Bruneau Subbasin Assessment

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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 28th 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 29th - July 2th (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.

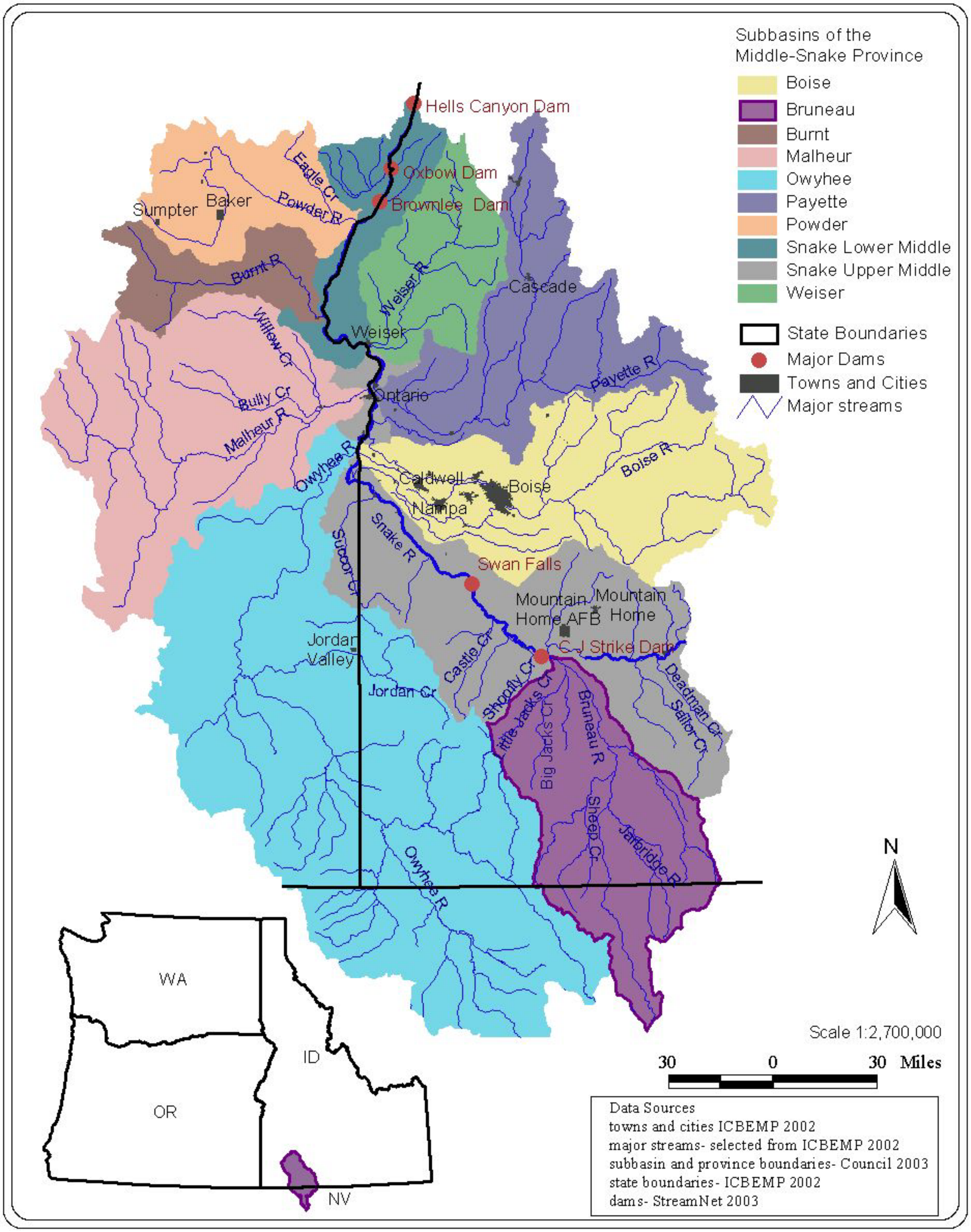

Figure 1. Subbasins, including the Bruneau subbasin, in the Middle Snake Province.

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).

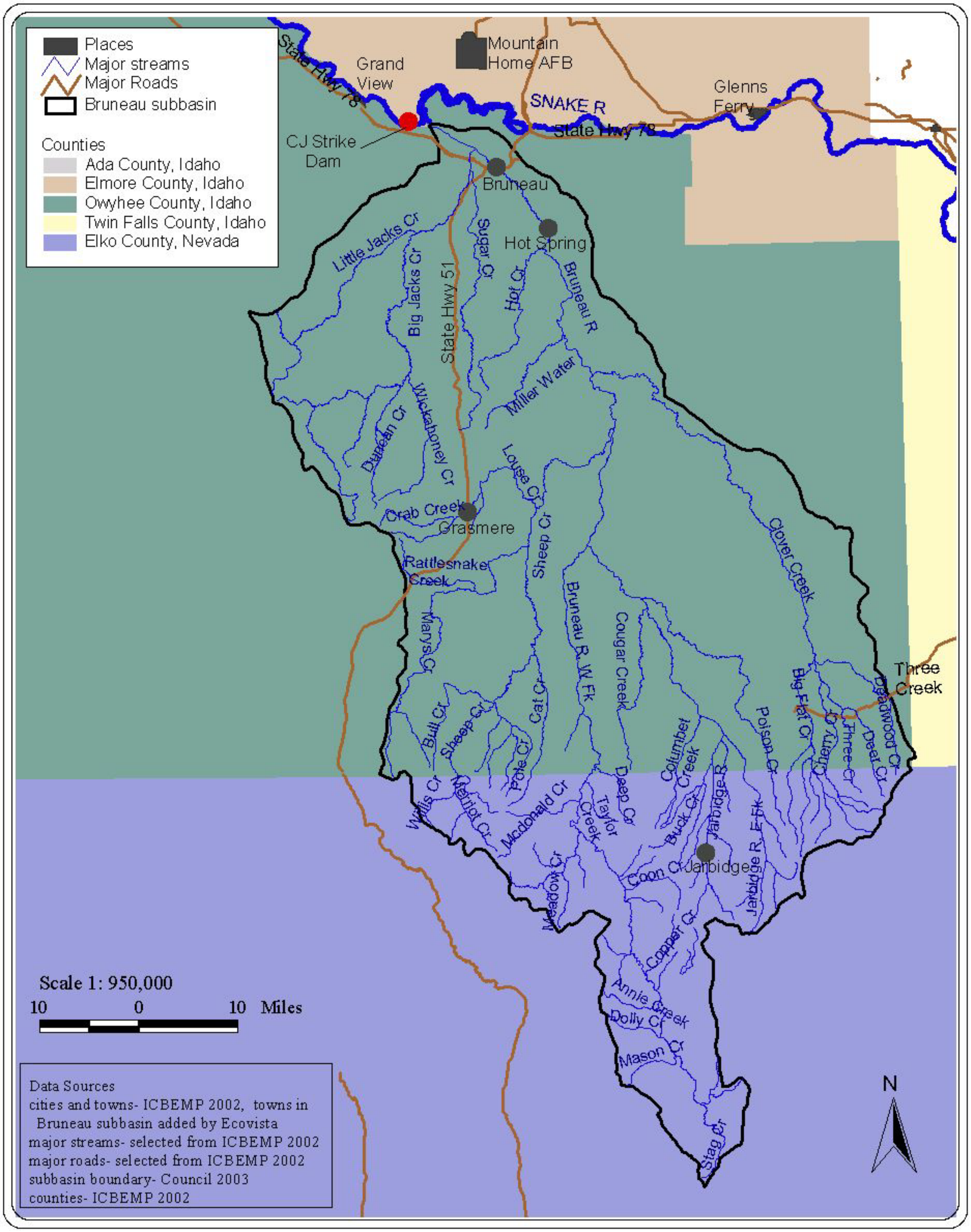

Figure 2. Location and major features of the Bruneau subbasin.

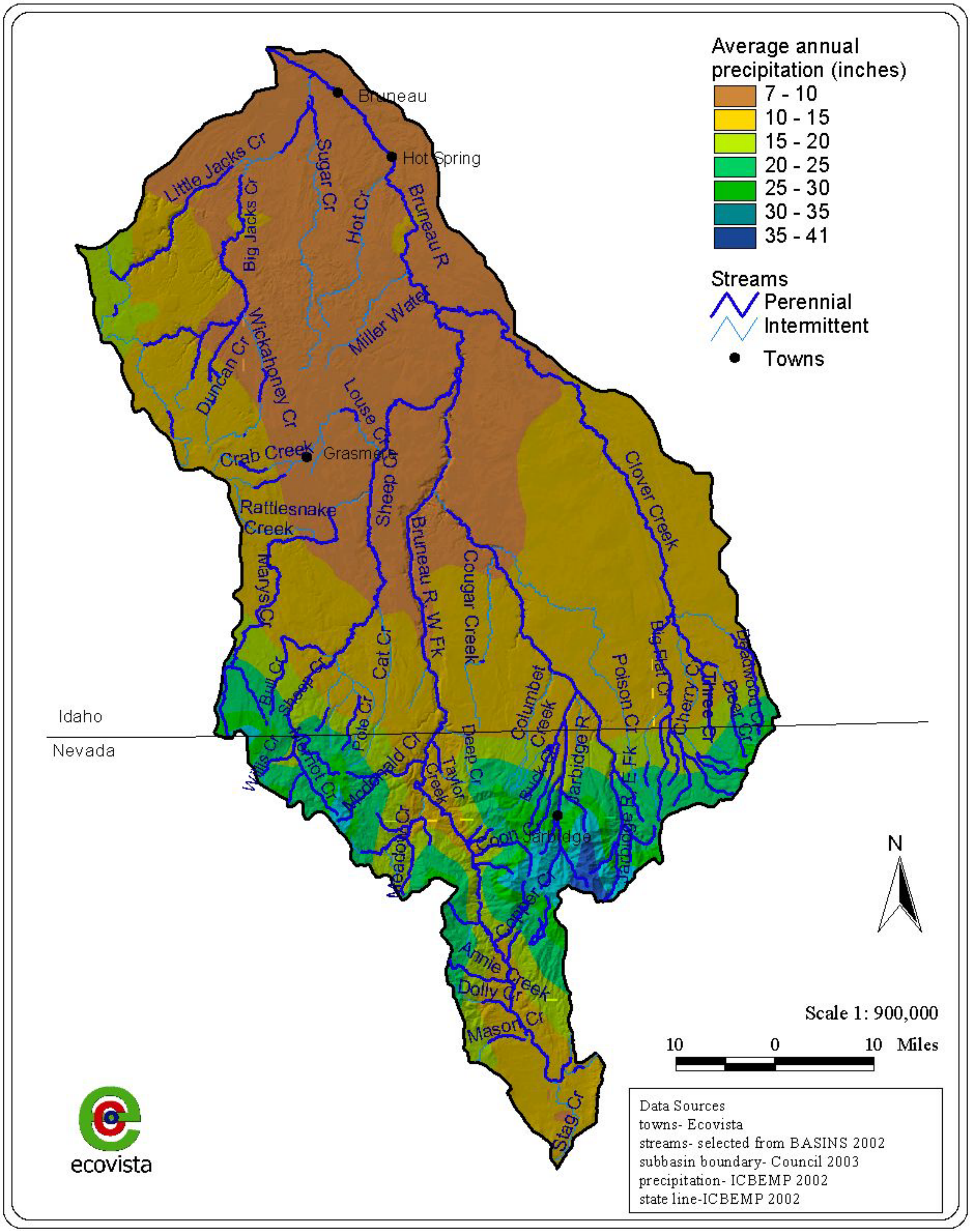

Figure 3. Precipitation and stream flow patterns, Bruneau subbasin.

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).

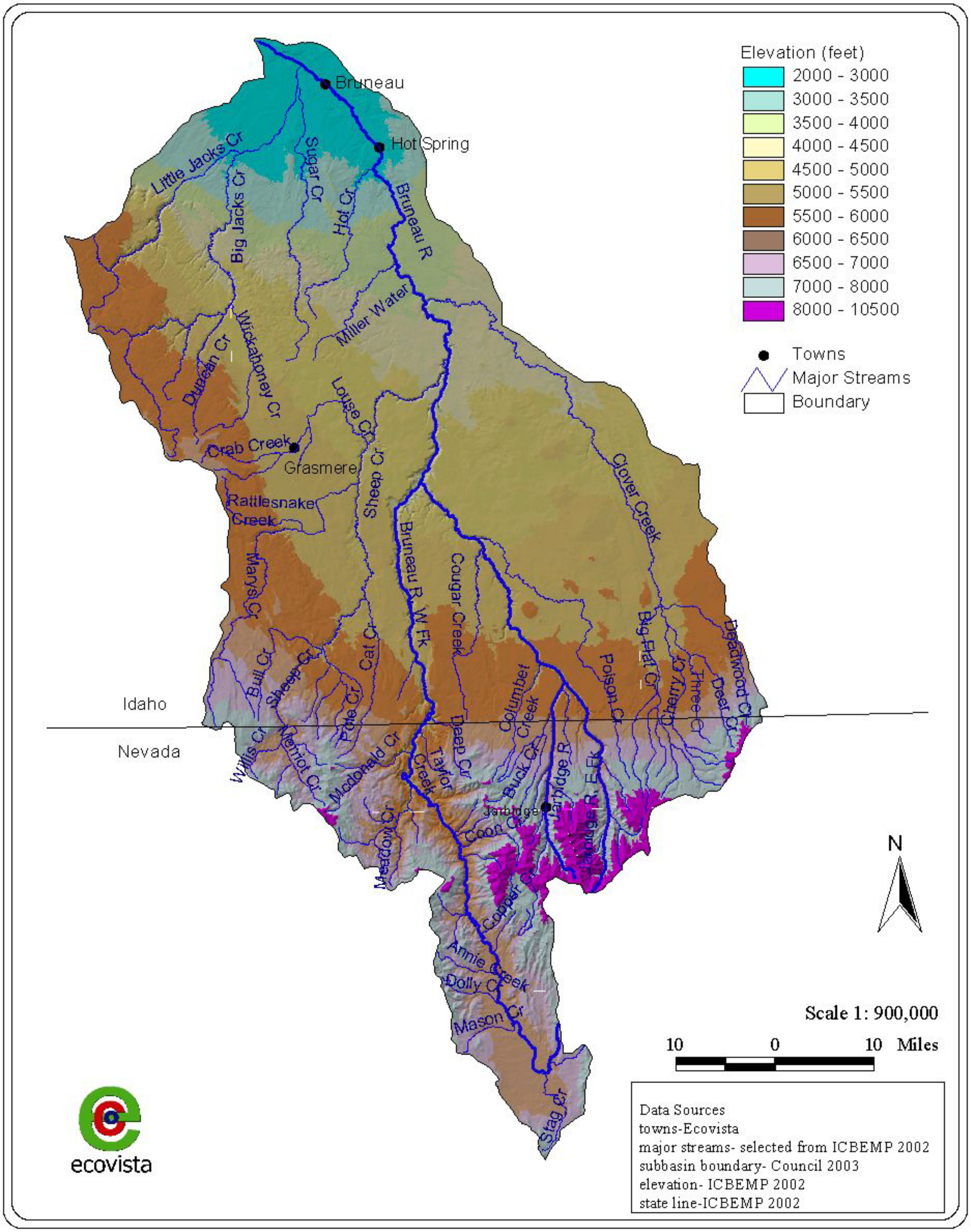

Figure 4. Topography and elevation in the Bruneau subbasin.

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).

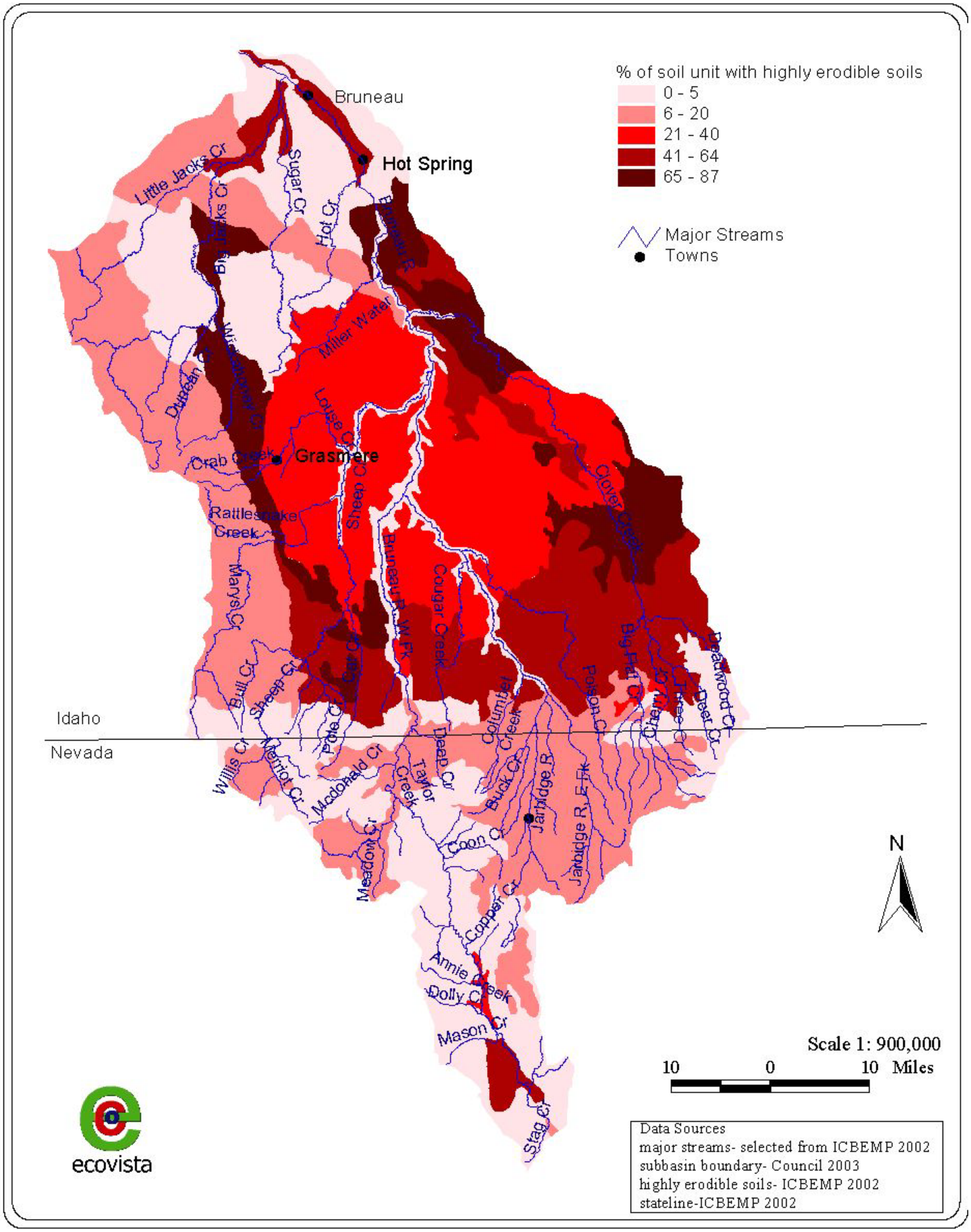

Figure 5. Soil erodibility in the Bruneau subbasin.

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.

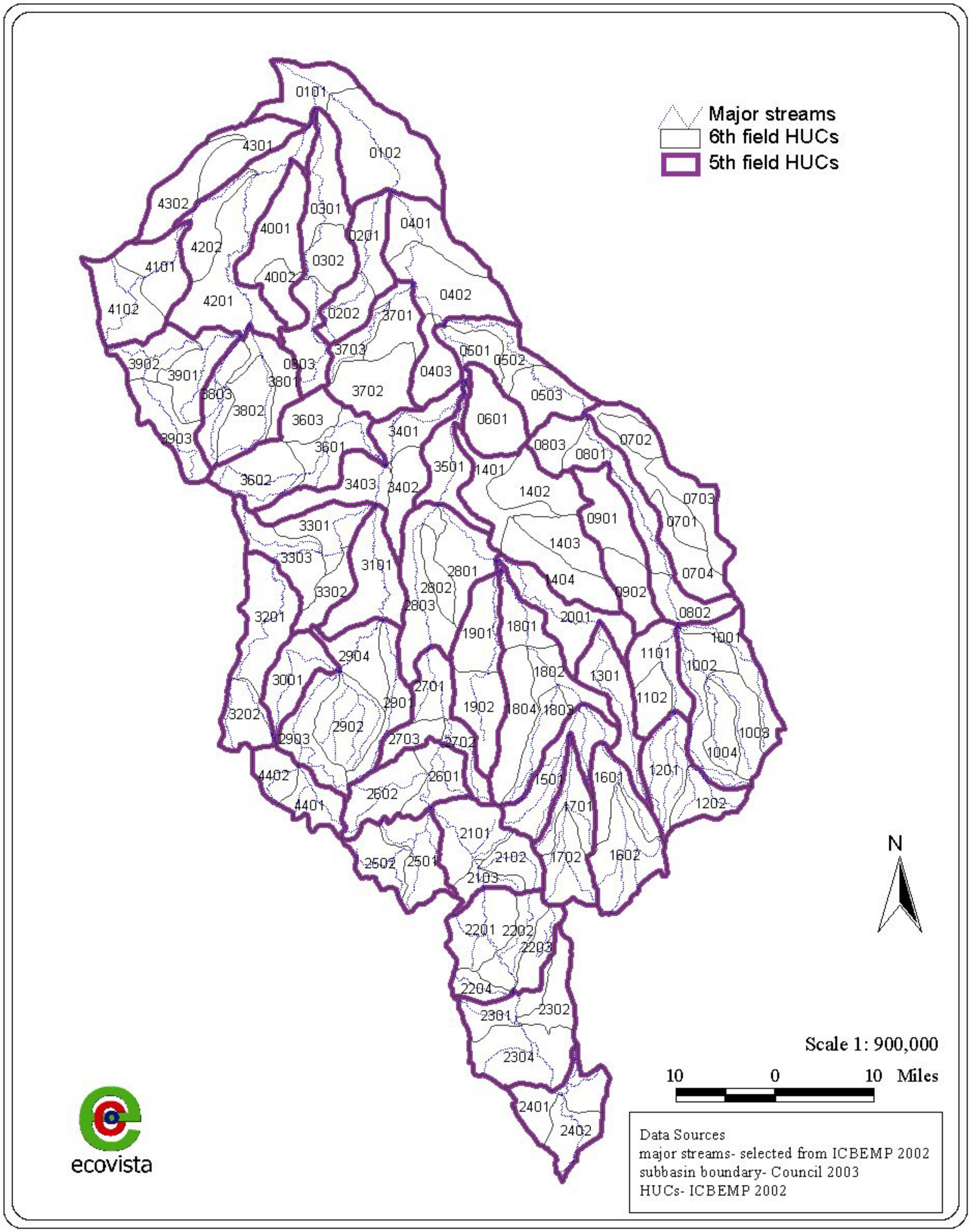

Figure 6. Fifth and sixth-field hydrologic unit codes (HUCs) in the Bruneau subbasin.

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.

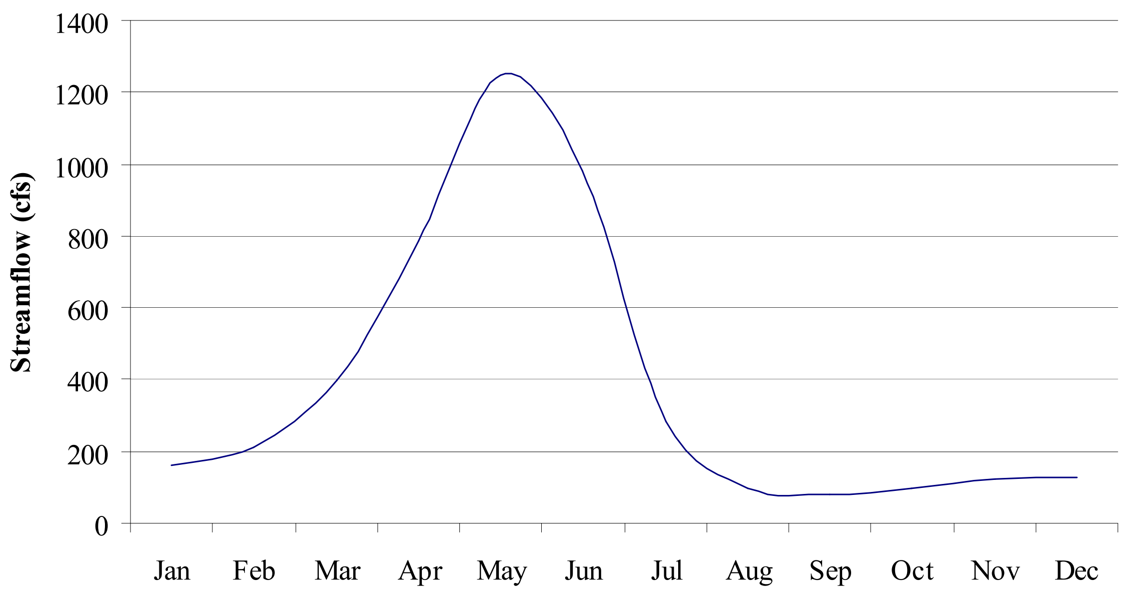

Figure 7. Monthly hydrograph for surface streamflows recorded on the mainstem Bruneau River, near Hot Springs, ID (gage 13168500). The hydrograph is based on 776 discrete monthly averages (1910–1914, 1944–2003).

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).

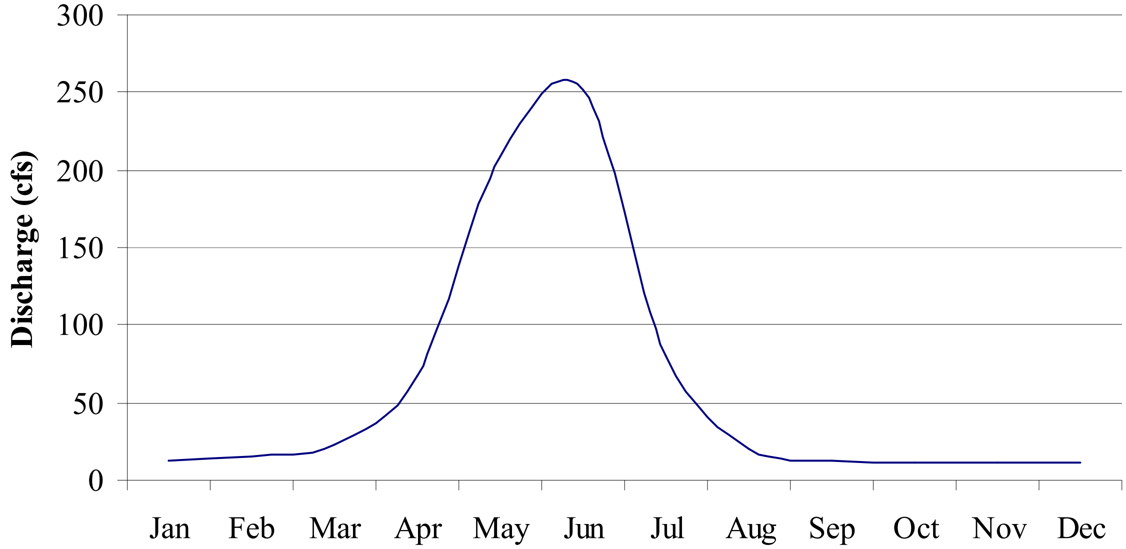

Figure 8. Monthly hydrograph for surface streamflows recorded on the East Fork Jarbidge River (gage 13162500). The hydrograph is based on 270 discrete monthly averages.

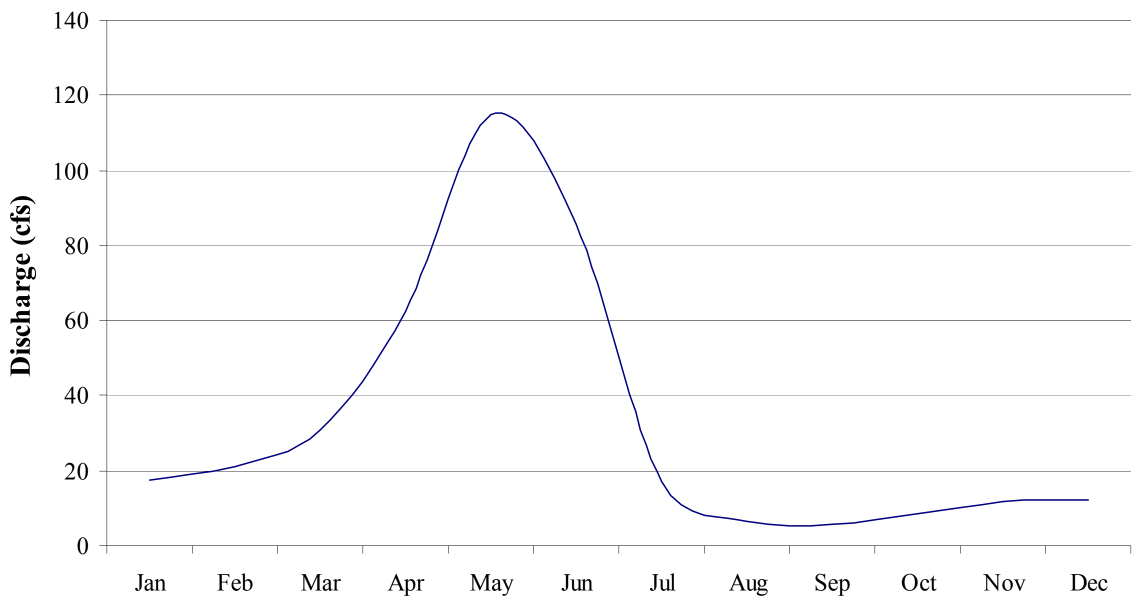

Figure 9. Monthly hydrograph for surface streamflows recorded on the East Fork Bruneau River (gage 13167500). The hydrograph is based on 327 discrete monthly averages.

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			

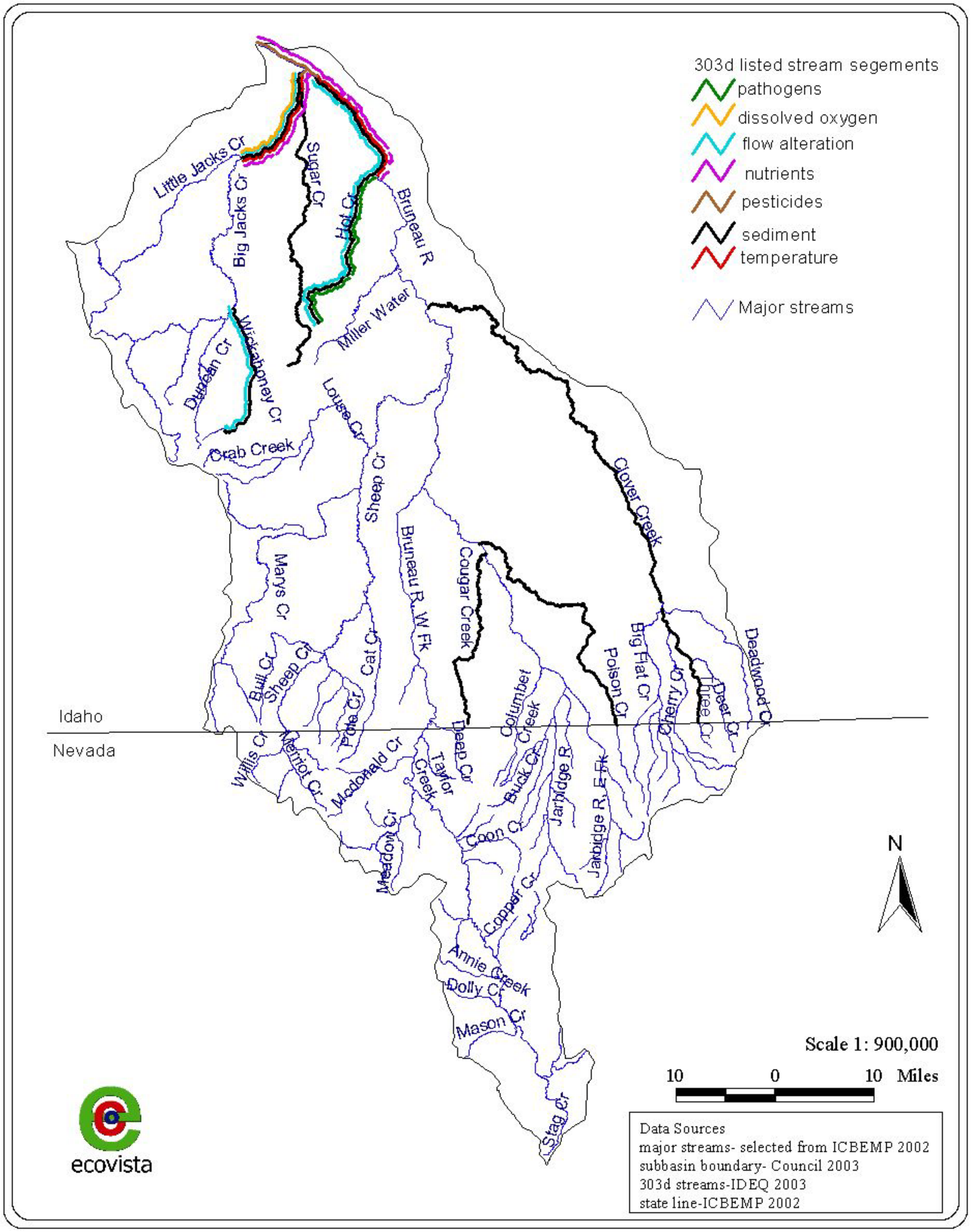

Figure 10. Location of 303(d)-listed stream segments, Bruneau subbasin.

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).

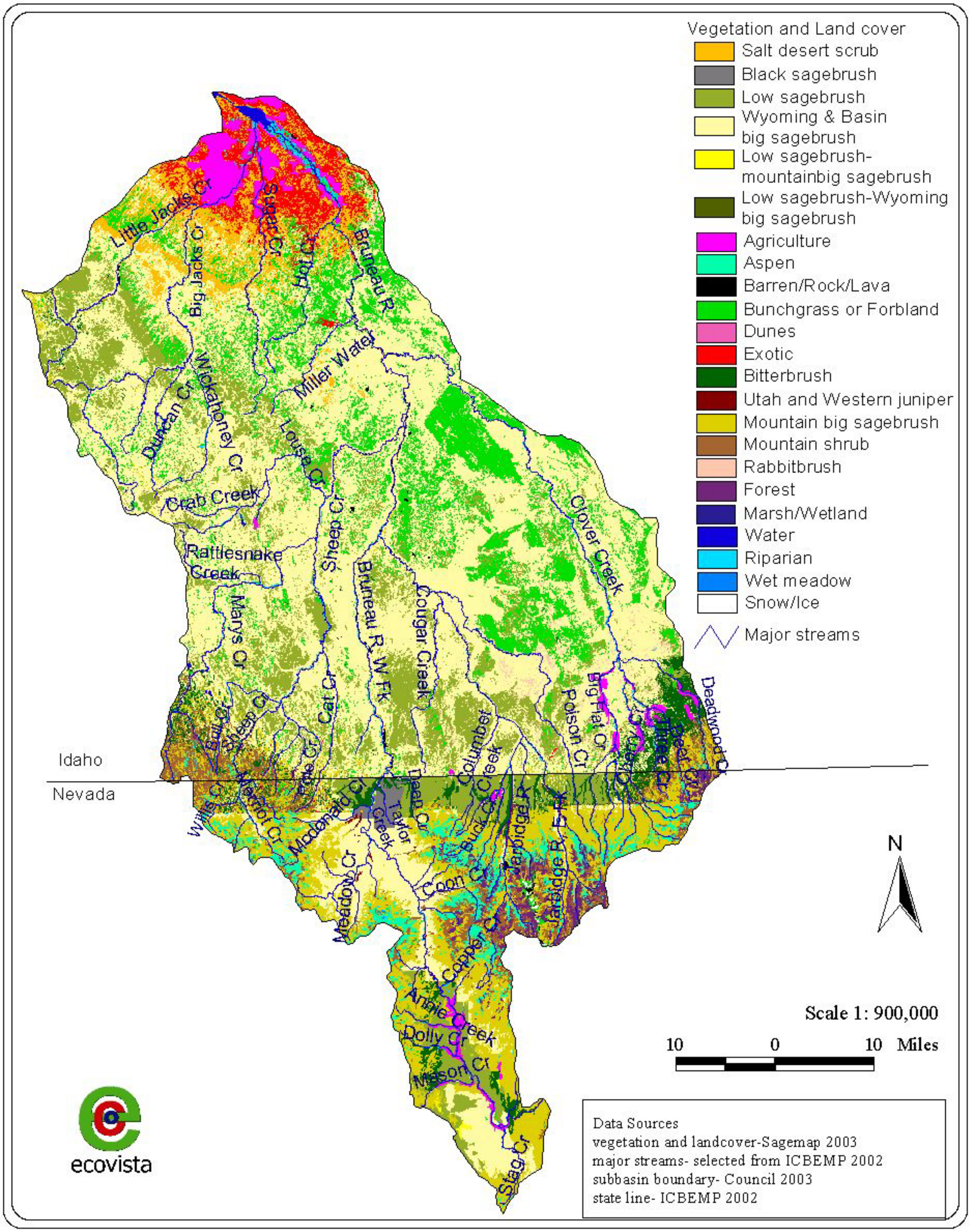

Figure 11. Vegetation and land cover in the Bruneau subbasin.

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**

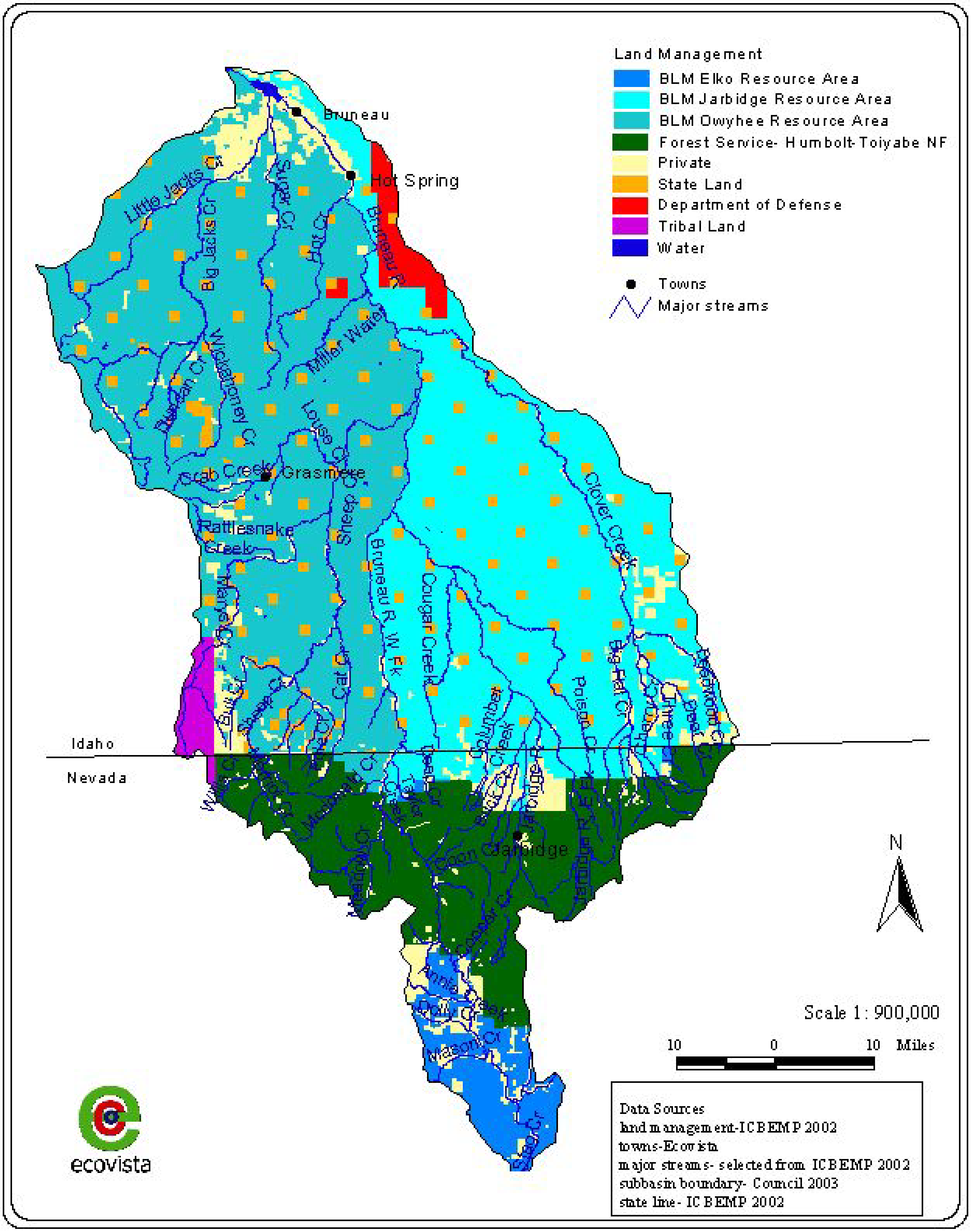

Figure 12. Land ownership and management in the Bruneau subbasin

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

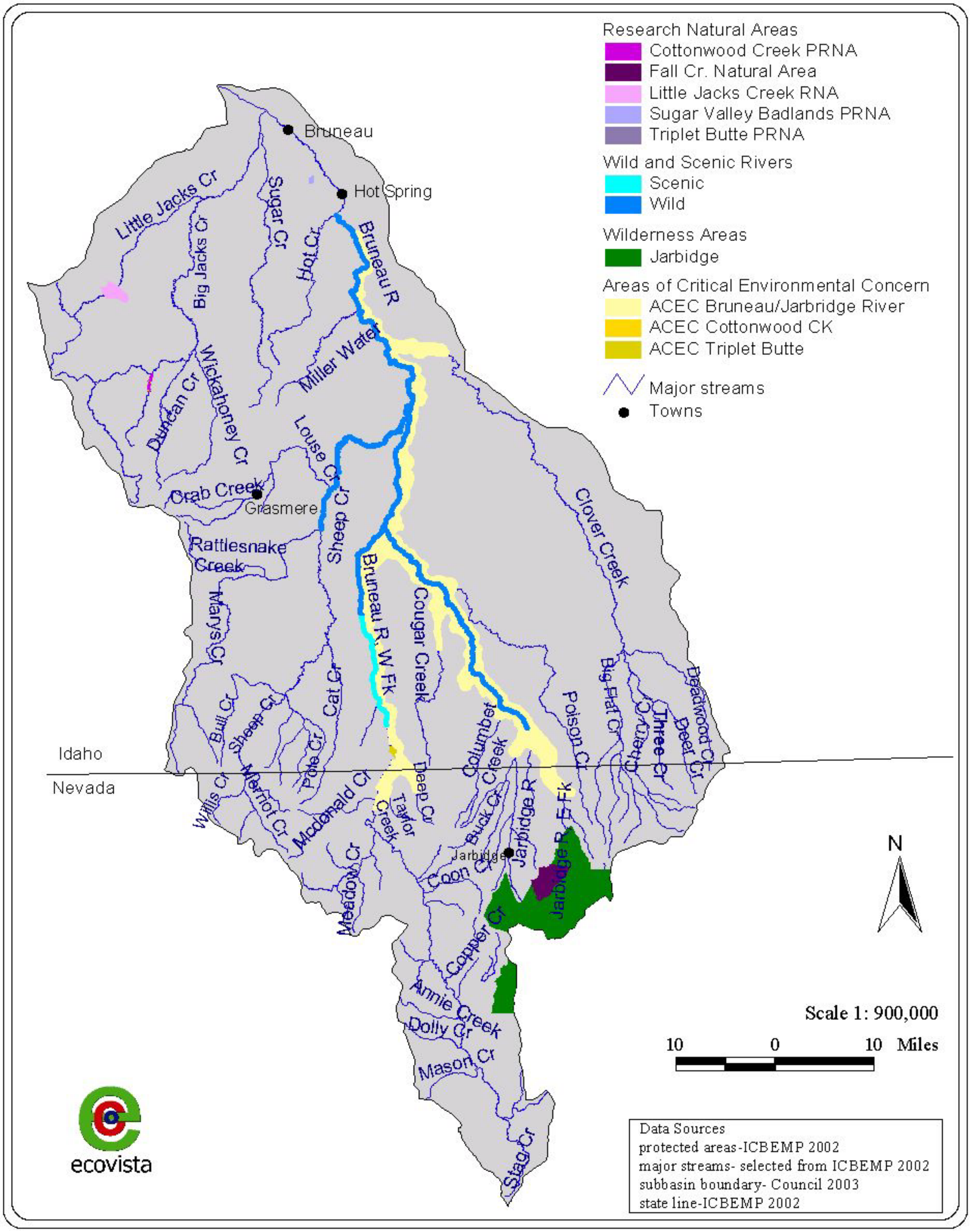

Figure 13. Areas in the Bruneau subbasin with conservation-based management or protection.

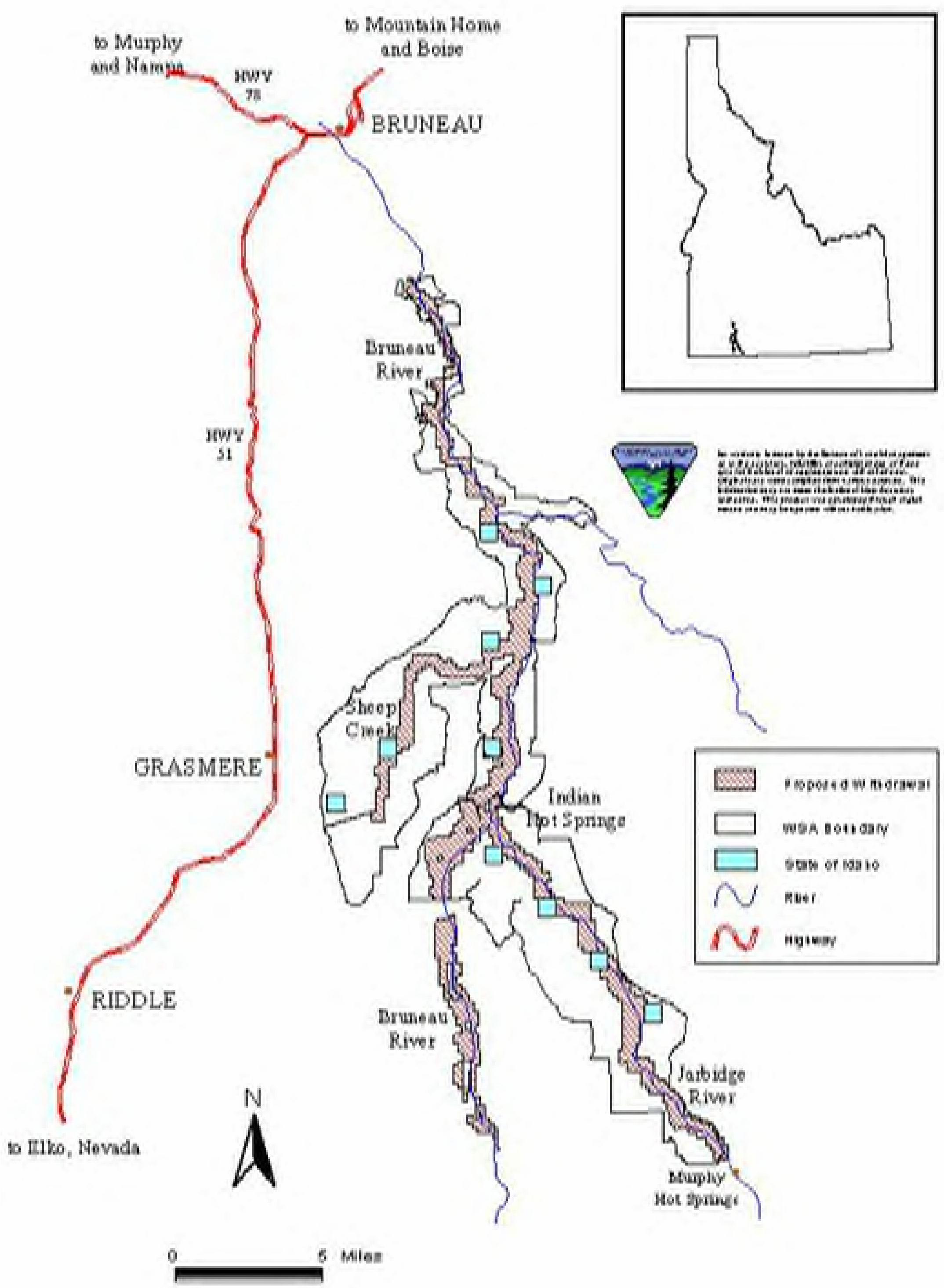

Figure 14. Area covered by State of Idaho PLO 6890 (BLM 2001a).

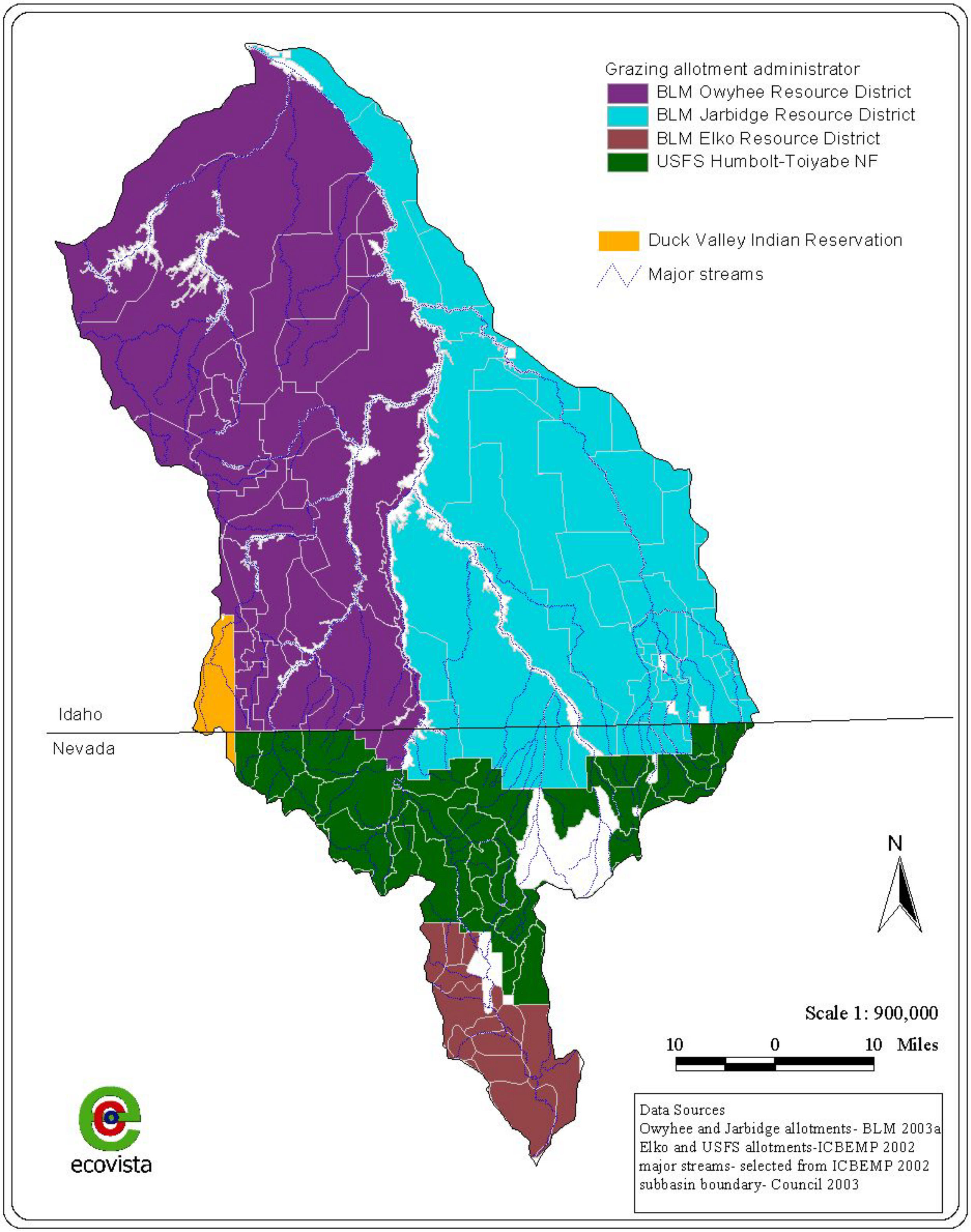

Figure 15. Grazing allotments and their administrators in the Bruneau subbasin

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

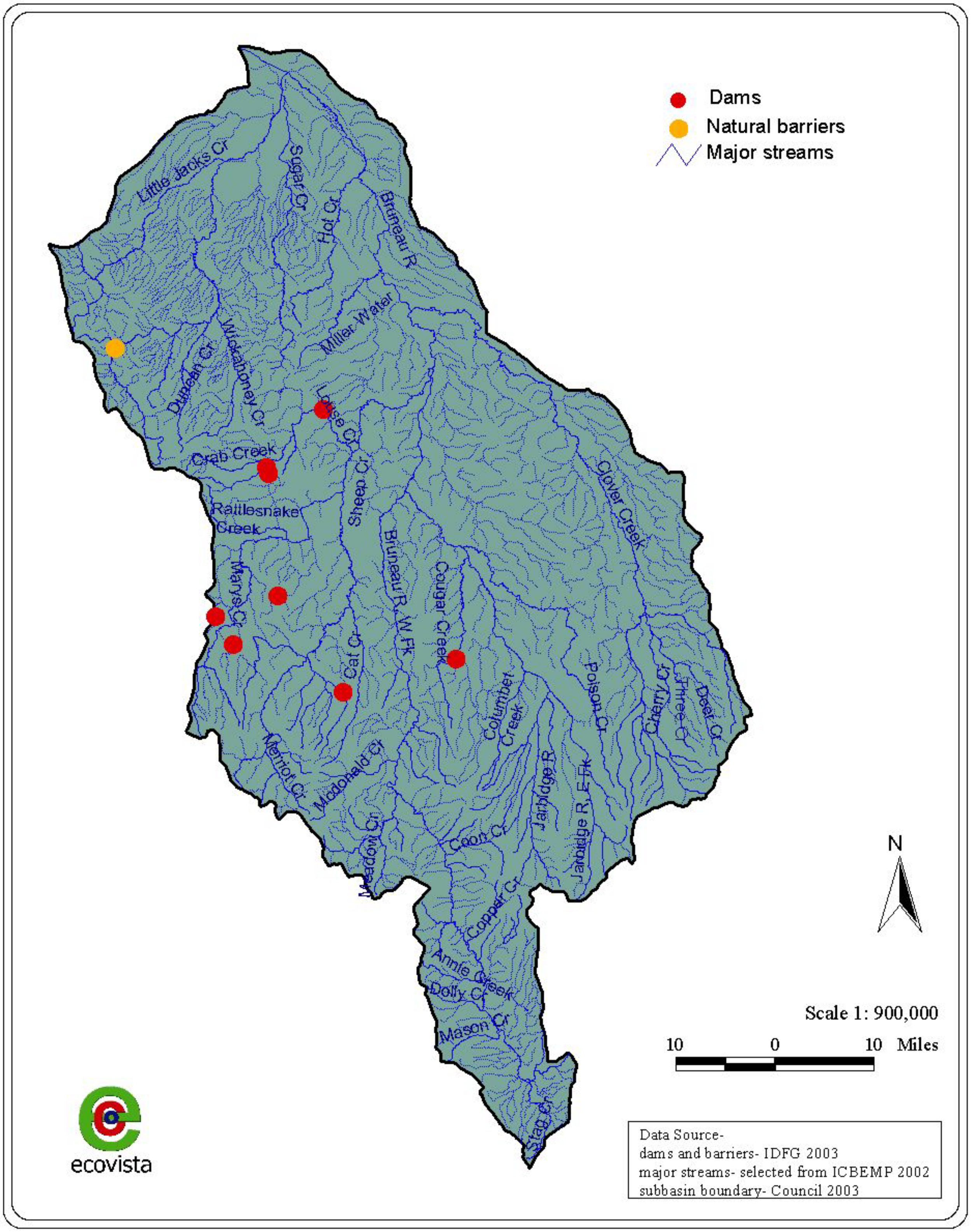

Figure 16. Dams and natural barriers within the Bruneau subbasin.

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).

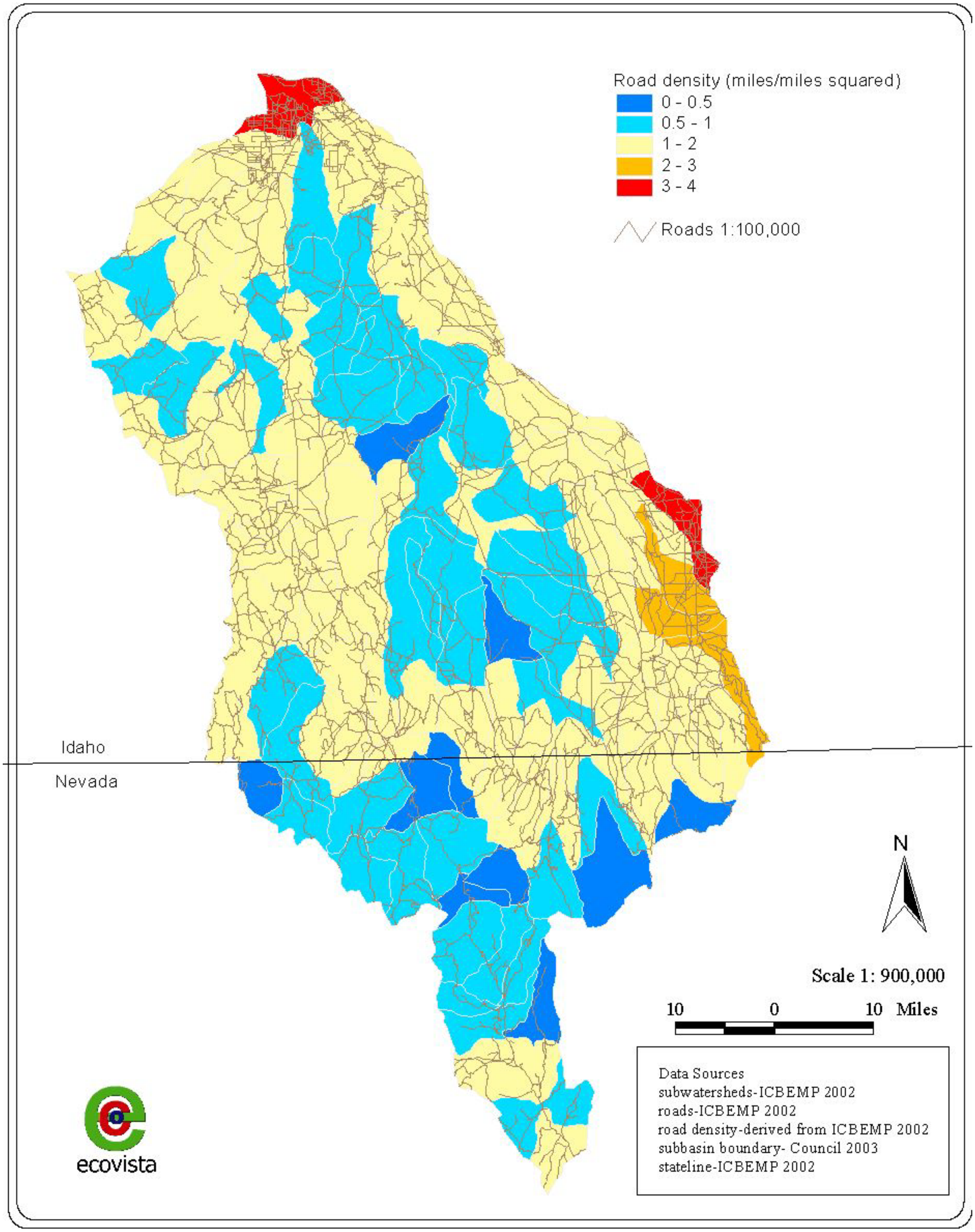

Figure 17. Road densities in the Bruneau subbasin.

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

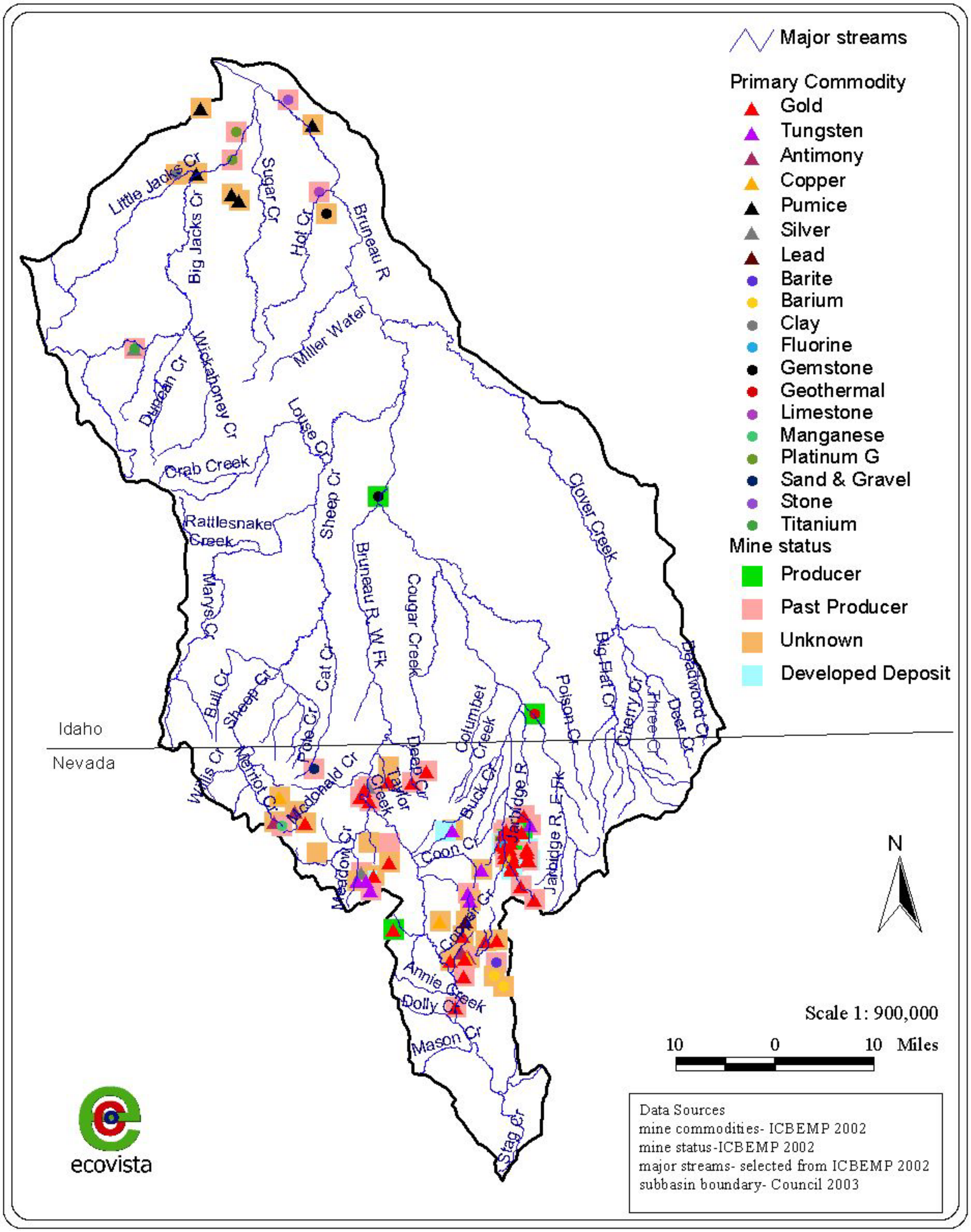

Figure 18. Historic and active mines in the Bruneau subbasin.

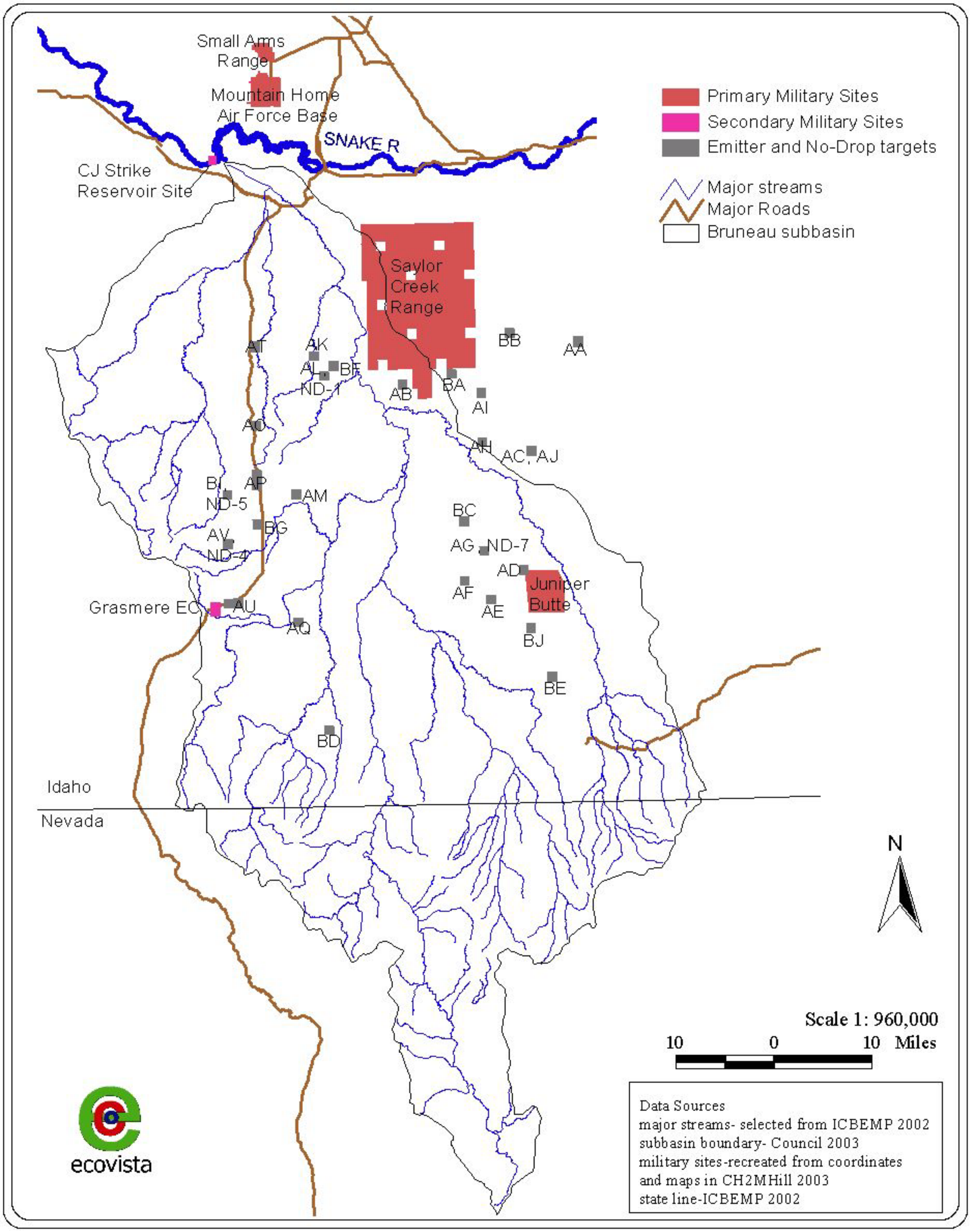

Figure 19. Location of military sites, emitters and no-drop targets in the Bruneau subbasin.

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 19th 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

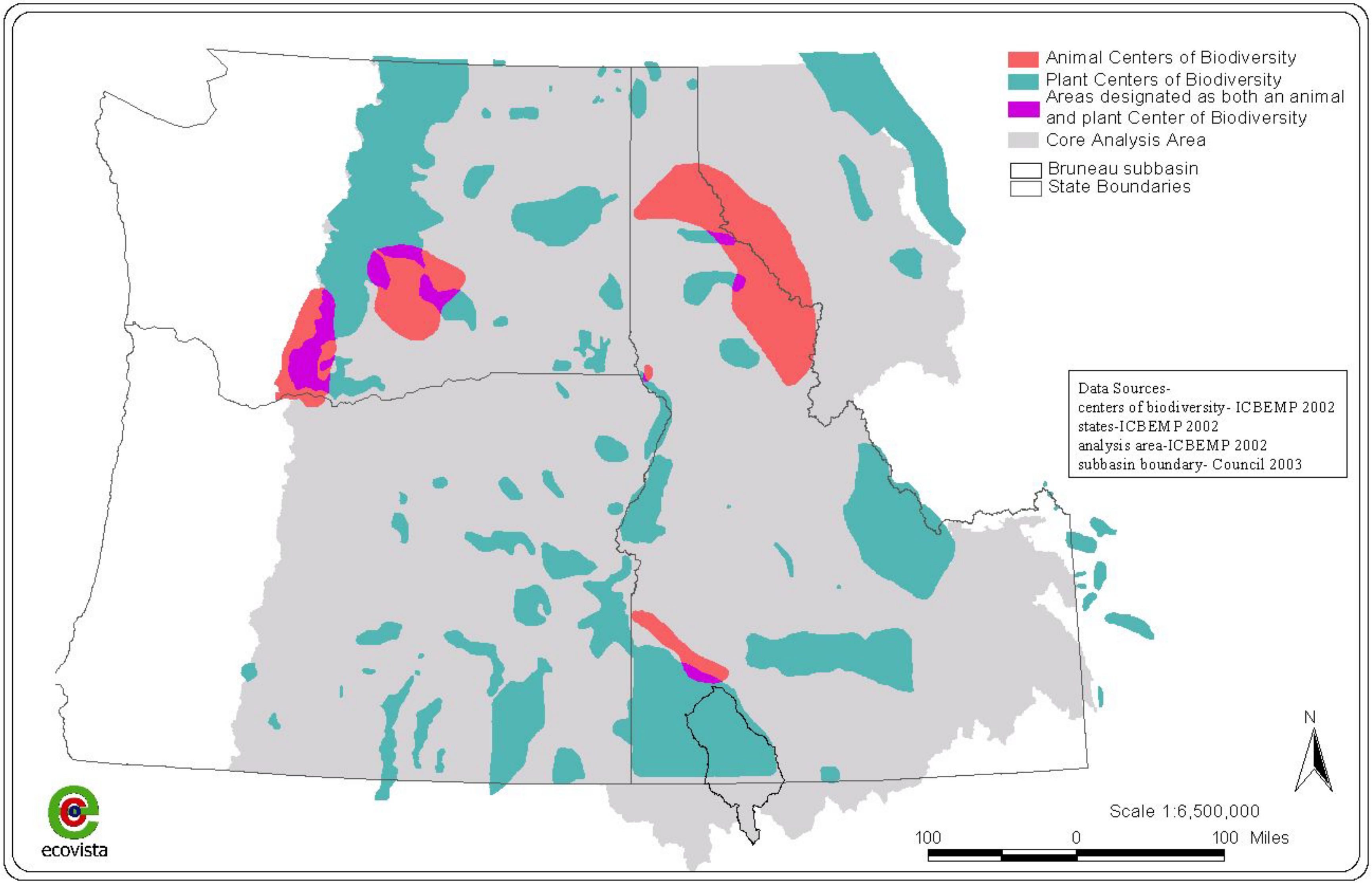

Figure 20. Centers of biodiversity in the ICBEMP analysis area and the Bruneau subbasin.

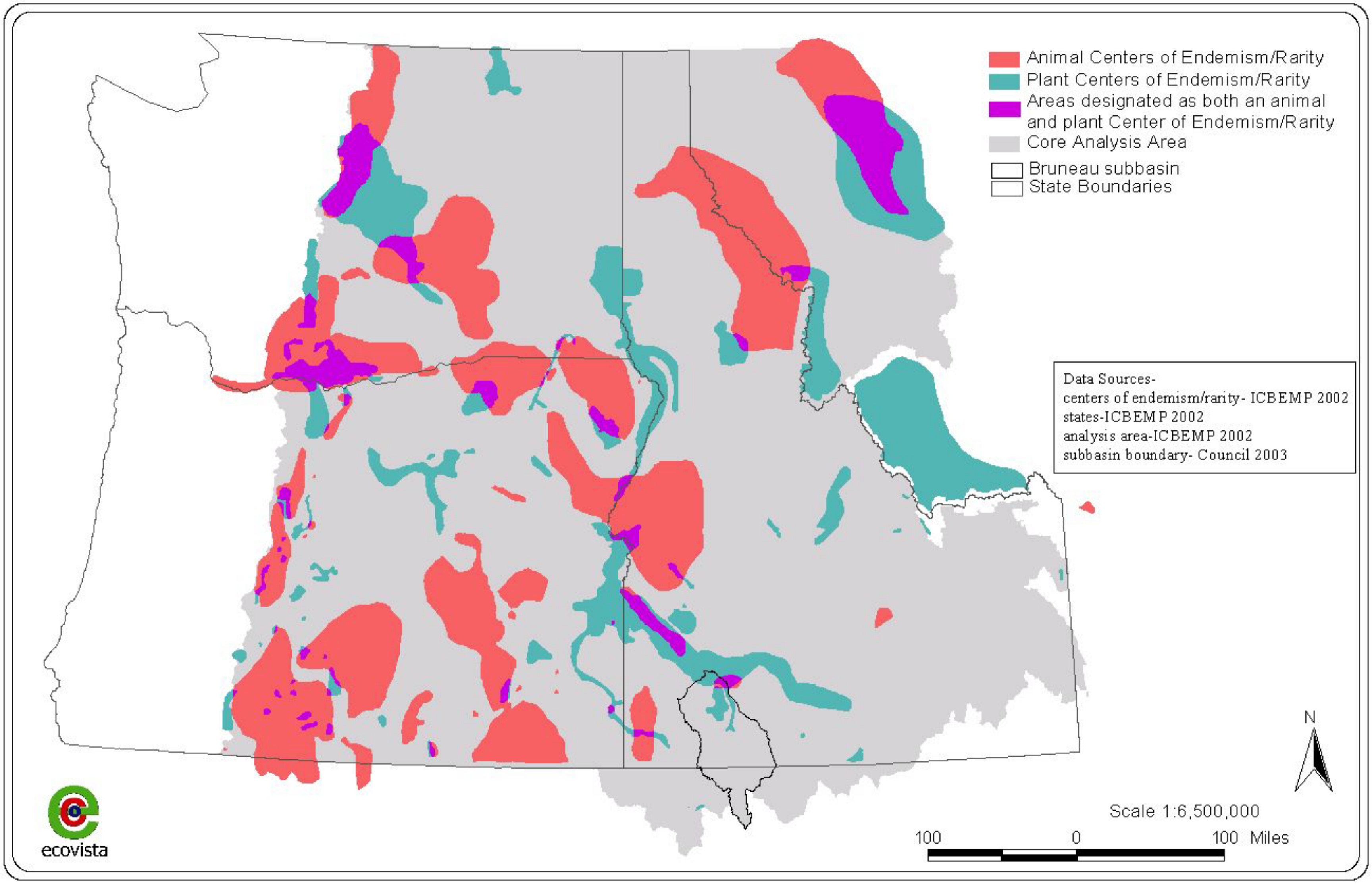

Figure 21. Centers of endemism and rarity in the ICBEMP analysis area and the Bruneau subbasin.

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 inital 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 bighorn sheep habitat 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

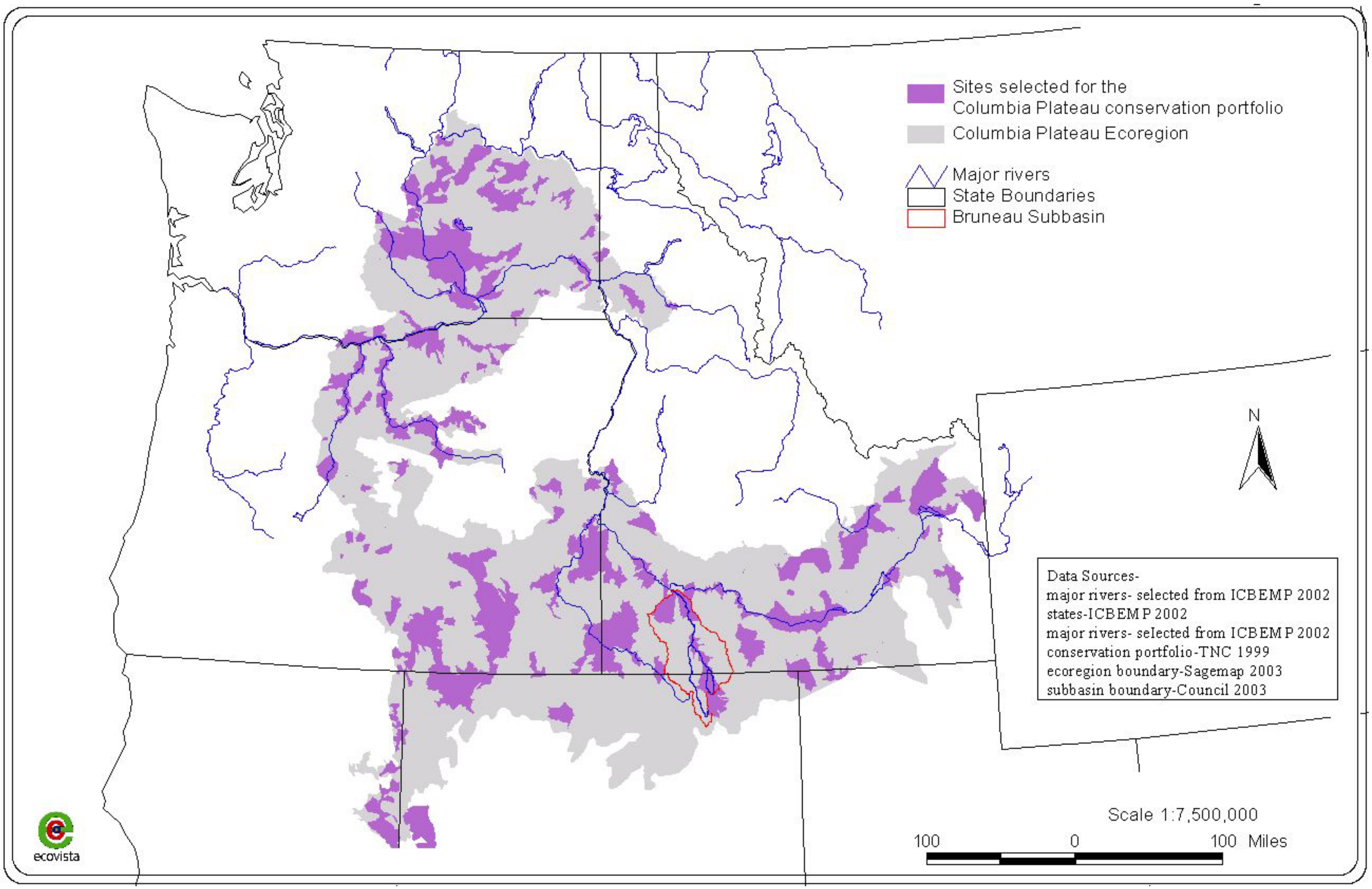

Figure 22. Sites identified in the TNC conservation portfolio for the Columbia Plateau Ecoregional Assessment.

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.