135,000 to 214,000 fall chinook salmon, 117,000 to 225,700 steelhead, and 14,400 to 57,400 sockeye salmon (*O. nerka*).

The loss of anadromy into the Bruneau subbasin has likely had profound effects on at least two of the extant focal species. Although their influence on redband populations is unknown, it is probable that the elimination of steelhead from the Bruneau subbasin represented an impact to redband population connectivity, genetic diversity, and/or refounding capacity (*e.g.,* Vigg and Company 2000). Similarly, the loss of anadromous carcasses and juvenile fish has affected current nutrient cycling and prey availability (respectively) for extant focal species, most notably for bull trout and redband trout.

The construction of impoundments outside of the subbasin has significantly affected connectivity of bull and redband trout populations to other migratory populations. Historic interactions between Bruneau bull and redband trout populations and those residing in other Snake River tributaries (*e.g.,* Boise, Weiser, Malheur, Payette, and Powder subbasins) is unknown, however, it is reasonable to assume that all historic migratory trout populations periodically interacted with other populations in the Snake River basin. Currently, interaction is difficult or impossible as most populations are isolated by fish barriers, primarily dams.

### 3.3.2 Effects on Terrestrial Focal Species

A number of the terrestrial focal species spend a portion of their life cycle outside the Bruneau River subbasin's designated boundaries. Although most are nongame avian species, at least one upland game species and several big game species potentially migrate between State jurisdictions. Depending on the extent, location, and timing of seasonal movements, out of subbasin effects may range from limited to potentially substantial. Potentially limiting factors encountered outside the subbasin, including hunting, environmental toxins, and habitat degradation, may influence species occurrence, annual survival, reproductive success, and ultimately population growth within the subbasin.

Several of the Bruneau subbasin focal bird species display varying degrees of seasonal movements. Yellow warbler, willow flycatcher, white-faced ibis, and yellow-billed cuckoos are primarily long-distant migrants; wintering south from Mexico to South America (Ryder and Manry 1994, Hughes 1999, Lowther et al. 1999, Sedgwick 2000). In contrast, sage grouse and northern goshawk populations may move relatively short distances or remain resident (Squires and Reynolds 1997, Connelly et al. 2000): although seasonal movement likely includes locations outside the subbasin boundaries. Migration is considered energetically expensive, loss of habitat along migratory paths and exposure to potential collisions with stationary or moving objects may increase this cost (Hughes 1999, Sedgwick 2000). Furthermore, loss or degradation of winter habitat due to pesticides, herbicides, fragmentation, and decline in extent has been suggested as a potential cause of declining populations of North American bird species (Ryder and Manry 1994, Hughes 1999, Connelly et al 2000, Sedgwick 2000). In general, insectivorous birds, birds in western North America, and birds migrating to Mexico and Central and South America are still contaminated with relatively high levels of organochlorines (primarily DDE; DeWeese et al. 1986). Seasonal movements, however, may not be limited to winter, as big game and sage grouse may move outside the subbasin during alternative seasons (Connelly 2000). However, independent of the timing of seasonal movements, the condition of habitats sought likely influences within subbasin population dynamics. For example, reduced sagebrush cover due to herbicide application, fire, and mechanical removal has been shown to be an important predictor of sage grouse occurrence and recruitment (Connelly et al. 2000). Isolating the causes of population declines requires a full understanding of species ecology in combination with long-term population monitoring data.

Five terrestrial focal species identified for the Bruneau subbasin are managed by both Idaho and Nevada as game animals. Depending on seasonal movements exhibited by populations, State agencies may be managing the same animals from opposite sides of the fence. Pronghorn antelope, mule deer, and sage grouse occurring in the subbasin are hunted in both Idaho and Nevada, although hunting seasons, limits, and pressure are variable among years and locations. Although seasons primarily overlap, in all three instances there is the potential for individuals from populations moving across State boundaries to be exposed to a longer hunting season. In the case of mule deer for example, the season has been “extended” approximately 2 weeks on either side. Coordination between these two State agencies, including an understanding of the migratory ecology of potentially shared populations, is essential for proper management (Connelly et al. 2000).

# 4 Identification and analysis of Limiting Factors

## 4.1 Aquatic Limiting Factors

Insufficient habitat quantity and quality, and the loss of connectivity between populations appear to be the primary factors limiting production of aquatic focal 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.

### 4.1.1 Natural Influences on Habitat Quantity and Quality

The semiarid 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 nondrought 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.*, BLM 1999). During drought years, salmonids are restricted to small habitat patches (*e.g.*, BLM 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.

Flooding is another hydrologically related factor that poses limitations to focal species. For example, in 1995, a debris torrent occurred on the West Fork of the Jarbidge River, and washed out a 1.5 mile section of the South Canyon Road. The effects from the washout, and those associated with the attempted repair of the road (*see* Section 4.1.2.3 below) posed a significant threat to the bull trout in the area, and could have resulted in the loss of 27 percent of the known occupied bull trout habitat in the West Fork of the Jarbidge River (USFWS unpublished data, http://nevada.fws.gov/public/jarbidge.htm). Mollusk species, such as the Bruneau hotsprings snail, are also susceptible to the effects of flooding, due to scouring of critical spawning substrate. For example, the Hot Creek population was reduced to approximately zero individuals following a flood event in 1991 and remained absent from the site until 1999. Although a natural phenomenon, flood effects are commonly exacerbated by human land use activities, including removal of upland vegetation, channel straightening, bridge construction, and reductions in riparian vegetation/floodplain interaction.

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.

### 4.1.2 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.

#### *4.1.2.1 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 (USFS 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 (USFS 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 32). 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 (see section 1.5.8.5), 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 32. Water quality limited stream segments in the Bruneau subbasin (Lay and IDEQ 2000).

| Water Body | Source Agency: BLM | | | | Source Agency: IDEQ | | |
|---|---|---|---|---|---|---|---|
| | Pollutant Source | Pollutant[a] | | | Pollutant Source | Pollutant[a] | |
| Bruneau River | irrigated crop | SED | | | irrigated crop | NUT | SED |
| | pasture | SED | Q | | pasture | NUT | SED |
| | range | SED | | | aquaculture | NUT | SED |
| | aquaculture | NUT | TM | Q | | | |
| | flow regulation | Q | | | | | |
| | riparian habitat removal | H | | | | | |
| | streambank destabilization | H | | | | | |
| | small dam construction | Q | | | | | |
| | natural | TM | | | | | |

| Water Body | Source Agency: BLM | | | | Source Agency: IDEQ | | |
|---|---|---|---|---|---|---|---|
| | Pollutant Source | Pollutant[a] | | | Pollutant Source | Pollutant[a] | |
| Jacks Creek | irrigated crop | SED | | | irrigated crop | NUT | SED |
| | pasture | SED | Q | | pasture | NUT | SED |
| | range | SED | | | aquaculture | NUT | SED |
| | aquaculture | NUT | TM | Q | feed lots | O | |
| | flow regulation | Q | | | | | |
| | riparian habitat removal | H | | | | | |
| | streambank destabilization | H | | | | | |
| Sugar Creek | | | | | irrigated crop | SED | |
| | | | | | pasture | SED | |
| | | | | | aquaculture | SED | |
| WickahoneyCreek | range | SED | Q | | | | |
| | riparian habitat removal | H | | | | | |
| | streambank destabilization | SED | | | | | |
| Hot Creek | range | SED | | | range | SED | |
| | flow regulation | Q | H | | | | |
| | riparian habitat removal | H | | | | | |
| | streambank destabilization | SED | H | | | | |
| | recreation | BACT | | | | | |
| Clover Creek | | | | | range | SED | |
| Three Creek | | | | | range | SED | |
| Cougar Creek | | | | | range | SED | |
| Poison Creek | | | | | range | SED | |

[a] Pollutants and/or stressors: NUT = nutrients, SED = sediment, Q = flow alteration, TM = temperature, BACT = pathogens, O = organic enrichment, H = habitat alteration

#### *4.1.2.2 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.,* Kauffman and Krueger 1984; Platts 1985, 1991; Chaney et al. 1993; 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 (BLM, personal communication, September 7, 2001), the BLM (1999a) 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 (USFS 1995, USDA 2000). The relative magnitude of these habitat alterations extends to other aquatic species such as gastropods and amphibians.

#### *4.1.2.3 Habitat Simplification*

Reductions in habitat complexity through land-use activities such as road construction and maintenance, grazing, and possibly agriculture, have 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 (see Figure 17), 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. One of these problems is that of undersized bridges. Several of the bridges in the West Fork Jarbidge watershed represent a limiting factor to natural river hydraulics, as they were undersized at the time of their construction (USFS 1998). Because of the narrowness of the bridge structures, it has been necessary to dike the stream channel above the bridge in order for it to fit under the bridge (USFS 1998; McNeill et al. 1997). These activities have functionally disconnected the channel from its floodplain, which has in turn contributed to increased stream power, scouring of spawning gravels, and elimination of overwintering and rearing habitat. Another problem is the access that roads provide 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).

In July 1998, with the Jarbidge River bull trout already proposed for listing, Elko County began reconstructing the South Canyon Road in the midst of known bull trout habitat. Potential direct and indirect impacts in the West Fork of the Jarbidge River included the harm and harassment of juvenile and adult bull trout; disruption or prevention of bull trout migration and spawning; alteration of stream flow and temperature; loss of riparian vegetation; and increased sediment transport. This combination of activities had the potential to affect the future survival and recovery of the Jarbidge River population. For these reasons, the Service temporarily emergency listed the Jarbidge River population as endangered on August 11, 1998 (63 Federal Register 42757). The emergency listing lasted for 240 days.

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 (USFS 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). 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.

Threats to springsnail populations include loss of habitat due to agriculture-related groundwater mining (Varricchione and Minshall 1995b), and degradation of habitat due to trampling of streambanks and springs. Direct mortality from trampling by livestock has been documented for both mature and juvenile springsnails (Mladenka 1992 cited in Klott 1996).

#### *4.1.2.4 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. Legacy effects from mining activities are also cited as contributing to reductions in water quality.

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.,* USFS 1995, Zoellick et al. 1996; McNeill et al. 1997, BLM 1999a) 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 BLM (1999a) 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 32). Total phosphorus (TP) concentrations in Jacks Creek are related to nonsediment 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 32) (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 (USFS 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 (BLM 1999a). Fine sediment percentages were greatest in livestock-accessible stream segments grazed in the spring (BLM 1999a). 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.

Historically, mining strongly influenced water quality in the Jarbidge River. The West Fork Jarbidge River, in the vicinity of Jarbidge, was placer mined in the 1880s (Zoellick et al. 1996). At the onset of operations, fish were reported to be plentiful. By 1935, the river was described as "polluted by mine tailings, starting 2 miles upstream of the town of Jarbidge, and unfit for fish" (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 (USFS 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 were dumped into the Jarbidge River at a continuous rate of 31 cfs. This volume exceeded the base flow of the Jarbidge River by six times 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, macroinvertebrates, and other coldwater 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, a pH of 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).
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 (see section 1.5.8.11 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).

#### *4.1.2.5 Exotic Species Introductions*

Eastern brook trout (*Salvelinus* fontinalis) occur in portions of the subbasin and represent a threat to native species. Brook trout occur in Emerald Lake near the headwaters of the East Fork of the Jarbidge River and in Bear Creek, a tributary to the West Fork of the Jarbidge River. Although interactions have not been documented, this exotic speices represents a possible hybridization threat to proximal bull trout populations due to the potential for future illegal transplants elsewhere in the subbasin. Brook trout populations have also established in Merritt Crek, and in the Idaho tributaries of Three, Big Flat, Deer, and Deadwood Creeks. These populations are known to be impacting redband trout deliteriously through increased competition (G. Johnson, NDOW, personal communication, April, 2004).

Non-native game species (*e.g.*, smallmouth bass) occur in the subbasin although their influence upon focal species is unknown (K. Meyer, IDFG, personal communication, May, 2004). The influence of this species, and the native northern pikeminnow, on redband trout currently represents a data gap.

Wild mosquito fish and tilapia were suspected of limiting springsnail recovery in Hot Creek, but gut content analysis indicated that tilapia were not preying on springsnails (Varricchione and Minshall 1995a). 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).

### 4.1.3 QHA-Based Limiting Factors Analysis and Prioritization

Qualitative Habitat Assessment (QHA; Mobrand Biometrics 2003b) was used to evaluate habitat conditions and limiting factors within and between sixth field HUCs in the Bruneau subbasin for redband trout, bull trout, mountain whitefish, the Idaho springsnail, and the Bruneau springsnail. Analyses were run based on the habitat occupied[1] for each species (Table 33 and Figure 41).

Raw data used in, and outputs from the QHA model are included in Appendix G. Information included in this section (with the exception of the two snail species) is not a direct reflection of those results. Adjustment was made to QHA restoration scores/ranks to account for relevant factors not considered within the QHA model itself (e.g., amount of available habitat). No adjustment was made to original QHA protection scores/ranks.

To account for the differing amount of habitat between HUCs (e.g., total stream miles in a sixth field HUC used by a given species), QHA restoration scores were standardized based on the average usable length of stream in the subbasin (Table 33). The estimated length utilized within each individual HUC was divided by the subbasin average; the result was then multiplied by the original QHA restoration score for that reach. The streams were re-ranked according to the resultant scores.

[1] Habitat occupation included consideration of four life history stages, as defined by Mobrand Biometrics (2004b). These were spawning and incubation, summer rearing, winter rearing, and migration.

Table 33. Average stream miles per sixth field HUC occupied by focal species in the Bruneau subbasin. Averages were used to standardize restoration scores derived from QHA modeling efforts.

| Focal Species | Total # of HUCs Occupied | Average Miles Occupied per HUC | Range (Miles) | | Standard Deviation |
|---|---|---|---|---|---|
| | | | Minimum | Maximum | |
| Redband Trout | 56 | 12.9 | 0.05 | 29.8 | 5.9 |
| Bull Trout | 8 | 12.0 | 7.7 | 31.5 | 8.0 |
| Mountain Whitefish | 9 | 11.7 | 8.2 | 16.5 | 2.7 |
| Bruneau springsnail | 2 | N/A | N/A | N/A | N/A |
| Idaho springsnail | 1 | N/A | N/A | N/A | N/A |

No adjustment was made to original QHA protection scores/ranks. Protection of both larger and smaller habitat areas used by the focal species will be critical to maintaining population/habitat diversity, irregardless of reach length. This concept is consistent with the guiding principles of the accompanying subbasin management plan and with the scientific principles of the Council's Fish and Wildlife Program (NPPC 2000).

Species-specific comparisons of protection versus (adjusted) restoration ranks for each sixth-field HUC are shown in Table 34, Table 37, and Table 40. A graphical representation of restoration *vs.* protection areas for each species follows the respective tables (Figure 42, Figure 43, and Figure 44).

Reaches prioritized for restoration activities are presented in rank order in Table 34, Table 38, and Table 41; those prioritized for protection are presented in rank order in Table 36, Table 39, and Table 42. In each of these tables, habitat priority factors in need of restoration or protection (respectively) are highlighted using rankings drawn directly from the QHA model outputs[2] (see Appendix G).

[2] Within QHA a maximum of eleven ranks are possible within each reach (one for each habitat variable). Due to tie rankings, the number of unique ranks observed in any reach considered in this assessment did not exceed 6. To extract only priority information from the QHA matrix, the following rules were applied in creating Table 2 and Table 3: If 2-3 unique ranks existed for a given reach, the single most important issue is highlighted in summary tables; If 4-6 unique ranks existed for a reach, the two most important issues are highlighted in summary tables. Ranks are taken directly from the QHA model output and are comparable within but not between rows/reaches.


Figure 41. Bruneau subbasin sixth-field HUCs used in the QHA modeling process.

#### 4.1.3.1 Redband Trout

Comparisons of where to focus restoration efforts and where to focus protection efforts, as they relate to redband trout are shown in Table 34 and in Figure 42. At the subbasin scale, restoration efforts are generally identified throughout the majority of the Clover Creek (a.k.a. East Fork Bruneau) watershed, in the Big Jacks Creek and Wickahoney and Crab Creek drainages, and in headwater tributaries to the West Fork Bruneau (primarily those occurring in the westernmost portion of Nevada). Eight HUCs, primarily in the West Fork Bruneau, fall into the "middle ground" with respect to both priorities, and are thus prioritized for both protection and restoration activities in subsequent tables. Priority areas for protection include the lower mainstem Bruneau, the majority of the Jarbidge watershed (East and West Forks inclusive), headwater reaches of the West Fork Bruneau, the Little Jacks Creek drainage, and the Rattlesnake and Mary's Creek drainages.

Table 34. Comparative restoration versus protection value for redband trout sixth field HUCs (shown in parenthesis) within the Bruneau subbasin based on (modified) QHA ranks for each activity.

| **Protection Rank** / **Restoration Rank** | **High** | **Moderate** | **Low** |
|---|---|---|---|
| High<br>(Note: Cells in this row have streams listed in order of Restoration Rank) | Priority = Restore<br>Bruneau 14 (2202)<br>Meadow (2501) | Priority = Restore<br>Deer (1003)<br>Telephone (2502)<br>McDonalds (2602)<br>Big Jacks 1 (4201)<br>Seventysix (2203)<br>Willow Creek/Tribs. (2302)<br>Cat (2901)<br>Sheep 4 (2903) | Priority = Restore<br>Louse 1 (3601)<br>Lower Three (1002)<br>Willis (4402)<br>Clover 3 (0801)<br>Upper Three (1004)<br>Louse 2 (3602)<br>Clover 1 (0502)<br>Merrit (4401) |
| Moderate<br>(Note: Cells in this row have streams listed in order of Restoration Rank) | Priority = Protect<br>EF Jarbidge 1 (1601)<br>Jarbidge 4 (1701)<br>Coon (2102)<br>Jarbidge 2 (1801)<br>Bruneau 12 (2201) | Priority = Protect & Restore<br>Jarbidge 5 (1702)<br>Bruneau 7 (2803)<br>Sheep 1 (3401)<br>Bruneau 6 (3501)<br>Flat and Coudle (1202)<br>Sheep 3 (2904)<br>Bruneau 8 (2701)<br>Jarbidge 1 (2801) | Priority = Restore<br>Big Flat Cr. (1101)<br>Clover 2 (0503)<br>Deadwood (1001)<br>Wickahoney 2 (3802)<br>Sheep (3101)<br>Clover 4 (0802) |
| Low<br>(Note: Cells in this row have streams listed in order of Protection Rank) | Priority = Protect<br>Bruneau 13 (2103)<br>Bruneau 11 (2101)<br>Jarbidge 3 (1501)<br>EF Jarbidge 2 (1602)<br>Cottonwood (3901)<br>Little Jacks 2 (4101)<br>Pole (2902)<br>Duncan (3803)<br>Marys 2 (3303)<br>Little Jacks 1 (4202) | Priority = Protect<br>Big Jacks 2 (3902)<br>Little Jacks 3 (4102)<br>Bruneau 4 (0402) | Priority = Protect<br>Bruneau 5 (0501)<br>Wickahoney 1 (3801)<br>Bruneau 3 (0401)<br>Marys 1 (3301)<br>Bruneau 2 (0102) |

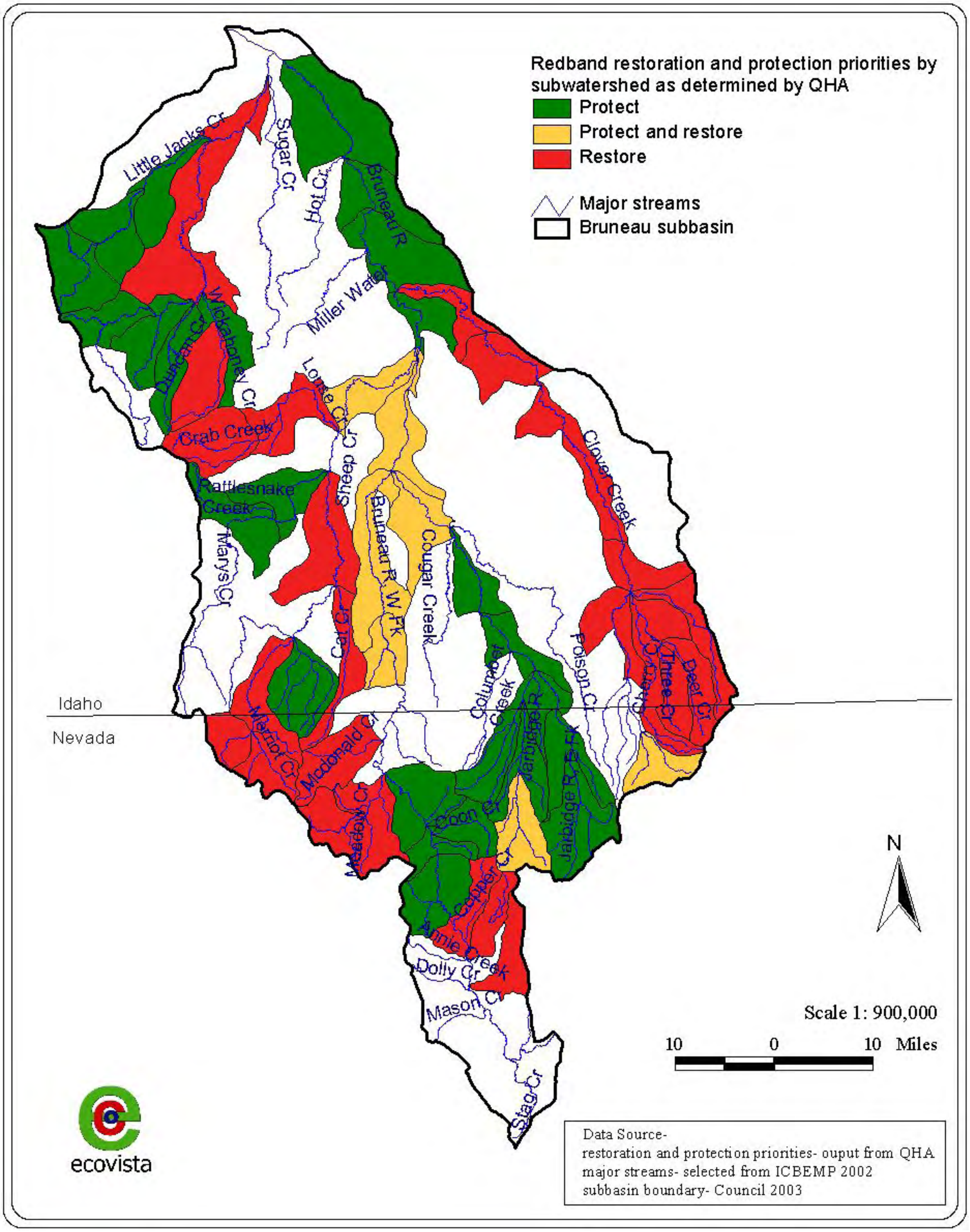


Figure 42. QHA-based restoration and protection areas for redband trout in the Bruneau subbasin.

Redband HUCs prioritized for restoration are shown in Table 35. Habitat metrics most frequently cited as being in need of restoration include low flows, high temperatures and oxygen, sediment, channel form, and obstructions to migration.

Table 35. Restoration ranks[1] for redband sixth code HUCs and habitat variables within each, for HUCs prioritized primarily for restoration within the Bruneau subbasin. HUC ranks are comparable between rows; variable ranks are comparable only within rows

| Restoration Rank | Reach Name[2] | Length (Miles)[3] | HUC_6 | Riparian Condition | Channel Form | Channel Stability | Fine Sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | DEER | 21.8 | 1003 | | | | | | 1 | 3 | | 2 | | |
| 2 | Telephone | 16.8 | 2502 | 5 | 3 | | 3 | | | | | | 1 | 1 |
| 2 | McDonalds | 20.5 | 2602 | | 2 | | | | 3 | 3 | | 3 | 3 | 1 |
| 4 | Louse 1 | 16.1 | 3601 | | | | | | 2 | 3 | | | | 1 |
| 5 | Lower Three | 29.9 | 1002 | | | | | | 3 | 2 | | 1 | | |
| 5 | Big Jacks 1 | 26.2 | 4201 | 3 | | 2 | | | | | | | 1 | |
| 7 | Willis | 12.1 | 4402 | | 3 | | 3 | | 1 | | | 1 | | |
| 8 | Clover 3 | 22.5 | 801 | | | | 3 | | 1 | | | 2 | | |
| 9 | Upper Three | 15.6 | 1004 | | | | | | 1 | 3 | | 2 | | |
| 10 | Bruneau 14 | 18.1 | 2202 | | | | | | 1 | | | 3 | | 2 |
| 11 | Seventysix | 11.1 | 2203 | | | | | 5 | 3 | 3 | | | 1 | 1 |
| 11 | Meadow | 19.9 | 2501 | | 6 | | 6 | | 1 | 1 | | 1 | 1 | 1 |
| 13 | Louse 2 | 13.8 | 3602 | | | | 3 | | 2 | | | | | 1 |
| 14 | Willow Creek/tribs | 20.2 | 2302 | | 1 | | | | 2 | 2 | | 2 | | |
| 15 | Clover 1 | 15.6 | 0502 | | | | | | 1 | 3 | | 2 | | |
| 16 | Merritt | 16.0 | 4401 | 2 | | | | | 3 | | | | | 1 |
| 17 | Cat | 11.6 | 2901 | | 2 | 3 | | | 1 | | | | | |
| 18 | Sheep 4 | 23.9 | 2903 | | 4 | | 4 | | 1 | 1 | | | | 1 |
| 19 | Big Flat Cr. | 10.9 | 1101 | | | | | | 1 | 3 | | 2 | | |
| 20 | Clover 2 | 9.4 | 0503 | | | | 3 | | 1 | | | 2 | | |
| 20 | Deadwood | 21.8 | 1001 | | | | 2 | | 1 | | | 3 | | |
| 22 | Jarbidge 5* | 12.7 | 1702 | | 1 | 2 | | | 3 | | | | 3 | |
| 23 | Bruneau 7* | 16.5 | 2803 | | | | 2 | | 1 | 3 | | 3 | | |
| 24 | Sheep 1* | 17.7 | 3401 | | | | 1 | | 2 | 2 | | 2 | | |
| 24 | Wickahoney 2 | 7.1 | 3802 | 3 | | 3 | 2 | | | | | | | 1 |
| 26 | Flat and Coudle* | 13.8 | 1202 | 2 | 1 | | 3 | | | | | 3 | | 3 |
| 26 | Bruneau 6* | 13.6 | 3501 | | | | 1 | | 2 | 2 | | 2 | | |
| 28 | Sheep | 15.9 | 3101 | | 2 | 2 | | | 1 | 4 | | | | 4 |
| 29 | Sheep 3* | 9.5 | 2904 | | 2 | 3 | | | 1 | | | | | |
| 30 | Clover 4 | 6.6 | 0802 | | | | 3 | | 1 | | | 2 | | |
| 31 | Bruneau 8* | 8.0 | 2701 | 4 | | 4 | 3 | | 1 | | | 1 | | |
| 31 | Jarbidge 1* | 9.6 | 2801 | | 4 | | 4 | | 1 | 1 | | 1 | | |

[1]/ Uses "adjusted" reach ranks (previously described) to give weight to amount of usable habitat (length)
[2]/ HUCs prioritized as "Protect and Restore" in Table 34 occur in Table 35 and Table 36; (asterisk (*))
[3]/ Measurement is an estimate of the total length of stream channels within a sixth field HUC for which redband trout are either known present or unknown but potentially present (IDFG data).

Redband HUCs prioritized for protection are shown in Table 36. Habitat metrics most frequently cited as being in need of protection (i.e. those that are functioning adequately) include pollutants, obstructions, and oxygen.

Table 36. Protection ranks for redband sixth code HUCs and habitat variables within each, for HUCs prioritized primarily for protection within the Bruneau subbasin. HUC ranks are comparable between rows; variable ranks are comparable only within rows. Cells with values indicate the respective variable is functioning adequately and deserves protection.

| Protection Rank | Reach Name[1] | HUC_6 | Riparian Condition | Channel Form | Channel Stability | Fine Sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Bruneau 13 | 2103 | | | | 6 | | 1 | 1 | | 5 | 1 | 1 |
| 2 | Coon | 2102 | | | | 5 | | 1 | 1 | | 6 | 1 | 1 |
| 3 | Jarbidge 3 | 1501 | | | 4 | | | 1 | 1 | | 5 | 5 | 1 |
| 3 | Bruneau 11 | 2101 | | | | 6 | | 1 | 1 | | 5 | 1 | 1 |
| 5 | Jarbidge 4 | 1701 | | | 4 | | | 1 | 1 | | 5 | 5 | 1 |
| 6 | E. Frk Jarbidge 1 | 1601 | | 5 | | | | 4 | 1 | | | 1 | 1 |
| 7 | E.Frk Jarbidge 2 | 1602 | | 6 | | 6 | | 1 | 1 | | 1 | 1 | 1 |
| 8 | Bruneau 12 | 2201 | | 6 | | 6 | | 1 | 1 | | 5 | 1 | 1 |
| 9 | Cottonwood | 3901 | | 4 | | 3 | | | 1 | | | 1 | |
| 10 | Little Jacks 2 | 4101 | 6 | | 6 | 1 | | | 1 | | 1 | 1 | 1 |
| 11 | Pole | 2902 | | | | 6 | | 2 | 2 | | 2 | 1 | 2 |
| 12 | Jarbidge 2 | 1801 | | 5 | | | | 4 | 1 | | | 1 | 1 |
| 13 | Duncan | 3803 | | | | 4 | | | 2 | | | 2 | 1 |
| 14 | Marys 2 | 3303 | | | | | | | 1 | | 4 | 1 | 3 |
| 15 | Little Jacks 1 | 4202 | 5 | | | 1 | | | 2 | | 2 | 2 | |
| 16 | Jarbidge 5* | 1702 | | | | 5 | | 3 | 1 | | | 3 | 1 |
| 17 | Big Jacks 2 | 3902 | | 3 | | 3 | | | 1 | | 3 | 1 | |
| 18 | Little Jacks 3 | 4102 | | 2 | | 2 | | | 2 | | 2 | 1 | 2 |
| 19 | Jarbidge 1* | 2801 | | 5 | | 5 | | 3 | 3 | | | 1 | 1 |
| 20 | Bruneau 6* | 3501 | | 5 | | | | 3 | 3 | | | 1 | 1 |
| 21 | Flat and Coudle* | 1202 | | | 7 | 4 | | 1 | 1 | | 4 | 1 | 4 |
| 22 | Sheep 1* | 3401 | | 4 | | | | | 3 | | | 1 | 1 |
| 23 | Bruneau 8* | 2701 | | | | | | 5 | 3 | | 5 | 1 | 1 |
| 24 | Bruneau 7* | 2803 | | | | | 5 | | 3 | | | 1 | 1 |
| 25 | Sheep 3* | 2904 | | | | | | | 2 | | 4 | 1 | 2 |
| 26 | Bruneau 4 | 0402 | | 4 | | | | | 2 | | | 2 | 1 |
| 26 | Bruneau 5 | 0501 | | 4 | | | | | 2 | | | 2 | 1 |
| 28 | Wickahoney 1 | 3801 | | 4 | | 4 | | | 3 | | | 1 | 1 |
| 29 | Bruneau 3 | 0401 | | 3 | | | | 2 | | | | | 1 |
| 30 | Marys 1 | 3301 | | 4 | | 4 | | | 2 | | | 1 | 2 |
| 31 | Bruneau 2 | 0102 | | 1 | | | | | 2 | | 2 | 2 | 2 |

[1]/ HUCs prioritized as "Protect and Restore" in Table 34 occur in Table 35 and Table 36; (asterisk (*)).

### *4.1.3.2 Bull Trout*

Comparisons of where to focus restoration efforts and where to focus protection efforts, as they relate to bull trout are shown in Table 37 and in Figure 43. Based on QHA output, high priority restoration efforts are primarily associated with headwater habitats in the Jarbidge watershed (Table 38). Habitat components most commonly identified as in need of restoration include channel form (habitat diversity), channel stability, and excessive stream temperatures.

Important bull trout protection areas include the lower reaches of the East Fork Jarbidge mainstem, and the mainstem reaches of the Jarbidge which provide critical connectivity between tributary reaches (Table 39). Habitat components that are considered to be functioning appropriately include water quality (pollutants) and streamflow.

Table 37. Comparative restoration versus protection value for bull trout sixth field HUCs (shown in parenthesis) within the Bruneau subbasin based on (modified) QHA ranks for each activity.

| **Protection Rank** / **Restoration Rank** | **High** | **Moderate** | **Low** |
|---|---|---|---|
| High<br>(Note: Cells in this row have streams listed in order of Restoration Rank) | Priority = Restore<br>EF Jarbidge 2 (1602)<br>Jarbidge 5 (1702) | Priority = Restore | Priority = Restore<br>Jarbidge 4 (1701) |
| Moderate<br>(Note: Cells in this row have streams listed in order of Restoration Rank) | Priority = Protect<br>EF Jarbidge 1 (1601) | Priority = Protect & Restore | Priority = Restore<br>Jarbidge 3 (1501) |
| Low<br>(Note: Cells in this row have streams listed in order of Protection Rank) | Priority = Protect | Priority = Protect<br>Jarbidge 2 (1801)<br>Jarbidge 3 (1802) | Priority = Protect<br>Jarbidge 1 (2801) |

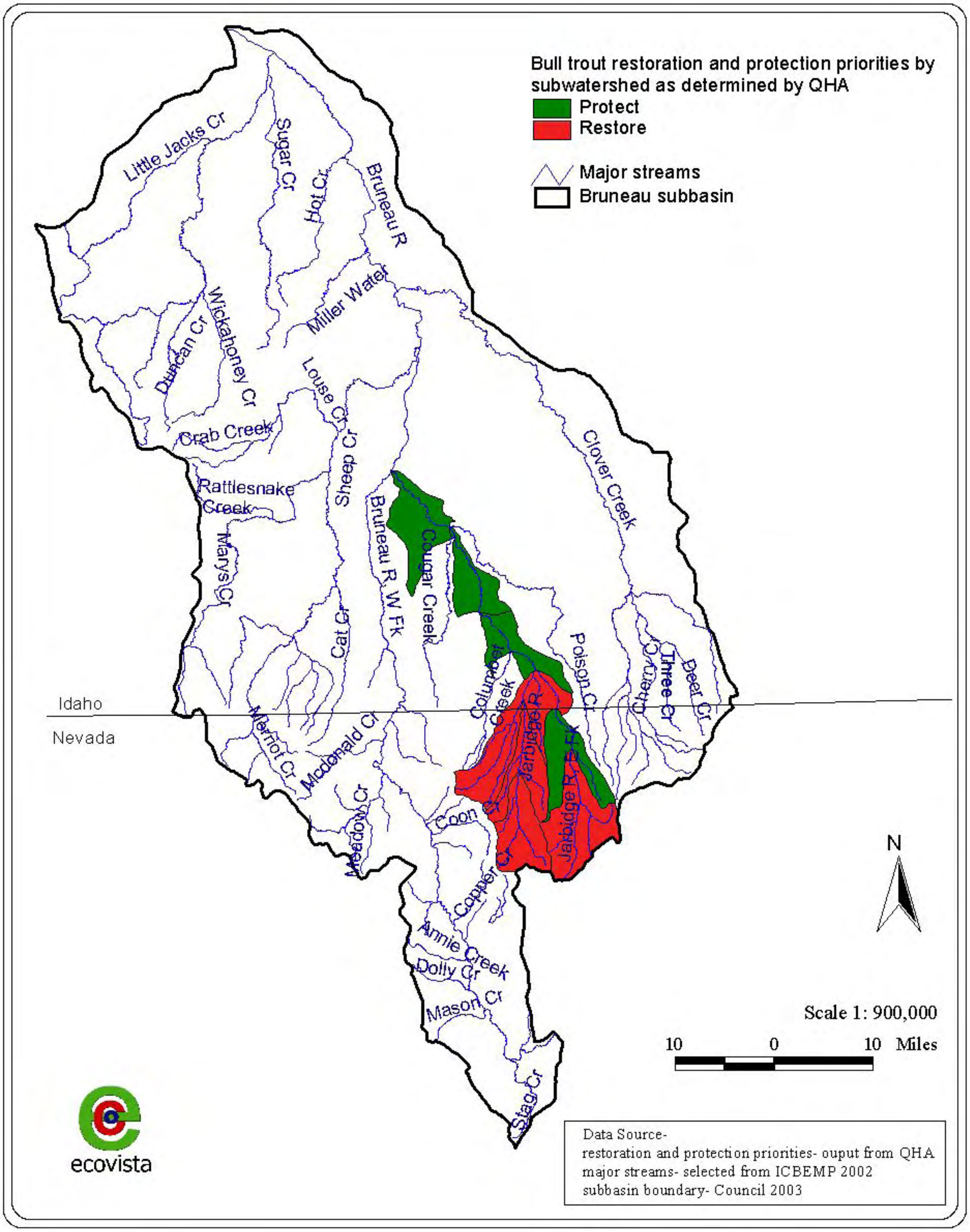


Figure 43. QHA-based restoration and protection areas for bull trout in the Bruneau subbasin

Table 38. Restoration ranks[1] for bull trout sixth code HUCs and habitat variables within each, for HUCs prioritized primarily for restoration within the Bruneau subbasin. HUC ranks are comparable between rows; variable ranks are comparable only within rows

| Restoration Rank | Reach Name | Length (Miles)[2] | HUC_6 | Riparian Condition | Channel Form | Channel Stability | Fine Sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | E.Frk Jarbidge 2 | 31.5 | 1602 | | 4 | 4 | 4 | | 1 | | | 1 | 1 | |
| 2 | Jarbidge 5 | 9.6 | 1702 | 4 | 1 | 1 | 1 | | | | | | | |
| 3 | Jarbidge 4 | 7.7 | 1701 | | 1 | 1 | 4 | | | | | 3 | | |
| 4 | Jarbidge 3 | 8.1 | 1501 | 3 | 1 | 1 | | | | | | 4 | 4 | |

[1]/ Uses "adjusted" reach ranks (previously described) to give weight to amount of usable habitat (stream length)
[2]/ Measurement is an estimate of the total length of stream channels within a sixth field HUC for which bull trout are either known present or unknown but potentially present (IDFG data; USFWS data; NDOW data)

Table 39. Protection ranks for bull trout sixth code HUCs and habitat variables within each, for HUCs prioritized primarily for protection within the Bruneau subbasin. HUC ranks are comparable between rows; variable ranks are comparable only within rows. Cells with values indicate the respective variable is functioning adequately and deserves protection.

| Protection Rank | Reach Name | HUC_6 | Riparian Condition | Channel Form | Channel Stability | Fine Sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | E. Frk Jarbidge 1 | 1601 | | 3 | 3 | 3 | | 1 | | | | 1 | |
| 2 | Jarbidge 2 | 1801 | | 3 | | 3 | | 1 | | | | 1 | 5 |
| 2 | Jarbidge 3 | 1802 | | 3 | | 3 | | 1 | | | | 1 | 5 |
| 2 | Jarbidge 1 | 2801 | | 3 | | 3 | | 1 | | | | 1 | 5 |

### *4.1.3.3 Mountain Whitefish*

Based on QHA output (Table 41), high priority restoration efforts are primarily associated with headwater portions of the Jarbidge, in lower portions of the mainstem Jarbidge, and in the confluence reach of the West Fork Jarbidge. Habitat components most commonly identified as in need of restoration include excessive temperatures, fine sediment, and low streamflow.

Mountain whitefish habitat in the East Fork Jarbidge, mainstem reaches of the Bruneau, and mainstem reaches of the Jarbidge River are functioning appropriately and warrant protection consideration (Table 42). Specific habitat components that should be protected include water quality (pollutants) and channel form.

Table 40. Comparative restoration versus protection value for mountain whitefish sixth field HUCs (shown in parenthesis) within the Bruneau subbasin based on (modified) QHA ranks for each activity.

| **Protection Rank** / **Restoration Rank** | **High** | **Moderate** | **Low** |
|---|---|---|---|
| High<br>(Note: Cells in this row have streams listed in order of Restoration Rank) | Priority = Restore<br>Bruneau 6 (3501)<br>E. Frk Jarbidge 1 (1601) | Priority = Restore<br>Bruneau 7 (2803) | Priority = Restore<br>Jarbidge 4 (1701) |
| Moderate<br>(Note: Cells in this row have streams listed in order of Restoration Rank) | Priority = Protect | Priority =<br>Protect & Restore<br>Jarbidge 5 (1702)<br>Jarbidge 3 (1802) | Priority = Restore<br>Jarbidge 1 (2801)<br>Jarbidge 2 (1801) |
| Low<br>(Note: Cells in this row have streams listed in order of Protection Rank) | Priority = Protect<br>E.Frk Jarbidge 2 (1602)<br>Bruneau 11 (2101) | Priority = Protect<br>Bruneau 4 (0402) | Priority = Protect<br>Jarbidge 3 (1501) |

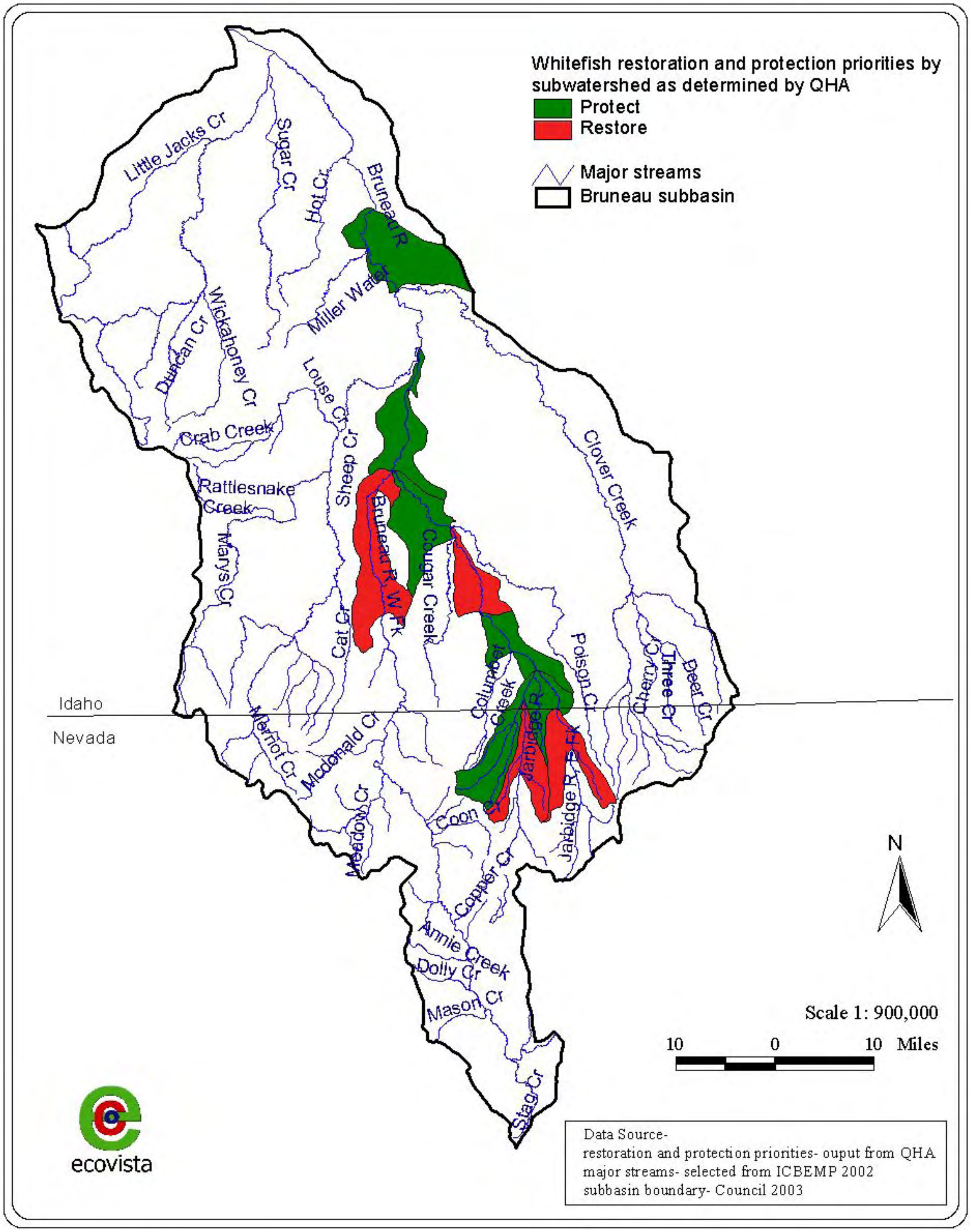


Figure 44. QHA-based restoration and protection areas for mountain whitefish in the Bruneau subbasin.

Table 41. Restoration ranks[1] for mountain whitefish sixth code HUCs and habitat variables within each, for HUCs prioritized primarily for restoration within the Bruneau subbasin. HUC ranks are comparable between rows; variable ranks are comparable only within rows.

| Restoration Rank | Reach Name[2] | Length (Miles)[3] | HUC_6 | Riparian Condition | Channel Form | Channel Stability | Fine Sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Jarbidge 4 | 13.2 | 1701 | | 2 | | 2 | | | | | 1 | | |
| 2 | Bruneau 7 | 16.5 | 2803 | | | | 2 | | 1 | | | 3 | | |
| 3 | E. Frk Jarbidge 1 | 13.2 | 1601 | 3 | | | 2 | | | | | 1 | | |
| 4 | Bruneau 6 | 13.6 | 3501 | | | | 1 | | 2 | | | 2 | | |
| 5 | Jarbidge 5* | 12.0 | 1702 | | 1 | 2 | | | 3 | | | | 3 | |
| 6 | Jarbidge 3* | 8.7 | 1802 | | | | 1 | | 2 | | | 2 | | |
| 7 | Jarbidge 2 | 13.6 | 1801 | 2 | 2 | 2 | 1 | | 2 | | | 2 | | |
| 8 | Jarbidge 1 | 9.6 | 2801 | 1 | 1 | 1 | 1 | | 1 | | | 1 | | |

1/ Uses "adjusted" reach ranks (previously described) to give weight to amount of usable habitat (stream length)
2/ HUCs prioritized as "Protect and Restore" in Table 40 are included in both Table 41 and Table 42 and are marked with an asterisk (*)
3/ Measurement is based on estimates of the total length of stream channels within a sixth field HUC for which redband trout are either known present or unknown but potentially present (IDFG data)

Table 42. Protection ranks for mountain whitefish sixth code HUCs and habitat variables within each, for HUCs prioritized primarily for protection within the Bruneau subbasin. HUC ranks are comparable between rows; variable ranks are comparable only within rows. Cells with values indicate the respective variable is functioning adequately and deserves protection.

| Protection Rank | Reach Name[1] | HUC_6 | Riparian Condition | Channel Form | Channel Stability | Fine Sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | E.Frk Jarbidge 2 | 1602 | | 4 | | 4 | | 1 | | | 1 | 1 | |
| 2 | Bruneau 11 | 2101 | | | | | | 1 | | | 3 | 1 | |
| 3 | Bruneau 4 | 0402 | | | | | | | | | | 1 | |
| 4 | Jarbidge 5 * | 1702 | | | | 3 | | 1 | | | | 1 | |
| 5 | Jarbidge 3* | 1501 | 1 | 1 | | 1 | | | | | | 1 | |
| 6 | Bruneau 4 | 0402 | | | | | | | | | | 1 | |
| 7 | Jarbidge 3 | 1802 | | 4 | | 1 | | 2 | | | 2 | | |

1/ HUCs prioritized as "Protect and Restore" in Table 40 are included in both Table 41 and Table 42 and are marked with an asterisk (*).

## 4.2 Terrestrial Limiting Factors

The primary limiting factors for terrestrial species and habitats in the Bruneau subbasin were selected by the Bruneau Technical Team and were based on a comparison of threats identified for focal and concern species, with changes in habitat conditions identified at the scale of the WHT. Addressing limiting factors at the habitat scale will provide the greatest benefit to the greatest number of species.

### 4.2.1 Grazing and/or Browsing

In western North America, livestock grazing is the most prevalent land management practice (Fleischner 1994). Habitats may be limited by grazing because livestock can serve as vectors for the spread of invasive plant species (Knick et al. 2003), change habitat features by reducing plant species diversity and biomass (Reynolds and Trost 1981), disrupt ecosystem function, or alter ecosystem structure (Fleischner 1994). In addition to plant communities, deleterious effects of grazing have been observed in all vertebrate classes. Many observers have noted that cattle prefer and select riparian zones because they provide shade, cooler temperatures, water, and an abundance of food (Fleischner 1994). Habitat disturbance of most western riparian communities has been attributed to livestock grazing (Mosconi and Hutto 1982, Fleischner 1994, Dobkin et al. 1998). Species richness and relative abundance of avian species decline in response to cattle grazing but restoration of riparian meadows and avifauna may be possible through exclosure management practices (Dobkin et al. 1998). The longer the time since an area was last grazed has significantly correlated with increases in avian abundance, shrub volume, and shrub heights (Taylor 1986).

All allotment evaluations and watershed assessments on portions of the subbasin rank grazing as a leading cause of degraded riparian area (BLM 1989, 1997, 2000b; USFS 1995, 1998; Klott 1996; McNeill et al. 1997; Parrish 1998; Schnitzspahn et al. [2000]; JSGWG 2001; Jim Klott, BLM, personal communication, August 26, 2001). Grazing has led to a loss of more succulent forbs and other plants favored by sage grouse, elk, mule deer and other wildlife. Grazing effects in aquatic habitat include raised stream temperatures, contribution of sediment through collapsing stream banks, reduction of bank storage and altered stream hydrologic processes.

The Riparian Recovery Initive program of the BLM (http://www.blm.gov/riparian) implemented four exclosure treatments within the Bruneau subbasin (Table 43).

Table 43. Areas identified for restoration through the Riparian Recovery Initiative within the Bruneau subbasin.

| Project Area | Type of Treatment | Date Began | Pre-treatment Condition |
|---|---|---|---|
| Battle Creek | Fencing | 1995 | Fisheries depleted |
| Big Jacks Creek Reservoir | Fencing | 1997 | Livestock on shores reduced habitat for other wildlife species |
| Duncan Creek | Electric fencing | 1996 | Riparian degradation from livestock grazing |
| Pasture 16 | Divided pasture and reduced season of use | 1997 | Riparian degradation from livestock grazing |

### 4.2.2 Invasive Exotics

Noxious weeds pose significant long-term threats to ecosystem health. These species reduce plant biodiversity, habitat quality and quantity and generally lower the ecological quality of the habitat. Shrub-steppe communities are particularly threatened by the expansion of cheatgrass, which has contributed to an increased fire frequency and conversion of sagebrush-steppe habitat to annual grasslands (Keane et al. 2002). Cheatgrass cures early in the season and forms a continuous, fine fuel source that ignites easily and allows fire to spread rapidly (USAF 1998). In years with above average spring precipitation, larger fires often develop due to increased grass production (BLM 1998). As a consequence of an altered fire regime, much of the subbasin east of the Bruneau River is now dominated by exotic annual and perennial grasses.

### 4.2.3 Altered Fire Regime

Many Rocky Mountain ecosystems are in declining health because of the exclusion of fire. Fire exclusion is accomplished through policy that aims to eliminate fires from the landscape using fire suppression techniques. In addition to firefighting efforts, livestock grazing has played a critical role in the decline of wildland fire through the removal of fine fuels from the landscape. Fire may be considered a “keystone” disturbance because it regulates succession, maintains biological diversity, reduces biomass, controls insect and disease populations, maintains biological and biogeochemical processes, and recycles nutrients. A “fire regime” is defined as “a description of the long-term, cumulative fire characteristics of a landscape and is often described by frequency, extent, pattern, severity, and seasonality”. A comparison of current and historical fire regimes for the Interior Columbia River basin revealed that recent fires tended to be less frequent and more severe than those that occurred prior to 1900 (Keane et al. 2002).

Sagebrush and native bunchgrass communities evolved with fire. Sagebrush-steppe ecosystems cover approximately 45 million ha in the Western United States and typically burned at 60- to 110-year intervals prior to European settlement (Keane et al. 2002). Mountain big sagebrush communities burned every 20 to 30 years while Wyoming big sagebrush communities burned every 50 to 100 years (BLM 1998). In many cases, fire suppression has led to unnaturally high densities of big sagebrush (USAF 1998) which reduces or eliminates perennial grasses and forbs depended upon by wildlife. An increase in density, biomass, and number of woody species, or increased fuel loads amplfy the likelihood of stand-replacing fires (Keane et al. 2002).

The historical role of large wildfires was habitat fragmentation and maintenance of mosaics of differing successional stages of sagebrush beneficial to sage grouse and other shrub obligate species (Knick and Rotenberry 1995). Fire exclusion can influence multiple terrestrial species. For example, bighorn sheep can benefit from fire by reduced lungworm infections, improved forage, and reduced tree cover. The absence of fire has prevented the expansion of aspen forests, therefore reducing this valuable forage base for ungulates (Keane et al. 2002). Within the Bruneau subbasin, mule deer and pronghorn winter range and fawning habitat have declined as a result of an altered fire regime (IDFG 2000c). The prey base for raptors and mammalian predators has also been reduced (Jim Klott, BLM, personal communication, September 7, 2001).

### 4.2.4 Crested Wheatgrass

Conversion of rangelands to areas producing livestock forage has occurred through prescribed fire, mechanical removal treatments, biological agents, and herbicides. These treatments are followed by reseeding with non-native grasses, primarily crested wheatgrass (*Agropyron cristatum*) (Knick et al. 2003). Grassland vegetation communities in the Bruneau subbasin are dominated by exotic perennial seedlings (intermediate wheatgrass, crested wheatgrass), nonnative weedy annuals (cheatgrass, tumble mustard, peppergrass), and to a lesser extent by native perennials (bluebunch wheatgrass, Idaho fescue, Sandberg's bluegrass, needle-and-thread) (USAF 1998). During the past decade, over 90% of the Jarbidge Resource Area has burned. In an attempt to prevent establishment of cheatgrass, large areas were seed-drilled with crested wheatgrass, a nonnative 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).

### 4.2.5 Noise and Other Military Activities

Environmental impacts of military training activities in the Bruneau subbasin include noise pollution from aircraft operations. Flight guidelines are outlined which specify minimum altitudes and restrict flight along the Bruneau canyon. Range operations entail periodic use of emitter sites and ongoing site maintenance for all locations (CH2M HILL 2003). In addition to aircraft noise and emitter site activity, construction of houses and additional facilities to accommodate the Air Force mission are potential future actions that may impact the local environment and biological communities.

The Air Force defines mission impacts as "problem areas that have the greatest impact on ecosystems functioning and those impacts that may occur on a landscape scale" (CH2MHILL 2003). Environmental impacts of military training activities in the Bruneau subbasin include air pollution, noise pollution, water pollution, hazardous materials and hazardous waste management, groundwater depletion, and implementation of ground safety requirements for fire prevention. Construction of houses and additional facilities to accommodate the Air Force mission are potential future actions that may impact the local environment and biological communities. Biological resources may be further affected by an increased use of roads and public thoroughfares. Range operations entail periodic use of emitter sites and ongoing site maintenance for all locations (CH2M HILL 2003). Natural resource management issues and concerns for the Juniper Butte Range (Table 44) and avoidance actions for sage grouse (Table 45) are outlined in the Integrated RMP (CH2M HILL 2003).

Table 44. Natural resource management issues and concerns of the Juniper Butte Range (CH2M HILL 2003).

| Resource | Issues and Concerns |
|---|---|
| Vegetation | impacts to slickspot peppergrass habitat and populations |
| | loss of sagebrush habitats |
| | exotic/noxious weed invasion |
| Wetlands | delineation of wetlands |
| Watershed protection | Erosion |
| Fish and wildlife management | exotic/noxious weed invasion |
| | disturbance to special status species and their habitats |
| Grounds maintenance/pest control | exotic/noxious weed invasion |
| | impacts to slickspot peppergrass |
| Outdoor recreation | No impacts identified |
| Grazing outleasing | integrating grazing with training requirements, fire prevention, and slickspot peppergrass habitat management |

Table 45. Emitter site sage grouse avoidance actions of Mountain Home Air Force Base (CH2M Hill 2003).

| | Dates | Time | Sites* |
|---|---|---|---|
| Wintering | December 15 to February 15 | 24 hours a day | AV/ND-4 |
| Breeding | March 15 to May 1 | 4 a.m. to 9:30 a.m. | AF, AI, AU, BD |
| Nesting | April 15 to June 7 | 24 hours a day | AI, AV/ND-4 |
| | No restrictions | No restrictions | AA, AB, AC, AD, AE, AF, AG, AH, AJ, AK, AL, AM, AN, AO, AP, AQ, AT, AU, BA, BB, BC, BD, BE, BG, BK, BJ, BI, BF, ND-1, ND-5, ND-7, ND-9 |

*see Figure 19 for site locations

### 4.2.6 Land-Use Conversion

Human activities have been the primary cause of the loss of sagebrush across its historical range. Land uses that have converted native range include agriculture, mining, powerline and natural-gas corridors, urbanization, and expansion of road networks which fragment landscapes or eliminate sagebrush from expansive tracts of land (Knick et al. 2003). Increased fragmentation of shrub-steppe negatively influences the presence of shrub-obligate species (Knick and Rotenberry 1995).

### 4.2.7 Water Use

Wells on private lands in the subbasin withdraw and pump groundwater for personal and agricultural uses. In the Bruneau/Grandview area, well withdrawals increased from zero to approximately 49,900 acre-feet of water per year from 1890 to 1978 (Berenbrock 1993). Withdrawals have been increasing since 1992, and data from monitoring in 2001 indicate a return to declining groundwater levels surpassing 1994 levels, which were previously the lowest monitored levels since 1991 (USFWS 2002). In addition to water use, several surface and subsurface leaking wells were identified in an artesian well inventory conducted by the Idaho Department of Water Resources (IDWR 1992) for which a majority have not been addressed.

Although the Conservation Reserve Program is a conservation measure that temporarily removes private land from agricultural production, there has been no continuation of the Program in Owyhee County since 1999 because of a dramatic decline in monetary compensation. Aquatic and terrestrial species and communities are not afforded any protection or conservation through the allocation of surface or groundwater in the Bruneau/Grandview area (USFWS 2002). Some conservation measures have been implemented, but levels of groundwater and associated springflows continue to decline (USFWS 2002). Continuation of extensive groundwater withdrawals and land irrigation affects terrestrial species and habitats by degrading, reducing and eliminating habitat.

### 4.2.8 Roads

There are seven general effects that roads may have on aquatic and terrestrial ecosystems: 1) increased mortality from road construction, 2) increased mortality from collision with vehicles, 3) modification of animal behavior, 4) alteration of the physical environment, 5) alteration of the chemical environment, 6) spread of exotic species, and 7) increased alteration and use of habitats by humans (Trombulak and Frissell 2000). Terrestrial species in the Bruneau subbasin could be affected by a number of these factors, although specific research on road effects have not been conducted within the subbasin.

The life history of amphibians (e.g., Columbia spotted frog) entails migratory movements between wetland and upland habitats. Because they are inconspicuous and slow moving, they may be especially vulnerable to roadkill which can result in population fragmentation (Joly and Morand 1997). Roads may also serve to act as barriers to gene flow in amphibians, leading to significant genetic differentiation among populations (Reh and Seitz 1990). Mule deer in Colorado exhibited preference for areas >200 m from roads during the winter (Rost and Bailey 1979). Physiological responses of roads have been recorded in female bighorn sheep where heart rate increased near a road independent of the level of use (MacArthur et al. 1979). They inferred the increase in heart rate would lead to an increased metabolic rate and energy expenditure. In addition to species effects, roads may affect terrestrial habitats through the disruption of the physical environment (e.g. redirection of water, sediment, and nutrients between streams and wetlands), alteration of the chemical environment (e.g. contamination of soils and plants), and through the spread of exotic species (e.g. providing habitat by alteration of conditions) (Trombulak and Frissell 2000). Although the Bruneau subbasin is not a densely populated area, roads likely influence aquatic and terrestrial species and habitats.

Thirteen road-associated factors and their potential effects on terrestrial species are noted in Table 46 (Wisdom et al. 2000).

Table 46. 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 roads and road rights-of-way |
| Negative edge effects | Specific case of fragmentation for species that respond negatively to openings or linear edges created by roads |
| Overhunting | Nonsustainable or nondesired legal harvest by hunting as facilitated by road access |
| Overtrapping | 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 motorized vehicles running over or hitting animals on roads |
| Movement barriers | 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 |

# Interpretation and Synthesis

## 5.1 Subbasinwide Problem Statement

### 5.1.1 Aquatic

A final synthesis component is presented in Table 47, Table 48 and in Figure 45. The multi-species prioritization is based on the previous, species-specific QHA information, but identifies priority areas only in HUCs where species overlap occurs, and where there are common management prescriptions (*e.g.*, restoration *vs.* protection *vs.* protection/restoration actions). HUCs are ranked using the QHA-derived weighting assigned to the importance of each species' life history stage.

An inherent problem associated with this type of prioritization is the different distributions of the focal species. For example, redband trout are distributed throughout the subbasin (occurring in 56 sixth field HUCs) and overlap most areas where other focal species occur. Conversely, the two snail species have a very narrow distribution, and either dont occur with any of the other focal species (*e.g.,* Idaho springsnail) or only overlap redband migratory habitat (*e.g.,* Bruneau springsnail). Mountain whitefish represent a species distributed throughout middle-elevation portions of the subbasin, occurring with bull and redband trout, whereas bull trout represent a headwater species distributed only in eight sixth field HUCs. Therefore, the differences in species occurrence insert spatial bias when it comes to prioritization, which limits the utility of using the multi-species matrix to derive subbasin scale problem statements.

Based on the previous limiting factors analysis and the multi-species matrix, several common denominators emerge. First, when considering <u>where</u> and <u>which</u> management actions would prove most beneficial to multiple focal species, the Jarbidge watershed (East Fork and mainstem Jarbidge) represents the area with the greatest focal species overlap, within which habitat and population protection appears to be the dominant management theme (Table 47).

The occurrence of multiple species in this portion of the subbasin should not be surprising, as it represents an area characterized by comparatively cooler water temperatures, sufficient flows (due to higher mean annual precipitation), and a moderate degree of protection from land use influences (Jarbidge Wilderness occurs in headwater portions of HUCs 1602 and 1702). The management prescription of "protection" is similarly logical, as the Jarbidge watershed contains core populations of bull trout, stronghold redband populations, and well distributed mountain whitefish populations. Protection of mainstem Jarbidge habitats (*e.g.*, sixth field HUCs 1802 and 1801) is also important for the maintenance of connectivity between other portions of the subbasin, and is consistent with underlying themes of conservation biology (*e.g.*, Doppelt et al. 1993) and metapopulation theory (*e.g.,* Rieman and Dunham 1999).

Table 47. Sixth-field HUCs within which redband trout (RB), bull trout (BT), mountain whitefish (MW), and Bruneau springsnail (BS) co-occur and within which common restoration, protection, or protection/restoration activities have been defined. HUCs shown are not ranked in order of management action (*e.g.*, Restoration, Protection, Restore/Protect) priority. The Idaho springsnail does not occur with any other focal species, hence its exclusion.

| | RB, BT, MW | RB, MW | RB, BS | BT, MW |
|---|---|---|---|---|
| **Priority: Restoration** | Jarbidge 4 (1701) [2] | | | Jarbidge 5 (1702) |
| **Priority: Protection** | Jarbidge 3 (1501)[2]<br>EF Jarbidge 1 (1601) [2]<br>EF Jarbidge 2 (1602)<br>Jarbidge 2 (1801) [2]<br>Jarbidge 3 (1802) [2] | Bruneau 4 (0402)<br>Bruneau 11 (2101) | | |
| **Priority: Protection/Restoration** | | | Bruneau 2 (0102)[1]<br>Bruneau 3 (0401)[1] | Jarbidge 1 (2801) |

[1]/ Rule 1: If two species occur in the same HUC yet one has a “restore” action and the other has a “protect” action, then a “protect/restore” action is prescribed.
[2]/ Rule 2: If three species occur in the same HUC, the dominant management action dictates the final action prescription.

Table 48. Multi-species prioritization of restoration, protection, and protection/restoration activities in the Imnaha subbasin. HUC rankings are based on the revised QHA restoration values and QHA protection scores (presented above), and are further stratified based on the relative importance of life history stages[1] defined in the HUC. HUCs are prioritized based on the highest rank assigned. This prioritization effort should be used in combination with individual species prioritization (presented above).

| | Name | HUC_6 | Redband Trout | | | | Bull Trout | | | | Mtn. Whitefish | | | | Bruneau Springsnail | | | | Lifestage Score | Rank |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | S/I | SR | WR | M | S/I | SR | WR | M | S/I | SR | WR | M | S/I | SR | WR | M | | |
| Priority: Restoration | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| | Jarbidge 5 | 1702 | 1.3 | 1.3 | 1.3 | 1 | 1 | 1.5 | 1.5 | 1.7 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 14.8 | 1 |
| | Jarbidge 4 | 1701 | 2 | 2 | 2 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 14.0 | 2 |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| Priority: Protection | E.Frk Jarbidge 2 | 1602 | 1.3 | 1.3 | 1.3 | 1.0 | 1.2 | 1.2 | 1.2 | 2.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14.6 | 1 |
| | E. Frk Jarbidge 1 | 1601 | 2.0 | 2.0 | 2.0 | 1.0 | 0.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14.0 | 2 |
| | Jarbidge 3 | 1501 | 2.0 | 2.0 | 2.0 | 1.0 | 0.0 | 1.0 | 1.0 | 1.0 | 0.0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12.0 | 3 |
| | Jarbidge 3 | 1802 | 1.3 | 1.3 | 1.3 | 1.0 | 0.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12.0 | 3 |
| | Bruneau 11 | 2101 | 1.5 | 2.0 | 2.0 | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 11.5 | 5 |
| | Jarbidge 2 | 1801 | 1.3 | 1.3 | 1.3 | 1.0 | 0.0 | 1.0 | 1.0 | 1.0 | 0.0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 10.0 | 6 |
| | Bruneau 4 | 0402 | 0.0 | 1.0 | 1.0 | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 1.0 | 1.3 | 0.0 | 0.0 | 0.0 | 0.0 | 7.3 | 7 |
| Priority: Protect/Restore | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| | Jarbidge 1 | 2801 | 1.0 | 1.2 | 1.2 | 1.0 | 0.0 | 1.0 | 1.0 | 1.0 | 0.0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9.3 | 1 |
| | Bruneau 2 | 0102 | 0.0 | 0.8 | 0.8 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 | 2.0 | 2.0 | 0.0 | 8.5 | 2 |
| | Bruneau 3 | 0401 | 0.0 | 1.0 | 1.0 | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.0 | 3 |
| | | | | | | | | | | | | | | | | | | | | |

[1]/ Life history stages include spawning/incubation (S/I), summer rearing (SR), winter rearing (WR), and migration (M)

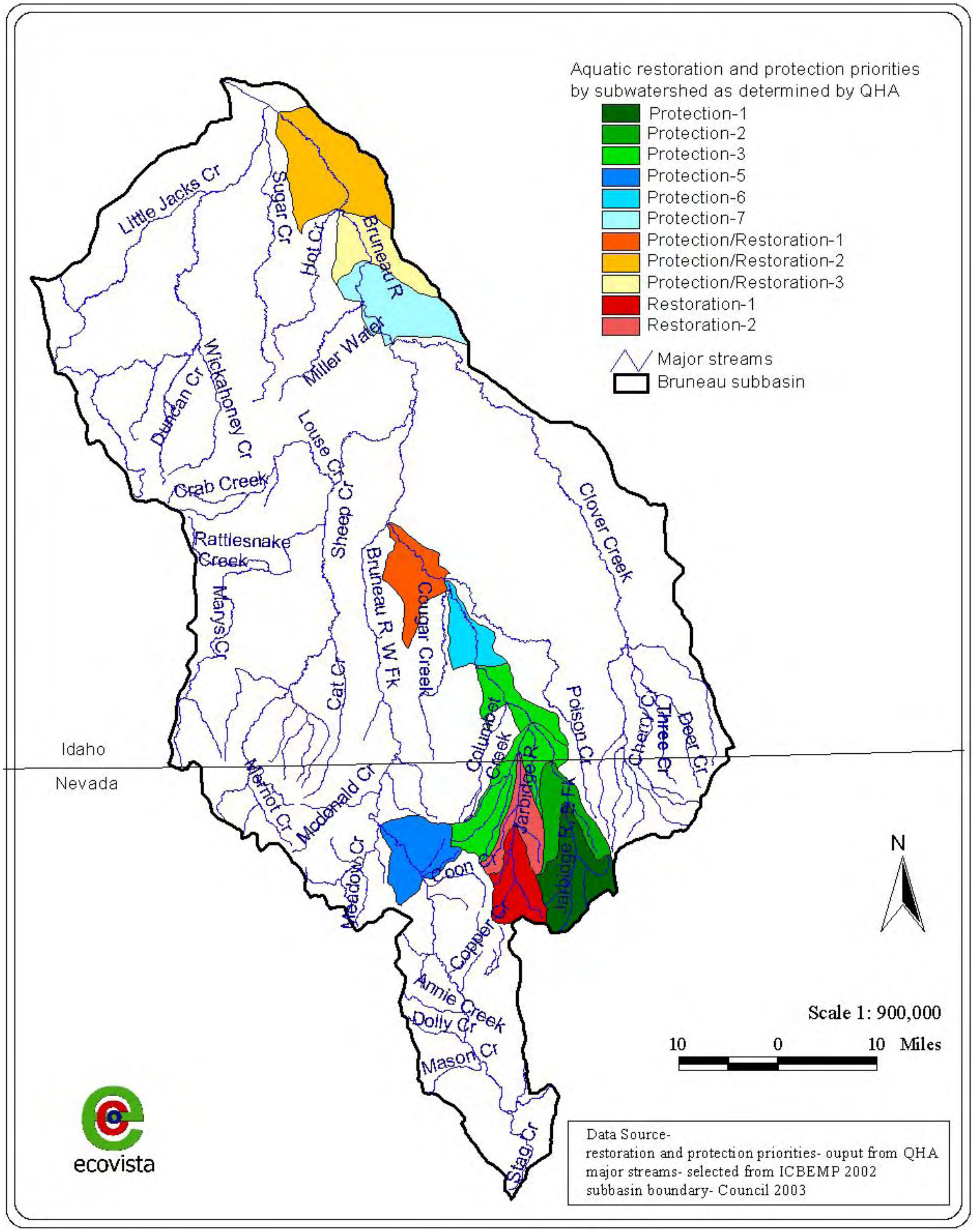


Figure 45. Multi-species representation of restoration, protection, and protection/restoration areas in the Bruneau subbasin.

Despite its apparent “Properly Functioning Condition,” portions of the Jarbidge watershed are in need of restoration. As shown in Figure 45, sixth field HUCs 1701 and 1702 were determined (based on QHA analyses) to be areas in the subbasin where restoration efforts would most benefit multiple focal species. Although it is somewhat surprising that HUC 1702 surfaced as one in need of restoration (based on its partial wilderness designation), it’s proximity to core bull trout habitat supports the theory of “building out from areas of strength,” which is one of the key considerations in conservation biology (Doppelt et al 1993). It is also logical to have restoration activities occurring in headwater reaches, as the benefits will most likely extend to downriver reaches.

Protection of core bull and redband trout habitat is defined a high priority in the upper reaches of the EF Jarbidge (*e.g.*, HUCs 1501, 1601 and 1602), as well as throughout the middle portions of the Jarbidge migratory corridor. Protection of these areas would provide a degree of connectivity between the core habitat portion of the subbasin and the less stable habitat occurring elsewhere. HUC 2801 is defined as a “protect and restore” HUC, which is appropriate since it contains the confluence reach of the Jarbidge River, a segment of stream that could stand improvement while equally warrant protection from further degradation.

Protection/restoration designations are also shown in Bruneau 3 and Bruneau 2 (HUCs 0102 and 0401), two HUCs occurring just upstream from the confluence of the Bruneau and Snake Rivers. The designations are due to co-occurrence of the Bruneau hot springsnail and redband trout. Because of the reservoir, certain restoration activities commonly applied in lotic systems would obviously not be applicable, however protection of unique resources (*e.g.*, groundwater discharge) found in these areas is critical for the continued persistence of the Bruneau hot springsnail.

### 5.1.2 Terrestrial

Following the development of focal habitats, species, and their limiting factors by the Bruneau Terrestrial Technical Team, expert field biologists performed a qualitative spatial analysis of terrestrial limiting factors of the Bruneau subbasin (Jerry Deal and Mike McDonald, Idaho Fish and Game; Jeff Beck, University of Idaho). For the analysis, thirteen terrestrial regions (Figure 46) were delineated within the Bruneau subbasin by merging 5th field HUCs that contained similar vegetation types. Vegetation types are based on satellite imagery derived maps of Wildlife Habitat Types developed by the Northwest Habitat Institute (NHI) for use in the subbasin planning process (Figure 31). Riparian and wetland habitats were under represented in NHI's mapping results, but they were added to each of the terrestrial regions because of their importance.

The eight limiting factors (see section 4.2) the Bruneau Terrestrial Technical Team identified to be most prominent in focal habitats were qualitatively ranked (Table 49) by focal habitat type in each terrestrial region.

Table 49. Description of ranks used in the qualitative spatial analysis of limiting factors in the Bruneau subbasin.

| Rank | Influence |
|---|---|
| 1 | Slight to none |
| 2 | Intermediate |
| 3 | Moderate |
| 4 | Moderate to severe |
| 5 | Severe and/or extensive |

A resulting rank of limiting factors identified as most influential within the Bruneau subbasin (Table 50) was provided to serve in the development of the Bruneau Management Plan. In addition to the limiting factors ranking, a spatial summary of the influence of individual limiting factors within terrestrial groups (Table 51) and an overall average influence of limiting factors by group (Table 52) were provided by this qualitative spatial analysis.

Grazing, invasive exotic plant species, and increased fire frequency and intensity were identified as the top three factors limiting focal habitats and species of the Bruneau subbasin. This analysis is not statistical which precludes interpretation of significant differences between limiting factors or terrestrial regions. No monitoring data were available that would allow such an analysis. These results are corroborated by local experts and peer reviewed literature on these limiting factors in other regions and are intended to guide the development of the objectives and strategies of the Bruneau Management Plan. Because this is an iterative process, the relative ranks of the limiting factors and terrestrial groups should be reevaluated and updated through the adaptive management process.

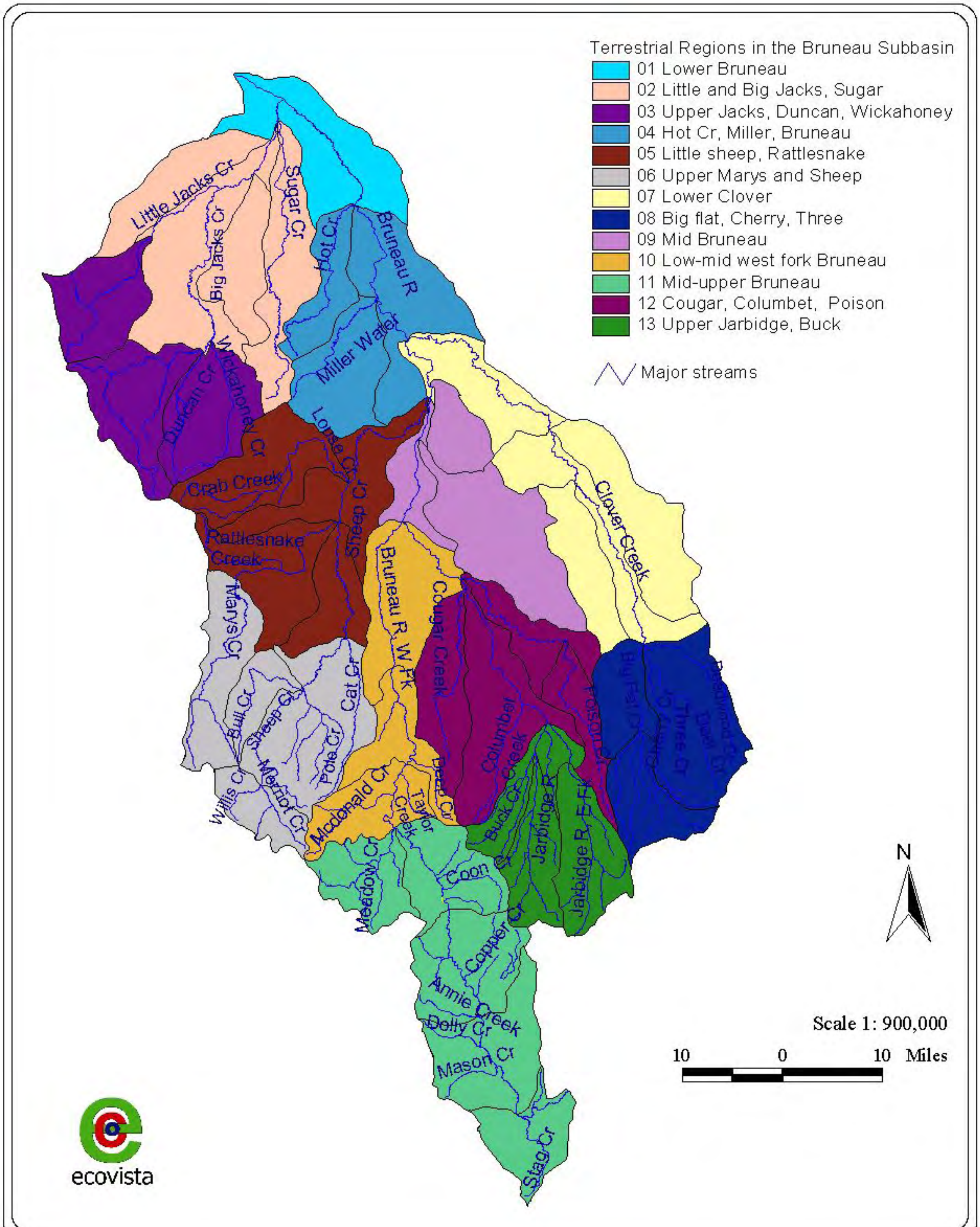


Figure 46. Terrestrial regions of the Bruneau subbasin

Table 50. Qualitative assessment of limiting factors by focal habitat type in the Bruneau subbasin. Limiting factors were ranked on a scale of 1 to 5, with 5 representing the most extensive prevalence of a limiting factor in a focal habitat.

| **Focal Habitat Type** | **Influence of Limiting Factor →** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Grazing** | **Invasive Exotics** | **Increased Fire** | **Crested Wheatgrass** | **Noise** | **Land-Use Conversion** | **Water Use** | **Decreased Fire** | **Roads** |
| Upland aspen | 3.1 | 2.1 | 2.4 | 1.9 | 1.7 | 1.0 | 1.0 | 4.0 | 1.3 |
| Shrub steppe | 3.9 | 3.9 | 3.8 | 3.9 | 2.7 | 1.4 | 1.0 | - | 1.4 |
| Dwarf shrub steppe | 3.7 | 3.8 | 3.8 | 3.6 | 2.5 | 1.3 | 1.0 | - | 1.4 |
| Riparian, wetland, spring | 4.3 | 2.6 | 1.7 | 0.9 | 2.3 | 2.6 | 4.6 | - | 1.0 |
| Western juniper | 2.5 | 2.7 | 1.0 | 0.5 | 1.0 | 1.0 | 1.0 | 1.5 | 1.0 |
| Desert playa | 3.7 | 4.3 | 3.3 | 3.0 | 3.0 | 2.3 | 1.0 | - | 1.2 |
| Montane Conifer Forest | 2.0 | 1.0 | - | 0.5 | 1.0 | 1.0 | 1.0 | 3.5 | 1.0 |

Table 51. Summary of limiting factors by terrestrial groups in the Bruneau subbasin. Limiting factors were ranked on a scale of 1 to 5, with 5 representing the most extensive prevalence of a limiting factor in a terrestrial group. Blank cell values indicate the limiting factor is not currently a threat within that terrestrial region.

| Terrestrial Group | Major Streams in Terrestrial Group | Grazing | Invasive Exotics | Increased Fire | Crested Wheatgrass | Noise | Land Use Conversion | Water Use | Decreased Fire | Roads |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | lower Bruneau | 3.7 | 3.7 | 3.7 | 3.0 | - | 3.0 | - | - | 1.0 |
| 2 | lower Little Jacks, lower Big Jacks, Sugar | 3.5 | 5.0 | 3.5 | 3.0 | - | 3.5 | - | - | 1.0 |
| 3 | upper Little Jacks, upper Big Jacks, Duncan, Wickahoney | 3.5 | 3.0 | 3.0 | 3.0 | - | 1.0 | - | - | 1.0 |
| 4 | lower Sheep, Louse, Crab, Rattlesnake, lower Mary’s | 3.7 | 3.0 | 4.0 | - | - | 1.0 | - | - | 1.0 |
| 5 | upper Mary’s, Bull Creek, upper Sheep Creek, Pole Creek, Cat Creek | 3.0 | 3.0 | 3.0 | - | - | 1.0 | - | - | 1.0 |
| 6 | Hot Creek, Miller Water, Bruneau | 5.0 | 4.4 | 3.5 | 2.8 | 3.0 | 1.0 | 2.0 | - | 1.4 |
| 7 | lower Clover and tributaries | 4.7 | 3.7 | 3.3 | 3.3 | 3.7 | 1.7 | 2.3 | - | 1.7 |
| 8 | Big Flat, Cherry, Three, Deadwood | 4.5 | 2.3 | 3.8 | 2.5 | 1.0 | 2.0 | 2.0 | - | 1.8 |

| Terrestrial Group | Major Streams in Terrestrial Group | Grazing | Invasive Exotics | Increased Fire | Crested Wheatgrass | Noise | Land Use Conversion | Water Use | Decreased Fire | Roads |
|---|---|---|---|---|---|---|---|---|---|---|
| 9 | middle Bruneau and tributaries | - | - | - | - | - | - | - | - | - |
| 10 | West Fork Bruneau, Taylor Deep, McDonald | - | - | - | - | - | - | - | - | - |
| 11 | upper West Fork Bruneau, Annie, Coon, Copper, Meadow | 3.0 | 3.0 | 1.0 | 5.0 | - | 1.0 | - | - | 1.0 |
| 12 | Cougar, Columbet, Poison | 3.9 | 3.1 | 2.1 | 2.8 | 3.0 | 1.5 | 2.0 | - | 1.4 |
| 13 | upper Jarbidge, Buck, East Fork Jarbidge | 2.8 | 1.6 | 2.5 | 1.0 | 1.2 | 1.8 | 1.4 | 3.0 | 1.3 |

Table 52. Qualitative assessment of limiting factors in the Bruneau subbasin. Ratings were pooled across limiting factors within each area to rank overall influence of human impacts by watershed group. No ratings were obtained for watershed groups 9 and 10.

| **Overall influence of limiting factors (highest → least)** | **Watershed Group** | **Major Streams** | **Average Rating** |
|---|---|---|---|
| 1 | 2 | lower Little Jacks, lower Big Jacks, Sugar | 3.3 |
| 2 | 7 | lower Clover and tributaries | 3.0 |
| 3 | 1 | lower Bruneau | 3.0 |
| 4 | 6 | Hot Creek, Miller Water, Bruneau | 2.9 |
| 5 | 8 | Big Flat, Cherry, Three, Deadwood | 2.5 |
| 6 | 12 | Cougar, Columbet, Poison | 2.5 |
| 7 | 4 | lower Sheep, Louse, Crab, Rattlesnake, lower Mary’s | 2.4 |
| 8 | 3 | upper Little Jacks, upper Big Jacks, Duncan, Wickahoney | 2.3 |
| 9 | 5 | upper Mary’s, Bull Creek, upper Sheep Creek, Pole Creek, Cat Creek | 2.1 |
| 10 | 11 | upper West Fork Bruneau, Annie, Coon, Copper, Meadow | 2.0 |
| 11 | 13 | upper Jarbidge, Buck, East Fork Jarbidge | 1.8 |
| ? | 9 | middle Bruneau and tributaries | N/A |
| ? | 10 | West Fork Bruneau, Taylor Deep, McDonald | N/A |

# 6 References

Allen, D. B, B. J. Flatter, and K. Fite. 1996. Redband Trout (*Oncorhynchus mykiss gairdneri*) Population and Habitat Surveys in Southern Owyhee County, Idaho. Idaho Department of Fish and Game. Idaho Bureau of Land Management Technical Bulletin No. 2001-2.

Allen, D. B., B. J. Flatter, and K. Fite. 1995. Redband Trout (*Oncorhynchus mykiss gairdneri*) Population and Habitat Surveys in Jump, Reynolds, and Sheep Creeks, and Sections of the Owyhee County, Idaho. Idaho Bureau of Land Management Technical Bulletin No. 95-6.

American Ornithologists' Union. 1957. Check-list of North American Birds. 5th edition. American Ornithological Union, Washington, DC.

Anderson, A. E., and O. C. Wallmo. 1984. *Odocoileus hemionus*. Mammalian Species **219**:1–9.

Aubry, K. B., Koehler, G. M., and J. R. Squires. 2000. Ecology of Canada Lynx in Southern Boreal Forests. In: L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, G. M. Koehler, C. J. Krebs, K. S. McKelvey, and J. R. Squires. Ecology and Conservation of Lynx in the United States. University Press of Colorado and U.S. Department of Agriculture, Rocky Mountain Research Station. p. 373–396.

Bailey, V. 1936. The Mammals and Life Zones of Oregon. North American Fauna No. 55. 416 pp.

Barbour, R. W., and W. H. Davis. 1969. Bats of America. University Press of Kentucky, Lexington. 286 pp.

Bat Conservation International, Inc. 2003. Website. <http://www.batcon.org/discover/species/emacula.html)>.

Batt, P. E. 1996. Governor Philip E. Batt's State of Idaho Bull Trout Conservation Plan. Boise, ID.

Behnke, R. J. 1992. Native Trout of Western North America. American Fisheries Society, Bethesda, MD.

Benedict, N. G., S. J. Oyler-McCance, S. E. Taylor, C. E. Braun, and T. W. Quinn. 2003. Evaluation of the Eastern (*Centrocercus urophasianus urophasianus*) and Western (*Centrocercus urophasianus phaios*) Subspecies of Sage-Grouse Using Mitochondrial Control-Region Sequence Data. Conservation Genetics **4**:301–310.

Berenbrock, C. 1993. Effects of well discharges on hydraulic heads in spring discharges from the geothermal aquifer system in the Bruneau area, Owyhee County, Southwestern Idaho. Water Resoources Investigations, U. S. Geological Survey.

Bjornn, T. C. and Reiser, D. W. (1991). Habitat Requirements of Salmonids in Streams. In: Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. M.

R. Meehan, Ed. Bethesda, MD: American Fisheries Society Special Publications, pp. 83-138.

Blair, C. 1997. C.J. Strike Habitat Evaluation Procedure Study. Technical Report E.3.2.-N. In: 1998. Technical Appendices for C.J. Strike Hydroelectric Project (FERC Project No. 2055). Volume 3. Prepared for Idaho Power Company, Boise, ID.

Bodie, W. L., E. Taylor, M. McCoy, and D. E. Toweill. 1990. Status and Distribution of California Bighorn Sheep in Idaho. In: J. A. Bailey, editor. Proceedings of the Biennial Symposium of the Northern Wild Sheep Council. Clarkston, WA. p. 12–18.

Bos, D. H., and J. W. Sites, Jr. 2001. Phylogeography and Conservation Genetics of the Columbia Spotted Frog (*Rana luteiventris*; Amphibia, Ranidae). Molecular Ecology **10**:1499–1513.

Bowens, J., Rasmussen, A., and R. Banner. 2003. Fourwing Saltbush. Utah State University Extension Service, Logan, UT. Available at <http://extension.usu.edu/rangeplants/Woody/fourwingsaltbush.htm>.

Buehler, D. A. 2000. Bald Eagle: *Haliaeetus leucocephalus*. In: A. Poole and F. Gill, editors. The Birds of North America, No. 506. The Birds of North America, Inc., Philadelphia, PA.

Bureau of Land Management (BLM). 1987. Jarbidge Resource Management Plan Record of Decision. U.S. Department of Interior, BLM, Boise District, ID.

Bureau of Land Management (BLM). 1989. Jacks Creek Wilderness Environmental Impact Statement. Final. U.S. Department of the Interior, BLM, Boise District, ID.

Bureau of Land Management (BLM). 1997. Castle Creek Allotment Analysis, Interpretation, and Evaluation. Bruneau Resource Area. U.S. Department of the Interior, BLM, Lower Snake River District.

Bureau of Land Management (BLM). 1998. Draft Southeast Oregon Resource Management Plan/Environmental Impact Statement. Volumes 1–2. U.S. Department of the Interior, BLM, Vale District Office, Vale, OR.

Bureau of Land Management (BLM). 1999. Proposed Owyhee Resource Management Plan and Final Environmental Impact Statement. 3 volumes. Lower Snake River District. Boise, Idaho.

Bureau of Land Management (BLM). 2000. Environmental Assessment: Northwest Allotment Grazing Permit Issuance and Modifications and Associated Range Projects. U.S. Department of the Interior, BLM, Owyhee Field Office, Boise, ID.

Bureau of Land Management (BLM). 2001a. Website. <http://www.id.blm.gov/information/brujar/index.htm>. Accessed October 17, 2001.

Bureau of Land Management (BLM). 2003b. Idaho Bureau of Land Management (BLM) Sensitive Species List. Memorandum No. ID-2003-057. U.S. Department of the Interior, BLM.

Bureau of Land Management (BLM). 1999a. Proposed Owyhee Resource Management Plan and Final Environmental Impact Statement. 3 volumes. U.S. Department of the Interior, BLM, Lower Snake River District, Boise, ID.

Bureau of Land Management (BLM). 2001b. GIS layers provide in support of the Bruneau subbasin summary by the Elko District of the BLM.

Bureau of Outdoor Recreation. 1977. Wild and Scenic River Recommendation: Bruneau River, Idaho. House Document No. 95-164, Part V.

Burleigh, T. D. 1972. Birds of Idaho. Caxton Printing, Ltd., Caldwell, ID.

Burton, T. J. Klott, and B. Zoellick. 2001. Project Title: Bull trout habitat restoration/protection program–Bruneau subbasin. BPA FY 2002 Provincial Project Review. Project #32007.

Busby, P. J.; Wainwright, T. C.; Bryant, G. J.; Lierheimer, L. J.; Waples, R. S.; Waknitz, F. W. and Lagomarsino, I. V. (1996). *Status Review of West Coat Steelhead from Washington, Idaho, Oregon, and California*. Seattle: National Marine Fisheries Service.

Buskirk, S. W., L. F. Ruggiero, and C. J. Krebs. 2000. Habitat Fragmentation and Interspecific Competition: Implications for Lynx Conservation. In: L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, G. M. Koehler, C. J. Krebs, K. S. McKelvey, and J. R. Squires, editors. Ecology and Conservation of Lynx in the United States. University Press of Colorado and U.S. Department of Agriculture, Rocky Mountain Research Station. p. 83–100.

Caswell, J., S. Huffaker, W. Wiggins, J. Kane, T. Hoffman, R. Baker, and K. L. Bennett. 2003. Candidate Conservation Agreement for Slickspot Peppergrass (*Lepidium papilliferum*). Available at <http://www.idahoes.fws.gov/LEPA.htm>.

CH2M HILL. 2003. Integrated Natural Resource Management Plan. CH2M HILL, Boise, ID. Prepared for Mountain Home Air Force Base. 169 pp.

Chandler, J. A. 2001. Feasibility of Reintroduction of Anadromous Fish Above or Within the Hells Canyon Complex. Idaho Power Corp. Technical Report, Appendix E.3.1-2

Chaney, E., W. Elmore, and W. S. Platts. 1993. Livestock Grazing on Western Riparian Areas. Northwest Resource Information Center. Prepared for U.S. Environmental Protection Agency.

Chapman, J. A., and J. E. C. Flux. 1990. Introduction and Overview of the Lagomorphs. In: J. A. Chapman and J. E. C. Flux, editors. Rabbits, Hares and Pikas: Status Survey and Conservation Action Plan. IUCN, Gland, Switzerland and Information Press, Oxford, UK. p. 1–6.

Connelly, J. W., Reese, K. P., Wakkinen, W. L., Robertson, M. D., and R. A. Fischer. 1994. Sage Grouse Ecology. Job Completion Report W-160-R-19, Subproject 9. Idaho Department of Fish and Game, Boise, ID.

Connelly, J. W., Schroeder, M. A., Sands, A. R., and Braun, C. E. 2000. Guidelines to Manage Sage Grouse Populations and Their Habitats. Wildlife Society Bulletin **28(4)**:967–985.

Cowan, I. M. 1940. Distribution and Variation in the Native Sheep of North America. American Midland Naturalist **24(3)**:505–580.

Cox, M., G. Tanner, M. Dobel, L. Gilbertson, J. Himes, S. Stiver, R. Woolstenhulme, and D. Carter. 2003. Nevada Division of Wildlife 2002–2003 Big Game Status. Nevada Division of Wildlife, Reno, NV. 122 pp.

Crawford, R. C., and J. Kagan. 2001a. Upland Aspen Forest. In: D. H. Johnson and T. A. O'Neil, editors. Wildlife–Habitat Relationships in Oregon and Washington. Oregon State University Press, Corvallis, OR. p. 37–38.

Crawford, R. C., and J. Kagan. 2001b. Shrub-Steppe. In: D. H. Johnson and T. A. O'Neil, editors. Wildlife–Habitat Relationships in Oregon and Washington. Oregon State University Press, Corvallis, OR. p. 50–51.

Crawford, R. C., and J. Kagan. 2001c. Eastside Riparian-Wetlands. In: D. H. Johnson and T. A. O'Neil, editors. Wildlife–Habitat Relationships in Oregon and Washington. Oregon State University Press, Corvallis, OR. p. 98-100.

Crawford, R. C., and J. Kagan. 2001d. Western Juniper and Mountain Mahogany Woodlands. In: D. H. Johnson and T. A. O'Neil, editors. Wildlife–habitat Relationships in Oregon and Washington. Oregon State University Press, Corvallis, OR. p. 45–46.

Crawford, R. C., and J. Kagan. 2001e. Desert playa and salt scrub shrublands. In: D. H. Johnson and T. A. O'Neil, editors. Wildlife–habitat relationships in Oregon and Washington. Oregon State University Press, Corvallis, OR. p. 53–54.

Crenshaw, J., J. Rachael, J. Rohlman, R. Smith, D. Meints, J. Naderman, and T. Keegan. 2003. Bighorn Sheep: Study I, Job 4; July 1, 2002–June 30, 2003. Edited by D. Toweill. IDFG Progress Report Project W-170-R-27. Idaho Department of Fish and Game, Boise, ID.

DeByle, N. V., and R. P. Winokur, editors. 1985. Aspen: Ecology and Management in the Western United States. U. S. Forest Service, General Technical Report RM-119. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.

DeWeese, L. R., L. C. McEwen, G. L. Hensler, and B. E. Petersen. 1986. Organochlorine contaminats in Passeriformes and other avian prey of the Peregrine Falcon in the Western United States. Environmental Toxicology and Chemistry **5**:675-693.

Dobkin, D. S., A. C. Rich, and W. H. Pyle. 1998. Habitat and Avifaunal Recovery from Livestock Grazing in a Riparian Meadow System of the Northwestern Great Basin. Conservation Biology **12**:209–221.

Dobler, F. C., and K. R. Dixon. 1990. The Pygmy Rabbit *Brachylagus idahoensis*. In: J. A. Chapman and J. E. C. Flux, editors. Rabbits, Hares and Pikas: Status Survey and Conservation Action Plan. IUCN, Gland, Switzerland and Information Press, Oxford, UK. p. 111–115.

Doering, R. W., and B. L. Keller. 1998. A Survey of Bat Species of the Bruneau–Jarbidge River Area of Southwestern Idaho with Special Reference to the Occurrence of the Spotted Bat (*Euderma maculatum*). Idaho Bureau of Land Management Technical Bulletin No. 98-18.

Doppelt, B.; Scurlock, M.; Frissel, C. and Karr, J. (1993). Entering the Watershed: A New Approach to Save America's Ecosystems. Covelo, CA: Island Press.

Drewek, J., Jr. 1970. Population Characteristics and Behavior of Introduced Bighorn Sheep in Owyhee County, Idaho. M.S. Thesis. University of Idaho, Moscow, ID. 46 pp.

Engle, J. C., and J. C. Munger. 1998. Population Structure of Spotted Frogs in the Owyhee Mountains. Technical Bulletin 98-20. Idaho Bureau of Land Management.

Engle, J. C., and J. C. Munger. 2003. Population Fragmentation of Spotted Frogs in the Owyhee mountains. Technical Bulletin No. 03-8. Idaho Bureau of Land Management.

Environmental Systems Research Institute, Inc. (ESRI). 2000. ESRI Data and Maps CDs. Redlands, CA.

Fenton, M. B., D. C. Tennant, and J. Wyszecki. 1987. Using Echolocation Calls to Measure the Distribution of Bats: The Case of *Euderma maculatum*. Journal of Mammalogy **68**:142–144.

Fisher, H., L. Eslick, and M. Seyfried. 1996. Edaphic Factors That Characterize the Distribution of *Lepidium papilliferum*. Technical Bulletin No. 96-6. Idaho Bureau of Land Management.

Fleischner, T. L. 1994. Ecological Costs of Livestock Grazing in Western North America. Conservation Biology **8**:629–644.

Gerber, M. F., J. C. Munger, A. Ames, and J. Stewart. 1997. Reptiles and Amphibians in Deep Canyons: The Big Jacks and Little Jacks Creek Drainages of Owyhee County, Idaho. Technical Bulletin No. 97-1. Idaho Bureau of Land Management.

Gheen, Levi. 1875. Correspondence to Smith 11-10-1875. San Mateo Archives, M-234, 541.

Gilligan, J., M. Smith, D. Rogers, and A. Contreras. 1994. Birds of Oregon. Cinclus Publishers, McMinnville, OR.

Green, D. M., H. Kaiser, T. F. Sharbel, J. Kearsley, and K. R. McAllister. 1997. Cryptic Species of Spotted Frogs, *Rana pretiosa* Complex, in Western North America. Copeia 1997**(1)**:1–8.

Green, J. S., and J. T. Flinders. 1980. *Brachylagus idahoensis*. Mammalian Species **125**:1–4.

Hall, R. E. 1946. Mammals of Nevada. University of California Berkeley Press, Berkeley, California. 710 pp.

Hanna, P., and M. Rath. 1976. A Successful Bighorn Sheep Reestablishment Program in Southwestern Idaho. In: E. T. Thorne, editor. Proceedings of the Biennial Symposium of the Northern Wild Sheep Council. Wyoming Game and Fish Department, Cheyenne, WY. p. 56–69.

Harp, A.J., N.R. Rimbey and T.D. Darden. 2001. Cohesion, Integration and Attachement in Owyhee County Communties. Paper presented at Annual Meeting of the Society for Range Management, Kailua-Kona, Hawaii, February 17-23, 2001.

Harris, J. H., S. D. Sanders, and M. A. Flett. 1987. Willow Flycatcher Surveys in the Sierra Nevada. Western Birds **18**:27–36.

Hayden, J., D. Spicer, J. Crenshaw, D. Koehler, J. Rachael, R. Smith, B. Palmer, C. Anderson, D. Meints, J. Short, and T. Keegan. 2003. Mule Deer Study I, Job 2: July 1, 2002, to June 30, 2003. Edited by B. Compton. Project W-170-R-27 Progress Report. Idaho Department of Fish and Game, Boise, ID.

Henny, C. J., and G. B. Herron. 1989. DDE, Selenium, Mercury, and White-Faced Ibis Reproduction at Carson Lake, Nevada. Journal of Wildlife Management **53**:1032–1045.

Herman, S. G., J. B. Bulger, and J. B. Buchanan. 1988. The Snowy Plover in Southeastern Oregon and Western Nevada. Journal of Field Ornithology **59**:13–21.

Hershler, R. H. 1990. *Pyrgulopsis bruneauensis*, a new springsnail (Gastropoda: Hrdrobiidae) from the Snake River Pln, Southern Idaho. Proceedings of the Biological Society of Washington. 103:803-814.

Hershler, R., and H. P. Liu. 2004. Taxonomic reappraisal of species assigned to the North American freshwater gastropod subgenus *Natricola* (Rissooidea: Hydrobiidae). The Veliger 47:66-81.

Hughes, J. M. 1999. Yellow-Billed Cuckoo: *Coccyzus americanus*. In: A. Poole and F. Gill, editors. The Birds of North America, No. 418. The Birds of North America, Inc., Philadelphia, PA.

Hunter, M. L., G. L. Jacobson Jr., and T. Webb III. 1998. Paleoecology and the coarse filter approach to maintaining biological diversity. Conservation Biology 7:420-423.

IBIS. 2003. Interactive Biodiversity Information System. Available at <http://ibis.nwhi.org>. Northwest Habitat Institute, Corvallis, OR.

Idaho Conservation Data Center (IDCDC). 2001. Element Occurrence Data in Arc/Info GIS format

Idaho Conservation Data Center (IDCDC). 2003. Website. <http://www2.state.id.us/fishgame/info/cdc/cdc.htm>.

Idaho Department of Commerce (IDOC). 2003. County Profiles. Available at <http://www.idoc.state.id.us/idcomm/profiles/>. Accessed October 2003.

Idaho Department of Environmental Quality (IDEQ). 2003. Streams for Idaho (303(d) Impaired 1998) GIS Layer http://www.insideidaho.org/data/statewide/ideq/

Idaho Department of Fish and Game (IDFG), Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, U.S. Forest Service, Bureau of Land Management, and Foundation of North American Wild Sheep. 1997. Restoration of the Bighorn Sheep to Hells Canyon, The Hells Canyon Initative. Technical Bulletin No. 97-14. Idaho Bureau of Land Management.

Idaho Department of Fish and Game (IDFG). 1995. Statewide Technical Assistance. Job Performance Report Project FW-7-T-2.

Idaho Department of Fish and Game (IDFG). 2002. Unpublished Records in Idaho Fish and Wildlife Information System (IFWIS) (46756). IDFG, Boise, ID.

Idaho Department of Fish and Game (IDFG). 2003a. Query of License Database: 2002 by County. Joe Kelly, IDFG. October 27.

Idaho Department of Fish and Game (IDFG). 2003b. Website. <http://www2.state.id.us/fishgame/index.htm>.

Idaho Department of Fish and Game (IDFG). 2003c. Unpublished GIS data. Contact Boise Office for more information

Idaho Department of Water Resources. 1992. Analysis of management alternatives and potential impacts on ground-water development due to proposed endangered species classification of the Bruneau Hot Springs Snail. Final Report to U. S. Fish and Wildlife Service. 145pp.

Idaho Soil Conservation Commission. 2002. Bruneau River Watershed Agricultural TMDL Implementation Plan. June 4, 2002 Draft.

Independent Economic Analysis Board. 2003. Recommendations and Guidance for Economic Analysis in Subbasin Planning.

Interior Columbia Basin Ecosystem Management Project (ICBEMP). 1997. Response on Centers of Endemism, Rarity, and Biodiversity and Hotspots by the Terrestrial Ecology Assessment Staff. Available at <http://www.icbemp.gov/spatial/metadata/aux_pdf/hotspots.pdf>. Accessed September 2003.

Interior Columbia Basin Ecosystem Management Project (ICBEMP). 2002. Spatial Data. Availalble at www.ICBEMP.gov

Jarbidge Sage Grouse Working Group (JSGWG). 2001. Draft Sage Grouse Management Plan. Rough Draft.

Jarbidge Sage Grouse Working Group (JSGWG). 2002. Jarbidge Area Sage Grouse Conservation Plan.

Johnson, G. L. 1999. The Status of The Bull Trout in Nevada. Nevada Department of Conservation and Natural Resources, Division of Wildlife, Reno, NV.

Joly, P., and A. Morand. 1997. Amphibian diversity and land-water ecotones. Pages 161-182 in J. P. Bravard and R. Juge, editors. Biodiversity in land-water ecotones. Man and biosphere series. Volume 18. United Nations Educational, Scientific and Cultural Organization, Paris.

Kauffman, J. B., and W. C. Krueger. 1984. Livestock Impacts on Riparian Ecosystems and Streamside Management Implications: A Review. Journal of Range Management **37**(5):430–438.

Keane, R. E., K. C. Ryan, T. T. Veblen, C. D. Allen, J. Logan, and B. Hawkes. 2002. Cascading Effects of Fire Exclusion in Rocky Mountain Ecosystems: A Literature Review. General Technical Report RMRS GTR-91. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Klott, J. 1996. Sensitive Animals of the Jarbidge Resource Area, Idaho. Technical Bulletin No. 96-10. Idaho Bureau of Land Management.

Klott, J. 1997. Sensitive Animals of the Jarbidge Resource Area, Idaho—Additions. Technical Bulletin No. 97-5. Idaho Bureau of Land Management.

Knick, S. T., and D. S. Rotenberry. 1995. Landscape Characteristics of Fragmented Shrubsteppe Habitats and Breeding Passerine Birds. Conservation Biology **9**:1059–1071.

Knick, S. T., D. S. Dobkin, J. T. Rotenberry, M. A. Schroeder, W. M. Vander Haegen, and C. van Riper, III. 2003. Teetering on the Edge or Too Late? Conservation and Research Issues for Avifauna of Sagebrush Habitats. Condor **105**:611–634.

Lay, C. H., and Idaho Department of Environmental Quality (IDEQ). 2000. Bruneau Subbasin Assessment and Total Maximum Daily Loads of the §303(d) Water Bodies: USEPA Submittal Draft. Idaho Department of Environmental Quality, State Office, Boise, ID.

Laymon, S. A. 1980. Feeding and nesting behavior of the Yellow-billed Cuckoo in the Sacramento Valley. Wildl. Manage. Admin. Rep. 80-2, Calif. Dept. Fish and Wildlife, Sacramento.

Leary, R. F., F. W. Allendorf, and K. L. Knudsen. 1983. Genetic Analysis of Four Rainbow Trout Populations from Owyhee County, Idaho. Population Genetics Lab Report 83/6.

Littlefield, C. R. 1990. Birds of Malheur National Wildlife Refuge, Oregon. Oregon State University Press, Corvallis, OR.

Lowther, P. E., C. Celada, N. K. Klein, C. C. Rimmer, and D. A. Spector. 1999. Yellow warbler: *Dendroica petechia.* In: A. Poole and F. Gill, editors. The Birds of North America, No. 454. The Birds of North America, Inc., Philadelphia, PA.

Lysne, S. 2003. Annual monitoring report on the Bruneau hot springsnail. U. S. Fish and Wildlife Service Snake River Fish and Wildlife Office, Boise, Idaho.

MacArthur, R. A., R. H. Johnston, and V. Geist. 1979. Factors influencing heart rate in free ranging bighorn sheep: a physiological approach to the study of wildlife harassment. Canadian Journal of Zoology 57:2010-2021.

Mancuso, M. 2000. Monitoring habitat integrity for *Lepidium papilliferum* (Slickspot Peppergrass): 1999 results. Idaho Department of Fish and Game, Idaho Conservation Data Center, Boise, ID. 15pp.

Mancuso, M., and S. Cooke. 2001. Field Investigation for *Lepidium papilliferum* (Slickspot Peppergrass) on Idaho BLM lands in the Bruneau Desert Area. Idaho Department of Fish and Game, Idaho Conservation Data Center, Boise, ID. 17 pp.

Mancuso, M., C. Murphy, and R. K. Moseley. 1998. Assessing and Monitoring Habitat Integrity for *Lepidium papilliferum* (Slickspot Peppergrass) in the Sagebrush-Steppe of Southwestern Idaho. Unpublished Report. Idaho Department of Fish and Game, Idaho Conservation Data Center, Boise, ID. Prepared for State of Idaho Military Division, Boise, ID. 28 pp. plus appendices.

McBride, J. 2000. Letter to Clyde Lay, Idaho Department of Environmental Quality. From the Bruneau River Watershed Agricultural TMDL Implementation Plan June 4 2002 Draft.

McDonald, M. 1996. Amphibian Inventory of the Jarbidge and Snake River Resource Areas. Technical Bulletin No. 96-13. Idaho Bureau of Land Management.

McDonald, M., and R. F. Marsh. 1995. Amphibian Inventory of the Jarbidge Resource Area Boise District. Technical Bulletin 95-4. Idaho Bureau of Land Management.

McKelvy, K. S. 2000. History and Distribution of Lynx in the Contiguous United States. In: L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, G. M. Koehler, C. J. Krebs, K. S. McKelvey, and J. R. Squires, editors. Ecology and Conservation of Lynx in the United States.

University Press of Colorado and U.S. Department of Agriculture, Rocky Mountain Research Station. p. 207–264.

McNeill, M. E., J. Frederick, and B. Whalen. 1997. Jarbidge River Watershed Analysis. Jarbidge Ranger District, Humboldt-Toiyabe National Forests, Elko, NV.

Mladenka, G. C. 1992. The ecological life history of the Bruneau Hot-springsnail (*Pyrgulopsis bruneauensis*). M.S. thesis, Idaho State University, Pocatello, Idaho

Mladenka, G. C. 1992. The Ecological Life History of the Bruneau Hot Springsnail (*Pyrgulopsis bruneauensis*). M.S. Thesis. Idaho State University, Pocatello, ID.

Mladenka, G. C., and G.W. Minshall. 1996. Report on the Re-survey of the Bruneau Hot Springsnail Sites. Stream Ecology Center, Department of Biological Sciences, Idaho State University, Pocatello, ID. Prepared for U.S. Fish and Wildlife Service, Boise, ID. 11 pp.

Mobrand Biometrics, Inc. 2003. Draft QHA Users Guide. 6pp.

Morrison, M. L., and E. C. Meslow. 1983. Bird Community Structure on Early-Growth Clearcuts in Western Oregon. American Midland Naturalist **110**:129–137.

Mosconi, S. L., and R. L. Hutto. 1982. The Effect of Grazing on the Land Birds of a Western Montana Riparian Habitat. In: L. Nelson, J. M. Peek, and P. D. Dalke, editors. Proceedings of the Wildlife–Livestock Relationships Symposium. Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow, ID. p. 221–233.

Moseley, R. K. 1994. Report on the Conservation Status of *Lepidium papilliferum*. Idaho Department of Fish and Game, Idaho Conservation Data Center, Boise, ID. 34 pp.

Munger, J. C., A. Ames, and B. Barnett. 1997. 1996 Survey for Columbia Spotted Frogs in the Owyhee Mountains of Southwestern Idaho. Technical Bulletin No. 97-13. Idaho Bureau of Land Management.

Munger, J. C., L. Heberger, D. Logan, W. Peterson, L. Mealy, and M. Cauglin. 1994. A survey of the herpetofauna of the Bruneau Resource Area, Boise District, with focus on the spotted frog, *Rana pretiosa*. Technical Bulletin No. 94-7. Idaho Bureau of Land Management.

Munger, J. C., M. Gerber, M. Carroll, K. Madrid, and C. Peterson. 1996. Status and Habitat Associations of the Spotted Frog *Rana pretiosa* in Southwestern Idaho. Technical Bulletin No. 96-1. Idaho Bureau of Land Management.

Myler, C. D., and G. W. Minshall. 1999. 1998 Monitoring Report: Bruneau Hot Springsnail (*Pyrgulopsis bruneauensis*). Prepared for Bureau of Land Management, Boise, ID.

Myler, C. D., and G. W. Minshall. 2000. 1999 Annual Monitoring Report. Bruneau Hot-spring Springsnail (*Pyrgulopsis bruneauensis*). Stream Ecology Center, Department of Biological Sciences, Idaho State University, Pocatello, ID. Prepared for U.S. Bureau of Land Management, Lower Snake River District, Boise, Idaho. 50pp.

Natural Resources Conservation Service (NRCS), U.S. Department of Agriculture. 2003. The PLANTS database. Available at <http://plants.usda.gov>. National Plant Data Center, Baton Rouge, LA.

Natural Resources Conservation Service (NRCS). 2000. Natural Resources Conservation Service Strategic Plan 2000–2005. U.S. Department of Agriculture, NRCS.

Neel, L. A., editor. 1999. Nevada Partners in Flight Bird Conservation Plan.

Nevada Department of Employment, Training, and Rehabilitation (NVDETR). 2002. Website. <http://detr.state.nv.us/lmi/data/empprofiles/top_007.htm>. March 2002 1st Quarter. Accessed December 2003.

Nevada Department of Wildlife (NDOW). 2003a. Query of License Database: 2002 by County. Joe Doucette, NDOW. Fax, October 29.

Nevada Department of Wildlife (NDOW). 2003b. Website. <http://ndow.org/>.

Nevada Department of Wildlife (NDOW). 2001 Sage grous lek location data in GIS format provided in support of the Bruneau Subbasin summary.

Nevada Natural Heritage Program (NNHP). 2003. Website. <http://heritage.nv.gov/index.htm>.

Nevada. 1998. Nevada’s 1998 §303(d) List. Available at <http://ndep.nv.gov/bwqp/303dlist.htm>

Northeastern Nevada Stewardship Group, Inc. 2001. Draft Elko County Sagebrush Ecosystem Conservation Plan.

Northwest Habitat Institute. 2003. Website. <http://www.nwhi.org>. Northwest Habitat Institute, Corvallis, OR.

Northwest Power Planning Council (NPPC [now NPCC]). 2001. Technical Guide for Subbasin Planners, Council Document 2001-20.

Northwest Power and Conservation Council (Council) 2003. Subbasin and Province Boundary layer downloaded using interactive mapper tool Available at: www.NWPPC.org

Northwest Power and Conservation Council (NPCC). 2004. Subbasin Planning website. <http://www.nwcouncil.org>

O’Gara, B. W. 1978. *Antilocarpa americana*. Mammalian Species **90**:1–7.

Orr, E. L., and W. N. Orr. 1996. Geology of the Northwest. McGraw Hill Publishing Company. 409 pp.

Page, G. W., J. S. Warriner, J. C. Warriner, and P. W. C. Paton. 1995. Snowy Plover: *Charadrius alexandrinus*. In: A. Poole and F. Gill, editors. The Birds of North America, No. 154. The Birds of North America, Inc., Philadelphia, PA.

Parrish, D. 1998. Jarbidge Key Watershed Bull Trout Problem Assessment. South West Basin Native Fish Advisory Group.

Partners in Flight—U.S. (PIF). 2003. Website. <http://www.partnersinflight.org/>.

Partridge, F. E., and C. D. Warren. 2000. Monitoring of Migratory Bull Trout in the Jarbidge River, 1999. Technical Bulletin No. 2000-01. Bureau of Land Management.

Partridge, F. E., and C. D. Warren. 1998. Monitoring of Migratory Bull Trout in the Jarbidge River. Technical Bulletin No. 98-9. Idaho Bureau of Land Management.

Perkins, J. M., and J. R. Peterson. 1997. Bat Distribution in the Juniper Woodlands of the Idaho Owyhee Mountains, Summer 1996. Technical Bulletin No. 97-4. Idaho Bureau of Land Management.

Platts, W. 1985. Stream Habitat and Fisheries Response to Livestock Grazing and Instream Improvement Structures, Big Creek, Utah. Journal of Soil and Water Conservation: 374–379.

Platts, W. S. 1991. Livestock Grazing. In: W. R. Meehan, editor. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. U.S. Forest Service, Bethesda, MD. p. 389–423.

Pratt, K. L. 1992. A Review of Bull Trout Life History. Pages 5–9 *in* P. I. Howell and D. V. Buchanan, editors. Proceedings of the Gearhart Mountain Bull Trout Workshop. Oregon Chapter of the American Fisheries Society, Corvallis, OR.

Pratt, K. L., Kozel, M., Mauser, J., Mauser, L., and R. Scarpella. 2003. Chronology of the Bruneau River Basin, *In* Special Appendix G, Annotated Bibliographies on the Chronology of Decline of Anadromous Fish in the Snake River Basin above Hells Canyon Dam, *In* Technical Report Appendix E.3.1-2 Feasibility of Reintroduction of Anadromous Fish above or within the Hells Canyon Complex. Idaho Power, Hells Canyon Complex, FERC No. 1971.

Quigley, T. M., and S. J. Arbelbide, editors. 1997. An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins. U.S. Department of Agriculture, Forest Service, Portland, OR.

Quinney, D. 1998. LEPA: *Lepidium papilliferum*. Idaho Army National Guard, Boise, ID. 25 pp.

Rabe, M. J., M. S. Siders, C. R. Miller, and T. K. Snow. 1998. Long Foraging Distance for a Spotted Bat (*Euderma maculatum*) in Northern Arizona. The Southwestern Naturalist **43(2)**:266–286.

Rachael, J., R. Smith, C. Anderson, C. Class, D. Meints, J. Naderman, and T. Keegan. 2003. Antelope, Study I, Job 7: July 1, 2002, to June 30, 2003. Edited by B. Compton. Progress Report Project W-170-R-27. Idaho Department of Fish and Game, Boise, ID.

Rachlow, J., and L. Svancara. 2003. Pygmy Rabbit Habitat in Idaho. Project Completion Report April 2003. Prepared for Idaho State Bureau of Land Management Office.

Ratliff, D. E. 1992. Bull Trout Investigations in the Metolius River-Lake Billy Chinook system. Pages 37–44 in P. J. Howell and D. V. Buchanan, editors. Proceedings of the Gearhart Mountain Bull Trout Workshop. Oregon Chapter of the American Fisheries Society, Corvallis, OR.

Ratliff, D. E., S. L. Thiesfeld, W. G. Weber, A. M. Stuart, M. D. Riehle, and D. V. Buchanan. 1996. Distribution, Life History, Abundance, Harvest, Habitat and Limiting Factors of Bull Trout in the Metolius River and Lake Billy Chinook, 1983–1994. Information Report. Oregon Department of Fish and Wildlife, Portland, OR.

Reaser, J. K. 1997. Amphibian Declines: Conservation Science and Adaptive Management. Dissertation. Stanford University, Stanford, CA.

Reaser, J. K. 2000. Demographic Analysis of the Columbia spotted frog (*Rana luteiventris*): Case Study in Spatiotemporal Variation. Canadian Journal of Zoology **78**:1158–1167.

Reh, W., and A. Seitz. 1990. The influence of land use on the genetic structure of populations of the common frog *Rana temporaria*. Biological Conservation 54:239-249.

Reid, L. M. 1993. Research and Cumulative Watershed Effects. U.S. Forest Service, Pacific Southwest Research Station, Albany, CA.

Reid, M., P. Comer, H. Barrett, S. Caicco, R. Crawford, C. Jean, G. Jones, J. Kagan, M. Karl, G. Kittel, P. Lyon, M. Manning, E. Peterson, R. Rosentreter, S. Rust, D. Tart, C. Williams, and A. Winward. 2002. International Classification of Ecological Communities: Terrestrial Vegetation of the United States. Sagebrush Vegetation of the Western United States. Final Report. NatureServe, Arlington, VA. Prepared for U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center, Boise, ID.

Reynolds, T., and C. Trost. 1981. Grazing, Crested Wheatgrass, and Bird Populations in Southeast Idaho. Northwest Science **55**:225–234.

Rieman, B. E. and Dunham, J. B. (1999). *Metapopulations and Salmonids: A Synthesis of Life History Patterns and Empirical Observations*. Boise: U. S. Forest Service, Rocky Mountain Research Station; Biological Resources Research Center.

Rieman, B. E. and McIntryre, J. D. (1993). *Demographic and Habitat Requirements for Conservation of Bull Trout*. Ogden, UT: U. S. Forest Service, Intermountain Research Station.

Rimbey, N.R., T.D. Darden, LA. Torell, J.A. Tanaka, L.W. Van Tassell, J.D. Wulfhorst. 2003. Ranch Level Economic Impacts of Public Land Grazing. Policy Alternatives in the Bruneau Resource Area of Owyhee County, Idaho. Agricultural Economics Extension Series No. 03-05.

Roberts, H. B. 2003. Status of the pygmy rabbit (*Brachylagus idahoensis*) in Idaho. Technical Bulletin No. 03-6, Idaho Bureau of Land Management.

Rost, G. R., and J. A. Bailey. 1979. Distribution of mule deer and elk in relation to roads. Journal of Wildlife Management 43:634-641.

Royer, T. V., and G. W. Minshall. 1993. Annual monitoring report: Bruneau Hot-springsnail (*Pyrgulopsis bruneauensis*). Prepared for the U. S. Bureau of Land Management, Boise, Idaho.

Rugenski, A. T., and G. W. Minshall. 2003. 2000 annual monitoring report Bruneau Hot-springsnail (*Pyrgulopsis bruneauensis*). Idaho Bureau of Land Management Technical Bulletin 03-10 (May). 49pp.

Ryder, R. R., and D. E. Manry. 1994. White-Faced Ibis: *Plegadis chihi*. In: A. Poole and F. Gill, editors. The Birds of North America, No. 130. The Birds of North America, Inc., Philadelphia, PA.

Sagemap 2003. Data Query and Download Page Available at: http://sagemap.wr.usgs.gov/form_query.asp

Sauer, J. R., J. E. Hines, and J. Fallon. 2003. The North American Breeding Bird Survey, Results and Analysis 1966–2002. Version 2003.1. U.S. Geolgoical Survey, Patuxent Wildlife Research Center, Laurel, MD.

Schnitzspahn, D., K. Fite, K. Moore, M. Medberry, A. Haak, and E. Kingston. 2000. Owyhee-Bruneau Canyon Lands: Legacy Landscape Overview. Wilderness Society, American Lands, Committee for Idaho’s High Desert, and Sierra Club.

Schroeder, M. A., Young, J. R., and C. E. Braun. 1999. Sage Grouse (*Centrocercus urophasianus*). In: A. Poole and F. Gill, editors. The Birds of North America, No. 425. The Birds of North America, Inc., Philadelphia, PA.

Sedgwick, J. A. 2000. Willow Flycatcher: *Empidonax traillii*. In: A. Poole and F. Gill, editors. The Birds of North America, No. 425. The Birds of North America, Inc., Philadelphia, PA. 31 pp.

Sedgwick, J. A., and W. M. Iko. 1999. Costs of Brown-Headed Cowbird Parasitism to Willow Flycatchers. Studies in Avian Biology **18**:167–181.

Shackleton, D. M. 1985. *Ovis canadensis*. Mammalian Species **230**:1–9.

Shoshone-Piaute Tribe of the Duck Valley Reservation. 1996. Economic Analysis in Support of Damages Claim Shoshone-Paiute Tribe of the Duck Valley Indian Reservation. Prepared by David Dornbusch & Company, Inc., San Francisco, CA. April.

Simpson, J. C., and Wallace, R. L. 1982. Fishes of Idaho. University of Idaho Press, Moscow, ID.

Smoliak, S., R. L. Ditterline, J. D. Scheetz, L. K. Holzworth, J. R. Sims, L. E. Wiesner, D. E. Baldridge, and G. L. Tibke. 2003. Fourwing Saltbush (*Atriplex canescens*). In: Montana Interagency Plant Materials Handbook. Animal and Range Sciences Extension Service, Montana State University. Available at <http://animalrangeextension.montana.edu/Articles/Forage/Species/Shrubs/FourwingSaltbush.htm>.

Southwick Associates, Inc. 2002. The Economic Importance of Hunting in America. International Association of Fish and Wildlife Agencies.

Squires, J. R., and R. T. Reynolds. 1997. Northern Goshawk: *Accipiter gentilis*. In: A. Poole and F. Gill, editors. The Birds of North America, No. 298. The Birds of North America, Inc., Philadelphia, PA.

Storch, I., compiler. 2000. Grouse Status Survey and Conservation Action Plan 2000–2004. WPA/BirdLife/SSC Grouse Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK and the World Pheasant Association, Reading, UK. X + 112 pp.

StreamNet 2003. Streamnet GIS Data Available at: http://www.streamnet.org/online-data/GISData.html

Taylor, D. M. 1986. Effects of Cattle Grazing on Passerine Birds Nesting in Riparian Habitat. Journal of Range Management **39**:254–258.

Taylor, D. M., and C. D. Littlefield. 1986. Willow Flycatcher and Yellow Warbler Response to Cattle Grazing. American Birds **40**:1169–1173.

Taylor, D. M., Trost, C. H., and B. Jamison. 1989. The Biology of the White-Faced Ibis in Idaho. Western Birds **20**:125–133.

Taylor, E., J. Klott, and R. B. Smith. 1998. California Bighorn Sheep Habitat Evaluation. Technical Bulletin No. 98-6. Idaho Bureau of Land Management. 39 pp.

The Nature Conservancy (TNC). 1999. Columbia Plateau Ecoregional Assessment: A pilot Effort in Ecoregional Conservation.

Toweill, D. E. 2001. Bighorn Sheep Job Progress Report. Project W-170-R-25. Idaho Department of Fish and Game, Boise, ID.

TREC, Inc. 2003. A Survey for Yellow-Billed Cuckoo in Recorded Historic and Other Likely Locations in Idaho. 2003 Summary Report. TREC, Inc., Rigby, ID. 18 pp.

Trombulak, S. C. and C. A. Frisell. 2000. Review of ecological effects of roads on terrestrial and aquatic communities. Conservation Biology 14:18-30.

Trout Unlimited. Website. <http://www.tu.org/sample_pages/press_release_list-members.asp>. Accessed October 17, 2001.

Tumlison, R. 1987. *Felis lynx*. Mammalian Species **269**:1–8.

U.S. Air Force (USAF). 1998. Final Environmental Impact Statement: Enhanced Training in Idaho. Volumes 1–3. Department of Defense, USAF.

U.S. Census Bureau. 2000a. Population Estimates. <http://eire.census.gov/popest/estimates.php>. Accessed October 2003.

U.S. Census Bureau. 2000b. State and County Quickfacts. <http://quickfacts.census.gov/qfd/>. Accessed October 2003.

U.S. Fish and Wildlife Service (USFWS) and U.S. Census Bureau. 2003. 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation: Idaho. Revised edition, March. U.S. Department of the Interior, USFWS and U.S. Department of Commerce, U.S. Census Bureau. <http://www.census.gov/prod/2003pubs/01fhw/fhw01-id.pdf>.

U.S. Fish and Wildlife Service (USFWS) and U.S. Census Bureau. 2003. The *1991 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation: Idaho.* Website accessed December, 2003. URL: http://www.census.gov/prod/www/abs/fishing.html

U.S. Fish and Wildlife Service (USFWS). 1980. Habitat Evaluation Procedure. Ecological Services Manual 102. Washington, DC.

U. S. Fish and Wildlife Service. 1995a. Snake River aquatic species recovery plan. Snake River Basin Office, Ecological Services, Boise, Idaho. 92pp.

U.S. Fish and Wildlife Service (USFWS). 1995b. Final Rule Determining Endangered Status for the Southwestern Willow Flycatcher. Federal Register 60:10694–10715 (February 27, 1995).

U.S. Fish and Wildlife Service (USFWS). 1997. Final Determination of Critical Habitat for the Southwestern Willow Flycatcher. Federal Register 62:39129–39146 (July 22, 1997).

U.S. Fish and Wildlife Service (USFWS). 2002. Birds of Conservation Concern 2002. Available at <http://migratorybirds.fws.gov/reports/bcc2002.pdf>. Division of Migratory Bird Management, Arlington, VA. 99 pp.

U.S. Fish and Wildlife Service (USFWS). 2002b. Recovery Plan for the Bruneau Hot Springsnail (Pyrgulopsis Bruneauensis). Region 1, Portland, Oregon. 52 pp.

U.S. Fish and Wildlife Service (USFWS). 2002c. Slickspot Peppergrass (Lepidium Papiliferum–LEPA) Estimated Historic Range, GIS Layer. Bob Kibler Boise, Idaho

U.S. Fish and Wildlife Service (USFWS). 2002d. Draft Recovery Plan for Bull Trout in the Conterminous United States: Klamath River, Columbia River, Jarbidge River, Coastal-Puget Sound, and St. Mary-Belly River Distinct Population Segments. USFWS, Portland, OR.

U.S. Fish and Wildlife Service (USFWS). 2003. Website. <http://endangered.fws.gov/>.

U.S. Fish and Wildlife Service. 2004. Chapter 25 Draft, Jarbidge River Distinct Population Segment, Idaho and Nevada. In: Bull Trout (Salvelinus confluentus) Recovery Plan. U.S. Fish and Wildlife Service, Portland, Oregon. 112 pp.

U.S. Forest Service (USFS). 1995. Environmental Assessment: Bruneau River Watershed Environmental Analysis. U.S. Department of Agriculture, USFS, Humboldt-Toiyabe National Forest, Mountain City Ranger District.

U.S. Forest Service (USFS). 1998. Jarbidge River Environmental Assessment for Access and Restoration Between Pine Creek Campground and the Jarbidge Wilderness. U.S. Department of Agriculture, USFS, Humboldt-Toiyabe National Forest, Northwest Nevada Eco-unit, Elko County, NV.

U.S. Forest Service (USFS). 1999. Hells Canyon National Recreation Area Comprehensive Management Plan: Revised Draft Environmental Impact Statement. U.S. Department of Agriculture, USFS, Wallowa-Whitman National Forest.

Valdez, R., and P. R. Krausman. 1999. Mountain Sheep of North America. The University of Arizona Press, Tucson, AZ. 353 pp.

Varricchione, J. T., and G. W. Minshall. 1995. 1994 monitoring report: Bruneau hot springsnail (*Pyrgulopsis bruneauensis*). Idaho Bureau of Land Management Technical Bulletin 95-14 (June). 23pp.

Varricchione, J. T., and G. W. Minshall. 1997. 1996 monitoring report: Bruneau hot springsnail (*Pyrgulopsis bruneauensis*). Steam Ecology Center, Department of Biological Sciences, Idaho State University, Pocatello, Idaho. Prepared for U. S. Bureau of Land Management. 65pp.

Varricchione, J. T., and G.W. Minshall. 1995b. 1994 Monitoring Report: Bruneau Hot Springsnail (*Pyrgulopsis bruneauensis*). Technical Bulletin No. 95-14. Idaho Bureau of Land Management.

Varricchione, J. T., K. W. Sant, and G. W. Minshall. 1998. Bruneau Hot-Spring Springsnail (*Pyrgulopsis bruneauensis*): Annual Monitoring Report: 1997. Technical Bulletin No. 98-4. Idaho Bureau of Land Management.

Vigg, S., and Company. 2000. Rationale for Wildlife Mitigation Conducted by the Shoshone-Paiute Tribes of the Duck Valley Indian Reservation, Nevada and Idaho: Based on the Distribution and Ecology of Their Ancestral Peoples as Documented in the Archaeological and Ethnographic Record.

Walker, Deward E., Jr. 1967. Mutual Cross-Utilization of Economic Resources in the Plateau; an Example from Aboriginal Nez Perce Fishing Practices. *Washington State University, Laboratory of Anthropology, Report of Investigations* No. 41. Pullman.

Walker, Deward E. Jr. 1992 Productivity of Tribal Dipnet Fishermen at Celilo Falls: Analysis of the Joe Pinkham Fish Buying Records. *Northwest Anthropological Research Notes,* 26(2): 123-135.

Walker, Deward E. Jr. 1993b Lemhi Shoshone-Bannock Reliance on Anadromous and Other Fish Resources. *Northwest Anthropological Research Notes* 27(2):215-250.

Warren, C. D., and F. E. Partridge. 1993. Evaluation of the Status of Bull Trout in the Jarbidge River Drainage, Idaho. Technical Bulletin No. 93-1. Idaho Bureau of Land Management.

Washington State University (WSU). 2003. Northwest Income Indicators Project. Available at <http://niip.wsu.edu/>. Accessed October 2003.

Watkins, L. C. 1977. *Euderma maculatum*. Mammalian Species **77**:1–4.

Wik, P. 2002. Ecology of Greater Sage-Grouse in South-Central Owyhee County, Idaho. M.S. Thesis. University of Idaho, Moscow, ID. 141 pp.

Wilde, D. B. 1978. A Population Analysis of the Pygmy Rabbit (*Sylvilagus idahoensis*) on the INEL Site. Dissertation. Idaho State University, Pocatello, ID.

Williams, R. N., J. E. Carter, D. K. Shiozawa, and R.F. Leary. 1991. Taxonomic and Genetic Analysis of Five Rainbow Trout Populations from Southern Idaho. BSU Evolutionary Genetics Lab Report No. 91-2. Boise State University, Boise, ID.

Williams, R. D. 2002. Testimony of Robert D. Williams, Field Supervisor, Nevada Fish and Wildlife Office, USFWS, Department of the Interior, before the House Committee on Resources, Field Hearing in Elko, Nevada, on the listing of the Jarbidge Population of bull trout. http://www.doi.gov/ocl/2002/jarbridge.htm

Wisdom, M. J., R. S. Holthausen, D. C. Lee, B. C. Wales, W. J. Murphy, M. R. Eames, C. D. Hargis, V. A. Saab, T. D. Rich, F. B. Samson, D. A. Newhouse, and N. Warren. 2000. Source Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin: Broadscale Trends and Management Implications. General Technical Report PNW-GTR-485. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, OR.

Wood, J. 2000. Draft Recovery Plan for the Bruneau Hot Springsnail (*Pyrgulopsis bruneauensis*). U.S. Fish and Wildlife Service, Region 1, Portland, OR.

Wydoski, R. S., and R. R. Whitney. 1979. Inland Fishes of Washington. University of Washington Press, Seattle, WA.

Younk, J. V., and M. J. Bechard. 1994. Breeding Ecology of the Northern Goshawk in High-Elevation Aspen Forest of Northern Nevada. Studies in Avian Biology **16**:119–121.

Zoellick, B. 1999. Stream Temperatures and the Elevational Distribution of Redband Trout in Southwestern Idaho. Great Basin Naturalist **59-2**:136–143.

Zoellick, B. W., R. Armstrong, and J. Klott. 1996. Status of the Migratory Bull Trout Population in the Jarbidge River Drainage. Bureau of Land Management, Owyhee Resource Area.

# 7 Appendices

Appendix A. Species of special concern (SC), game special concern (GSC), protected (P), or endangered (E) in Idaho; species considered endangered (E), threatened (T), or protected (P) by Nevada; BLM special status species (Type [T] 2–5); and USFS Region 4 sensitive (S) species that are present or have potential habitat in the Bruneau subbasin (BLM 2003b, IBIS 2003, IDCDC 2003, IDFG 2003b, NDOW 2003b, NNHP 2003).

| Common Name | Scientific Name | ID | NV | BLM | USFS |
|---|---|---|---|---|---|
| **Birds** | | | | | |
| American peregrine falcon | *Falco peregrinus anatum* | E | E | T3 | |
| American white pelican | *Pelecanus erythrorhynchos* | SC/P | P | T2 | |
| Bald eagle | *Haliaeetus leucocephalus* | P | T/P | T1 | S |
| Barn owl | *Tyto alba* | P | | | |
| Barrow’s goldeneye | *Bucephala islandica* | G | | T5 | |
| Black swift | *Cypseloides niger* | P | | T4 | |
| Black tern | *Chlidonias niger* | SC/P | P | T3 | |
| Black-backed woodpecker | *Picoides arcticus* | SC/P | | T5 | |
| Black-crowned night-heron | *Nycticorax nycticorax* | P | | | |
| Black-throated gray warbler | *Dendroica nigrescens* | P | | | |
| Blue grouse | *Dendragapus obscurus* | | | T5 | |
| Bohemian waxwing | *Bombycilla garrulus* | P | | | |
| Brewer’s blackbird | *Euphagus cyanocephalus* | P | | T5 | |
| Brewer’s sparrow | *Spizella breweri* | P | | T3 | |
| California gull | *Larus californicus* | P | | | |
| Calliope hummingbird | *Stellula calliope* | P | | T3 | |
| Caspian tern | *Sterna caspia* | P | | | |
| Cassin’s finch | *Carpodacus cassinii* | P | | T5 | |
| Cattle egret | *Bubulcus ibis* | P | | | |
| Clark’s grebe | *Aechmophorus clarkii* | P | | | |
| Columbian sharp-tailed grouse | *Tympanuchus phasianellus columbianus* | GSC | | T3 | S |
| Common loon | *Gavia immer* | SC/P | P | | S |
| Common nighthawk | *Chordeiles minor* | P | P | | |
| Common tern | *Sterna hirundo* | P | | | |
| Cooper’s hawk | *Accipiter cooperii* | P | P | | |
| Cordilleran flycatcher | *Empidonax occidentalis* | P | | T5 | |
| Double-crested cormorant | *Phalacrocorax auritus* | P | | | |
| Eared grebe | *Podiceps nigricollis* | P | | | |

| Common Name | Scientific Name | ID | NV | BLM | USFS |
|---|---|---|---|---|---|
| Ferruginous hawk | *Buteo regalis* | P | P | T3 | |
| Flammulated owl | *Otus flammeolus* | SC/P | P | T3 | S |
| Forster's tern | *Sterna forsteri* | P | | | |
| Franklin's gull | *Larus pipixcan* | P | | | |
| Golden eagle | *Aquila chrysaetos* | P | P | | |
| Grasshopper sparrow | *Grasshopper sparrow* | P | | T5 | |
| Great egret | *Ardea alba* | SC/P | | | |
| Great horned owl | *Bubo virginianus* | P | P | | |
| Green-tailed towhee | *Pipilo chlorurus* | P | | T5 | |
| Hammond's flycatcher | *Empidonax hammondii* | P | | T3 | |
| Harlequin duck | *Histrionicus histrionicus* | GSC | | T4 | S |
| Horned grebe | *Podiceps auritus* | P | | | |
| Lesser goldfinch | *Carduelis psaltria* | P | | | |
| Lewis's woodpecker | *Melanerpes lewis* | P | | T3 | |
| Loggerhead shrike | *Lanius ludovicianus* | SC/P | | T3 | |
| Long-billed curlew | *Numenius americanus* | P | | T5 | |
| Long-eared owl | *Asio otus* | P | P | | |
| Merlin | *Falco columbarius* | P | | | |
| Mountain quail | *Oreortyx pictus* | SC | PG | T3 | S |
| Northern goshawk | *Accipiter gentilia* | SC/P | P | T3 | S |
| Northern harrier | *Circus cyaneus* | P | P | | |
| Northern mockingbird | *Mimus polyglottos* | P | | | |
| Northern pygmy owl | *Glaucidium gnoma* | SC/P | | T5 | |
| Olive-sided flycatcher | *Contopus borealis* | P | | T3 | |
| Osprey | *Pandion haliaetus* | P | P | | |
| Pinyon jay | *Gymnorhinus cyanocephalus* | P | | T5 | |
| Prairie falcon | *Falco mexicanus* | P | P | T3 | |
| Purple martin | *Progne subis* | P | | | |
| Red-naped sapsucker | *Sphyrapicus nuchalis* | P | | T5 | |
| Red-necked grebe | *Podiceps grisegena* | P | | | |
| Red-tailed hawk | *Buteo jamaicensis* | P | P | | |
| Ring-billed gull | *Larus delawarensis* | P | | | |
| Rough-legged hawk | *Buteo lagopus* | P | P | | |
| Sage grouse | *Centrocercus urophasianus* | | PG | T2 | |
| Sage sparrow | *Amphispiza belli* | P | | T3 | |
| Sage thrasher | *Oreoscoptes montanus* | P | | T5 | |

| Common Name | Scientific Name | ID | NV | BLM | USFS |
|---|---|---|---|---|---|
| Sharp-shinned hawk | *Accipiter striatus* | P | P | | |
| Short-eared owl | *Asio flammeus* | P | P | T5 | |
| Snowy egret | *Egretta thula* | P | | | |
| Swainson's hawk | *Buteo swainsoni* | P | P | T5 | |
| Three-toed woodpecker | *Picoides tridactylus* | SC/P | P | | S |
| Trumpeter swan | *Cygnus buccinator* | SC/P | PG | T3 | S |
| Turkey vulture | *Cathartes aura* | P | P | | |
| Vaux's swift | *Chaetura vauxi* | P | | T5 | |
| Virginia's warbler | *Vermivora virginiae* | P | | T5 | |
| Western burrowing owl | *Speotyto cunicularia hypugea* | P | P | T5 | |
| Western grebe | *Aechmophorus occidentalis* | P | | | |
| Western scrub-jay | *Aphelocoma californica* | P | | | |
| White-faced ibis | *Plegadis chihi* | P | P | T4 | |
| White-headed woodpecker | *Picoides albolarvatus* | SC/P | P | T4 | S |
| White-winged crossbill | *Loxia leucoptera* | P | | | |
| Williamson's sapsucker | *Sphyrapicus thyroideus* | P | | T3 | |
| Willow flycatcher | *Empidonax trailii* | P | | T3 | |
| Wilson's phalarope | *Phalaropus tricolor* | P | | T5 | |
| Yellow-billed cuckoo | *Coccyzus americanus* | SC | | T1 | |
| **Mammals** | | | | | |
| American pika | *Ochotona princeps* | | P | | |
| California bighorn sheep | *Ovis canadensis californiana* | | | T3 | |
| California myotis | *Myotis californicus* | | | T4 | |
| Dark kangaroo mouse | *Microdipodops megacephalus* | SC | | T4 | |
| Fringed myotis | *Myotis thysanodes* | SC | | T3 | |
| Kit fox | *Vulpes macrotis* | SC | | T4 | |
| Little pocket mouse | *Perognathus longimembris* | SC | | T4 | |
| Long-eared myotis | *Myotis evotis* | | | T5 | |
| Long-legged myotis | *Myotis volans* | | | T5 | |
| North american wolverine | *Gulo gulo luscus* | SC | | T3 | S |
| Pygmy rabbit | *Brachylagus idahoensis* | GSC | G | T2 | |
| Rock squirrel | *Spermophilus variegatus* | SC | | T5 | |
| Spotted bat | *Euderma maculatum* | SC | T | T3 | S |
| Townsend's big-eared bat | *Corynorhinus townsendii* | SC | | T3 | S |
| Western small-footed myotis | *Myotis ciliolabrum* | | | T5 | |
| Western pipistrelle | *Pipistrellus hesperus* | SC | | T5 | |

| Common Name | Scientific Name | ID | NV | BLM | USFS |
|---|---|---|---|---|---|
| Yuma myotis | *Myotis yumanensis* | | | T5 | |
| **Amphibians and Reptiles** | | | | | |
| Columbia spotted frog | *Rana luteiventris* | SC | P | T1 | S |
| Common garter snake | *Thamnophis sirtalis* | | | T3 | |
| Longnose snake | *Rhinocheilus lecontei* | | | T3 | |
| Mojave black-collared lizard | *Crotaphytus bicinctores* | SC | | T3 | |
| Night snake | *Hypsiglena torquata* | | | T5 | |
| Northern leopard frog | *Rana pipiens* | SC | | T2 | |
| Ringneck snake | *Diadophis punctatus* | SC | | T5 | |
| Western ground snake | *Sonora semiannulata* | SC | | T3 | S |
| Western toad | *Bufo boreas* | SC | | T3 | |

Appendix B. Special status plant species known to occur or with potential habitat in the Bruneau subbasin. The appendix contains status rankings from the Idaho Native Plant Society (INPS, IDCDC 2003), Bureau of Land Management sensitive species in Owyhee (BLM OW) and Jarbidge (BLM JA) Field Office areas, and natural heritage state ranks from Idaho (ICDC 2003) and Nevada (NNHP 2003). U.S. Forest Service Region Four sensitive species are denoted by a superscript number one (e.g. Astragalus yoder-williamsii[1]).

| Scientific Name | Common Name | INPS | BLM OW | BLM JA | CDC | N NHP |
|---|---|---|---|---|---|---|
| *Angelica kingii* | Nevada angelica | 1 | T3 | | S1 | |
| *Astragalus conjunctus* | Stiff milkvetch | S | T5 | | S2 | |
| *Astragalus mulfordiae* | Mulford's milkvetch | GP2 | T2 | | S2 | |
| *Astragalus newberryi var castoreus* | Newberry's milkvetch | S | T4 | | S2 | |
| *Astragalus purshii var ophiogenes* | Snake river milkvetch | M | T5 | T5 | S3 | |
| *Astragalus sterilis* | Barren milkvetch | GP3 | T3 | | S1 | |
| *Astragalus tetrapterus* | Four-wing milkvetch | 1 | T3 | | S1 | |
| *Astragalus yoder-williamsii*[1] | Mud flat milkvetch | GP3 | T3 | | S3 | S1 |
| *Blepharidachne kingii* | King's desertgrass | 1 | T3 | | S1 | |
| *Camissonia palmeri* | Palmer's evening primrose | GP3 | T2 | | S1 | |
| *Camissonia pterosperma* | Winged-seed evening primrose | S | | | S2 | |
| *Carex tumulicola* | Foothill sedge | S | T4 | | S1 | |
| *Catapyrenium congestum* | Catapyrenium congestum | | T4 | | | |
| *Chaenactis cusickii* | Cusick's false yarrow | GP3 | T2 | | S2 | |
| *Chainactis stevioides* | Desert pincushion | S | T4 | T4 | S2 | |
| *Cleomella plocasperma* | Alkali cleomella | 1 | T3 | | SH | |
| *Coryphantha vivipara* | Cushion cactus | S | | | S2 | |
| *Cryptantha propria* | Malheur cryptantha | | T5 | | | |
| *Cymopterus acaulis var greeleyorum* | Greeley's wavewing | GP2 | T3 | T3 | S2 | |
| *Cyperus rivularis* | Shining flatsedge | M | | | S2 | |
| *Damasonium californicum* | Fringed waterplantain | M | | | S2 | |
| *Dimeresia howellii* | Dimeresia | 2 | T3 | | S2 | |
| *Downingia bacigalupii* | Bacigalupi's downingia | S | T4 | T4 | S2 | |
| *Downingia insignis* | Downingia | 1 | T3 | | S1 | |
| *Eatonella nivea* | White eatonella | S | T4 | T4 | S3 | |
| *Epipactis gigantea* | Giant helleborine | 2 | T3 | T3 | S3 | |

| Scientific Name | Common Name | INPS | BLM OW | BLM JA | CDC | N NHP |
|---|---|---|---|---|---|---|
| *Eriogonum shockleyi var packardiae* | Packard's buckwheat | GP2 | T2 | T2 | S2 | |
| *Eriogonum shockleyi var shockleyi* | Matted cowpie buckwheat | 2 | T3 | T3 | S2 | |
| *Glyptopleura marginata* | White-margined wax plant | S | T4 | T4 | S3 | |
| *Hackelia ophiobia* | Rattlesnake stickseed | GP3 | T3 | | S1 | |
| *Haplopappus bloomeri* | Rabbitbrush goldenweed | | T5 | | | |
| *Haplopappus uniflorus var howellii* | Howell's one-flowered goldenweed | | T4 | | | |
| *Ipomopsis polycladon* | Spreading gilia | 2 | T3 | T3 | S2 | |
| *Lepidium davisii* | Davis' peppergrass | GP3 | T3 | T3 | S3 | S1 |
| *Lepidium papilliferum*[1] | Slickspot peppergrass | GP2 | | T1 | S2 | |
| *Leptodactylon glabrum* | Bruneau river prickly phlox | GP2 | T3 | T3 | S2 | S1 |
| *Lomatium packardiae* | Packard's desert-parsley | GP2 | T2 | | S2 | S1? |
| *Lupinus uncialis* | Inch-high lupine | S | T4 | | S2 | |
| *Machaerocarpus californicus* | Star water plantain | | T5 | T5 | | |
| *Mentzelia mollis* | Smooth stickleaf | GP2 | T2 | | S2 | S1 |
| *Mimulus evanescens* | Disappearing monkey-flower | | T5 | | | |
| *Nemacladus rigidus* | Rigid threadbush | S | T4 | T4 | S2 | |
| *Pediocactus simpsonii* | Simpson's hedgehog cactus | M | T5 | T5 | S3 | |
| *Penstemon janishiae* | Janish's penstemon | 2 | T3 | T3 | S2 | |
| *Penstemon seorsus* | Short-lobed penstemon | | T5 | | | |
| *Peteria thompsoniae* | Spine-noded milkvetch | S | T4 | T4 | S2 | |
| *Phacelia lutea var calva* | Malheur yellow phacelia | GP3 | T3 | | S3 | |
| *Phacelia minutissima*[1] | Least phacelia | GP3 | T2 | | S2 | S2 |
| *Polystichum kruckebergii* | Kruckberg's sword-fern | S | | | S2 | |
| *Potamogeton diversifolius* | Diverse-leaved pondweed | | T5 | | | |
| *Psathyrotes annua* | Annual brittlebrush | 1 | T3 | | S2 | |
| *Solidago spectabilis* | Basin goldenrod | | T5 | | | |
| *Stanleya confertiflora* | Biennial princesplume | GP1 | T2 | | S1 | |
| *Teucrium canadense var occidentale* | American wood sage | 1 | T3 | T3 | S2 | |
| *Trifolium owyheense* | Owyhee clover | GP3 | T2 | | S1 | |

Appendix C. Wildlife species designated as rare or significant to the Bruneau subbasin. Natural heritage state ranks are presented from the IDCDC (2003) and NNHP (2003).

| Common Name | Scientific Name | IDCDC | NNHP |
|---|---|---|---|
| **Birds** | | | |
| American white pelican | *Pelecanus erythrorhynchos* | S1B | S2B |
| Bald eagle | *Halliaeetus leucocephalus* | S3B,S4N | S1B |
| Barn owl | *Tyto alba* | S3? | |
| Barrow's goldeneye | *Bucephala islandica* | S3B,S3N | |
| Black swift | *Cypseloides niger* | S1B | |
| Black tern | *Chlidonlas niger* | S2B | S2S3B |
| Black-backed woodpecker | *Picoides arcticus* | S3 | |
| Black-crowned night-heron | *Nycticorax nycticorax* | S3B | |
| Black-throated sparrow | *Amphispiza bilineata* | S2B | |
| Bobolink | *Dolichonyx oryzivorus* | | S3?B |
| Bohemian waxwing | *Bombycilla garrulus* | S1B,S3N | |
| Bufflehead | *Bucephala albeola* | S3B,S3N | |
| California gull | *Larus californicus* | S2S3B,S3N | |
| Caspian tern | *Sterna caspia* | S1B | |
| Cattle egret | *Bubulcus ibis* | S2B | |
| Clark's grebe | *Aechmophorus clarkii* | S2B | |
| Columbian sharp-tailed grouse | *Tympanuchus phasianellus columbianus* | S3 | S1? |
| Common goldeneye | *Bucephala clangula* | S3B,S3N | |
| Common loon | *Gavia immer* | S1B,S2N | S2S3N |
| Common tern | *Sterna hirundo* | S1B | |
| Common yellowthroat | *Geothlypis trichas* | | S3B |
| Double-crested cormorant | *Phalacrocorax auritus* | S2B | |
| Ferruginous hawk | *Buteo regalis* | S3B | S3 |
| Flammulated owl | *Otus flammeolus* | S3B | |
| Forster's tern | *Sterna forsteri* | S2S3B | |
| Franklin's gull | *Larus pipixcan* | S2B | |
| Great egret | *Ardea alba* | S1B | |
| Harlequin duck | *Histrionicus histrionicus* | S1B | SAN |
| Hooded merganser | *Lophodytes cucullatus* | S2B,S3N | |
| Horned grebe | *Podiceps auritus* | S1? | |
| Least bittern | *Ixobrychus exilis* | | S2N |

| Common Name | Scientific Name | IDCDC | NNHP |
|---|---|---|---|
| Lesser goldfinch | *Carduelis psaltria* | S1B | |
| Loggerhead shrike | *Lanius ludovicianus* | S3 | |
| Long-billed curlew | *Numenius americanus* | S3B | S3?B |
| Merlin | *Falco columbarius* | S1B,S2N | |
| Mountain quail | *Oreortyx pictus* | S2 | S3 |
| Mountain willow flycatcher | *Empidonax traillii adastus* | | S2? |
| Northern goshawk | *Accipiter gentilis* | | S3 |
| Northern mockingbird | *Mimus polyglottos* | S1B | |
| Osprey | *Pandion haliaetus* | | S2B |
| Peregrine falcon | *Falco peregrinus anatum* | S1B | S2 |
| Pinyon jay | *Gymnorhinus cyanocephalus* | S2? | |
| Purple martin | *Progne subis* | S1?B | |
| Red-necked grebe | *Podiceps grisegena* | S3B | |
| Ring-billed gull | *Larus delawarensis* | S2S3B,S3N | |
| Snowy egret | *Egretta thula* | S2B | |
| Snowy plover | *Charadrius alexandrinus* | | S1B |
| Swainson's hawk | *Buteo swainsoni* | | S2B |
| Three-toed woodpecker | *Picoides tridactylus* | S3? | |
| Tri-colored blackbird | *Agelaius tricolor* | | S2 |
| Trumpeter swan | *Cygnus buccinator* | S1B,S2N | S2B |
| Western burrowing owl | *Athene cunicularia hypugaea* | S3S4 | S3B |
| Western scrub-jay | *Aphelocoma californica* | S2? | |
| White-faced ibis | *Plegadis chihi* | S2B | S3B |
| White-headed woodpecker | *Picoides albolarvatus* | S2B | S3? |
| White-winged crossbill | *Loxia leucoptera* | S1? | |
| Yellow warbler | *Dendroica petechia* | | S3B |
| Yellow-billed cuckoo | *Coccyzus americanus* | S1B | S1B |
| Yellow-breasted chat | *Icteria virens* | | S3B |
| **Mammals** | | | |
| American pika | *Ochotona princeps* | | S3 |
| California bighorn sheep | *Ovis Canadensis californiana* | S3 | |
| California myotis | *Myotis californicus* | S1? | S3B |
| Dark kangaroo mouse | *Microdipodops megacephalus* | S1 | S2 |
| Fringed myotis | *Myotis thysanodes* | S1? | S2B |
| Kit fox | *Vulpes velox* | S1 | |
| Little pocket mouse | *Perognathus longimembris* | S1? | |

| Common Name | Scientific Name | IDCDC | NNHP |
|---|---|---|---|
| Long-eared myotis | *Myotis evotis* | S3? | |
| Long-legged myotis | *Myotis volans* | S3? | |
| Lynx | *Lynx canadensis* | S1 | |
| Merriam's shrew | *Sorex merriami* | S2? | S3 |
| North american wolverine | *Gulo gulo luscus* | S2 | SP |
| Pallid bat | *Antrozous pallidus* | S1? | S3B |
| Pinon mouse | *Peromyscus truei* | S2 | |
| Pygmy rabbit | *Brachylagus idahoensis* | S3 | S3? |
| Rock squirrel | *Spermophilus variegatus* | S1 | |
| Spotted bat | *Euderma maculatum* | S2 | S1S2 |
| Townsend's big-eared bat | *Corynorhinus townsendii* | S2? | S3B |
| Western jumping mouse | *Zapus princeps* | | S3 |
| Western pipistrelle | *Pipistrellus hesperus* | S1? | |
| Western small-footed myotis | *Myotis ciliolabrum* | | S3B |
| Yuma myotis | *Myotis yumanensis* | S3? | |
| **Amphibians and Reptiles** | | | |
| Columbia spotted frog | *Rana luteiventris* | S2S3 | S2S3 |
| Longnose snake | *Rhinocheilus lecontei* | S3 | |
| Mojave black-collared lizard | *Crotaphytus bicinctores* | S2 | |
| Northern leopard frog | *Rana pipiens* | S3 | |
| Ringneck snake | *Diadophis punctatus* | S1? | |
| Western toad | *Bufo boreas* | S? | |
| Woodhouse's toad | *Bufo woodhousii* | S3? | |

Appendix D.  Game (G) and furbearing (F) wildlife species that are managed by Idaho and Nevada that are present or have potential habitat in the Bruneau subbasin (IBIS 2003, NDOW 2003b, NNHP 2003).

| Common Name | Scientific Name | ID | NV |
|---|---|---|---|
| **Birds** | | | |
| American coot | *Fulica americana* | G | G |
| American crow | *Corvus brachyrhynchos* | G | G |
| American wigeon | *Anas americana* | G | G |
| Barrow's goldeneye | *Bucephala islandica* | G | G |
| Blue grouse | *Dendragapus obscurus* | G | G |
| Blue-winged teal | *Anas discors* | G | G |
| Bufflehead | *Bucephala albeola* | G | G |
| California quail | *Callipepla californica* | G | G |
| Canada goose | *Branta canadensis* | G | G |
| Canvasback | *Aythya valisineria* | G | G |
| Chukar | *Alectoris chukar* | G | G |
| Cinnamon teal | *Anas cyanoptera* | G | G |
| Common goldeneye | *Bucephala clangula* | G | G |
| Common merganser | *Mergus merganser* | G | G |
| Common snipe | *Gallinago gallinago* | G | G |
| Gadwall | *Anas strepera* | G | G |
| Gray partridge | *Perdix perdix* | G | G |
| Greater scaup | *Aythya marila* | | G |
| Greater white-fronted goose | *Anser albifrons* | G | G |
| Green-winged teal | *Anas crecca* | G | G |
| Harlequin duck | *Histrionicus histrionicus* | G | G |
| Hooded merganser | *Lophodytes cucullatus* | G | G |
| Lesser scaup | *Aythya affinis* | G | G |
| Mallard | *Anas platyrhynchos* | G | G |
| Mountain quail | *Oreortyx pictus* | G | G |
| Mourning dove | *Zenaida macroura* | G | G |
| Northern pintail | *Anas acuta* | G | G |
| Northern shoveler | *Anas clypeata* | G | G |
| Red-breasted merganser | *Mergus serrator* | G | G |
| Redhead | *Aythya americana* | G | G |
| Ring-necked duck | *Aythya collaris* | G | G |
| Ring-necked pheasant | *Phasianus colchicus* | G | G |

| Common Name | Scientific Name | ID | NV |
|---|---|---|---|
| Ross's goose | *Chen rossii* | G | G |
| Ruddy duck | *Oxyura jamaicensis* | G | G |
| Ruffed grouse | *Bonasa umbellus* | G | G |
| Sage grouse | *Centrocercus urophasianus* | G | G |
| Sandhill crane | *Grus canadensis* | G | |
| Sharp-tailed grouse | *Tympanuchus phasianellus* | G | G |
| Snow goose | *Chen Ccaerulescens* | G | G |
| Trumpeter swan | *Cygnus buccinator* | | G |
| Wild turkey | *Meleagris gallopavo* | G | G |
| Wood duck | *Aix sponsa* | G | G |
| **Mammals** | | | |
| American badger | *Taxidea taxus* | G | |
| American beaver | *Castor canadensis* | G | F |
| Bighorn sheep | *Ovis canadensis* | G | G |
| Bobcat | *Lynx rufus* | G | F |
| Gray fox | *Urocyon cinereoargenteus* | | F |
| Kit fox | *Vulpes velox* | | F |
| Mink | *Mustela vison* | G | F |
| Mountain lion | *Puma concolor* | G | G |
| Mule deer | *Odocoileus hemionus* | G | G |
| Muskrat | *Ondatra zibethicus* | G | F |
| Northern river otter | *Lutra canadensis* | G | F |
| Nuttall's (mountain) cottontail | *Sylvilagus nuttallii* | G | G |
| Pronghorn | *Antilocapra americana* | G | G |
| Pygmy rabbit | *Brachylagus idahoensis* | G | G |
| Raccoon | *Procyon lotor* | G | G |
| Red fox | *Vulpes vulpes* | G | G |
| Rocky mountain elk | *Cervus elaphus nelsoni* | G | G |
| Snowshoe hare | *Lepus americanus* | G | G |
| White-tailed jackrabbit | *Lepus townsendii* | | G |

Appendix E. Partners in Flight priority and focal species identified in the Idaho (ID PIF) and Nevada (NV PIF) Bird Conservation Plans (Y=yes; IBIS 2003, Neel 1999).

| **Common name** | **Scientific name** | **ID PIF** | **NV PIF** |
|---|---|---|---|
| American avocet | *Recurvirostra americana* | Y | Y |
| American dipper | *Cinclus mexicanus* | Y | |
| American white pelican | *Pelecanus erythrorhynchos* | Y | Y |
| Ash-throated flycatcher | *Myiarchus cinerascens* | | Y |
| Bank swallow | *Riparia riparia* | | Y |
| Barrow’s goldeneye | *Bucephala islandica* | Y | |
| Black rosy-finch | *Leucosticte atrata* | Y | Y |
| Black swift | *Cypseloides niger* | Y | |
| Black tern | *Chlidonias niger* | | Y |
| Black-backed woodpecker | *Picoides arcticus* | Y | |
| Black-billed magpie | *Pica pica* | Y | |
| Black-chinned hummingbird | *Archilochus alexandri* | Y | |
| Black-necked stilt | *Himantopus mexicanus* | Y | |
| Black-throated gray warbler | *Dendroica nigrescens* | Y | Y |
| Blue grouse | *Dendragapus obscurus* | Y | |
| Bobolink | *Dolichonyx oryzivorus* | | Y |
| Brewer’s sparrow | *Spizella breweri* | Y | |
| Brown creeper | *Certhia americana* | Y | |
| Burrowing owl | *Athene cunicularia* | | Y |
| Calliope hummingbird | *Stellula calliope* | Y | Y |
| Cinnamon teal | *Anas cyanoptera* | Y | |
| Clark’s grebe | *Aechmophorus clarkii* | | Y |
| Cooper’s hawk | *Accipiter cooperii* | | Y |
| Dusky flycatcher | *Empidonax oberholseri* | Y | |
| Ferruginous hawk | *Buteo regalis* | Y | Y |
| Flammulated owl | *Otus flammeolus* | Y | Y |
| Franklin’s gull | *Larus pipixcan* | Y | |
| Golden eagle | *Aquila chrysaetos* | Y | |
| Grasshopper sparrow | *Ammodramus savannarum* | Y | |
| Gray flycatcher | *Empidonax wrightii* | Y | Y |
| Hammond’s flycatcher | *Empidonax hammondii* | Y | |
| Hooded merganser | *Lophodytes cucullatus* | Y | |
| Juniper titmouse | *Baeolophus griseus* | | Y |
| Killdeer | *Charadrius vociferus* | Y | |

| Common name | Scientific name | ID PIF | NV PIF |
|---|---|---|---|
| Lark sparrow | *Chondestes grammacus* | Y | |
| Lewis's woodpecker | *Melanerpes lewis* | Y | Y |
| Loggerhead shrike | *Lanius ludovicianus* | | Y |
| Long-billed curlew | *Numenius americanus* | Y | Y |
| Macgillivray's warbler | *Oporornis tolmiei* | Y | Y |
| Mountain quail | *Oreortyx pictus* | Y | |
| Northern goshawk | *Accipiter gentilis* | Y | Y |
| Olive-sided flycatcher | *Contopus cooperi* | Y | Y |
| Orange-crowned warbler | *Vermivora celata* | | Y |
| Pinyon jay | *Gymnorhinus cyanocephalus* | Y | Y |
| Prairie falcon | *Falco mexicanus* | Y | Y |
| Redhead | *Aythya americana* | Y | |
| Red-naped sapsucker | *Sphyrapicus nuchalis* | | Y |
| Rock wren | *Salpinctes obsoletus* | Y | |
| Ruffed grouse | *Bonasa umbellus* | Y | |
| Rufous hummingbird | *Selasphorus rufus* | Y | |
| Sage grouse | *Centrocercus urophasianus* | Y | Y |
| Sage sparrow | *Amphispiza belli* | Y | Y |
| Sage thrasher | *Oreoscoptes montanus* | Y | Y |
| Sandhill crane | *Grus canadensis* | Y | Y |
| Sharp-shinned hawk | *Accipiter striatus* | Y | |
| Sharp-tailed grouse | *Tympanuchus phasianellus* | Y | |
| Short-eared owl | *Asio flammeus* | Y | Y |
| Snowy plover | *Charadrius alexandrinus* | | Y |
| Swainson's hawk | *Buteo swainsoni* | Y | Y |
| Three-toed woodpecker | *Picoides tridactylus* | | Y |
| Townsend's warbler | *Dendroica townsendi* | Y | |
| Trumpeter swan | *Cygnus buccinator* | Y | |
| Varied thrush | *Ixoreus naevius* | Y | |
| Vaux's swift | *Chaetura vauxi* | Y | |
| Vesper sparrow | *Pooecetes gramineus* | | Y |
| Western bluebird | *Sialia mexicana* | | Y |
| Western grebe | *Aechmophorus occidentalis* | Y | |
| Western tanager | *Piranga ludoviciana* | Y | |
| White-faced ibis | *Plegadis chihi* | Y | Y |
| White-headed woodpecker | *Picoides albolarvatus* | Y | Y |

| Common name | Scientific name | ID PIF | NV PIF |
|---|---|---|---|
| Williamson’s sapsucker | *Sphyrapicus thyroideus* | Y | |
| Willow flycatcher | *Empidonax traillii* | Y | Y |
| Wilson’s warbler | *Wilsonia pusilla* | | Y |
| Yellow warbler | *Dendroica petechia* | Y | |
| Yellow-billed cuckoo | *Coccyzus americanus* | | Y |
| Yellow-breasted chat | *Icteria virens* | | Y |

Appendix F. Critical functionally linked species present or with potential habitat in the Bruneau subbasin (IBIS 2003).

| KEF Code | KEF Description | Species | Wildlife-Habitat Type |
|---|---|---|---|
| 1_1_1_13 | Trophic relationships:<br>Heterotrophic consumer:<br>Primary consumer (herbivore):<br>Bark/cambium/bole feeder | American beaver (*Castor canadensis*) | Open Water–Lakes, Rivers, and Streams |
| 1_1_1_3 | Trophic relationships:<br>Heterotrophic consumer:<br>Primary consumer (herbivore):<br>Browser (leaf, stem eater) | White-tailed deer (*Odocoileus virginianus ochrourus*) | Agriculture, Pastures, and Mixed Environs |
| 1_1_1_5 | Trophic relationships:<br>Heterotrophic consumer:<br>Primary consumer (herbivore):<br>Frugivore (fruit-eater) | Raccoon (*Procyon lotor*) | Open Water–Lakes, Rivers, and Streams |
| 1_1_1_6 | Trophic relationships:<br>Heterotrophic consumer:<br>Primary consumer (herbivore):<br>Sap feeder | House finch (*Carpodacus mexicanus*) | Agriculture, Pastures, and Mixed Environs<br>Urban and Mixed Environs |
| 1_1_1_7 | Trophic relationships:<br>Heterotrophic consumer:<br>Primary consumer (herbivore):<br>Root feeders | Northern pocket gopher (*Thomomys talpoides*) | Desert Playa and Salt Scrub Shrublands<br>Agriculture, Pastures, and Mixed Environs |
| 1_1_1_8 | Trophic relationships:<br>Heterotrophic consumer:<br>Primary consumer (herbivore):<br>Nectivore (nectar feeder) | Black-chinned hummingbird (*Archilochus alexandri*) | Shrub-steppe<br>Dwarf Shrub-steppe<br>Desert Playa and Salt Scrub Shrublands |
| 1_1_1_9 | Trophic relationships: | Deer mouse (*Peromyscus maniculatus*) | Urban and Mixed Environs |

| KEF Code | KEF Description | Species | Wildlife-Habitat Type |
|---|---|---|---|
| | Heterotrophic consumer: Primary consumer (herbivore): Fungivore (fungus feeder) | | |
| 1_1_2_1_3 | Trophic relationships: Heterotrophic consumer Secondary consumer Invertebrate eater Freshwater or marine zooplankton | Long-toed salamander (*Ambystoma macrodactylum*) | Upland Aspen Forest<br>Alpine Grasslands and Shrublands<br>Interior Canyon Shrublands<br>Montane Coniferous Wetlands |
| 1_1_2_2_1 | Trophic relationships: Heterotrophic consumer: Secondary consumer: Vertebrate eater: Piscivorous (fish eater) | Raccoon (*Procyon lotor*) | Urban and Mixed Environs |
| 1_1_5 | Trophic relationships: Heterotrophic consumer: Cannibalistic | Great Basin spadefoot (*Scaphiopus intermontanus*) | Western Juniper and Mountain Mahogany Woodlands<br>Desert Playa and Salt Scrub Shrublands |
| 1_1_6 | Trophic relationships: Heterotrophic consumer: Coprophagous (feeds on fecal material) | American pika (*Ochotona princes*) | Alpine Grasslands and Shrublands |
| 1_1_6 | Trophic relationships: Heterotrophic consumer: Coprophagous (feeds on fecal material) | Nuttall’s (mountain) cottontail (*Sylvilagus nuttallii*) | Western Juniper and Mountain Mahogany Woodlands |
| 1_1_6 | Trophic relationships: Heterotrophic consumer: | Snowshoe hare (*Lepus americanus*) | Lodgepole Pine Forest and Woodlands<br>Ponderosa Pine & Interior White Oak Forest and Woodlands |

| KEF Code | KEF Description | Species | Wildlife-Habitat Type |
|---|---|---|---|
| | Coprophagous (feeds on fecal material) | | Montane Coniferous Wetlands |
| 2 | Aids in physical transfer of substances for nutrient cycling (C,N,P, etc.) | Big brown bat (*Eptesicus fuscus*) | Agriculture, Pastures, and Mixed Environs<br>Urban and Mixed Environs |
| 3 | Organismal relationships | Black phoebe (*Sayornis nigricans*) | Open Water–Lakes, Rivers, and Streams |
| 3 | Organismal relationships | Horned lark (*Eremophila alpestris*) | Alpine Grasslands and Shrublands<br>Shrub-steppe<br>Dwarf Shrub-steppe<br>Desert Playa and Salt Scrub Shrublands |
| 3 | Organismal relationships | Spotted towhee (*Pipilo maculates*) | Interior Mixed Conifer Forest<br>Interior Canyon Shrublands |
| 3 | Organismal relationships | Lapland longspur (*Calcarius lapponicus*) | Herbaceous Wetlands |
| 3_1 | Organismal relationships:<br><br>Controls or depresses insect population peaks | Big brown bat (*Eptesicus fuscus*) | Urban and Mixed Environs |
| 3_15 | Organismal relationships:<br><br>Pirates food from other species | American crow (*Corvus brachyrhynchos*) | Agriculture, Pastures, and Mixed Environs<br>Urban and Mixed Environs |
| 3_16 | Organismal relationships:<br><br>Interspecific hybridization | Oregon spotted frog (*Rana pretiosa*) | Open Water–Lakes, Rivers, and Streams |
| 3_16 | Organismal relationships:<br><br>Interspecific hybridization | American crow (*Corvus brachyrhynchos*) | Urban and Mixed Environs |
| 3_2 | Organismal relationships:<br><br>Controls terrestrial vertebrate populations (through predation or displacement) | Raccoon (*Procyon lotor*) | Urban and Mixed Environs |

| KEF Code | KEF Description | Species | Wildlife-Habitat Type |
|---|---|---|---|
| 3_3 | Organismal relationships:<br><br>Pollination vector | Black-chinned hummingbird (*Archilochus alexandri*) | Shrub-steppe<br><br>Dwarf Shrub-steppe<br>Desert Playa and Salt Scrub Shrublands |
| 3_3 | Organismal relationships:<br><br>Pollination vector | Rufous hummingbird (*Selasphorus rufus*) | Alpine Grasslands and Shrublands |
| 3_4_1 | Organismal relationships:<br><br>Transportation of viable seeds, spores, plants or animals:<br>Disperses fungi | Deer Mouse (*Peromyscus maniculatus*) | Agriculture, Pastures, and Mixed Environs<br>Urban and Mixed Environs |
| 3_4_4 | Organismal relationships:<br><br>Transportation of viable seeds, spores, plants or animals:<br>Disperses insects and other invertebrates | Golden-mantled ground squirrel (*Spermophilus lateralis*) | Lodgepole Pine Forest and Woodlands<br>Upland Aspen Forest<br><br>Interior Canyon Shrublands |
| 3_4_6 | Organismal relationships:<br><br>Transportation of viable seeds, spores, plants or animals:<br><br>Disperses vascular plants | Golden-mantled ground squirrel (*Spermophilus lateralis*) | Upland Aspen Forest<br><br>Western Juniper and Mountain Mahogany Woodlands<br>Interior Canyon Shrublands |
| 3_5_1 | Organismal relationships:<br><br>Creates feeding, roosting, denning, or nesting opportunities for other organisms:<br>Creates feeding opportunities (other than direct prey relations) | Great blue heron (*Ardea herodias*) | Open Water–Lakes, Rivers, and Streams |
| 3_5_1 | Organismal relationships:<br><br>Creates feeding, roosting, denning, or nesting opportunities for other organisms: | Mountain lion (*Puma concolor*) | Western Juniper and Mountain Mahogany Woodlands<br>Interior Canyon Shrublands |

| KEF Code | KEF Description | Species | Wildlife-Habitat Type |
|---|---|---|---|
| | Creates feeding opportunities (other than direct prey relations) | | |
| 3_5_1_1 | Organismal relationships:<br>Creates feeding, roosting, denning, or nesting opportunities for other organisms:<br>Creates feeding opportunities:<br>Creates sapwells in trees | Williamson's sapsucker (*Sphyrapicus thyroideus*) | Western Juniper and Mountain Mahogany Woodlands<br>Interior Canyon Shrublands |
| 3_5_2 | Organismal relationships:<br>Creates feeding, roosting, denning, or nesting opportunities for other organisms:<br>Creates roosting, denning, or nesting opportunities | Great blue heron (*Ardea herodias*) | Open Water–Lakes, Rivers, and Streams<br>Herbaceous Wetlands<br>Interior Riparian-Wetlands |
| 3_5_2 | Organismal relationships:<br>Creates feeding, roosting, denning, or nesting opportunities for other organisms:<br>Creates roosting, denning, or nesting opportunities | Red squirrel (*Tamiasciurus hudsonicus*) | Montane Mixed Conifer Forest<br>Interior Mixed Conifer Forest<br>Lodgepole Pine Forest and Woodlands<br>Ponderosa Pine & Interior White Oak Forest and Woodlands |
| 3_6_2 | Organismal relationships:<br>Primary creation of structures (possibly used by other organisms):<br>Ground structures | Bushy-tailed woodrat (*Neotoma cinerea*) | Upland Aspen Forest<br>Agriculture, Pastures, and Mixed Environs<br>Montane Coniferous Wetlands<br>Interior Riparian-Wetlands |
| 3_6_3 | Organismal relationships:<br>Primary creation of structures (possibly used by other organisms): | American beaver (*Castor Canadensis*) | Montane Mixed Conifer Forest<br>Interior Mixed Conifer Forest |

| KEF Code | KEF Description | Species | Wildlife-Habitat Type |
|---|---|---|---|
| | Aquatic structures | | Lodgepole Pine Forest and Woodlands<br>Ponderosa Pine & Interior White Oak Forest and Woodlands<br>Upland Aspen Forest<br>Western Juniper and Mountain Mahogany Woodlands<br>Montane Coniferous Wetlands |
| 3_7_1 | Organismal relationships:<br>User of structures created by other species:<br>Aerial structures | Black tern (*Chlidonias niger*) | Open Water–Lakes, Rivers, and Streams |
| 3_7_1 | Organismal relationships:<br>User of structures created by other species:<br>Aerial structures | Great horned owl (*Bubo virginianus*) | Desert Playa and Salt Scrub Shrublands |
| 3_7_2 | Organismal relationships:<br>User of structures created by other species:<br>Ground structures | Deer mouse (*Peromyscus maniculatus*) | Montane Mixed Conifer Forest<br>Upland Aspen Forest<br>Alpine Grasslands and Shrublands<br>Desert Playa and Salt Scrub Shrublands<br>Agriculture, Pastures, and Mixed Environs<br>Urban and Mixed Environs<br>Montane Coniferous Wetlands |
| 3_7_3 | Organismal relationships:<br>User of structures created by other species: | Mink (*Mustela vison*) | Lodgepole Pine Forest and Woodlands<br>Upland Aspen Forest |

| KEF Code | KEF Description | Species | Wildlife-Habitat Type |
|---|---|---|---|
| | Aquatic structures | | Western Juniper and Mountain Mahogany Woodlands<br>Interior Canyon Shrublands<br>Interior Grasslands<br>Shrub-steppe<br>Desert Playa and Salt Scrub Shrublands |
| 3_8_1 | Organismal relationships:<br>Nest parasite:<br>Interspecies parasite | Redhead (*Aythya americana*) | Open Water–Lakes, Rivers, and Streams |
| 3_8_1 | Organismal relationships:<br>Nest parasite:<br>Interspecies parasite | Brown-headed cowbird (*Molothrus ater*) | Montane Mixed Conifer Forest<br>Interior Mixed Conifer Forest<br>Lodgepole Pine Forest and Woodlands<br>Ponderosa Pine & Interior White Oak Forest and Woodlands<br>Upland Aspen Forest<br>Western Juniper and Mountain Mahogany Woodlands<br>Interior Canyon Shrublands<br>Interior Grasslands<br>Shrub-steppe<br>Dwarf Shrub-steppe<br>Desert Playa and Salt Scrub Shrublands<br>Agriculture, Pastures, and Mixed Environs<br>Montane Coniferous Wetlands |
| 3_8_2 | Organismal relationships: | Greater scaup (*Aythya marila*) | Open Water–Lakes, Rivers, and Streams |

| KEF Code | KEF Description | Species | Wildlife-Habitat Type |
|---|---|---|---|
| | Nest parasite:<br>Common interspecific host | | |
| 3_8_2 | Organismal relationships:<br><br>Nest parasite:<br>Common interspecific host | House finch | Urban and Mixed Environs |
| 4 | Carrier, transmitter, or reservoir of vertebrate diseases | Sagebrush vole (*Lemmiscus curtatus*) | Interior Grasslands<br><br>Shrub-steppe<br>Dwarf Shrub-steppe |
| 4_2 | Carrier, transmitter, or reservoir of vertebrate diseases:<br><br>Diseases that affect domestic animals | Double-crested cormorant (*Phalacrocorax auritus*) | Open Water–Lakes, Rivers, and Streams<br><br>Herbaceous Wetlands<br>Interior Riparian-Wetlands |
| 4_3 | Carrier, transmitter, or reservoir of vertebrate diseases:<br>Diseases that affect other wildlife species | Common porcupine (*Erethizon dorsatum*) | Montane Coniferous Wetlands |
| 6_1 | Wood structure relationships (either living or dead wood):<br><br>Physically fragments down wood | White-tailed deer (eastside) (*Odocoileus virginianus ochrourus*) | Agriculture, Pastures, and Mixed Environs |
| 7_1 | Water relationships:<br><br>Impounds water by creating diversions or dams | American beaver (*Castor canadensis*) | Montane Mixed Conifer Forest<br>Interior Mixed Conifer Forest<br>Lodgepole Pine Forest and Woodlands<br>Ponderosa Pine & Interior White Oak Forest and Woodlands<br>Upland Aspen Forest<br>Western Juniper and Mountain Mahogany Woodlands<br>Open Water–Lakes, Rivers, and Streams |

| KEF Code | KEF Description | Species | Wildlife-Habitat Type |
|---|---|---|---|
| | | | Herbaceous Wetlands<br>Montane Coniferous Wetlands<br>Interior Riparian-Wetlands |
| 7_2 | Water relationships:<br><br>Creates ponds or wetlands through wallowing | American beaver (*Castor canadensis*) | Open Water–Lakes, Rivers, and Streams |
| 7_2 | Water relationships:<br><br>Creates ponds or wetlands through wallowing | Feral horse (*Equus caballus*) | Desert Playa and Salt Scrub Shrublands |
| 7_2 | Water relationships:<br><br>Creates ponds or wetlands through wallowing | Rocky mountain elk (*Cervus elaphus nelsoni*) | Alpine Grasslands and Shrublands<br>Interior Canyon Shrublands |
| 8_3 | Vegetation structure and composition relationships:<br>Herbivory on grasses or forbs that may alter vegetation structure and composition (grazers) | Canada goose (*Branta canadensis*) | Open Water–Lakes, Rivers, and Streams |
| 8_3 | Vegetation structure and composition relationships:<br>Herbivory on grasses or forbs that may alter vegetation structure and composition (grazers) | Montane vole (*Microtus montanus*) | Agriculture, Pastures, and Mixed Environs |

Appendix G.  Raw data and results of the qualitative habitat assessment (QHA) model

Various input and output information from the QHA model is presented to provide transparency regarding data inputs and allow readers the opportunity to consider possible alternative interpretations of outputs.  All data inputs represent professional judgments since no suitable and timely method could be developed for defensibly transforming real habitat data into categorical classifications used by the QHA model.  Regional biologists within IDFG and ODFW most familiar with the streams of interest populated the QHA model, and their input was subsequently reviewed by the subbasin aquatic technical team.  No changes were requested or made to original data inputs based on technical team review.

The following information is presented by focal species (*e.g.*, redband trout, bull trout, mountain whitefish, Bruneau hot springsnail, Idaho springsnail) in this appendix:

Model Inputs:

1. Existing conditions
2. Reference conditions
3. Species habitat hypotheses
4. Species use/distribution

Model Outputs:

1. Habitat scores
2. Habitat ranks

Readers interested in detailed explanation of the QHA model development and function are referred to the QHA users guide (Mobrand Biometrics 2003).

## Existing Conditions–Redband Trout

| Scoring | |
|---|---|
| Confidence Rating | Attribute Rating |
| 0 = Unknown | 0 = 0% of normative |
| 1 = Expert Opinion | 1 = 25% of normative |
| 2 = Well Documented | 2 = 50% of normative |
| | 3 = 75% of normative |
| Definitions | 4 = 100% of normative |

Describe the natural physical condition of the stream

Stream Name: Bruneau Subbasin

Describe the current condition for this stream in regard to the **physical conditions** in this ecological province.

| HUC_6 | Reach Name | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0102 | Bruneau 2 | 1.0 | 2.0 | 0.0 | 1.0 | 2.0 | 0.0 | 1.0 | 4.0 | 1.0 | 1.0 | 1.0 |
| 0401 | Bruneau 3 | 2.8 | 4.0 | 3.0 | 3.0 | 4.0 | 3.5 | 2.0 | 4.0 | 2.8 | 3.0 | 4.0 |
| 0402 | Bruneau 4 | 3.0 | 4.0 | 3.0 | 3.0 | 4.0 | 2.0 | 3.0 | 4.0 | 2.0 | 3.0 | 4.0 |
| 0501 | Bruneau 5 | 3.0 | 4.0 | 3.0 | 3.0 | 4.0 | 2.0 | 3.0 | 4.0 | 2.0 | 3.0 | 4.0 |
| 0502 | Clover 1 | 4.0 | 3.5 | 3.0 | 2.3 | 4.0 | 0.7 | 1.3 | 4.0 | 0.8 | 3.5 | 4.0 |
| 0503 | Clover 2 | 2.0 | 2.0 | 1.7 | 2.0 | 4.0 | 0.7 | 1.3 | 4.0 | 0.8 | 3.5 | 3.0 |
| 0801 | Clover 3 | 2.7 | 2.0 | 2.0 | 2.0 | 4.0 | 0.7 | 1.3 | 4.0 | 0.8 | 3.5 | 3.0 |
| 0802 | Clover 4 | 2.7 | 2.0 | 3.0 | 2.0 | 4.0 | 0.7 | 1.3 | 4.0 | 0.8 | 3.5 | 3.0 |
| 1001 | Deadwood | 2.7 | 2.0 | 2.3 | 2.0 | 4.0 | 1.3 | 1.3 | 4.0 | 1.2 | 3.5 | 3.0 |
| 1002 | Lower Three | 2.8 | 2.3 | 2.6 | 2.3 | 4.0 | 1.5 | 2.0 | 4.0 | 1.4 | 3.6 | 3.3 |
| 1003 | DEER | 3.0 | 2.0 | 2.5 | 2.0 | 4.0 | 1.0 | 1.3 | 4.0 | 1.2 | 3.5 | 3.0 |
| 1004 | Upper Three | 2.7 | 1.0 | 2.0 | 2.0 | 4.0 | 1.0 | 1.3 | 4.0 | 1.2 | 3.5 | 4.0 |
| 1101 | Big Flat Creek | 2.7 | 2.0 | 2.0 | 2.0 | 4.0 | 1.0 | 1.3 | 4.0 | 1.2 | 3.5 | 4.0 |
| 1202 | Flat and Coudle | 2.0 | 2.0 | 3.0 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 3.0 |
| 1501 | Jarbidge 3 | 3.0 | 3.0 | 4.0 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 3.0 | 4.0 |
| 1601 | E. Frk Jarbidge 1 | 2.0 | 3.0 | 3.0 | 2.0 | 4.0 | 3.0 | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 |
| 1602 | E.Frk Jarbidge 2 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 1701 | Jarbidge 4 | 3.0 | 3.0 | 4.0 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 3.0 | 4.0 |
| 1702 | Jarbidge 5 | 2.5 | 2.5 | 2.5 | 3.0 | 3.0 | 3.0 | 4.0 | 3.0 | 2.5 | 3.0 | 4.0 |
| 1801 | Jarbidge 2 | 2.3 | 3.0 | 3.3 | 2.3 | 4.0 | 3.3 | 4.0 | 3.0 | 2.0 | 4.0 | 4.0 |
| 1802 | Jarbidge 3 | 2.3 | 3.0 | 3.0 | 2.3 | 4.0 | 3.3 | 4.0 | 3.0 | 2.0 | 4.0 | 4.0 |
| 2101 | Bruneau 11 | 4.0 | 3.0 | 4.0 | 3.5 | 4.0 | 4.0 | 4.0 | 4.0 | 3.5 | 4.0 | 4.0 |
| 2102 | Coon | 3.0 | 3.0 | 3.5 | 3.5 | 3.5 | 4.0 | 4.0 | 3.5 | 3.0 | 4.0 | 4.0 |
| 2103 | Bruneau 13 | 4.0 | 3.0 | 3.5 | 3.5 | 4.0 | 4.0 | 4.0 | 4.0 | 3.5 | 4.0 | 4.0 |
| 2201 | Bruneau 12 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 4.0 | 4.0 | 4.0 | 3.5 | 4.0 | 4.0 |
| 2202 | Bruneau 14 | 3.0 | 3.0 | 3.0 | 3.5 | 4.0 | 2.0 | 4.0 | 4.0 | 3.0 | 4.0 | 2.5 |
| 2203 | Seventysix | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 3.0 | 2.0 | 2.0 | 2.0 |
| 2302 | Willow Creek/tribs | 2.5 | 2.5 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.5 | 3.0 | 4.0 | 4.0 |

| HUC_6 | Reach Name | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2501 | Meadow | 3.5 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.5 | 3.0 | 3.0 | 3.0 |
| 2502 | Telephone | 1.5 | 1.5 | 1.8 | 1.5 | 1.8 | 1.8 | 1.8 | 2.9 | 1.5 | 1.8 | 1.8 |
| 2602 | McDonalds | 3.0 | 2.8 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.5 | 3.0 | 3.0 | 2.0 |
| 2701 | Bruneau 8 | 2.5 | 3.0 | 2.5 | 2.0 | 3.5 | 2.0 | 3.0 | 3.0 | 2.0 | 4.0 | 4.0 |
| 2801 | Jarbidge 1 | 2.3 | 3.0 | 3.0 | 3.0 | 4.0 | 3.0 | 3.0 | 3.0 | 2.0 | 4.0 | 4.0 |
| 2803 | Bruneau 7 | 2.8 | 3.0 | 2.8 | 2.0 | 4.0 | 2.0 | 3.0 | 3.0 | 2.0 | 4.0 | 4.0 |
| 2901 | Cat | 1.8 | 2.0 | 2.0 | 3.0 | 4.0 | 1.8 | 3.0 | 2.0 | 2.0 | 4.0 | 2.8 |
| 2902 | Pole | 3.0 | 2.0 | 2.0 | 3.0 | 4.0 | 3.0 | 3.0 | 3.0 | 3.0 | 4.0 | 3.0 |
| 2903 | Sheep 4 | 3.0 | 3.3 | 3.3 | 3.3 | 4.0 | 3.3 | 3.3 | 3.3 | 3.3 | 4.0 | 3.3 |
| 2904 | Sheep 3 | 2.7 | 2.0 | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | 3.0 | 2.8 | 4.0 | 3.0 |
| 3101 | Sheep 3 | 3.0 | 2.0 | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | 3.0 | 3.0 | 4.0 | 3.0 |
| 3301 | Marys 1 | 2.8 | 3.0 | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | 2.0 | 2.0 | 4.0 | 3.0 |
| 3303 | Marys 2 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 2.0 | 4.0 | 3.0 | 2.8 | 4.0 | 3.0 |
| 3401 | Sheep 1 | 3.0 | 3.0 | 3.0 | 2.0 | 3.0 | 2.0 | 3.0 | 3.0 | 2.0 | 4.0 | 4.0 |
| 3501 | Bruneau 6 | 3.0 | 3.0 | 3.0 | 2.0 | 4.0 | 3.0 | 3.0 | 3.0 | 2.0 | 4.0 | 4.0 |
| 3601 | Louse 1 | 2.0 | 3.0 | 2.0 | 2.0 | 1.0 | 1.0 | 2.0 | 2.0 | 1.3 | 4.0 | 0.0 |
| 3602 | Louse 2 | 2.5 | 2.7 | 2.7 | 2.0 | 3.0 | 2.0 | 3.0 | 3.0 | 3.0 | 4.0 | 0.0 |
| 3801 | Wickahoney 1 | 3.0 | 3.0 | 2.0 | 3.0 | 4.0 | 2.0 | 3.7 | 4.0 | 2.0 | 4.0 | 4.0 |
| 3802 | Wickahoney 2 | 1.0 | 2.0 | 1.0 | 1.2 | 4.0 | 2.0 | 3.7 | 4.0 | 2.0 | 3.7 | 0.0 |
| 3803 | Duncan | 2.8 | 3.0 | 2.5 | 4.0 | 4.0 | 2.0 | 3.7 | 4.0 | 2.3 | 3.7 | 4.0 |
| 3901 | Cottonwood | 4.0 | 3.8 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 | 3.3 | 4.0 | 2.0 |
| 3902 | Big Jacks 2 | 3.0 | 3.0 | 3.0 | 3.0 | 4.0 | 2.7 | 3.7 | 4.0 | 3.0 | 3.7 | 2.0 |
| 4101 | Little Jacks 2 | 4.0 | 3.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 4102 | Little Jacks 3 | 2.3 | 3.0 | 3.0 | 3.0 | 4.0 | 2.3 | 3.0 | 3.0 | 3.0 | 4.0 | 3.0 |
| 4201 | Big Jacks 1 | 2.2 | 2.5 | 2.0 | 3.0 | 4.0 | 2.0 | 3.0 | 4.0 | 1.5 | 2.3 | 3.0 |
| 4202 | Little Jacks 1 | 4.0 | 2.7 | 3.8 | 4.0 | 4.0 | 2.0 | 3.7 | 4.0 | 3.7 | 3.7 | 3.0 |
| 4401 | Merritt | 2.1 | 2.9 | 3.0 | 3.0 | 4.0 | 2.8 | 4.0 | 4.0 | 3.0 | 4.0 | 2.5 |
| 4402 | Willis | 2.0 | 2.0 | 2.0 | 2.0 | 3.0 | 2.0 | 3.0 | 3.0 | 2.0 | 3.0 | 2.5 |

## Reference Conditions–Redband Trout

| Scoring | |
|---|---|
| Confidence Rating | Attribute Rating |
| 0 = Unknown | 0 = 0% of normative |
| 1 = Expert Opinion | 1 = 25% of normative |
| 2 = Well Documented | 2 = 50% of normative |
| | 3 = 75% of normative |
| Definitions | 4 = 100% of normative |

Describe the natural physical condition of the stream

Stream Name: Bruneau Subbasin

Describe the current condition for this stream in regard to the **physical conditions**
in this ecological province.

| HUC_6 | Reach Name | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0102 | Bruneau 2 | 3.0 | 4.0 | 3.0 | 4.0 | 2.0 | 4.0 | 3.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 0401 | Bruneau 3 | 3.0 | 4.0 | 3.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 0402 | Bruneau 4 | 3.0 | 4.0 | 3.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 0501 | Bruneau 5 | 3.0 | 4.0 | 3.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 0502 | Clover 1 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 0503 | Clover 2 | 3.3 | 3.0 | 3.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 0801 | Clover 3 | 3.3 | 3.0 | 3.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 0802 | Clover 4 | 3.3 | 3.0 | 3.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 1001 | Deadwood | 3.3 | 3.0 | 3.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 1002 | Lower Three | 3.3 | 3.3 | 4.0 | 4.0 | 4.0 | 3.3 | 4.0 | 3.3 | 4.0 | 4.0 | 3.3 |
| 1003 | DEER | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 1004 | Upper Three | 3.3 | 3.0 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 1101 | Big Flat Creek | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 1202 | Flat and Coudle | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 1501 | Jarbidge 3 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 1601 | E. Frk Jarbidge 1 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 1602 | E.Frk Jarbidge 2 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 1701 | Jarbidge 4 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 1702 | Jarbidge 5 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 1801 | Jarbidge 2 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 1802 | Jarbidge 3 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 2101 | Bruneau 11 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 2102 | Coon | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 2103 | Bruneau 13 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 2201 | Bruneau 12 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 2202 | Bruneau 14 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 2203 | Seventysix | 3.0 | 3.0 | 3.0 | 3.0 | 3.5 | 3.0 | 3.0 | 3.5 | 2.5 | 4.0 | 4.0 |
| 2302 | Willow Creek/ tribs | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |

| HUC_6 | Reach Name | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2501 | Meadow | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 2502 | Telephone | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 2.5 | 2.5 | 3.8 | 2.5 | 4.0 | 4.0 |
| 2602 | McDonalds | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 2701 | Bruneau 8 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 2801 | Jarbidge 1 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 2803 | Bruneau 7 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 2901 | Cat | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 2902 | Pole | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 2903 | Sheep 4 | 3.3 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.3 | 4.0 | 4.0 |
| 2904 | Sheep 3 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 3101 | Sheep 3 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 3301 | Marys 1 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 3303 | Marys 2 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 3401 | Sheep 1 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 3501 | Bruneau 6 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 3601 | Louse 1 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 3602 | Louse 2 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 3801 | Wickahoney 1 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 |
| 3802 | Wickahoney 2 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 |
| 3803 | Duncan | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 2.0 | 3.3 | 4.0 | 2.0 | 4.0 | 4.0 |
| 3901 | Cottonwood | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 2.0 |
| 3902 | Big Jacks 2 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 2.0 |
| 4101 | Little Jacks 2 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 2.0 |
| 4102 | Little Jacks 3 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 2.0 |
| 4201 | Big Jacks 1 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 | 2.0 | 4.0 | 3.0 |
| 4202 | Little Jacks 1 | 4.0 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 |
| 4401 | Merritt | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 4402 | Willis | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |

**Species Hypothesis–Redband Trout**

| | Spawning/incubation | Summer Rearing | Winter Rearing | Migration |
|---|---|---|---|---|
| **Life Stage Rank (1-4)** | **3.0** | **3.0** | **3.0** | **2.0** |

Assign a weight to each attribute (0-2) relative to its importance to the life stage

| | | | | |
|---|---|---|---|---|
| **Riparian Condition** | 1.0 | 2.0 | 2.0 | 0.5 |
| **Channel stability** | 2.0 | 2.0 | 2.0 | 0.5 |
| **Habitat Diversity** | 1.0 | 2.0 | 2.0 | 0.5 |
| **Fine sediment** | 2.0 | 2.0 | 2.0 | 0.5 |
| **High Flow** | 2.0 | 1.0 | 1.0 | 0.5 |
| **Low Flow** | 2.0 | 2.0 | 2.0 | 2.0 |
| **Oxygen** | 2.0 | 2.0 | 2.0 | 2.0 |
| **Low Temp** | 0.5 | 0.0 | 0.0 | 0.0 |
| **High Temp** | 2.0 | 2.0 | 2.0 | 2.0 |
| **Pollutants** | 2.0 | 2.0 | 2.0 | 2.0 |
| **Obstructions** | 2.0 | 2.0 | 2.0 | 2.0 |

### Species Range–Redband Trout

| Reach Name | Current Range (0-4) Spawn and incubation | Summer rearing | Winter rearing | Migration | Reference Range (0-4) Spawn and incubation | Summer rearing | Winter rearing | Migration | HUC_6 |
|---|---|---|---|---|---|---|---|---|---|
| Bruneau 2 | 0.0 | 0.8 | 0.8 | 0.8 | 0.0 | 1.0 | 1.0 | 1.0 | 0102 |
| Bruneau 3 | 0.0 | 0.8 | 0.8 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0401 |
| Bruneau 4 | 0.0 | 1.0 | 1.0 | 2.0 | 0.0 | 1.0 | 1.0 | 2.0 | 0402 |
| Bruneau 5 | 0.0 | 1.0 | 1.0 | 2.0 | 0.0 | 1.0 | 1.0 | 2.0 | 0501 |
| Clover 1 | 0.0 | 0.5 | 0.8 | 1.3 | 1.0 | 1.5 | 1.5 | 1.5 | 0502 |
| Clover 2 | 0.0 | 0.0 | 0.0 | 0.3 | 1.0 | 1.0 | 1.5 | 1.0 | 0503 |
| Clover 3 | 0.0 | 0.0 | 0.3 | 0.0 | 1.0 | 1.0 | 1.5 | 0.5 | 0801 |
| Clover 4 | 0.0 | 0.0 | 0.3 | 0.0 | 1.0 | 1.0 | 1.5 | 0.5 | 0802 |
| Deadwood | 0.0 | 0.0 | 0.5 | 0.0 | 0.5 | 0.5 | 1.0 | 0.0 | 1001 |
| Lower Three | 0.0 | 0.0 | 0.3 | 0.0 | 1.0 | 1.0 | 1.5 | 1.0 | 1002 |
| DEER | 1.0 | 1.5 | 1.5 | 0.5 | 1.0 | 1.8 | 1.5 | 1.0 | 1003 |
| Upper Three | 0.8 | 1.2 | 1.2 | 0.0 | 1.5 | 1.5 | 1.5 | 0.5 | 1004 |
| Big Flat Creek | 0.0 | 0.0 | 0.5 | 0.0 | 1.0 | 1.0 | 1.0 | 0.5 | 1101 |
| Flat and Coudle | 0.8 | 1.3 | 1.3 | 0.0 | 1.5 | 1.5 | 1.0 | 0.0 | 1202 |
| Jarbidge 3 | 2.0 | 2.0 | 2.0 | 1.0 | 2.0 | 2.0 | 2.0 | 2.0 | 1501 |
| E. Frk Jarbidge 1 | 2.0 | 2.0 | 2.0 | 1.0 | 2.0 | 2.0 | 2.0 | 2.0 | 1601 |
| E.Frk Jarbidge 2 | 1.3 | 1.3 | 1.3 | 1.0 | 1.5 | 1.5 | 1.5 | 1.0 | 1602 |
| Jarbidge 4 | 2.0 | 2.0 | 2.0 | 1.0 | 2.0 | 2.0 | 2.0 | 2.0 | 1701 |
| Jarbidge 5 | 1.3 | 1.3 | 1.3 | 1.0 | 1.5 | 1.5 | 1.5 | 1.0 | 1702 |
| Jarbidge 2 | 1.3 | 1.3 | 1.3 | 1.0 | 1.5 | 1.5 | 1.5 | 1.0 | 1801 |
| Jarbidge 3 | 1.3 | 1.3 | 1.3 | 1.0 | 1.5 | 1.5 | 1.5 | 1.0 | 1802 |
| Bruneau 11 | 1.5 | 2.0 | 2.0 | 2.0 | 1.5 | 2.0 | 2.0 | 2.0 | 2101 |
| Coon | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2102 |
| Bruneau 13 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2103 |
| Bruneau 12 | 1.5 | 1.0 | 1.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2201 |
| Bruneau 14 | 1.5 | 1.0 | 1.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2202 |
| Seventysix | 2.0 | 2.0 | 2.0 | 1.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2203 |
| Willow Creek/tribs | 1.0 | 1.0 | 1.0 | 1.0 | 2.0 | 1.0 | 1.0 | 2.0 | 2302 |

| Reach Name | Current Range (0-4) | | | | Reference Range (0-4) | | | | HUC_6 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | Spawn and incubation | Summer rearing | Winter rearing | Migration | Spawn and incubation | Summer rearing | Winter rearing | Migration | |
| Meadow | 2.0 | 1.0 | 1.0 | 2.0 | 2.0 | 1.0 | 1.0 | 2.0 | 2501 |
| Telephone | 2.0 | 2.0 | 1.0 | 2.0 | 2.0 | 2.0 | 1.0 | 2.0 | 2502 |
| McDonalds | 1.0 | 1.0 | 1.0 | 0.5 | 2.0 | 2.0 | 2.0 | 2.0 | 2602 |
| Bruneau 8 | 0.8 | 1.0 | 1.0 | 1.3 | 1.0 | 1.0 | 1.0 | 1.5 | 2701 |
| Jarbidge 1 | 1.0 | 1.2 | 1.2 | 1.0 | 1.0 | 1.5 | 1.5 | 1.0 | 2801 |
| Bruneau 7 | 0.8 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 2803 |
| Cat | 1.2 | 1.2 | 1.2 | 1.0 | 1.5 | 1.5 | 1.5 | 1.0 | 2901 |
| Pole | 1.7 | 1.3 | 1.3 | 1.9 | 2.0 | 1.5 | 1.5 | 2.0 | 2902 |
| Sheep 4 | 1.0 | 1.0 | 1.0 | 1.0 | 1.5 | 1.5 | 1.5 | 1.5 | 2903 |
| Sheep 3 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 2904 |
| Sheep 3 | 0.0 | 1.0 | 1.0 | 1.0 | 0.0 | 1.0 | 1.0 | 1.0 | 3101 |
| Marys 1 | 0.0 | 0.8 | 0.8 | 1.0 | 0.0 | 1.0 | 1.0 | 1.0 | 3301 |
| Marys 2 | 1.3 | 1.3 | 1.3 | 1.0 | 1.5 | 1.5 | 1.5 | 1.0 | 3303 |
| Sheep 1 | 0.8 | 1.0 | 1.0 | 1.3 | 1.0 | 1.0 | 1.0 | 1.5 | 3401 |
| Bruneau 6 | 0.8 | 1.0 | 1.0 | 1.3 | 1.2 | 1.3 | 1.3 | 1.5 | 3501 |
| Louse 1 | 1.0 | 1.0 | 1.0 | 0.0 | 2.0 | 1.0 | 1.0 | 2.0 | 3601 |
| Louse 2 | 1.0 | 1.0 | 1.0 | 0.0 | 2.0 | 1.0 | 1.0 | 2.0 | 3602 |
| Wickahoney 1 | 1.0 | 0.8 | 0.8 | 0.0 | 1.0 | 1.0 | 1.0 | 0.0 | 3801 |
| Wickahoney 2 | 1.0 | 1.0 | 1.0 | 0.0 | 2.0 | 1.0 | 1.0 | 2.0 | 3802 |
| Duncan | 1.3 | 1.3 | 1.3 | 1.0 | 1.5 | 1.5 | 1.5 | 1.3 | 3803 |
| Cottonwood | 1.3 | 1.3 | 1.3 | 1.0 | 1.5 | 1.5 | 1.5 | 1.0 | 3901 |
| Big Jacks 2 | 1.3 | 1.3 | 1.3 | 0.0 | 1.5 | 1.5 | 1.5 | 1.0 | 3902 |
| Little Jacks 2 | 1.3 | 1.3 | 1.3 | 0.0 | 1.5 | 1.5 | 1.5 | 0.0 | 4101 |
| Little Jacks 3 | 1.3 | 1.3 | 1.3 | 0.0 | 1.5 | 1.5 | 1.5 | 0.0 | 4102 |
| Big Jacks 1 | 0.8 | 1.2 | 1.2 | 1.0 | 1.0 | 1.8 | 1.5 | 1.5 | 4201 |
| Little Jacks 1 | 1.3 | 1.3 | 1.3 | 0.0 | 1.5 | 1.5 | 1.5 | 1.0 | 4202 |
| Merritt | 0.5 | 0.5 | 0.5 | 1.0 | 2.0 | 1.5 | 1.5 | 1.5 | 4401 |
| Willis | 0.5 | 0.5 | 0.5 | 1.0 | 2.0 | 2.0 | 1.5 | 2.0 | 4402 |

## Habitat Scores–Redband Trout

| Reach Name | Reach Score | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions | Reach Score | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bruneau 2 | -0.1 | -0.1 | -0.1 | 0.0 | -0.1 | -0.1 | 0.0 | -0.1 | 0.0 | -0.1 | -0.1 | -0.1 | 0.2 | 0.1 | 0.1 | 0.2 | 0.2 | 0.0 | 0.4 | 0.2 | 0.0 | 0.2 | 0.3 | 0.3 |
| Bruneau 3 | -0.2 | -0.2 | -0.3 | -0.2 | -0.2 | -0.1 | -0.3 | -0.2 | 0.0 | -0.2 | -0.2 | -0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 |
| Bruneau 4 | -0.3 | -0.2 | -0.3 | -0.2 | -0.2 | -0.2 | -0.2 | -0.3 | 0.0 | -0.2 | -0.3 | -0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.2 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 |
| Bruneau 5 | -0.3 | -0.2 | -0.3 | -0.2 | -0.2 | -0.2 | -0.2 | -0.3 | 0.0 | -0.2 | -0.3 | -0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.2 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 |
| Clover 1 | -0.1 | -0.2 | -0.2 | -0.2 | -0.1 | -0.1 | -0.1 | -0.1 | 0.0 | -0.1 | -0.3 | -0.3 | 0.1 | 0.0 | 0.1 | 0.0 | 0.2 | 0.0 | 0.6 | 0.3 | 0.0 | 0.4 | 0.1 | 0.0 |
| Clover 2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.1 | 0.1 | 0.1 | 0.3 | 0.0 | 0.5 | 0.2 | 0.0 | 0.3 | 0.1 | 0.1 |
| Clover 3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.1 | 0.1 | 0.1 | 0.2 | 0.0 | 0.4 | 0.2 | 0.0 | 0.3 | 0.1 | 0.1 |
| Clover 4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.0 | 0.2 | 0.0 | 0.4 | 0.2 | 0.0 | 0.3 | 0.1 | 0.1 |
| Deadwood | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 | -0.1 | 0.1 | 0.0 | 0.1 | 0.0 | 0.1 | 0.0 | 0.2 | 0.1 | 0.0 | 0.1 | 0.0 | 0.1 |
| Lower Three | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.0 | 0.2 | 0.3 | 0.0 | 0.4 | 0.1 | 0.0 |
| DEER | -0.3 | -0.4 | -0.3 | -0.3 | -0.3 | -0.4 | -0.1 | -0.2 | 0.0 | -0.2 | -0.5 | -0.4 | 0.2 | 0.1 | 0.3 | 0.2 | 0.3 | 0.0 | 0.5 | 0.4 | 0.0 | 0.5 | 0.1 | 0.2 |
| Upper Three | -0.2 | -0.3 | -0.1 | -0.2 | -0.2 | -0.3 | -0.1 | -0.1 | 0.0 | -0.1 | -0.4 | -0.4 | 0.2 | 0.1 | 0.3 | 0.1 | 0.3 | 0.0 | 0.5 | 0.4 | 0.0 | 0.5 | 0.1 | 0.0 |
| Big Flat Creek | -0.3 | -0.2 | -0.2 | -0.3 | -0.3 | -0.3 | -0.4 | -0.4 | 0.0 | -0.3 | -0.4 | -0.3 | 0.1 | 0.2 | 0.3 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.1 |
| Flat and Coudle | -0.7 | -0.5 | -0.6 | -0.7 | -0.6 | -0.6 | -0.9 | -0.9 | -0.1 | -0.7 | -0.7 | -0.9 | 0.1 | 0.2 | 0.2 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.0 |
| Jarbidge 3 | -0.6 | -0.4 | -0.6 | -0.5 | -0.4 | -0.6 | -0.7 | -0.9 | -0.1 | -0.5 | -0.9 | -0.9 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 |
| E. Frk | -0.5 | -0.5 | -0.6 | -0.5 | -0.6 | -0.4 | -0.6 | -0.6 | 0.0 | -0.6 | -0.6 | -0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

| Reach Name | **Reach Score** | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions | **Reach Score** | **Riparian Condition** | **Channel stability** | **Habitat Diversity** | **Fine sediment** | **High Flow** | **Low Flow** | **Oxygen** | **Low Temperature** | **High Temperature** | **Pollutants** | **Obstructions** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jarbidge 1 | | | | | | | | | | | | | | | | | | | | | | | | |
| E.Frk Jarbidge 2 | -0.7 | -0.5 | -0.6 | -0.7 | -0.6 | -0.6 | -0.9 | -0.9 | -0.1 | -0.7 | -0.7 | -0.9 | 0.1 | 0.2 | 0.2 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.0 |
| Jarbidge 4 | -0.4 | -0.3 | -0.4 | -0.3 | -0.4 | -0.3 | -0.5 | -0.6 | 0.0 | -0.4 | -0.5 | -0.6 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.1 | 0.2 | 0.0 | 0.0 | 0.1 | 0.2 | 0.0 |
| Jarbidge 5 | -0.4 | -0.3 | -0.4 | -0.4 | -0.3 | -0.4 | -0.5 | -0.6 | 0.0 | -0.3 | -0.6 | -0.6 | 0.1 | 0.1 | 0.2 | 0.1 | 0.3 | 0.0 | 0.1 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 |
| Jarbidge 2 | -0.4 | -0.3 | -0.4 | -0.4 | -0.3 | -0.4 | -0.5 | -0.6 | 0.0 | -0.3 | -0.6 | -0.6 | 0.1 | 0.1 | 0.2 | 0.1 | 0.3 | 0.0 | 0.1 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 |
| Jarbidge 3 | -0.7 | -0.7 | -0.6 | -0.7 | -0.7 | -0.5 | -0.9 | -0.9 | -0.1 | -0.8 | -0.9 | -0.9 | 0.0 | 0.0 | 0.2 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 |
| Bruneau 11 | -0.7 | -0.5 | -0.6 | -0.6 | -0.8 | -0.5 | -1.0 | -1.0 | -0.1 | -0.8 | -1.0 | -1.0 | 0.1 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 |
| Coon | -0.8 | -0.7 | -0.6 | -0.6 | -0.8 | -0.6 | -1.0 | -1.0 | -0.1 | -0.9 | -1.0 | -1.0 | 0.0 | 0.0 | 0.2 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 |
| Bruneau 13 | -0.5 | -0.4 | -0.5 | -0.4 | -0.5 | -0.3 | -0.7 | -0.7 | -0.1 | -0.6 | -0.7 | -0.7 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 |
| Bruneau 12 | -0.4 | -0.3 | -0.4 | -0.3 | -0.5 | -0.4 | -0.3 | -0.7 | -0.1 | -0.5 | -0.7 | -0.4 | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | 0.0 | 0.5 | 0.0 | 0.0 | 0.3 | 0.0 | 0.4 |
| Bruneau 14 | -0.4 | -0.4 | -0.4 | -0.4 | -0.4 | -0.3 | -0.5 | -0.5 | -0.1 | -0.5 | -0.5 | -0.5 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.0 | 0.1 | 0.5 | 0.5 |
| Seventysix | -0.3 | -0.2 | -0.3 | -0.3 | -0.3 | -0.2 | -0.4 | -0.4 | 0.0 | -0.4 | -0.5 | -0.5 | 0.1 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.0 | 0.2 | 0.0 | 0.0 |
| Willow Creek & tribs | -0.4 | -0.4 | -0.4 | -0.3 | -0.4 | -0.3 | -0.5 | -0.5 | -0.1 | -0.5 | -0.5 | -0.5 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.0 | 0.2 | 0.2 | 0.2 |
| Meadow | -0.3 | -0.2 | -0.3 | -0.3 | -0.3 | -0.2 | -0.4 | -0.4 | 0.0 | -0.3 | -0.4 | -0.4 | 0.3 | 0.3 | 0.4 | 0.3 | 0.4 | 0.2 | 0.2 | 0.2 | 0.0 | 0.2 | 0.5 | 0.5 |
| Telephone | -0.3 | -0.3 | -0.3 | -0.3 | -0.3 | -0.2 | -0.3 | -0.3 | 0.0 | -0.3 | -0.3 | -0.2 | 0.2 | 0.2 | 0.3 | 0.2 | 0.2 | 0.1 | 0.3 | 0.3 | 0.0 | 0.3 | 0.3 | 0.5 |
| McDonalds | -0.3 | -0.2 | -0.3 | -0.2 | -0.2 | -0.2 | -0.3 | -0.4 | 0.0 | -0.3 | -0.5 | -0.5 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.0 | 0.3 | 0.1 | 0.0 | 0.3 | 0.0 | 0.0 |
| Bruneau 8 | -0.3 | -0.2 | -0.4 | -0.3 | -0.4 | -0.3 | -0.4 | -0.4 | 0.0 | -0.3 | -0.5 | -0.5 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.2 | 0.2 | 0.0 | 0.2 | 0.0 | 0.0 |

| Reach Name | Reach Score | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions | **Reach Score** | **Riparian Condition** | **Channel stability** | **Habitat Diversity** | **Fine sediment** | **High Flow** | **Low Flow** | **Oxygen** | **Low Temperature** | **High Temperature** | **Pollutants** | **Obstructions** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bruneau 9 | -0.3 | -0.2 | -0.3 | -0.2 | -0.2 | -0.3 | -0.2 | -0.4 | 0.0 | -0.2 | -0.5 | -0.5 | 0.1 | 0.0 | 0.1 | 0.1 | 0.2 | 0.0 | 0.3 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 |
| Jarbidge 1 | -0.3 | -0.2 | -0.3 | -0.2 | -0.4 | -0.3 | -0.3 | -0.4 | 0.0 | -0.3 | -0.6 | -0.4 | 0.2 | 0.2 | 0.3 | 0.3 | 0.2 | 0.0 | 0.4 | 0.2 | 0.0 | 0.2 | 0.0 | 0.2 |
| Bruneau 7 | -0.4 | -0.4 | -0.3 | -0.2 | -0.5 | -0.4 | -0.6 | -0.6 | 0.0 | -0.6 | -0.7 | -0.6 | 0.1 | 0.0 | 0.4 | 0.3 | 0.2 | 0.0 | 0.2 | 0.2 | 0.0 | 0.0 | 0.0 | 0.2 |
| Cat | -0.3 | -0.3 | -0.4 | -0.3 | -0.4 | -0.3 | -0.4 | -0.4 | 0.0 | -0.4 | -0.5 | -0.4 | 0.1 | 0.0 | 0.1 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 |
| Pole | -0.3 | -0.2 | -0.2 | -0.2 | -0.3 | -0.2 | -0.3 | -0.4 | 0.0 | -0.4 | -0.5 | -0.4 | 0.1 | 0.0 | 0.2 | 0.2 | 0.1 | 0.1 | 0.3 | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 |
| Sheep 4 | -0.2 | -0.2 | -0.1 | -0.1 | -0.2 | -0.1 | -0.2 | -0.3 | 0.0 | -0.3 | -0.4 | -0.3 | 0.1 | 0.0 | 0.1 | 0.1 | 0.1 | 0.0 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 |
| Sheep 3 | -0.2 | -0.2 | -0.2 | -0.1 | -0.2 | -0.1 | -0.2 | -0.2 | 0.0 | -0.2 | -0.3 | -0.2 | 0.1 | 0.0 | 0.1 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.0 | 0.1 |
| Sheep 3 | -0.4 | -0.4 | -0.4 | -0.4 | -0.4 | -0.3 | -0.3 | -0.6 | 0.0 | -0.5 | -0.6 | -0.5 | 0.1 | 0.0 | 0.2 | 0.1 | 0.2 | 0.1 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 |
| Marys 1 | -0.3 | -0.3 | -0.3 | -0.3 | -0.2 | -0.2 | -0.3 | -0.4 | 0.0 | -0.3 | -0.5 | -0.5 | 0.1 | 0.0 | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 |
| Marys 2 | -0.3 | -0.3 | -0.3 | -0.3 | -0.2 | -0.3 | -0.4 | -0.4 | 0.0 | -0.3 | -0.5 | -0.5 | 0.1 | 0.0 | 0.1 | 0.1 | 0.3 | 0.0 | 0.2 | 0.2 | 0.0 | 0.2 | 0.0 | 0.0 |
| Sheep 1 | -0.2 | -0.2 | -0.3 | -0.2 | -0.2 | -0.1 | -0.1 | -0.2 | 0.0 | -0.1 | -0.4 | 0.0 | 0.3 | 0.1 | 0.1 | 0.2 | 0.3 | 0.3 | 0.5 | 0.4 | 0.0 | 0.3 | 0.0 | 0.7 |
| Bruneau 6 | -0.2 | -0.2 | -0.3 | -0.2 | -0.2 | -0.2 | -0.2 | -0.3 | 0.0 | -0.3 | -0.4 | 0.0 | 0.2 | 0.1 | 0.2 | 0.2 | 0.3 | 0.1 | 0.4 | 0.2 | 0.0 | 0.0 | 0.0 | 0.7 |
| Louse 1 | -0.2 | -0.2 | -0.3 | -0.1 | -0.3 | -0.3 | -0.2 | -0.3 | 0.0 | -0.2 | -0.4 | -0.4 | 0.0 | 0.1 | 0.1 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Louse 2 | -0.2 | -0.1 | -0.2 | -0.1 | -0.1 | -0.3 | -0.2 | -0.4 | 0.0 | -0.2 | -0.4 | 0.0 | 0.2 | 0.3 | 0.3 | 0.3 | 0.4 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 0.7 |
| Wickahoney 1 | -0.4 | -0.3 | -0.4 | -0.3 | -0.6 | -0.4 | -0.3 | -0.6 | 0.0 | -0.4 | -0.6 | -0.6 | 0.0 | 0.2 | 0.2 | 0.2 | 0.0 | 0.0 | 0.0 | -0.1 | 0.0 | -0.1 | 0.1 | 0.0 |
| Wickahoney 2 | -0.5 | -0.5 | -0.5 | -0.4 | -0.6 | -0.4 | -0.5 | -0.6 | 0.0 | -0.5 | -0.6 | -0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 | 0.0 | 0.0 |
| Duncan | -0.4 | -0.3 | -0.4 | -0.3 | -0.4 | -0.4 | -0.4 | -0.5 | 0.0 | -0.4 | -0.5 | -0.3 | 0.1 | 0.1 | 0.2 | 0.0 | 0.2 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 |
| Cottonwood | -0.4 | -0.5 | -0.4 | -0.5 | -0.5 | -0.4 | -0.4 | -0.5 | 0.0 | -0.5 | -0.5 | -0.5 | 0.0 | 0.0 | 0.2 | -0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.2 | 0.0 | -0.3 |

| Reach Name | **Reach Score** | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions | **Reach Score** | **Riparian Condition** | **Channel stability** | **Habitat Diversity** | **Fine sediment** | **High Flow** | **Low Flow** | **Oxygen** | **Low Temperature** | **High Temperature** | **Pollutants** | **Obstructions** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Big Jacks 2 | -0.4 | -0.3 | -0.4 | -0.3 | -0.4 | -0.4 | -0.3 | -0.4 | 0.0 | -0.4 | -0.5 | -0.4 | 0.1 | 0.2 | 0.2 | 0.0 | 0.2 | 0.0 | 0.1 | 0.2 | 0.0 | 0.0 | 0.0 | -0.2 |
| Little Jacks 2 | -0.3 | -0.2 | -0.3 | -0.2 | -0.3 | -0.3 | -0.3 | -0.4 | 0.0 | -0.2 | -0.3 | -0.4 | 0.2 | 0.3 | 0.2 | 0.3 | 0.2 | 0.0 | 0.2 | 0.2 | 0.0 | 0.1 | 0.3 | 0.0 |
| Little Jacks 3 | -0.4 | -0.5 | -0.4 | -0.4 | -0.5 | -0.4 | -0.3 | -0.5 | 0.0 | -0.5 | -0.5 | -0.4 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.4 | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 |
| Big Jacks 1 | -0.2 | -0.1 | -0.2 | -0.1 | -0.2 | -0.2 | -0.2 | -0.3 | 0.0 | -0.2 | -0.3 | -0.2 | 0.1 | 0.3 | 0.2 | 0.1 | 0.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.2 | 0.0 | 0.3 |
| Little Jacks 1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.2 | 0.0 | -0.1 | -0.2 | -0.2 | 0.3 | 0.3 | 0.4 | 0.3 | 0.4 | 0.1 | 0.5 | 0.2 | 0.0 | 0.5 | 0.2 | 0.3 |
| Merritt | -0.1 | -0.1 | -0.1 | 0.0 | -0.1 | -0.1 | 0.0 | -0.1 | 0.0 | -0.1 | -0.1 | -0.1 | 0.2 | 0.1 | 0.1 | 0.2 | 0.2 | 0.0 | 0.4 | 0.2 | 0.0 | 0.2 | 0.3 | 0.3 |
| Willis | -0.2 | -0.2 | -0.3 | -0.2 | -0.2 | -0.1 | -0.3 | -0.2 | 0.0 | -0.2 | -0.2 | -0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 |

## Habitat Ranking–Redband Trout

| Reach Name | Reach Rank | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions | | Reach Rank | Riparian Condition | Channel form | Channel complexity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bruneau 2 | **50** | 7 | 1 | 9 | 7 | 6 | 9 | 2 | 9 | 2 | 2 | 2 | | **10** | 8 | 8 | 4 | 4 | 10 | 1 | 6 | 10 | 6 | 2 | 2 |
| Bruneau 3 | **43** | 8 | 3 | 6 | 6 | 10 | 2 | 9 | 11 | 5 | 4 | 1 | | **52** | 6 | 7 | 7 | 3 | 7 | 4 | 1 | 7 | 5 | 1 | 7 |
| Bruneau 4 | **37** | 5 | 4 | 5 | 5 | 10 | 8 | 2 | 11 | 8 | 2 | 1 | | **48** | 5 | 5 | 5 | 4 | 5 | 1 | 5 | 5 | 2 | 2 | 5 |
| Bruneau 5 | **37** | 5 | 4 | 5 | 5 | 10 | 8 | 2 | 11 | 8 | 2 | 1 | | **48** | 5 | 5 | 5 | 4 | 5 | 1 | 5 | 5 | 2 | 2 | 5 |
| Clover 1 | **48** | 3 | 4 | 5 | 6 | 7 | 10 | 8 | 11 | 9 | 2 | 1 | | **17** | 7 | 6 | 7 | 4 | 7 | 1 | 3 | 7 | 2 | 5 | 7 |
| Clover 2 | **56** | 7 | 7 | 10 | 7 | 4 | 6 | 3 | 11 | 5 | 1 | 2 | | **11** | 5 | 8 | 6 | 3 | 10 | 1 | 4 | 10 | 2 | 9 | 7 |
| Clover 3 | **55** | 3 | 4 | 4 | 4 | 4 | 10 | 8 | 11 | 9 | 1 | 2 | | **15** | 8 | 6 | 7 | 3 | 10 | 1 | 4 | 10 | 2 | 9 | 5 |
| Clover 4 | **54** | 4 | 5 | 2 | 5 | 5 | 10 | 8 | 11 | 9 | 1 | 2 | | **18** | 7 | 6 | 9 | 3 | 9 | 1 | 4 | 9 | 2 | 8 | 5 |
| Deadwood | **52** | 3 | 5 | 4 | 5 | 5 | 8 | 8 | 11 | 10 | 1 | 2 | | **40** | 7 | 5 | 8 | 2 | 10 | 1 | 4 | 10 | 3 | 9 | 5 |
| Lower Three | **53** | 3 | 5 | 4 | 5 | 7 | 9 | 7 | 11 | 10 | 1 | 2 | | **21** | 7 | 6 | 5 | 4 | 9 | 3 | 2 | 11 | 1 | 8 | 9 |
| DEER | **33** | 3 | 6 | 5 | 6 | 4 | 10 | 8 | 11 | 9 | 1 | 2 | | **5** | 8 | 4 | 6 | 4 | 10 | 1 | 3 | 10 | 2 | 9 | 7 |
| Upper Three | **41** | 4 | 9 | 6 | 5 | 3 | 9 | 7 | 11 | 8 | 2 | 1 | | **7** | 7 | 4 | 6 | 4 | 9 | 1 | 3 | 9 | 2 | 8 | 9 |
| Big Flat Creek | **51** | 3 | 4 | 4 | 4 | 4 | 10 | 8 | 11 | 9 | 2 | 1 | | **14** | 7 | 4 | 6 | 4 | 9 | 1 | 3 | 9 | 2 | 8 | 9 |
| Flat and Coudle | **27** | 10 | 9 | 7 | 4 | 8 | 1 | 1 | 11 | 4 | 1 | 4 | | **29** | 2 | 1 | 6 | 3 | 7 | 7 | 7 | 7 | 3 | 7 | 3 |

| Reach Name | Reach Rank | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions | Reach Rank | Riparian Condition | Channel form | Channel complexity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jarbidge 3 | 4 | 10 | 7 | 4 | 7 | 9 | 1 | 1 | 11 | 5 | 5 | 1 | 37 | 4 | 2 | 5 | 2 | 5 | 5 | 5 | 5 | 5 | 1 | 5 |
| E.F.Jarb. 1 | 6 | 10 | 5 | 7 | 9 | 6 | 4 | 1 | 11 | 8 | 1 | 1 | 25 | 5 | 3 | 5 | 3 | 7 | 1 | 7 | 7 | 1 | 7 | 7 |
| E.F. Jarb. 2 | 7 | 8 | 6 | 8 | 6 | 10 | 1 | 1 | 11 | 1 | 1 | 1 | 54 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Jarbidge 4 | 4 | 10 | 7 | 4 | 7 | 9 | 1 | 1 | 11 | 5 | 5 | 1 | 37 | 4 | 2 | 5 | 2 | 5 | 5 | 5 | 5 | 5 | 1 | 5 |
| Jarbidge 5 | 19 | 8 | 7 | 8 | 5 | 10 | 3 | 1 | 11 | 6 | 3 | 1 | 26 | 8 | 1 | 2 | 5 | 6 | 3 | 10 | 9 | 7 | 3 | 10 |
| Jarbidge 2 | 13 | 10 | 5 | 6 | 8 | 7 | 4 | 1 | 11 | 9 | 1 | 1 | 36 | 5 | 3 | 5 | 1 | 8 | 4 | 8 | 7 | 2 | 8 | 8 |
| Jarbidge 3 | 14 | 10 | 5 | 7 | 8 | 6 | 4 | 1 | 11 | 9 | 1 | 1 | 33 | 6 | 3 | 4 | 1 | 8 | 5 | 8 | 7 | 2 | 8 | 8 |
| Bruneau 11 | 3 | 7 | 9 | 7 | 6 | 10 | 1 | 1 | 11 | 5 | 1 | 1 | 53 | 4 | 1 | 4 | 3 | 4 | 4 | 4 | 4 | 2 | 4 | 4 |
| Coon | 2 | 9 | 7 | 8 | 5 | 10 | 1 | 1 | 11 | 6 | 1 | 1 | 34 | 3 | 2 | 5 | 4 | 6 | 8 | 8 | 7 | 1 | 8 | 8 |
| Bruneau 13 | 1 | 7 | 8 | 9 | 6 | 10 | 1 | 1 | 11 | 5 | 1 | 1 | 47 | 5 | 1 | 4 | 3 | 5 | 5 | 5 | 5 | 2 | 5 | 5 |
| Bruneau 12 | 8 | 8 | 6 | 8 | 6 | 10 | 1 | 1 | 11 | 5 | 1 | 1 | 46 | 4 | 2 | 4 | 2 | 6 | 7 | 7 | 7 | 1 | 7 | 7 |
| Bruneau 14 | 16 | 9 | 6 | 9 | 4 | 7 | 8 | 1 | 11 | 3 | 1 | 5 | 13 | 5 | 4 | 5 | 7 | 8 | 1 | 8 | 8 | 3 | 8 | 2 |
| Seventysix | 20 | 8 | 6 | 8 | 6 | 10 | 1 | 1 | 11 | 1 | 1 | 1 | 4 | 8 | 6 | 8 | 6 | 5 | 3 | 3 | 11 | 10 | 1 | 1 |
| Willow Cr. | 25 | 9 | 8 | 7 | 6 | 10 | 3 | 3 | 11 | 3 | 1 | 1 | 24 | 5 | 1 | 7 | 6 | 7 | 2 | 2 | 9 | 2 | 10 | 10 |
| Meadow | 12 | 8 | 6 | 9 | 6 | 9 | 1 | 1 | 11 | 1 | 1 | 1 | 22 | 10 | 6 | 8 | 6 | 8 | 1 | 1 | 11 | 1 | 1 | 1 |
| Telephone | 31 | 10 | 6 | 8 | 6 | 9 | 1 | 1 | 11 | 5 | 1 | 1 | 3 | 5 | 3 | 6 | 3 | 7 | 9 | 9 | 11 | 8 | 1 | 1 |
| McDonalds | 35 | 7 | 6 | 7 | 5 | 10 | 1 | 1 | 11 | 1 | 1 | 9 | 6 | 8 | 2 | 8 | 7 | 10 | 3 | 3 | 11 | 3 | 3 | 1 |

| Reach Name | Reach Rank | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions | | Reach Rank | Riparian Condition | Channel form | Channel complexity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bruneau 8 | **30** | 8 | 4 | 8 | 10 | 7 | 5 | 3 | 11 | 5 | 1 | 1 | | **23** | 4 | 7 | 4 | 3 | 8 | 1 | 6 | 9 | 1 | 10 | 10 |
| Bruneau 9 | **57** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | **54** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Jarbidge 1 | **23** | 10 | 5 | 8 | 5 | 7 | 3 | 3 | 11 | 9 | 1 | 1 | | **30** | 7 | 4 | 6 | 4 | 9 | 1 | 1 | 8 | 1 | 9 | 9 |
| Bruneau 7 | **32** | 6 | 4 | 6 | 10 | 5 | 8 | 3 | 11 | 8 | 1 | 1 | | **32** | 7 | 5 | 6 | 2 | 9 | 1 | 3 | 8 | 3 | 9 | 9 |
| Cat | **28** | 10 | 8 | 9 | 4 | 5 | 7 | 2 | 11 | 6 | 1 | 3 | | **12** | 8 | 2 | 3 | 7 | 10 | 1 | 5 | 9 | 5 | 10 | 4 |
| Pole | **11** | 8 | 9 | 10 | 6 | 7 | 2 | 2 | 11 | 2 | 1 | 2 | | **20** | 8 | 1 | 2 | 6 | 8 | 3 | 3 | 7 | 8 | 8 | 3 |
| Sheep 4 | **24** | 10 | 6 | 8 | 6 | 8 | 2 | 2 | 11 | 2 | 1 | 2 | | **39** | 7 | 4 | 6 | 4 | 9 | 1 | 1 | 8 | 9 | 9 | 1 |
| Sheep 3 | **34** | 7 | 9 | 10 | 5 | 8 | 6 | 2 | 11 | 4 | 1 | 2 | | **27** | 8 | 2 | 3 | 6 | 7 | 1 | 4 | 10 | 9 | 11 | 4 |
| Sheep 3 | **42** | 5 | 8 | 8 | 5 | 10 | 7 | 2 | 11 | 2 | 1 | 2 | | **41** | 8 | 2 | 2 | 6 | 7 | 1 | 4 | 8 | 8 | 8 | 4 |
| Marys 1 | **46** | 6 | 4 | 9 | 4 | 10 | 7 | 2 | 11 | 7 | 1 | 2 | | **42** | 9 | 6 | 1 | 6 | 8 | 2 | 2 | 10 | 2 | 10 | 2 |
| Marys 2 | **17** | 7 | 5 | 7 | 5 | 10 | 9 | 1 | 11 | 4 | 1 | 3 | | **31** | 9 | 3 | 5 | 3 | 6 | 1 | 9 | 8 | 7 | 9 | 1 |
| Sheep 1 | **29** | 5 | 4 | 5 | 10 | 9 | 7 | 3 | 11 | 7 | 1 | 1 | | **35** | 9 | 5 | 6 | 1 | 7 | 2 | 2 | 8 | 2 | 9 | 9 |
| Bruneau 6 | **26** | 7 | 5 | 7 | 10 | 6 | 3 | 3 | 11 | 9 | 1 | 1 | | **28** | 8 | 5 | 6 | 1 | 8 | 2 | 2 | 7 | 2 | 8 | 8 |
| Louse 1 | **47** | 5 | 2 | 5 | 3 | 9 | 8 | 3 | 10 | 7 | 1 | 1<br>1 | | **2** | 9 | 8 | 7 | 6 | 4 | 2 | 3 | 10 | 5 | 11 | 1 |
| Louse 2 | **40** | 6 | 4 | 5 | 7 | 9 | 7 | 2 | 10 | 2 | 1 | 1<br>1 | | **9** | 8 | 4 | 6 | 3 | 7 | 2 | 5 | 9 | 10 | 10 | 1 |
| Wickahoney 1 | **39** | 7 | 4 | 10 | 4 | 6 | 8 | 3 | 11 | 8 | 1 | 1 | | **50** | 4 | 2 | 1 | 2 | 6 | 6 | 5 | 6 | 6 | 6 | 6 |
| Wickahoney | **44** | 8 | 4 | 8 | 7 | 3 | 4 | 1 | 10 | 4 | 1 | 1 | | **8** | 3 | 5 | 3 | 2 | 8 | 8 | 6 | 8 | 8 | 6 | 1 |

| Reach Name | Reach Rank | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | | | | | | | | | | | | 1 |
| Duncan | **15** | 8 | 5 | 10 | 4 | 6 | 9 | 2 | 11 | 7 | 2 | 1 |
| Cottonwood | **9** | 6 | 4 | 9 | 3 | 8 | 6 | 1 | 11 | 5 | 1 | 10 |
| Big Jacks 2 | **21** | 8 | 3 | 8 | 3 | 6 | 7 | 1 | 11 | 3 | 1 | 10 |
| L. Jacks 2 | **10** | 6 | 8 | 6 | 1 | 10 | 8 | 1 | 11 | 1 | 1 | 1 |
| L. Jacks 3 | **22** | 10 | 2 | 8 | 2 | 7 | 9 | 2 | 11 | 2 | 1 | 2 |
| Big Jacks 1 | **36** | 8 | 6 | 9 | 3 | 5 | 7 | 1 | 11 | 10 | 4 | 1 |
| L. Jacks 1 | **18** | 5 | 9 | 6 | 1 | 8 | 10 | 2 | 11 | 2 | 2 | 7 |
| Merritt | **45** | 10 | 7 | 9 | 6 | 8 | 4 | 1 | 11 | 3 | 1 | 5 |
| Willis | **49** | 9 | 7 | 9 | 7 | 6 | 4 | 1 | 11 | 4 | 1 | 3 |

| Reach Name | Reach Rank | Riparian Condition | Channel form | Channel complexity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | | | | | | | | | | | | |
| Duncan | **51** | 3 | 2 | 1 | 5 | 5 | 5 | 10 | 5 | 11 | 4 | 5 |
| Cottonwood | **66** | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 11 | 2 | 2 |
| Big Jacks 2 | **44** | 3 | 1 | 7 | 1 | 7 | 4 | 4 | 7 | 7 | 4 | 7 |
| L. Jacks 2 | **67** | 2 | 1 | 9 | 2 | 2 | 2 | 2 | 2 | 10 | 2 | 11 |
| L. Jacks 3 | **43** | 1 | 2 | 7 | 2 | 7 | 5 | 2 | 6 | 7 | 7 | 11 |
| Big Jacks 1 | **16** | 3 | 4 | 2 | 7 | 9 | 5 | 5 | 9 | 8 | 1 | 9 |
| L. Jacks 1 | **45** | 7 | 5 | 6 | 7 | 7 | 1 | 2 | 7 | 2 | 2 | 7 |
| Merritt | **19** | 2 | 5 | 7 | 6 | 8 | 3 | 8 | 8 | 4 | 8 | 1 |
| Willis | **1** | 6 | 3 | 6 | 3 | 10 | 1 | 8 | 11 | 1 | 8 | 5 |

## Existing Conditions–Bull Trout

| Scoring | |
|---|---|
| Confidence Rating | Attribute Rating |
| 0 = Unknown | 0 = 0% of normative |
| 1 = Expert Opinion | 1 = 25% of normative |
| 2 = Well Documented | 2 = 50% of normative |
| | 3 = 75% of normative |
| Definitions | 4 = 100% of normative |

Describe the natural physical condition of the stream

Stream Name: Bruneau Subbasin

Describe the current condition for this stream in regard to the **physical conditions** in this ecological province.

| HUC 6 | Reach Name | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1501 | Jarbidge 3 | 1.0 | 1.0 | 1.0 | 2.0 | 4.0 | 3.0 | 4.0 | 4.0 | 2.0 | 2.0 | 4.0 |
| 1601 | E. Frk Jarbidge 1 | 3.0 | 3.0 | 3.0 | 3.0 | 4.0 | 3.0 | 4.0 | 4.0 | 2.0 | 3.0 | 4.0 |
| 1602 | E.Frk Jarbidge 2 | 3.0 | 3.0 | 2.0 | 3.0 | 4.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 1701 | Jarbidge 4 | 2.0 | 1.0 | 1.0 | 2.0 | 4.0 | 3.0 | 4.0 | 4.0 | 2.0 | 3.0 | 4.0 |
| 1702 | Jarbidge 5 | 2.0 | 2.0 | 2.0 | 2.0 | 4.0 | 3.0 | 4.0 | 4.0 | 3.0 | 3.0 | 3.5 |
| 1801 | Jarbidge 2 | 3.0 | 3.0 | 2.0 | 3.0 | 4.0 | 3.0 | 4.0 | 4.0 | 2.0 | 3.0 | 4.0 |
| 1802 | Jarbidge 3 | 3.0 | 3.0 | 2.0 | 3.0 | 4.0 | 3.0 | 4.0 | 4.0 | 2.0 | 3.0 | 4.0 |
| 2801 | Jarbidge 1 | 3.0 | 3.0 | 2.0 | 3.0 | 4.0 | 3.0 | 4.0 | 4.0 | 2.0 | 3.0 | 4.0 |

## Reference Conditions–Bull Trout

| HUC 6 | Reach Name | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1501 | Jarbidge 3 | 4 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 1601 | E. Frk Jarbidge 1 | 4 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 1602 | E.Frk Jarbidge 2 | 4 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 1701 | Jarbidge 4 | 4 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 1702 | Jarbidge 5 | 4 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 1801 | Jarbidge 2 | 3 | 4.0 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 1802 | Jarbidge 3 | 3 | 4.0 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 2801 | Jarbidge 1 | 3 | 4.0 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |

**Species Hypothesis–Bull Trout**

| | Spawning/incubation | Summer Rearing | Winter Rearing | Migration |
|---|---|---|---|---|
| **Life Stage Rank (1-4)** | **3.0** | **3.0** | **3.0** | **2.0** |

Assign a weight to each attribute (0-2) relative to its importance to the life stage

| | Spawning/incubation | Summer Rearing | Winter Rearing | Migration |
|---|---|---|---|---|
| **Riparian Condition** | 1.0 | 2.0 | 2.0 | 0.5 |
| **Channel stability** | 2.0 | 2.0 | 2.0 | 1.0 |
| **Habitat Diversity** | 2.0 | 2.0 | 2.0 | 1.0 |
| **Fine sediment** | 2.0 | 2.0 | 2.0 | 1.0 |
| **High Flow** | 2.0 | 1.0 | 1.0 | 1.0 |
| **Low Flow** | 2.0 | 2.0 | 2.0 | 2.0 |
| **Oxygen** | 2.0 | 2.0 | 2.0 | 2.0 |
| **Low Temp** | 1.0 | 1.0 | 1.0 | 1.0 |
| **High Temp** | 2.0 | 2.0 | 2.0 | 2.0 |
| **Pollutants** | 2.0 | 2.0 | 2.0 | 2.0 |
| **Obstructions** | 0.0 | 1.0 | 1.0 | 2.0 |

**Species Range–Bull Trout**

| | **Current Range (0-2)** | | | | Reference Range (0-2) | | | |
|---|---|---|---|---|---|---|---|---|
| Reach Name | Spawn and incubation | Summer rearing | Winter rearing | Migration | Spawn and incubation | Summer rearing | Winter rearing | Migration |
| Jarbidge 3 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| E. Frk Jarbidge 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| E.Frk Jarbidge 2 | 1.2 | 1.2 | 1.2 | 2 | 1.2 | 1.2 | 1.2 | 2 |
| Jarbidge 4 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Jarbidge 5 | 1 | 1.5 | 1.5 | 1.75 | 1.5 | 1.5 | 1.5 | 2 |
| Jarbidge 2 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| Jarbidge 3 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| Jarbidge 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 |

## Habitat Score–Bull Trout

| Reach Name | Reach Score | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jarbidge 3 | -0.2 | -0.1 | -0.1 | -0.1 | -0.2 | -0.2 | -0.3 | 0.0 | 0.0 | -0.2 | -0.2 | -0.3 |
| E. F. Jarb. 1 | -0.3 | -0.3 | -0.3 | -0.3 | -0.3 | -0.2 | -0.3 | 0.0 | 0.0 | -0.2 | -0.3 | -0.3 |
| E.F. Jarb. 2 | -0.6 | -0.4 | -0.5 | -0.4 | -0.5 | -0.5 | -0.6 | 0.0 | 0.0 | -0.6 | -0.8 | -0.4 |
| Jarbidge 4 | -0.2 | -0.2 | -0.1 | -0.1 | -0.2 | -0.2 | -0.3 | 0.0 | 0.0 | -0.2 | -0.3 | -0.3 |
| Jarbidge 5 | -0.5 | -0.3 | -0.4 | -0.4 | -0.4 | -0.5 | -0.7 | 0.0 | 0.0 | -0.7 | -0.7 | -0.4 |
| Jarbidge 2 | -0.3 | -0.3 | -0.3 | -0.2 | -0.3 | -0.2 | -0.3 | 0.0 | 0.0 | -0.2 | -0.3 | -0.3 |
| Jarbidge 3 | -0.3 | -0.3 | -0.3 | -0.2 | -0.3 | -0.2 | -0.3 | 0.0 | 0.0 | -0.2 | -0.3 | -0.3 |
| Jarbidge 1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

| Reach Name | Reach Score | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Jarbidge 3 | 0.2 | 0.3 | 0.3 | 0.3 | 0.2 | 0.0 | 0.1 | 0.0 | 0.0 | 0.2 | 0.2 |
| E. F. Jarb. 1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.2 | 0.0 | 0.0 | 0.3 | 0.2 |
| E.F. Jarb. 2 | 0.1 | 0.1 | 0.2 | 0.4 | 0.2 | 0.0 | 0.2 | 0.0 | 0.0 | 0.2 | 0.0 |
| Jarbidge 4 | 0.2 | 0.2 | 0.4 | 0.4 | 0.3 | 0.0 | 0.2 | 0.0 | 0.0 | 0.3 | 0.2 |
| Jarbidge 5 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.3 |
| Jarbidge 2 | 0.1 | 0.0 | 0.1 | 0.1 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 0.1 |
| Jarbidge 3 | 0.1 | 0.0 | 0.1 | 0.1 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.2 | 0.1 |
| Jarbidge 1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

**Habitat Ranking–Bull Trout**

| Reach Name | **Reach Rank** | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jarbidge 3 | **8** | 9 | 7 | 7 | 6 | 3 | 1 | 10 | 10 | 3 | 3 | 2 |
| E. F. Jarb. 1 | **3** | 7 | 3 | 3 | 3 | 8 | 1 | 10 | 10 | 8 | 1 | 6 |
| E.F. Jarb. 2 | **1** | 8 | 4 | 9 | 4 | 6 | 2 | 10 | 10 | 2 | 1 | 7 |
| Jarbidge 4 | **7** | 7 | 8 | 8 | 6 | 4 | 1 | 10 | 10 | 4 | 1 | 3 |
| Jarbidge 5 | **2** | 9 | 6 | 6 | 6 | 4 | 1 | 10 | 10 | 1 | 1 | 5 |
| Jarbidge 2 | **4** | 6 | 3 | 9 | 3 | 7 | 1 | 10 | 10 | 7 | 1 | 5 |
| Jarbidge 3 | **4** | 6 | 3 | 9 | 3 | 7 | 1 | 10 | 10 | 7 | 1 | 5 |
| Jarbidge 1 | **4** | 6 | 3 | 9 | 3 | 7 | 1 | 10 | 10 | 7 | 1 | 5 |

| Reach Name | **Reach Rank** | Riparian Condition | Channel form | Channel complexity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jarbidge 3 | **3** | 3 | 1 | 1 | 6 | 8 | 7 | 8 | 8 | 4 | 4 | |
| E. F. Jarb. 1 | **5** | 7 | 4 | 4 | 4 | 8 | 2 | 8 | 8 | 1 | 2 | |
| E.F. Jarb. 2 | **4** | 6 | 4 | 1 | 4 | 7 | 2 | 7 | 7 | 2 | 7 | |
| Jarbidge 4 | **2** | 5 | 1 | 1 | 4 | 8 | 6 | 8 | 8 | 3 | 6 | |
| Jarbidge 5 | **1** | 4 | 1 | 1 | 1 | 9 | 5 | 9 | 9 | 5 | 5 | |
| Jarbidge 2 | **7** | 7 | 4 | 4 | 4 | 7 | 1 | 7 | 7 | 1 | 1 | |
| Jarbidge 3 | **6** | 7 | 4 | 4 | 4 | 7 | 2 | 7 | 7 | 1 | 2 | |
| Jarbidge 1 | **7** | 7 | 4 | 4 | 4 | 7 | 1 | 7 | 7 | 1 | 1 | |

## Existing Conditions–Mountain Whitefish

| Scoring | |
|---|---|
| Confidence Rating | Attribute Rating |
| 0 = Unknown | 0 = 0% of normative |
| 1 = Expert Opinion | 1 = 25% of normative |
| 2 = Well Documented | 2 = 50% of normative |
| | 3 = 75% of normative |
| Definitions | 4 = 100% of normative |

Describe the natural physical condition of the stream

Stream Name: Bruneau Subbasin

Describe the current condition for this stream in regard to the **physical conditions** in this ecological province.

| HUC_6 | Reach Name | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0402 | Bruneau | 3.0 | 4.0 | 3.0 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 3.0 | 4.0 |
| 1501 | Jarbidge 3 | 3.0 | 3.0 | 4.0 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 3.0 | 4.0 |
| 1601 | E. Frk Jarb. 1 | 2.0 | 3.0 | 3.0 | 2.0 | 4.0 | 3.0 | 4.0 | 4.0 | 2.0 | 4.0 | 4.0 |
| 1602 | E.Frk Jarb. 2 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 1701 | Jarbidge 4 | 2.0 | 2.0 | 2.0 | 2.0 | 4.0 | 3.0 | 4.0 | 3.0 | 2.0 | 3.0 | 4.0 |
| 1702 | Jarbidge 5 | 2.5 | 2.5 | 2.5 | 3.0 | 3.0 | 3.0 | 4.0 | 3.0 | 2.5 | 3.0 | 4.0 |
| 1801 | Jarbidge 2 | 2.0 | 3.0 | 3.0 | 2.0 | 4.0 | 3.0 | 4.0 | 3.0 | 2.0 | 4.0 | 4.0 |
| 1802 | Jarbidge 3 | 2.0 | 3.0 | 3.0 | 2.0 | 4.0 | 3.0 | 4.0 | 3.0 | 2.0 | 4.0 | 4.0 |
| 2101 | Bruneau 11 | 4.0 | 3.0 | 4.0 | 3.5 | 4.0 | 4.0 | 4.0 | 4.0 | 3.5 | 4.0 | 4.0 |
| 2801 | Jarbidge 1 | 2.0 | 3.0 | 3.0 | 3.0 | 4.0 | 3.0 | 3.0 | 3.0 | 2.0 | 4.0 | 4.0 |
| 2803 | Bruneau 7 | 3.0 | 3.0 | 3.0 | 2.0 | 4.0 | 2.0 | 3.0 | 3.0 | 2.0 | 4.0 | 4.0 |
| 3501 | Bruneau 6 | 3.0 | 3.0 | 3.0 | 2.0 | 4.0 | 3.0 | 3.0 | 3.0 | 2.0 | 4.0 | 4.0 |

## Reference Conditions–Mountain Whitefish

| Description | Reach Name | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0402 | Bruneau 4 | 3.0 | 4.0 | 3.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 1501 | Jarbidge 3 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 1601 | E. Frk Jarbidge 1 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 1602 | E.Frk Jarbidge 2 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 1701 | Jarbidge 4 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |

| Description | Reach Name | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1702 | Jarbidge 5 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 1801 | Jarbidge 2 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 1802 | Jarbidge 3 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 2101 | Bruneau 11 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 2801 | Jarbidge 1 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 2803 | Bruneau 7 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| 3501 | Bruneau 6 | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |

**Species Hypothesis–Mountain Whitefish**

| | Spawning/incubation | Summer Rearing | Winter Rearing | Migration |
|---|---|---|---|---|
| **Life Stage Rank (1-4)** | **3.0** | **3.0** | **3.0** | **2.0** |

Assign a weight to each attribute (0-2) relative to its importance to the life stage

| | Spawning/incubation | Summer Rearing | Winter Rearing | Migration |
|---|---|---|---|---|
| **Riparian Condition** | 1.0 | 2.0 | 2.0 | 0.5 |
| **Channel stability** | 2.0 | 2.0 | 2.0 | 0.5 |
| **Habitat Diversity** | 1.0 | 2.0 | 2.0 | 0.5 |
| **Fine sediment** | 2.0 | 2.0 | 2.0 | 0.5 |
| **High Flow** | 2.0 | 1.0 | 1.0 | 0.5 |
| **Low Flow** | 2.0 | 2.0 | 2.0 | 2.0 |
| **Oxygen** | 2.0 | 2.0 | 2.0 | 2.0 |
| **Low Temp** | 0.5 | 0.0 | 0.0 | 0.0 |
| **High Temp** | 2.0 | 2.0 | 2.0 | 2.0 |
| **Pollutants** | 2.0 | 2.0 | 2.0 | 2.0 |
| **Obstructions** | 0.0 | 1.0 | 1.0 | 2.0 |

**Species Range–Mountain Whitefish**

| Reach Name | Current Spawn and incubation | Current Summer rearing | Current Winter rearing | Current Migration | Reference Spawn and incubation | Reference Summer rearing | Reference Winter rearing | Reference Migration |
|---|---|---|---|---|---|---|---|---|
| Bruneau 4 | 0.0 | 1.0 | 1.0 | 1.3 | 0.0 | 1.0 | 1.0 | 1.0 |
| Jarbidge 3 | | 1.0 | 1.0 | | | 1.0 | 1.0 | |
| E. Frk Jarbidge 1 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| E.Frk Jarbidge 2 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Jarbidge 4 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Jarbidge 5 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Jarbidge 2 | | 1.0 | 1.0 | | | 1.0 | 1.0 | |
| Jarbidge 3 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Bruneau 11 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Jarbidge 1 | | 1.0 | 1.0 | | | 1.0 | 1.0 | |
| Bruneau 7 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Bruneau 6 | 0.8 | 1.0 | 1.0 | 1.3 | 1.0 | 1.2 | 1.2 | 1.5 |

## Habitat Score–Mountain Whitefish

| Reach Name | Reach Score | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions | | Reach Score | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bruneau 4 | **-0.4** | -0.4 | -0.5 | -0.4 | -0.4 | -0.3 | -0.7 | 0.0 | 0.0 | -0.5 | -0.5 | 0.0 | | **0.0** | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 |
| Jarbidge 3 | **-0.4** | -0.3 | -0.3 | -0.5 | -0.3 | -0.2 | -0.5 | 0.0 | 0.0 | -0.3 | -0.3 | 0.0 | | **0.1** | 0.1 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 |
| E. F. Jarbidge 1 | **-0.5** | -0.3 | -0.5 | -0.5 | -0.4 | -0.5 | -0.6 | 0.0 | 0.0 | -0.4 | -0.8 | 0.0 | | **0.2** | 0.3 | 0.2 | 0.2 | 0.4 | 0.0 | 0.2 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 |
| E.F. Jarbidge 2 | **-0.7** | -0.6 | -0.7 | -0.6 | -0.7 | -0.5 | -0.8 | 0.0 | 0.0 | -0.8 | -0.8 | 0.0 | | **0.0** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Jarbidge 4 | **-0.4** | -0.3 | -0.4 | -0.3 | -0.4 | -0.5 | -0.6 | 0.0 | 0.0 | -0.4 | -0.6 | 0.0 | | **0.3** | 0.3 | 0.4 | 0.3 | 0.4 | 0.0 | 0.2 | 0.0 | 0.0 | 0.4 | 0.2 | 0.0 |
| Jarbidge 5 | **-0.5** | -0.4 | -0.4 | -0.4 | -0.5 | -0.4 | -0.6 | 0.0 | 0.0 | -0.5 | -0.6 | 0.0 | | **0.2** | 0.1 | 0.3 | 0.2 | 0.2 | 0.1 | 0.2 | 0.0 | 0.0 | 0.1 | 0.2 | 0.0 |
| Jarbidge 2 | **-0.3** | -0.2 | -0.3 | -0.3 | -0.2 | -0.2 | -0.3 | 0.0 | 0.0 | -0.2 | -0.5 | 0.0 | | **0.1** | 0.1 | 0.1 | 0.1 | 0.2 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 |
| Jarbidge 3 | **-0.5** | -0.3 | -0.5 | -0.5 | -0.4 | -0.5 | -0.6 | 0.0 | 0.0 | -0.4 | -0.8 | 0.0 | | **0.2** | 0.2 | 0.2 | 0.2 | 0.4 | 0.0 | 0.2 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 |
| Bruneau 11 | **-0.7** | -0.6 | -0.5 | -0.6 | -0.6 | -0.5 | -0.8 | 0.0 | 0.0 | -0.7 | -0.8 | 0.0 | | **0.0** | 0.0 | 0.2 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 |
| Jarbidge 1 | **-0.3** | -0.2 | -0.3 | -0.3 | -0.3 | -0.2 | -0.3 | 0.0 | 0.0 | -0.2 | -0.5 | 0.0 | | **0.1** | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 |
| Bruneau 7 | **-0.5** | -0.5 | -0.5 | -0.5 | -0.4 | -0.5 | -0.4 | 0.0 | 0.0 | -0.4 | -0.8 | 0.0 | | **0.2** | 0.0 | 0.2 | 0.2 | 0.4 | 0.0 | 0.4 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 |
| Bruneau 6 | **-0.5** | -0.4 | -0.5 | -0.4 | -0.3 | -0.5 | -0.6 | 0.0 | 0.0 | -0.4 | -0.8 | 0.0 | | **0.2** | 0.0 | 0.2 | 0.2 | 0.4 | 0.0 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 |

## Habitat Ranking—Mountain Whitefish

| Reach Name | Reach Rank | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions | | Reach Rank | Riparian Condition | Channel form | Channel complexity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bruneau 4 | **8** | 5 | 2 | 5 | 5 | 8 | 1 | 9 | 9 | 3 | 3 | 9 | | **11** | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 1 | 3 |
| Jarbidge 3 | **10** | 3 | 3 | 1 | 3 | 8 | 1 | 9 | 9 | 3 | 3 | 9 | | **9** | 1 | 1 | 5 | 1 | 5 | 5 | 5 | 5 | 5 | 1 | 5 |
| E. Frk Jarbidge 1 | **4** | 8 | 3 | 5 | 7 | 4 | 2 | 9 | 9 | 6 | 1 | 9 | | **2** | 3 | 5 | 6 | 2 | 7 | 4 | 7 | 7 | 1 | 7 | 7 |
| E.Frk Jarbidge 2 | **1** | 6 | 4 | 6 | 4 | 8 | 1 | 9 | 9 | 1 | 1 | 9 | | **12** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Jarbidge 4) | **9** | 7 | 5 | 7 | 5 | 3 | 1 | 9 | 9 | 4 | 1 | 9 | | **1** | 4 | 2 | 4 | 2 | 8 | 6 | 8 | 8 | 1 | 6 | 8 |
| Jarbidge 5) | **7** | 6 | 5 | 6 | 3 | 8 | 1 | 9 | 9 | 4 | 1 | 9 | | **3** | 8 | 1 | 2 | 5 | 6 | 3 | 9 | 9 | 7 | 3 | 9 |
| Jarbidge 2) | **12** | 5 | 2 | 2 | 5 | 5 | 2 | 9 | 9 | 5 | 1 | 9 | | **7** | 2 | 2 | 2 | 1 | 7 | 2 | 7 | 7 | 2 | 7 | 7 |
| Jarbidge 3) | **4** | 8 | 3 | 5 | 7 | 4 | 2 | 9 | 9 | 6 | 1 | 9 | | **6** | 5 | 4 | 5 | 1 | 7 | 2 | 7 | 7 | 2 | 7 | 7 |
| Bruneau 11) | **2** | 5 | 7 | 5 | 4 | 8 | 1 | 9 | 9 | 3 | 1 | 9 | | **10** | 4 | 1 | 4 | 3 | 4 | 4 | 4 | 4 | 2 | 4 | 4 |
| Jarbidge 1) | **11** | 6 | 2 | 2 | 2 | 6 | 2 | 9 | 9 | 6 | 1 | 9 | | **8** | 1 | 1 | 1 | 1 | 7 | 1 | 7 | 7 | 1 | 7 | 7 |
| Bruneau 7) | **6** | 4 | 2 | 4 | 8 | 3 | 6 | 9 | 9 | 6 | 1 | 9 | | **4** | 6 | 4 | 5 | 2 | 6 | 1 | 6 | 6 | 3 | 6 | 6 |
| Bruneau 6 | **3** | 5 | 3 | 5 | 8 | 4 | 2 | 9 | 9 | 7 | 1 | 9 | | **5** | 6 | 4 | 5 | 1 | 6 | 2 | 6 | 6 | 2 | 6 | 6 |

## Existing Conditions—Bruneau Hot Springsnail

| Scoring | |
|---|---|
| Confidence Rating | Attribute Rating |
| 0 = Unknown | 0 = 0% of normative |
| 1 = Expert Opinion | 1 = 25% of normative |
| 2 = Well Documented | 2 = 50% of normative |
| | 3 = 75% of normative |
| Definitions | 4 = 100% of normative |

Describe the natural physical condition of the stream

Stream Name: Bruneau Subbasin

Describe the current condition for this stream in regard to the **physical conditions**

in this ecological province.

| HUC_6 | Reach Name | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0102 | Bruneau2 | 2.0 | 1.0 | 2.0 | 0.5 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 4.0 |
| 0201 | Bruneau3 | 4.0 | 4.0 | 4.0 | 1.0 | 3.0 | 2.0 | 4.0 | 4.0 | 4.0 | 1.0 | 4.0 |

## Reference Conditions—Bruneau Hot Springsnail

| HUC_6 | Reach Name | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0102 | Bruneau2 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 0201 | Bruneau3 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 0401 | Lower Hot Creek | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |

**Species Hypothesis—Bruneau Hot Springsnail**

| | Spawning/incubation | Summer Rearing | Winter Rearing | Migration |
|---|---|---|---|---|
| Life Stage Rank (1-4) | 4.0 | 4.0 | 4.0 | 0.0 |
| Assign a weight to each attribute (0-2) relative to its importance to the life stage | | | | |
| Riparian Condition | 0.0 | 0.0 | 0.0 | 0.0 |
| Channel stability | 1.0 | 1.0 | 1.0 | 0.0 |
| Habitat Diversity | 1.0 | 1.0 | 1.0 | 0.0 |
| Fine sediment | 2.0 | 2.0 | 2.0 | 0.0 |
| High Flow | 2.0 | 2.0 | 2.0 | 0.0 |
| Low Flow | 1.0 | 1.0 | 1.0 | 0.0 |
| Oxygen | 2.0 | 2.0 | 2.0 | 0.0 |
| Low Temp | 0.0 | 0.0 | 0.0 | 0.0 |
| High Temp | 1.0 | 1.0 | 1.0 | 0.0 |
| Pollutants | 2.0 | 2.0 | 2.0 | 0.0 |
| Obstructions | 0.0 | 0.0 | 0.0 | 0.0 |

**Species Range—Bruneau Hot Springsnail**

| | Current Range (0-2) | | | | Reference Range (0-2) | | | |
|---|---|---|---|---|---|---|---|---|
| Reach Name | Spawn and incubation | Summer rearing | Winter rearing | Migration | Spawn and incubation | Summer rearing | Winter rearing | Migration |
| Bruneau2 | 2.0 | 2.0 | 2.0 | 0.0 | 2.0 | 2.0 | 2.0 | 0.0 |
| Bruneau3 | 2.0 | 2.0 | 2.0 | 0.0 | 2.0 | 2.0 | 2.0 | 0.0 |
| Lower Hot Creek | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 | 2.0 | 2.0 | 0.0 |

## Habitat Scores—Bruneau Hot Springsnail

| Reach Name | Reach Score | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions | | Reach Score | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bruneau2 | **-0.2** | 0.0 | -0.1 | -0.3 | -0.1 | -0.3 | -0.1 | 0.0 | 0.0 | -0.1 | -0.3 | 0.0 | | **0.5** | 0.0 | 0.4 | 0.3 | 0.9 | 0.8 | 0.4 | 0.0 | 0.0 | 0.4 | 0.8 | 0.0 |
| Bruneau3 | **-0.4** | 0.0 | -0.5 | -0.5 | -0.3 | -0.8 | -0.3 | 0.0 | 0.0 | -0.5 | -0.3 | 0.0 | | **0.3** | 0.0 | 0.0 | 0.0 | 0.8 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 0.8 | 0.0 |
| Lower Hot Creek | **0.0** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | **0.2** | 0.0 | 0.1 | 0.1 | 0.3 | 1.0 | 0.3 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 |

## Habitat Ranking—Bruneau Hot Springsnail

| Reach Name | Reach Rank | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions | | Reach Rank | Riparian Condition | Channel form | Channel complexity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bruneau2 | **2** | 8 | 4 | 1 | 4 | 1 | 4 | 8 | 8 | 4 | 1 | 8 | | **1** | 8 | 4 | 7 | 1 | 2 | 4 | 8 | 8 | 4 | 2 | 8 |
| Bruneau3 | **1** | 8 | 2 | 2 | 5 | 1 | 5 | 8 | 8 | 2 | 5 | 8 | | **2** | 5 | 5 | 5 | 1 | 3 | 3 | 5 | 5 | 5 | 1 | 5 |
| Lower Hot Creek | | | | | | | | | | | | | | **3** | 7 | 4 | 4 | 2 | 1 | 2 | 7 | 7 | 4 | 7 | 7 |

### Existing Conditions—Idaho Springsnail

| HUC_6 | Reach Name | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0101 | Bruneau 1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 1.0 | 1.0 | 0.0 | 4.0 |

### Reference Conditi—Idaho Springsnail

| HUC_6 | Reach Name | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0101 | Bruneau 1 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |

### Species Hypothesis–Idaho Springsnail

| | Spawning/incubation | Summer Rearing | Winter Rearing | Migration |
|---|---|---|---|---|
| **Life Stage Rank (1-4)** | **4.0** | **4.0** | **4.0** | **0.0** |

Assign a weight to each attribute (0-2) relative to its importance to the life stage

| | Spawning/incubation | Summer Rearing | Winter Rearing | Migration |
|---|---|---|---|---|
| **Riparian Condition** | 0.0 | 0.0 | 0.0 | 0.0 |
| **Channel stability** | 1.0 | 1.0 | 1.0 | 0.0 |
| **Habitat Diversity** | 1.0 | 1.0 | 1.0 | 0.0 |
| **Fine sediment** | 2.0 | 2.0 | 2.0 | 0.0 |
| **High Flow** | 2.0 | 2.0 | 2.0 | 0.0 |
| **Low Flow** | 1.0 | 1.0 | 1.0 | 0.0 |
| **Oxygen** | 2.0 | 2.0 | 2.0 | 0.0 |
| **Low Temp** | 0.0 | 0.0 | 0.0 | 0.0 |
| **High Temp** | 1.0 | 1.0 | 1.0 | 0.0 |
| **Pollutants** | 2.0 | 2.0 | 2.0 | 0.0 |
| **Obstructions** | 0.0 | 0.0 | 0.0 | 0.0 |

**Species Range–Idaho Springsnail**

| Reach Name | Current Range (0-2) | | | | Reference Range (0-2) | | | |
|---|---|---|---|---|---|---|---|---|
| | Spawn and incubation | Summer rearing | Winter rearing | Migration | Spawn and incubation | Summer rearing | Winter rearing | Migration |
| Bruneau 1 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 | 2.0 | 2.0 | 0.0 |

## Habitat Score–Idaho Springsnail

| Reach Name | **Reach Score** | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions | | **Reach Score** | **Riparian Condition** | **Channel stability** | **Habitat Diversity** | **Fine sediment** | **High Flow** | **Low Flow** | **Oxygen** | **Low Temperature** | **High Temperature** | **Pollutants** | **Obstructions** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bruneau 1 | **0.0** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | **0.6** | 0.0 | 0.5 | 0.5 | 1.0 | 1.0 | 0.5 | 0.0 | 0.0 | 0.4 | 1.0 | 0.0 |

## Habitat Rank–Idaho Springsnail

| Reach Name | **Reach Rank** | Riparian Condition | Channel stability | Habitat Diversity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions | | **Reach Rank** | Riparian Condition | Channel form | Channel complexity | Fine sediment | High Flow | Low Flow | Oxygen | Low Temperature | High Temperature | Pollutants | Obstructions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bruneau 1 | **NPC** | | | | | | | | | | | | | **1** | 8 | 4 | 4 | 1 | 1 | 4 | 8 | 8 | 7 | 1 | 8 |