Bruneau Subbasin Management Plan

May 2004

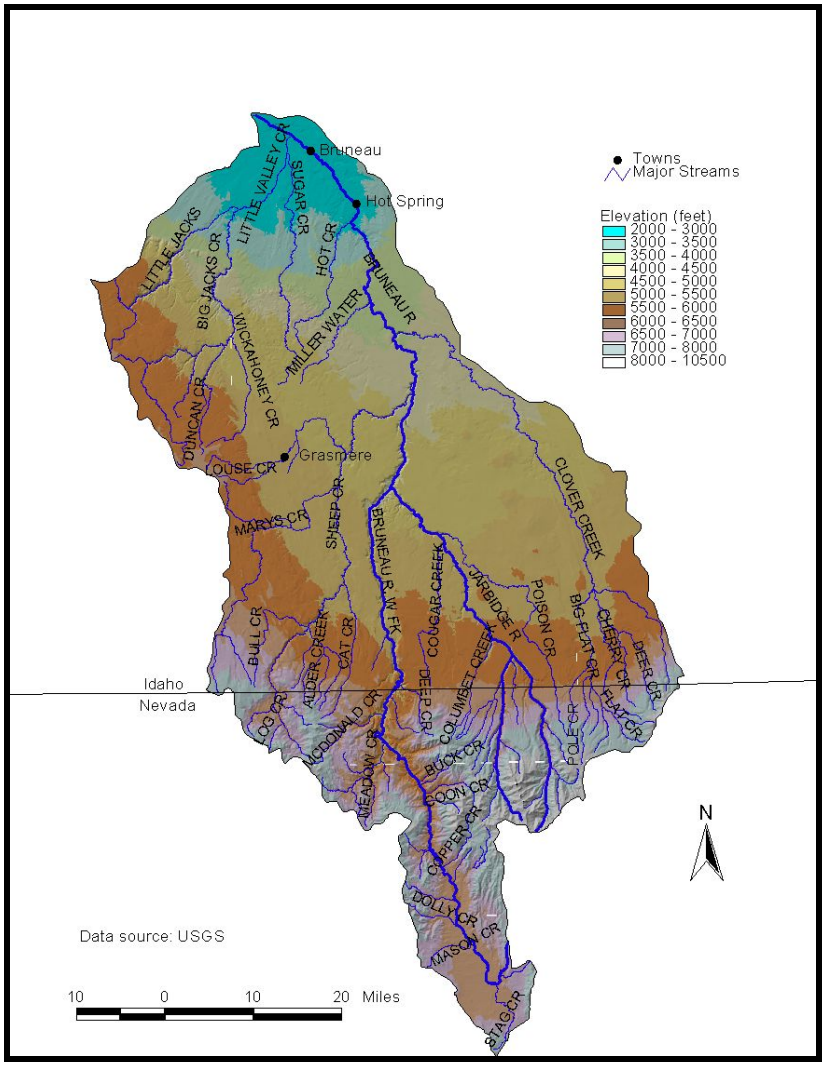

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Table of Contents

LIST OF TABLES

LIST OF FIGURES

Table 1. Acronyms used in the *Bruneau Subbasin Management Plan*.

Acronym	Definition
Agencies or Groups	
BLM	U.S. Bureau of Land Management
BPA	Bonneville Power Administration (Bonneville)
CBFWA	Columbia Basin Fish and Wildlife Authority
Council	(see NPCC below)
IASCD	Idaho Association of Soil Conservation Districts
ICIE	Idaho Council on Industry and the Environment
IDFG	Idaho Department of Fish and Game
IDEQ	Idaho Department of Environmental Quality
ISDA	Idaho State Department of Agriculture
ISRP	Independent Scientific Review Panel
NDOW	Nevada Department of Wildlife
NOAA Fisheries	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPCC	Northwest Power and Conservation Council (formerly the Northwest Power Planning Council or NPPC)
NRCS	Natural Resources Conservation Service
ODEQ	Oregon Department of Environmental Quality
TNC	The Nature Conservancy
USEPA	U.S. Environmental Protection Agency
USFS	U. S. Forest Service
USFWS	U.S. Fish and Wildlife Service
Terms	
AUM	animal unit months
BMP	best management practice
BURP	Beneficial Use Reconnaissance Program
CAFO	confined animal feedlot operation
CRFMP	Columbia River Fish Management Plan
CRP	Conservation Reserve Program (FSA)
CSMEP	Collaborative Systemwide Monitoring and Evaluation Project
CWA	Clean Water Act
CWMA	Cooperative Weed Management Area
ESA	Endangered Species Act
FCRPS	Federal Columbia River Power System
FLIR	forward-looking infrared radar
FSA	Farm Service Agency
GAP	Gap Analysis Program
GIS	geographic information systems
HGMP	hatchery and genetic management plan
HUC	Hydrologic Unit Code
ICBEMP	Interior Columbia Basin Ecosystem Management Project
ISMS	Interagency Species Management System
KEF	key ecological function

Acronym	Definition
KEC	key environmental correlate
LIDAR	light detection and ranging
LSRCP	Lower Snake River Compensation Plan
PFC	proper functioning condition
PIT	passive integrated transponder
PMU	Potential Management Unit
QHA	Quality Habitat Assessment
RC&D	Resource and Conservation Development
RM&E	research, monitoring, and evaluation
TMDL	total maximum daily load

1 Introduction

The Bruneau Subbasin Plan was produced as part of the Northwest Power and Conservation Council's (NPCC) Fish and Wildlife Program. This plan will help direct Bonneville Power Administration's funding of projects that mitigate for damage to fish and wildlife caused by the development and operations of the Columbia River's hydropower system. Subbasin plans were developed in an open public process that included the participation of a wide range of state, federal and tribal governments, landowners, local governments, and other stakeholders, a process the Council intends to direct funding to fish and wildlife projects that will provide the most benefit to the 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 three interrelated volumes that describe the characteristics, management, and vision for the future of the Bruneau Subbasin.

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 the programs and projects currently addressing the objectives and strategies in the Bruneau Subbasin Plan and 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.

1.1 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.

1.1.1 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.

1.1.2 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.

1.1.3 Bonneville Power Administration

The BPA is a federal agency established to market power produced by the federal dams in the Columbia River Basin. As a result of the Northwest Power Act of 1980, BPA is required to allocate a portion of power revenues to mitigate the damages caused to fish and wildlife

populations and habitat from federal hydropower construction and operation. These funds are provided and administered through the Lower Snake River Compensation Plan (LSRCP).

1.1.4 Project Team

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. Ecovista and ICIE employees are not Technical or Planning Team members. Ecovista staff facilitated meetings and participated in order to accurately represent the decisions made at the meetings by the planning and technical team members.

Table 2. 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

1.1.5 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 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 3.

Table 3. 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

1.1.6 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 4).

Table 4. 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

1.2 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.

1.2.1 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.

1.2.2 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.

1.2.3 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.

1.2.4 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.

1.3 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. Priorities 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 basinwide 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.

2 Vision for Bruneau Subbasin

The Planning Team developed this vision and set of guiding principles for the Bruneau Subbasin Plan during the summer and fall of 2003. The vision was developed to present a common goal and desirable future for the subbasin. The guiding principles provide context for, and clarification of, the vision. These principles are not prioritized.

2.1 Vision Statement

The vision for the Bruneau Subbasin is of a healthy ecosystem with abundant, productive, and diverse aquatic and terrestrial species and habitats, which will also support sustainable resource-based human activities.

2.1.1 Guiding Principles

Respect, recognize, and honor the legal authority, jurisdiction, tribal and cultural rights, and all legal rights of all parties.

Maintain, enhance, and/or restore habitats to sustain and recover, to the extent currently possible, native aquatic and terrestrial species with emphasis on Endangered Species Act listed and other native species.

Foster ecosystem protection, enhancement, and restoration that result in stewardship of natural resources, recognizing all components of the ecosystem, including the human component.

Provide information to residents of the Bruneau subbasin to promote understanding and appreciation of the need to maintain, enhance, and/or restore a healthy and properly functioning ecosystem.

Provide opportunities for sustainable natural resource-based economies to recover in concert with aquatic and terrestrial species.

Promote and enhance local participation in, and contribution to, natural resource problem solving and subbasin-wide conservation efforts.

Coordinate efforts to implement the Pacific Northwest Electric Power Planning and Conservation Act, the Endangered Species Act, the Clean Water Act, tribal and cultural rights, and other local, state, federal, and tribal programs, obligations, and authorities.

Develop a scientific foundation for diagnosing biological problems and designing and prioritizing projects.

Monitor and evaluate plan implementation, using principles of adaptive management, to achieve the biological objectives.

Enhance key species populations to a level of healthy and harvestable abundance to support tribal and state harvest goals.

2.1.2 Definitions and Qualifications

The Planning Team developed definitions of key words to clarify the meaning of the vision and guiding principles.

Adaptive Management
Adaptive management is a continual process of planning, implementation, monitoring, research, reevaluation, and adjusting management.

Ecosystem
An ecosystem is a biological community of plants, animals, and other organisms interacting with each other and their physical environment. This system is subject to natural disturbance processes.

Enhance
To intensify, increase, or further improve the quality, value or extent of the designated subject.

Promote
To further the progress of an activity; to support or actively encourage it.

Restoration

Restoration means the return of an ecosystem to a close approximation of its natural condition.

Scientific foundation

1. Relies upon the best available scientific knowledge. Describes the best understanding of biological realities that will govern how the vision is accomplished. Provides the basis for the working hypotheses that underlie the Council's program. Applies eight principles from established scientific literature to form the foundation of the Council's program. The scientific principles are:

Principle 1. The abundance, productivity, and diversity of organisms are integrally linked to the characteristics of their ecosystems.

Principle 2. Ecosystems are dynamic, resilient, and develop over time.

Principle 3. Biological systems operate on various spatial and time scales that can be organized hierarchically (e.g., ecosystems, landscapes, communities, populations).

Principle 4. Habitats develop, and are maintained, by physical and biological processes.

Principle 5. Species play key roles in developing and maintaining ecological conditions.

Principle 6. Biological diversity allows ecosystems to persist in the face of environmental variation.

Principle 7. Ecological management is adaptive and experimental.

Principle 8. Ecosystem function, habitat structure, and biological performance are affected by human actions.

Stewardship
Stewardship is the management of natural resources that conserves them for future generations.

Sustainable
Conserving an ecological balance by avoiding depletion of natural resources for future generations. In terms of development, meeting economic objectives in ways that do not degrade the underlying environmental support system.

3 Problem Statements, Objectives, and Strategies

The various components (problem statements, biological objectives, and strategies) of the *Bruneau Subbasin Management Plan* described in this section have been developed from information presented in the *Bruneau Subbasin Assessment* and *Bruneau Subbasin Inventory*. References to information contained in other volumes of the subbasin plan, or sections in the management plan, are provided where applicable to aid readers in finding more detailed information regarding particular problem statements, objectives, and strategies. Focal species and habitat types are described in sections 2.3 and 2.4 of the *Bruneau Subbasin Assessment*. The

limiting factors for aquatic and terrestrial species are described in sections 4.1 and 4.2 of the assessment.

Although the problem statements, objectives, and strategies are commonly related to individual species or communities, none of these ecosystem components function independently. Any actions that benefit or harm one species within the subbasin also impact other species (aquatic or terrestrial, including humans) that rely on that species. In addition, every action has social, political, and economic implications that must be addressed.

Social, economic, and political factors in the Bruneau subbasin are important considerations in determining the success of the implementation phase of this management plan. These factors are referenced in the vision and guiding principles for the Bruneau subbasin and must be considered at all levels of the planning process, including the development of appropriate problem statements, objectives, and strategies. Accounting for the human component of the subbasin increases the probability that this plan will be successfully implemented and viewed as a necessary, socially acceptable, and reasonable step in the protection and recovery of aquatic and terrestrial species in the subbasin.

3.1 Problem Statement Summary

The problem statement summary is defined as the *working hypothesis* in NPCC documents. It is intended to provide a scientific basis for the development of objectives and strategies. In this plan, we follow the recommendation of the Independent Scientific Review Panel (ISRP) to state the hypotheses as problem statements (2003). The NPCC recognizes eight scientific principles (NPCC 2001) that form the scientific foundation, and all actions taken to implement the program must be consistent with these principles. The following problem statement is based on information and findings presented in the subbasin assessment, thereby summarizing the available science for development of the management plan. The problem statement provides an explicit scientific rationale under which various component problem statements, objectives, and strategies are organized to provide a linkage between the science and strategies presented within this plan.

Ecosystems within the Bruneau subbasin have been substantially impacted by human activities both in and outside the subbasin, most commonly with negative impacts to aquatic and terrestrial species. Many aquatic and terrestrial species are currently at risk within the subbasin, and without appropriate management planning and implementation, the viability of these populations may be further compromised. (See Assessment Section 2 for species discussions and focal species selection.) Humans are themselves an ecosystem component, and this management plan relies on the ability of human and nonhuman components to interact and coexist.

Insufficient habitat quantity and quality and the loss of connectivity between populations appear to be the primary factors limiting production of coldwater fish species in the Bruneau subbasin. Grazing, irrigated agriculture, and road construction limit aquatic species in the subbasin. Streamflow reduction and decreased habitat from reduced flows has resulted from irrigation of pastures, aquaculture, and small dam construction. Groundwater mining limits surface water volume and has posed a threat to the Bruneau hot springsnail. Grazing has removed riparian vegetation, reducing water storage capacity and impacting both aquatic and terrestrial focal

species. Changes in channel morphology in grazing allotments affects fish and other aquatic species. Habitat complexity has been reduced by these land-use activities. Poor, degraded water quality is a key factor that limits habitat for aquatic species. Parameters of concern are excessive temperatures, nutrients, and sediment.

Terrestrial habitat is limited by past and present land-use practices. The two most critical threats are 1) conversion from sagebrush-steppe to annual grasslands fostering cheatgrass invasion and 2) loss and depletion of riparian habitat. The introduction of exotic species and fire suppression have altered natural fire regimes and changed the distribution, composition, and structure of native plant communities. Biological crusts have been damaged and destroyed by road maintenance and road building, grazing, off-road vehicles, and other human uses such as rock collecting and fire. Disturbance increases the spread of noxious weeds and exotics.

3.2 Problem Statements, Objectives, and Strategies

The following list of problem statements, associated objectives, and strategies are derived from the problem statement summary with added detail. The problem statements were developed from the factors limiting focal species and habitats in the subbasin and from conditions that inhibit natural ecological processes as described in the subbasin assessment. Objectives describe the changes needed to achieve the vision, consistent with the scientific principles. Strategies provide specific steps necessary to accomplish the objectives.

Problem statements, objectives, and strategies are organized into aquatic, terrestrial, and socioeconomic categories, although the three groups are intrinsically linked. Aquatic and terrestrial objectives (see sections 3.2.1, 3.2.2, and 3.2.3) were developed by the Project and Technical Teams, with support from the Planning Team. The socioeconomic section (section 3.2.4) contains objectives and strategies addressing the human components of protecting and enhancing fish and wildlife populations and their habitats. These components are considered by the Planning Team as critical to successfully implementing the *Bruneau Subbasin Management Plan*. Economic and social objectives, as appropriate, were developed by the Planning Team. Recommendations for further data collection or prioritization were noted where data gaps limit the development of sound biological objectives and strategies. These information needs are addressed in further detail in section 4 (about research, monitoring, and evaluation) of this volume.

Objectives are consistent with the four overarching biological objectives for the 2000 Columbia River Basin Fish and Wildlife Program (NPCC 2004):

1. A Columbia River ecosystem that sustains an abundant, productive, and diverse community of fish and wildlife.

2. Mitigation across the basin for the adverse effects to fish and wildlife caused by the development and operation of the Columbia Basin hydrosystem.

3. Sufficient populations of fish and wildlife for abundant opportunities for tribal trust and treaty right harvest and for non-tribal harvest.

4. Recovery of fish and wildlife that are listed under the Endangered Species Act and that are affected by the development and operation of the Columbia basin hydrosystem.

The formatting of the problem statements, objectives, and strategies is consistent with guidance in the Technical Guide (NPCC 2001) and used in this document with minor modifications. Table 5 summarizes problem statements and objectives in relation to the aquatic and terrestrial limiting factors within the Bruneau subbasin.

Table 5. Problem statements and objectives addressing factors limiting fish and wildlife habitats and species.

Problem	Objective
Aquatic Problem Statements and Objectives	
1. Low flows reduce available habitat and limit distribution of all focal species in the subbasin.	1A: Improve efficiency of water-delivery infrastructures to reduce the volume of water needed for consumptive purposes.
	1B: Work cooperatively with local irrigation districts to see whether they are either willing or able to put water back into channels that have been identified as "low flow" limited.
	1C: Improve stream flows in HUCs defined as "low flow" limited (see section 4.1.3 for specific sixth field HUCs) through passive and active restoration and rehabilitation techniques.
2. Low flows and reductions in riparian shading contribute to excessive stream temperatures and oxygen deficiencies throughout most of the subbasin, which have demonstrable (e.g., Rieman and McIntyre 1993, Zoellick 2004) negative consequences to redband and bull trout population productivity.	2A: In areas not highly influenced by geothermal inputs, work to restore stream temperatures to levels meeting state criteria. Idaho water quality regulations designated to protect coldwater aquatic life prescribe that water temperatures not exceed 22 °C, with a maximum daily average of ≤19 °C (Lay 2000). Nevada water quality standards for beneficial uses in the Jarbidge and West Fork Bruneau rivers stipulate that stream temperatures from May through October be less than 21 °C and from November through April be less than 7°C, with no more than a 1 °C change year-round.
3. Sedimentation of aquatic habitats is occurring throughout numerous portions of the subbasin and is considered to be negatively influencing the productivity of all aquatic focal species, albeit at varying levels.	3A: Prevent and/or reduce sediment delivery to streams.
	3B: Restore fine sediment levels in Dave Creek, Nevada (HUC 1601), to those within a proper functioning condition to protect critical bull trout habitat.
4. Legacy effects from land-use activities still impact channel form and stability, which in turn are contributing to low flow problems.	4A: Aquatic Objective 4A: Within the next 15 years, improve channel stability and channel form in portions of the subbasin where low flow problems also exist

Problem	Objective
5. Obstructions to migration prohibit fish movement and eliminate access to potential habitat.	5A: Within the next five years, remove, replace, or reconstruct structural barriers on Wickahoney Creek, West Fork Bruneau River, and McDonald Creek to allow for redband trout migration.
	5B: Within the next five years, examine the effects of the Grassmere diversion on habitat connectivity between redband trout populations in Louse and Crab creeks.
	5C: Identify and address barriers to bull trout migration in the Jarbidge River Core Area.
	5D: Within the next five years, conduct a subbasinwide fish barrier inventory.
6. Thermal and organic pollutants are identified as limiting factors to aquatic focal species in several sixth field HUCs throughout the subbasin. The effects from these pollutants on aquatic focal species have not been definitively determined.	6A: Conduct research, monitoring, and evaluation to identify and address point and nonpoint pollutant sources and to determine associated impacts on various life history stages of aquatic focal species.
7. Impacts to riparian vegetation have contributed to excessively high stream temperatures and decreased channel stability and adversely modified the channel throughout much of the subbasin.	7A: Within the next 10 years, increase riparian cover and stream shading in high-priority restoration HUCs to levels consistent with the proper functioning condition and site capability. These levels vary, but in small to medium-sized streams (i.e., those measuring less than 5 meters in width), shading should equal between 60 and 80% (Zoellick 2004).
8. There is a limited understanding of factors limiting recruitment, survival, abundance, and distribution of redband trout throughout the subbasin.	8A: Ensure that systematic redband habitat and population inventories are conducted on a regular basis so that critical factors limiting populations can be defined and subsequent management can occur.
	8B: Determine, at the subbasin scale, whether the effects of riparian fencing and grazing management will do more for redband population protection and restoration than increasing streamflows will.
	8C: Assess how redband trout cope with high summer water temperatures.
	8D: Assess the impact (or lack thereof) that northern pikeminnow and nonnative game species (such as smallmouth bass) have on redband trout distribution and abundance.
9. Current knowledge of redband trout genetic diversity and gene flow among local populations in the Bruneau subbasin is inadequate, as is the extent of hybridization with nonnative strains of rainbow trout.	9A: Determine the degree of genetic purity of redband trout populations and the degree of genetic variability among and within populations of redband trout.

Problem	Objective
10. Interactions between nonnative fishes and bull trout in Emerald Lake and Bear Creek represent a potential threat to bull trout population stability.	10A: Implement control of nonnative fishes in the Jarbidge River Core Area, where it is found to be feasible and appropriate.
11. Current fisheries management goals and objectives for the Jarbidge watershed are inconsistent with bull trout recovery and implementation practices defined in the recently released Jarbidge River Core Area recovery plan.	11A: Develop and implement state fisheries management plans, specifically for the Jarbidge River watershed, that integrate adaptive management concepts.
	11B: Evaluate and minimize illegal harvest and incidental angling mortality of bull trout in the Jarbidge River Core Area.
	11C: Evaluate effects of existing and proposed angling regulations on bull trout in the Jarbidge River Core Area.
12. The necessary characterization of bull trout genetic diversity and gene flow among local populations in the Bruneau subbasin is inadequate to allow for scientifically based conservation management.	12A: Incorporate conservation of genetic and phenotypic attributes of bull trout into recovery tasks and fisheries management plans for the Jarbidge River Core Area.
	12B: Maintain and improve opportunities for gene flow among local bull trout populations in the Jarbidge River Core Area.
13. Current research and monitoring programs in the Bruneau subbasin do not incorporate an adaptive management approach and, therefore, lack necessary feedback loops to evaluate the effectiveness of site-specific bull trout recovery efforts.	13A: Design and implement a standardized monitoring program to assess the effectiveness of recovery tasks affecting bull trout and their habitats within the Jarbidge River Core Area.
	13B: Conduct research that evaluates relationships among bull trout distribution and abundance, habitat, and recovery tasks.
	13C: Develop and conduct research and monitoring studies to improve information concerning the distribution and status of bull trout in the Jarbidge River distinct population segment.
	13D: Identify evaluations needed to improve understanding of relationships among genetic characteristics, phenotypic traits, and local populations of bull trout.
14. Freshwater mollusks have declined in distribution and abundance throughout the Bruneau subbasin, due primarily to habitat alteration.	14A: Support freshwater mollusk conservation and recovery through habitat restoration, groundwater and surface water conservation, and continued research of environmental factors limiting mollusk growth, survival, and reproduction.
Terrestrial Problem Statements and Objectives	
15. The loss and degradation of wetland and riparian areas have negative effects on fish and wildlife species that use these habitats.	15A: Minimize grazing effects in riparian and wetland habitats.
	15B: Minimize adverse effects of roads in riparian and wetland habitats.

Problem	Objective
	15C: Maintain and restore the hydrologic regime in riparian and wetland habitats.
16. Degradation, fragmentation, and loss of native shrub-steppe/dwarf shrub-steppe habitat adversely affect associated terrestrial species.	16A: Minimize impacts of livestock grazing to native shrub-steppe/dwarf shrub-steppe habitats and terrestrial species within the Bruneau subbasin.
	16B: Reduce the intensity, frequency, and size of wildfire in shrub-steppe/dwarf shrub-steppe habitats of the Bruneau subbasin.
	16C: Limit noise disturbance to shrub-steppe/dwarf shrub-steppe wildlife species.
	16D: Reduce the prevalence of crested wheatgrass in shrub-steppe habitats.
	16E: Protect existing high-quality shrub-steppe/dwarf shrub-steppe plant communities while reducing the extent and density of nonnative invasive plant species and noxious weeds in the Bruneau subbasin.
17. Desert playa habitats have lost native grasses and undergone structural changes.	17A: Encourage maximum plant performance in desert playa habitats.
	17B: Reduce livestock-facilitated invasions of nonnative invasive plants and noxious weeds into desert playa habitat.
	17C: Minimize adverse effects of roads in desert playa habitats.
18. Habitat condition of western juniper and mountain mahogany woodland habitats is influenced by the presence of nonnative invasive plants/noxious weeds, fire suppression, and grazing.	18A: Provide habitat for big game and other wildlife species.
19. Changes in species composition and structure of aspen habitats in the Bruneau subbasin have had negative effects on wildlife species.	19A: Reduce the impacts of livestock grazing on aspen habitats in the subbasin.
	19B: Maintain viable stands of aspen through management practices encouraging and/or emulating natural fire processes.
	19C: Retain viable stands of aspen for native terrestrial species associated with upland aspen habitats.
20. Limited understanding of the composition, population trends, and habitat requirements of the wildlife and plant (terrestrial) communities of the Bruneau subbasin limits the ability to effectively manage or conserve these species.	20A: Increase understanding of the composition, population trends, habitat requirements, and impacts of management activities on terrestrial communities of the Bruneau subbasin.
Socioeconomic Problem Statements and Objectives	
21. Management of both public and private lands in the Bruneau subbasin impacts local	21A: Balance fish and wildlife needs with socioeconomic needs and limitations.

Problem	Objective
communities and their economies. Historically, socioeconomic needs have not been adequately balanced with fish and wildlife needs.	21B: Maximize socioeconomic benefits as much as possible while implementing the *Bruneau Subbasin Plan.*
22. As reflected in the inventory, numerous agencies and entities are implementing programs and projects in the subbasin. Lack of coordination and integration limits the economic, social, cultural, and biological benefits of aquatic and terrestrial protection and restoration in the subbasin.	22A: Increase coordination and consistency of implementation of this plan by forming a group in the Bruneau subbasin focused on fish and wildlife planning and implementation to coordinate and prioritize activities.
23. Many important cultural uses of the Bruneau subbasin are impacted by fish and wildlife activities. Tribal, non-tribal, and local industry users all face difficulty in maintaining cultural uses.	23A: Protect and foster both Indian and non-Indian cultural uses of natural resources in the Bruneau subbasin.

3.2.1 Aquatic QHA-Based Problem Statements, Objectives, and Strategies

The following QHA-based problem statements, objectives, and strategies occur in order of importance. The ranking of this information is based on output from the QHA model, specifically as it relates to importance of restoration needs at the subbasin scale and for all focal species considered. The restoration needs are highlighted in the aquatic limiting factors section of the assessment (section 4.1, specifically section 4.1.3).

Problem 1: Low flows reduce available habitat and limit distribution of all focal species in the subbasin.

Aquatic Objective 1A: Improve efficiency of water-delivery infrastructures to reduce the volume of water needed for consumptive purposes.

Strategies:

1A1. Identify diversion points throughout the subbasin that are ineffective or are conveying water that is not currently being used.

1A2. Work with the local irrigators to assess whether their diversion structure can be voluntarily modified to leave more water in the channel.

1A3. Seek funding to participate in cost-share agreements with landowners and irrigation districts to repair, replace, or retrofit diversion structures.

Aquatic Objective 1B: In accordance with Idaho and Nevada water laws, work cooperatively with local irrigation districts to see whether they are willing and able to put water back into channels that have been identified as “low flow” limited.

Strategies:

1B1. Petition State Water Resource Departments to purchase or lease water rights (10-year or 20-year term) from willing private landowners.

1B2. Petition State Water Resource Departments to purchase or lease water rights from local agri-businesses (e.g., Simplot Corporation, ConAgra, etc.) so as to increase the amount of water in stream channels.

1B3. Upon purchase/lease agreements, establish minimum stream flows through the legislature (*e.g.,* Idaho Department of Water Resources Board of Directors) so as to create a water bank to ensure that increases in streamflow are not appropriated to junior water right holders.

Aquatic Objective 1C: Improve stream flows in HUCs defined as "low flow" limited (see section 4.1.3 for specific sixth field HUCs) through passive and active restoration and rehabilitation techniques.

Strategies:

1C1. Monitor usage. Work cooperatively with the Idaho Department of Water Resources to install meters or functional weirs on head gates to monitor amount of flow diverted for consumptive uses.

1C2. Manipulate vegetation. Augment flows through the use of vegetation manipulation. Ensure that changes to vegetation do not adversely affect aquatic or terrestrial species, ecologic processes, consumptive uses or water rights.

1C3. Construct drift fences. Augment flows through sustained snowmelt from snowdrifts that accumulate against "drift fences." Construct drift fences in areas that are proximal to stream channels and in such a manner as to enhance the accumulation of windblown snow and prolong snowmelt.

1C4. Where appropriate, introduce beavers in headwater areas to prolong runoff. Coordinate beaver introductions with landowners, the IDFG, and the Nevada Department of Wildlife.

1C5. Monitor and evaluate—At all treatment sites, ensure that monitoring and evaluation occurs prior to, and following, project implementation. Variables that should be monitored include seasonal changes in streamflow, water temperature changes, changes in available habitat, changes in vegetation, and impacts on water rights. Integrate results with biological objectives designed to evaluate fish distribution, reproductive success, and life history-specific habitat utilization.

Discussion: Lack of water depth and adequate stream flows for fisheries limits population growth and reproduction and seriously constricts habitat quality for the aquatic focal species in the Bruneau subbasin. During summer flow periods, trout are confined to remaining scattered pools, many of which may become disconnected from mainstem habitats. High

mortalities can occur due to excessive water temperatures and increased disease and predation. Increasing stream flows will ultimately increase salmonid populations and provide access to larger tributaries and other refugia during low flow periods.

Problem 2: Low flows and reductions in riparian shading contribute to excessive stream temperatures and oxygen deficiencies throughout most of the subbasin, which have demonstrable (e.g., Rieman and McIntyre 1993, Zoellick 2004) negative consequences to redband and bull trout population productivity.

Aquatic Objective 2A: In areas not highly influenced by geothermal inputs, work to restore stream temperatures to levels meeting state criteria. Idaho water quality regulations designated to protect coldwater aquatic life prescribe that water temperatures not exceed 22 °C, with a maximum daily average of ≤19 °C (Lay 2000). Nevada water quality standards for beneficial uses in the Jarbidge and West Fork Bruneau rivers stipulate that stream temperatures from May through October be less than 21 °C and from November through April be less than 7°C, with no more than a 1 °C change year-round.

Strategies:

2A1. Ensure appropriate grazing management approaches occurs on allotments. Use intensive livestock management practices as the primary method to improve riparian habitat condition and decrease instream temperatures. Where not already conducted, work with range biologists and leasees to minimize damage to riparian resources through a combination of the following practices:

a. Change the present grazing systems in riparian areas to rest rotation, deferred grazing, or exclusion to allow management of these pastures with emphasis on attaining good habitat condition for fisheries.

b. Reduce livestock stocking rates in riparian pastures.

c. Limit the season of use to accommodate vegetative regrowth.

d. Redistribute cattle away from riparian areas through the use of raised juniper structures placed perpendicular to the stream. Require the placement of salt away from riparian areas through license stipulations.

e. Increase water developments away from streams.

2A2. Inventory and protect coldwater inflows. Inventory streams throughout the subbasin that contribute cold surface or groundwater inflows that should be protected from physical disturbance. Stream inventories would preliminarily involve locating areas of cold spring inflows and bedrock

channel constrictions where groundwater upwelling is likely, as well as by examining existing stream water temperature data logger recordings and bull trout occurrence locations, and, if feasible, using active approaches such as Forward Looking Infrared Radar (FLIR) or Light Detection And Ranging (LIDAR).

2A3. Assess the extent that temperature is a limiting factor in the distribution and abundance of focal species such as redband trout and whitefish

2A3. Monitor and evaluate. Use Tier 3 RM&E to assess effectiveness of management actions. Integrate findings into biological objectives assessing fish distribution, reproductive success, and life history-specific habitat utilization. Use appropriate feedback loops and adaptive management techniques until desired temperatures are achieved.

Discussion: Obligate coldwater salmonid species are limited by excessive stream temperatures throughout much of the Bruneau subbasin. And while some of these species have probably evolved adaptations to temperature extremes (*e.g.,* redband trout), their abundance likely declines with temperature increases because of increased metabolic costs (Li et al. 1994).

Zoellick (2004) found redband trout density to be negatively correlated with increases in water temperature and solar insolation in a paired basin study of Big Jacks and Little Jacks creeks. Little Jacks Creek, which received less grazing than Big Jacks Creek, had higher trout biomass and lower water temperatures and solar insolation than Big Jacks Creek did. Temperature problems in the Jarbidge watershed are also likely affecting bull trout abundance and distribution.

Excessive temperatures are primarily a result of intensive livestock grazing of riparian shrubs and trees but have also resulted from water withdrawals (see problem statement 7 and associated objectives and strategies). Studies such as those conducted by Zoellick (2004) clearly demonstrate that improvements in stream shading and water volume will have positive benefits to coldwater salmonids.

Problem 3: Sedimentation of aquatic habitats is occurring throughout numerous portions of the subbasin and is considered to be negatively influencing the productivity of all aquatic focal species, albeit at varying levels.

Aquatic Objective 3A: Prevent and/or reduce sediment delivery to streams.

Strategies:

3A1. Ensure regular occurrence of road maintenance and repair. Road maintenance activities should be conducted on a regular basis and should adhere to best management practices (*e.g.*, where immediately proximal to stream channels, minimize side-cast material from grading). Special

attention should be paid to the repair and maintenance of culverts and other associated stream crossings. Priority roads in the Jarbidge Watershed identified as needing repair and maintenance include the Jarbidge Road extending between Pine Creek Campground and Murphy Hot Springs, Idaho. Implement actions to reduce sediment input to the West Fork Jarbidge River from the Jarbidge Road, as identified in the U.S. Forest Service's road management plan (USFS 2003, cited in USFWS 2004). A dirt road crossing on Dave Creek (T47N, R58E, sections 24 and 25) is also a priority site for repair and sedimentation reduction. Other possible sites for implementation include road crossings on Jack and Deer creeks.

3A2. Repair, relocate, close, and/or decommission roads. On a case-by-case basis, identify roads that qualify for repair, closure, relocation, or decommissioning. Roads that are susceptible to mass-wasting such as those occurring on geologically unstable areas (e.g., on steep granitic slopes) or those occurring within the 100-year floodplain should receive special consideration. Also, identify for repair, relocation, closure, or decommissioning, roads that intercept surface or groundwater, negatively impact riparian areas, or inhibit floodplain connectivity and natural stream functions.

3A3. Manage grazing. Reduce stream sedimentation from grazed lands through optimal livestock management. Include adequate utilization standards and targets to protect and enhance riparian habitat and water quality conditions in federal permits for grazing allotments. Use management alternatives such as riparian fencing, seasons of use, and off-stream watering to reduce impacts of grazing on streams inhabited by aquatic focal species. Priority areas include riparian areas occurring in steep-sloped watersheds with erosive soils (e.g., granitic geology). In the Jarbidge watershed, Dave (including Morgan Draw), Jack, and Slide creeks should be managed using grazing management alternatives. Also important in the Jarbidge are Buck Creek and livestock-accessible reaches of the East Fork Jarbidge River.

3A4. Conduct effectiveness and status monitoring. Monitor and evaluate implementation efforts using a Tier 3 RM&E approach (*refer to* Appendix B, Section 7.2). Monitor biological responses using a Tier 2 M&E. Ensure that an adaptive management approach is used and appropriate feedback loop exists so as to incorporate findings into biological objectives designed to evaluate fish distribution, reproductive success, and life history-specific habitat utilization.

Aquatic Objective 3B: Restore fine sediment levels in Dave Creek, Nevada (HUC 1601), to those within a proper functioning condition to protect critical bull trout habitat.

Strategies:

3B1. Acquire land. Pursue land acquisition, lease, or cooperative agreements (Partners for Fish and Wildlife Program, Environmental Quality Incentive Program, Wildlife Habitat Incentives Program).

3B2. Manage grazing. If acquisition efforts fail, pursue grazing management changes (e.g., if we were to get an easement).

3B3. Stabilize streambanks. Revegetate riparian areas to stabilize streambanks.

3B4. Reduce overland erosion. To minimize the amount of fine sediment accrued through overland erosion, return the stream to its original channel (below the road crossing).

3B5. Conduct effectiveness monitoring. Monitor and evaluate implementation efforts using a Tier 3 M&E approach (see Table 6 and section 4). Ensure that an adaptive management approach is used and appropriate feedback loop exists so as to incorporate findings into biological objectives designed to evaluate fish distribution, reproductive success, and life history-specific habitat utilization.

Discussion: Unsurfaced roads and grazing are the main sources of fine sediment delivered to streams throughout the Bruneau subbasin. The primary mechanisms of sediment delivery into stream channels include sloughing due to destabilized streambanks, overland erosion due to removal of vegetation, and gully/sheet erosion due to ground compaction and devegetation. Flood events and landslides represent additional sources of sediment, although they are less common than other processes.

Roads that parallel stream channels are especially problematic. The Jarbidge River Road, which borders the West Fork Jarbidge River, has been built in the bottom of the canyon and often restricts the natural lateral movement of the stream channel. And since the stream is in constant search of equilibrium, the adjacent roadbed/streambank is frequently eroding and contributing fine sediment to the channel. Although relocation, closure, or decommissioning of primary roads such as the Jarbidge River Road may not be feasible, stabilization of the streambank through planting or other means is warranted to reduce chronic additions of fines to the channel.

Private and federally managed stream segments impacted by concentrated livestock use and/or natural erosive soil conditions contribute excessive silt loads to channels. Some of the most problematic areas occur in "feeder" streams with steep-sloped watersheds that are ≥25% in granitic areas and ≥35% in volcanic areas. These and other areas should be stabilized from gully and sheet erosion by providing adequate vegetative cover on side slopes. Livestock use of these watershed areas should be adjusted in areas of high erosion susceptibility to reduce soil movement to natural runoff amounts.

Habitat conditions for bull trout in Dave Creek, Nevada (HUC 1601), are also compromised by excessive amounts of fine sediment. Dave Creek, a headwater tributary to the East Fork Jarbidge River, is unique among Jarbidge River tributaries because it is a lower-gradient

system and less confined (G. Johnson, Nevada Department of Wildlife, personal communication, April 2004). Because of its morphology, Dave Creek contains comparatively higher amounts of spawning gravels than similar tributaries, making it some of the most critical habitat for bull trout spawning and rearing (G. Johnson, Nevada Department of Wildlife, personal communication, April 2004). The stream, however, has been impacted by roading, grazing, and other land-use activities, which have resulted in elevated amounts of fine sediment, excessive width to depth ratios, and limited riparian coverage. Currently, there are efforts between the Nevada Department of Wildlife and the primary landowner to acquire land in the Dave Creek drainage. Depending on the outcome of these efforts, restoration activities should focus on returning the stream to its original channel, removing livestock grazing pressures, and revegetating the streambanks.

Table 6. Example of possible catalog format for listing opportunities for Tier 3 action effectiveness evaluations. Table would be repeated for each class of action being considered for effectiveness evaluations within a given subbasin (reproduced from the draft Collaborative Systemwide Monitoring and Evaluation Project, 03-17-04, downloaded from http://www.cbfwa.org/rme.htm). Refer to Appendix 7.2 for Bruneau aquatic implementation monitoring and evaluation that is based on this format.

Context	**State, Province, Subbasin, Watershed**					
Which type of action is being considered here for effectiveness evaluation (either retrospectively using historical data, or in the future)?	*Habitat Actions:* maintenance of instream flows, compliance with water quality standards (alteration of grazing practices and reduction of sediment through road closures), improved riparian conditions (alternation of grazing practices and active stream restoration), screening of irrigation diversions, etc. *Hydro Actions*: bypasses, spill, transportation, flow ramping rates, changes in storage reservoir operations, barrier removal, etc. *Hatchery Actions:* supplementation, release sites, brood stock, methods of fish culture, etc. *Harvest Actions:* timing, magnitude, method of harvest					
Reference	*List citations describing when and where action was planned, evidence that it was actually implemented, and contact people.*					
Location of action and spatial scale of implementation	*Location*: watershed, (latitude, longitude) or UTM coordinates, river mile *Scale of Implementation:* upland area, whole watershed, reach, tributary, mainstem					
Time span over which action was / will be implemented	List years over which action was implemented and significant milestones which influence the "strength" of the treatment signal (e.g., little erosion control benefit would be expected in first 2 years of reforestation).					
Performance measures available to evaluate action	Possible Treatment Area(s) and Times			Possible Control Area(s) and Times		
	Location of Measurements	Sampling Frequency and Duration Before Action Implemented	Sampling Frequency and Duration Before Action Implemented	Location of Measurements	Sampling Frequency and Duration Before Action Implemented	Sampling Frequency and Duration After Action Implemented
Habitat performance measures:						
(list...)						
Fish performance measures:						
(list...)						

Problem 4: Legacy effects from land-use activities still impact channel form and stability, which in turn are contributing to low flow problems

Aquatic Objective 4A: Within the next 15 years, improve channel stability and channel form in portions of the subbasin where low flow problems also exist (see assessment section 4.1.3 for specific sixth field HUCs within which channel stability/form has been determined to limit aquatic focal species).

Strategies:

4A1. Retard downcutting. In areas of high channel incision, install low-head rock weir structures to encourage sediment accrual and raise the elevation of the streambed.

4A2. Improve floodplain interaction. Identify and treat areas where road encroachment has limited stream channel interaction with the floodplain and implement road relocation, reengineering, or removal actions.

4A3. Implement bioengineering approaches. With the assistance of geomorphologists and hydrologists, work with local contractors to modify channel form (in sixth field HUCs identified in assessment section 4.1.3) so as to improve width:depth ratios, sinuosity, and bank stability.

4A4. Implement passive restoration approaches. Where channel form and riparian problems occur in the same "high restoration" HUC (see assessment section 4.1.3 for specific sixth field HUCs), plant riparian vegetation and place rootwads or pieces of LWD in the stream channel.

4A5. Address headcuts. Where there are headcuts, conduct restoration activities to stop upstream progression.

4A6. Monitor and evaluate. Conduct regionally accepted effectiveness monitoring using Tier 3 RM&E assessment approaches, as defined in the draft *Collaborative Systemwide Monitoring and Evaluation Project* (CBFWA 2004).

Discussion: Despite recent (last 10 years) riparian restoration efforts, channel form and stability continue to pose a limitation to habitat suitability for key aquatic focal species. Fencing projects, such as the completion of 10.5 miles of riparian exclosure in the Big Springs and Northwest allotments, completion of 6.8 miles of fencing on Battle and Big Springs creeks, 1.75 miles of fencing on Big Jacks Creek Reservoir, fencing and planting on Duncan Creek, fencing on the Northwest Pasture (Allotment #16), 1.5 miles of riparian fencing on Summit Creek, and 8 miles of fencing on Sawmill Creek have significantly improved reestablishment of streamside vegetation in key redband habitat. The response of stream channel form (e.g., improved width to depth ratios) and channel stability in these and other areas has been rapid and dramatic.

In areas where riparian treatments or changes to grazing practices have not occurred, channel form and stability continue to be problematic. Channel incision, advancement of headcuts, and loss of floodplain interaction are among the primary symptoms. In some cases, short-term, active restoration approaches, such as the placement of instream woody debris or construction of low-head weirs, are warranted as channel response to passive restoration actions has either not occurred or has been deemed ineffective. Similarly, in areas where riparian improvement actions or grazing management changes have occurred very recently (i.e., in the past 5 years), short-term restoration actions would augment the practices and expedite recovery.

Problem 5: Obstructions to migration prohibit fish movement and eliminate access to potential habitat.

Aquatic Objective 5A: Within the next five years, remove, replace, or reconstruct structural barriers on Wickahoney Creek, the West Fork Bruneau River, and McDonald Creek to allow for redband trout migration.

Strategies:

5A1. Coordinate with the Owyhee County roads department and the landowner to remove or replace the Wickahoney culvert.

5A2. Determine whether a bottomless culvert on Wickahoney Creek would be more appropriate than total removal.

5A3. Reconstruct the "Davidson A" irrigation diversion structure on the West Fork Bruneau River (Nevada).

5A4. Restore connectivity between McDonald Creek and the mainstem Bruneau River by addressing the culvert blockage.

5A5. Monitor and evaluate redband distribution abundance before and after barrier removal.

Aquatic Objective 5B: Within the next five years, examine the effects of the Grassmere diversion on habitat connectivity between redband trout populations in Louse and Crab creeks.

Strategies:

5B1. Evaluate the impacts of the Grassmere diversion on the Louse Creek redband population.

5B2. If impacts exist, determine ways to mitigate for the diversion. Suggested options include returning flow to the channel depending on annual storage needs.

Aquatic Objective 5C: Identify and address barriers to bull trout migration in the Jarbidge River Core Area.

Strategies:

5C1. Identify and evaluate physical barriers to bull trout passage. Identify all potential natural (e.g., log jams, boulder piles, waterfalls) and constructed (e.g., rock dams and diversions) physical barriers to fish passage, including seasonal and year-round barriers. Potential seasonal natural barriers have already been identified in Jack and Robinson creeks, as well as the West Fork Jarbidge River. Potential manmade barriers in need of evaluation also occur in the West Fork Jarbidge River, especially near residential and recreational areas.

Aquatic Objective 5D: Within the next five years, conduct a subbasinwide fish barrier inventory.

Strategies:

5D1. Cooperate with ongoing efforts (i.e., IDFG barrier assessment) and expand where necessary.

5D2. Develop a subbasinwide database identifying structural, thermal, and hydrologic migration barriers to all focal species.

5D3. Conduct effectiveness monitoring at sites where barriers have been modified or removed.

Discussion: Connectivity between salmonid habitats throughout the Bruneau subbasin is essential for maintaining opportunities for genetic exchange, population refounding, thermal refuge, spawning and rearing habitat availability, and expression of various life history forms. Barriers to migration, both manmade and natural, currently represent limiting factors to this connectivity.

The Aquatics Technical Team considered structural barriers to represent one of the most important and readily addressable factors currently limiting aquatic focal species in the subbasin, yet agreed that its ordering of importance should be consistent with the overall prioritization methods.

Culverts on Wickahoney and McDonald creeks are currently blocking redband trout access to suitable upstream habitat. In McDonald Creek, the barrier is prohibiting fluvial spawners from ascending the stream (G. Johnson, Nevada Department of Wildlife, personal communication, April 2004). Similarly, the Grassmere diversion impedes redband migration into suitable habitat in Louse Creek, although the effects on the population are currently unknown. The headwater portions of streams such as Wickahoney, McDonald, and Louse creeks contain currently unoccupied spawning and rearing habitat. If these and other habitats were to become accessible, redband trout, bull trout, and mountain whitefish productivity could potentially increase.

In Nevada, the "Davidson A" diversion, which occurs on the West Fork Bruneau River above the McDonald Creek confluence and below the Meadow Creek confluence, has been identified as a redband trout migration barrier by the Aquatics Technical Team. The concrete diversion structure is built at a 45-degree angle to the water surface and spans the width of the channel. Although a passage assessment has not officially been conducted, it is unlikely that there is sufficient flow during irrigation periods to allow for fish migration. As with the culvert on McDonald Creek, it is suspected that fluvial forms of redband trout are restricted by the structure from accessing upstream spawning habitats.

There is currently an effort underway by IDFG to identify known or suspected natural and artificial barriers to salmonid migration. The Jarbidge River Recovery Team has also stated that it will work to evaluate the merits of providing fish passage at identified barriers, and where necessary for recovery, the group will develop and implement tasks to facilitate passage. The coordination between these and other groups will help address this problem.

Problem 6: Thermal and organic pollutants are identified as limiting factors to aquatic focal species in several sixth field HUCs throughout the subbasin. The effects from these pollutants on aquatic focal species have not been definitively determined.

Aquatic Objective 6A: Conduct research, monitoring, and evaluation to identify and address point and nonpoint pollutant sources and to determine associated impacts on various life history stages of aquatic focal species.

Strategies:

6A1. Identify study sites. Using IDEQ BURP data, NDEP Bureau of Water Quality data, and professional opinions, establish where water quality criteria are in excess of state standards due to thermal and organic pollutants. Identify additional sites where appropriate.

6A2. Determine water quality. Using appropriate water quality monitoring protocol (*e.g.,* MacDonald et al. 1991; USFS 1994), establish monitoring sites above and below affected areas (e.g., East and West Forks of the Jarbidge River, Dave Creek, Buck Creek, Jack Creek, Slide Creek, Big Jacks Creek), as well as at sites in similar, but undisturbed drainages containing similar fauna. Use continuous water quality samplers at monitoring sites to obtain necessary water quality information. Nonpoint sources of thermal pollution that have been defined in the subbasin watershed include modified riparian vegetation structure, reduced instream flows, altered groundwater dynamics, and altered channel morphology. Point source thermal pollutants include natural thermal springs (which would not be addressed), livestock grazing, residential development (*e.g.,* Murphy Hot Springs), and thermal groundwater effluent from historical mine sites.

6A3. Assess pollutant effects on focal species. Using a combination of literature reviews, *in situ* laboratory experiments, and field observations, determine the degree to which identified thermal and chemical pollutants may be affecting the various life history stages of bull trout, redband trout, mountain whitefish, and mollusks. Provided sufficient empirical information is not available, assess biological response of test organisms (e.g., fish species or aquatic macroinvertebrates) to varying levels of organic pollutants in both field and laboratory studies. Also assess response (e.g., avoidance, tolerance, decreased metabolic function, etc.) of test organisms to varying flows and temperatures. In the field, ensure that sampling at all sites occurs before, during, and after storm events.

6A4. Develop a nutrient budget. Using sediment, develop a nutrient budget to help determine the impact of organic pollutants on focal aquatic species.

6A5. Assess groundwater and/or hyporheic influence. If possible, determine the degree to which groundwater or hyporheic flows ameliorate or enhance organic and thermal pollutants (*e.g.*, groundwater discharge from the Gray Rock, Norman, Pavlak, and 4M Mine sites on the West Fork Jarbidge River may be contributing pollutants). Use available techniques (*e.g.*, FLIR, wells, continuous water quality monitoring stations, etc.) to make determinations.

6A6. Implement restoration. Based on the outcome from assessment and associated laboratory studies, treat point and nonpoint pollution sources using appropriate actions.

If pollutants are mine-related thermal, consider 1) reclaiming inoperational mine sites by removing debris and potentially hazardous materials (e.g., 4M Mine on the West Fork Jarbidge River), 2) stabilizing, removing, recontouring, and/or revegetating mine tailings formerly deposited in stream channels and floodplains (e.g., Elkoro site on the West Fork Jarbidge River), 3) revegetating irrigation ditches; 4) providing tertiary treatment of water used for miscellaneous (e.g., hatchery operations) consumptive purposes.

If identified pollutants are organic (e.g., nitrogen or phosphorus), consider 1) modifying grazing practices in allotments, 2) working with willing landowners to identify and repair any leaking domestic sewage disposal systems, and 3) assisting willing landowners in managing confined animal feedlot operation (CAFO) runoff.

6A7. Conduct effectiveness monitoring. Following restoration efforts, continue to monitor treatment areas to determine relative effectiveness. Ensure that an adaptive management approach is used and appropriate feedback loop exists so as to incorporate findings into biological objectives designed to

evaluate fish distribution, reproductive success, and life history-specific habitat utilization.

Discussion: The specific effects of thermal and organic pollutants on aquatic focal species in the Bruneau subbasin currently represent a data gap. Point and nonpoint thermal pollutants from mine tailings, irrigation return flows, devegetated stream channels, or miscellaneous consumptive uses occur throughout the subbasin yet may or may not negatively influence salmonid species. For example, the 4M Mine and the Elkoro site, both on the West Fork Jarbidge River, are known to contribute thermal pollutants to the stream, yet it is unknown whether their influence is significant enough to limit redband, bull trout, or mountain whitefish use in areas downstream from the discharge zone. The contribution of temperature-ameliorating groundwater or hyporheic discharge in or above the mixing zone has not been defined, which contributes to this uncertainty. Collection of baseline data at known discharge sites will provide the needed information for conducting follow-up studies designed to specifically address the degree to which thermal pollutants are impacting water quality for focal aquatic species.

As with thermal pollutants, organic pollutants have been defined as a potential limiting factor to aquatic focal species, but their specific impact is unknown. Poorly maintained septic systems, runoff from CAFOs, and nonpoint runoff from allotments are known to contribute organics to the stream channel, and due to the inherently low mean annual discharge throughout most of the Bruneau system, they likely have negative effects on water quality conditions. The first step, however, is to specifically define which source is most deleterious to which aquatic species and where the impacts are most pronounced.

Problem 7: Impacts to riparian vegetation have contributed to excessively high stream temperatures, decreased channel stability, and adversely modified the channel throughout much of the subbasin.

Aquatic Objective 7A: Within the next 10 years, increase riparian cover and stream shading in high-priority restoration HUCs to levels consistent with the proper functioning condition and site capability. These levels vary, but in small to medium-sized streams (i.e., those measuring less than 5 meters in width), shading should equal between 60 and 80% (Zoellick 2004).

Strategies:

7A1. Use existing stream inventory data to refine HUC-level restoration designations and define specific reaches where riparian restoration activities should occur.

7A2. Encourage implementation of BMPs on grazing allotments, near roads (i.e., road maintenance activities), near residential areas, and in designated firewood-gathering areas.

7A3. In BLM Jarbidge Resource Area HUCs (e.g., HUCs 1202, 1501, 1601, 1702, 1801, 2801), conduct riparian plantings (where appropriate).

7A4. In BLM Owyhee Resource Area HUCs (i.e., HUCs 3802, 4201) implement or continue to implement best management practices for livestock grazing in riparian areas.

Discussion: Zoellick (2004) examined the relationships between redband trout abundance and stream shading, solar insolation, and stream temperature in Big Jacks and Little Jacks creeks in the Bureau of Land Management (BLM) Owyhee Resource Area. Despite a higher degree of stream shading in Little Jacks Creek (mean of 80% versus 46% in Big Jacks) and a lower degree of solar insolation (Little Jacks mean = 7.9 versus Big Jacks mean = 15.1 $mJ/m^{-2}/day^{-1}$), the two streams were similar (e.g., width, depth, gradient, median substrate size). Zoellick (2004) found redband trout density and biomass to be greater in Little Jacks Creek (means of 0.8 $fish/m^{-2}$ and 25.0 g/m^{-2}) than in Big Jacks Creek (0.03 $fish/m^{-2}$ and 8.9 g/m^{-2}). In both streams, trout density was negatively correlated with increases in water temperature and solar insolation. Trout biomass increased with stream shading and was negatively correlated with solar insolation.

The differences in the density and biomass of redband inhabiting the two streams clearly illustrate the influence that riparian shading has on desert ecosystems: the system that provides more shade provides more fish. Zoellick (2004) validates Li's (et al. 1994) findings because, while redband trout distribution may not be limited by increased stream temperatures, redband trout abundance likely declines with increased temperatures due to higher metabolic costs.

Riparian protection efforts have been made throughout many portions of the subbasin, although more work is needed. Fencing projects, such as the completion of 10.5 miles of riparian exclosure in the Big Springs and Northwest allotments, completion of 6.8 miles of fencing on Battle and Big Springs creeks, 1.75 miles of fencing on Big Jacks Creek Reservoir, fencing and planting on Duncan Creek, fencing on the Northwest Pasture (Allotment #16), 1.5 miles of riparian fencing on Summit Creek, and 8 miles of fencing on Sawmill Creek have significantly improved reestablishment of streamside vegetation in key redband habitat.

3.2.2 Aquatic Biologically Based Problem Statements, Objectives, and Strategies

The following biologically based problem statements, objectives, and strategies are linked to aquatic species information provided in sections 2.3 and 4.1 of the subbasin assessment. This information summarizes the non-habitat-based problems, such as species interactions, fisheries management issues, research uncertainties, and other issues not addressed by the QHA model that are deemed to be negatively affecting individual focal species, and/or our ability to effectively manage for the continued persistence of these species. The problem statements, objectives, and strategies are stratified by aquatic focal species, and unlike the previous "QHA-based" section, *are not* listed in order of importance. Bull trout problem statements, objectives,

and strategies are largely derived from the Jarbidge Core Area bull trout recovery plan (USFWS 2004), unless otherwise indicated.

3.2.2.1 Redband Trout

Problem 8: There is a limited understanding of factors limiting recruitment, survival, abundance, and distribution of redband trout throughout the subbasin.

Aquatic Objective 8A: Ensure that systematic redband habitat and population inventories are conducted on a regular basis so that critical factors limiting populations can be defined and subsequent management can occur.

Strategies:

8A1. Ensure continuation of funding. Secure adequate funding for the continuation of habitat and population inventories.

8A2. Assign inventory responsibilities. Create an *ad hoc* team to assign responsibilities to different agencies or groups to inventory different reaches in the subbasin.

8A3. Enhance data availability. Ensure that geospatial inventory data are available to relevant agencies/groups.

Aquatic Objective 8B: Determine, at the subbasin scale, whether the effects of riparian fencing and grazing management will do more for redband population protection and restoration than increasing streamflows will.

Strategies:

8B1. Conduct paired-drainage studies examining riparian influences. Conduct paired-drainage studies, similar to that completed by Zoellick (2004), using systems with intact riparian areas versus those lacking vegetation to examine differences in redband abundance, biomass, and distribution. Assess differences in stream temperature.

8B2. Conduct paired-drainage studies examining streamflow influences. Conduct paired-drainage studies, similar to that completed by Zoellick (2004), using systems with augmented base flows versus those that have not been augmented to examine differences in redband abundance, biomass, and distribution. Ensure that riparian area composition and function in both treatment and control drainages are similar. Assess differences in stream temperature.

Aquatic Objective 8C. Assess how redband trout cope with high summer water temperatures.

Strategies:

8C1. Assess importance of thermal refugia. Using information provided through aquatic objective 6A (strategy 6A5), determine the influence of cool water discharge (*e.g.,* springs, seeps, hyporheic flows) on seasonal redband trout distribution, abundance, and habitat use.

8C2. Assess redband redistribution mechanisms. Using radio telemetry, determine at which point high stream temperatures elicit redband redistribution and assess response effectiveness.

8C3. Assess physiological adaptations. Using radio telemetry or snorkel surveys, determine the proportion of fish that are able to withstand extreme temperatures (i.e., those that either don't move or are unable to move out of excessively warm stream reaches) so as to assess their physiological adaptations to thermal extremes.

Aquatic Objective 8D. Assess the impact (or lack thereof) that northern pikeminnow and nonnative game species (such as smallmouth bass) have on redband trout distribution and abundance.

Strategies:

8D1. Relate distribution patterns. Using recent and ongoing inventory data, determine relationships between the distribution of northern pikeminnow and nonnative game species (such as smallmouth bass) and redband trout.

8D2. Assess piscivory. Collect stomach samples from potential piscivores (e.g., northern pikeminnow, smallmouth bass) to determine composition of diet comprising redband trout.

8D3. Assess competitive interactions. Where redband (and mountain whitefish) occur with target species (e.g., northern pikeminnow, smallmouth bass) determine (using available methods such as snorkel surveys) whether competition for the same limited resource is occurring. Assess competition mechanisms (e.g., interference competition versus exploitation competition).

Discussion: Factors limiting redband recruitment, survival, abundance, and distribution in the Bruneau subbasin are currently not well understood. Factors such as streamflow, habitat availability, water temperatures, competition, and sedimentation are suspected to act independently or cumulatively to influence year class strength, although their level of influence is largely unknown. For example, biologists have noted dramatic increases in redband young-of-the-year following a favorable flow year and attribute the response to increased access to otherwise unusable tributary habitat (B. Zoellick, BLM, personal communication, February, 2004). The increase in redband recruitment following a favorable winter is especially notable since redds have been essentially absent in accustomed mainstem habitats. Biologists hypothesize that sedimentation may be a factor limiting egg to fry survival success in mainstem habitats and that redband are evolutionarily adapted to use areas (e.g., tributary or headwater streams) where streambed pavement is less of a factor.

Continuation and/or expansion of redband redd surveys and associated studies therefore represent a high priority in an attempt to better understand recruitment dynamics of the species and to prescribe appropriate management actions.

Obtaining a better understanding of whether or not one particular limiting factor is more important than another will allow for the most efficient use of limited province funding. For example, if biologists were able to ascertain whether riparian fencing (or livestock exclusion) is clearly the most effective mechanism for expanding redband distribution and protecting current distribution, less emphasis may be needed on augmenting, or securing, additional streamflows. It is also likely that fencing and streamflow could be connected (i.e., more healthy riparian will increase perennial stream miles, decrease water temperatures, and increase flow availability).

Similarly, biologists lack a clear understanding of the upper incipient lethal values Bruneau redband trout possess. Increased knowledge of how redband respond to thermal extremes will allow for more effective management of the species. Such research could identify upper lethal limits, or limits in distribution, and demonstrate which constraints cannot be overcome by redband trout regardless of their method to cope with such temperatures (K. Meyer, IDFG, personal communication, May 2004).

The degree to which native (e.g., northern pikeminnow) and nonnative game species (e.g., smallmouth bass) limit redband trout is also not well understood. An increased understanding of piscivorous and/or competitive interactions between target species and redband trout will provide fish managers a better tool for meeting protection and restoration objectives.

Problem 9: Current knowledge of redband trout genetic diversity and gene flow among local populations in the Bruneau subbasin is inadequate, as is the extent of hybridization with nonnative strains of rainbow trout.

Aquatic Objective 9A. Determine the degree of genetic purity of redband trout populations and the degree of genetic variability among and within populations of redband trout.

Strategies:

9A1. Develop genetic markers to distinguish between native redband trout and nonnative rainbow trout from hatchery origin.

9A2. Determine the degree of genetic differentiation between populations of desert redband trout and between desert and montane redband trout.

9A3. Considering the extreme habitat conditions aquatic organisms in the Bruneau drainage are exposed to on an almost yearly basis, determine the genotypic or phenotypic uniqueness of focal species such as redband trout

and whitefish in the Bruneau drainage, compared to other areas where they exist.

Discussion: Redband trout from desert environments have purportedly adapted unique abilities to contend with harsh environmental conditions (Behnke 1992). If such adaptations have occurred, it would be expected that the adaptations would have led to genetic differentiation from montane redband trout populations and coastal rainbow trout. No such differentiation has been found to date, although more work is needed to investigate this more thoroughly. In addition, the degree of genetic variability and heterozygosity between possible isolated populations is unknown but would be important to know when developing restoration and protection plans for the subbasin. Past stocking of hatchery rainbow trout may have compromised redband trout genetic integrity in the subbasin. Studies should be implemented to address the above questions in regard to the uniqueness of desert redband trout and their genetic population structure compared with those of other redband populations. To date, no genetic markers have been developed to distinguish between native strains of redband trout and introduced strains of coastal rainbow trout. The development of such markers could be important in determining the status of pure desert redband trout in the Bruneau subbasin.

Based on their uniqueness, some researchers have suggested the need for special protection for these desert redband populations. One such possibility would be for concerned parties to petition the species for federal protection pursuant to the Endangered Species Act of 1973, as amended (United States Code, Title 5, Section 553(e)). , from which ultimately a petition to list redband trout under the ESA would be developed.

3.2.2.2 Bull Trout

Problem 10: Interactions between nonnative fishes and bull trout in Emerald Lake and Bear Creek represent a potential threat to bull trout population stability.

Aquatic Objective 10A: Implement control of nonnative fishes in the Jarbidge River Core Area, where it is found to be feasible and appropriate.

Strategies:

10A1. Implement brook trout removal. Removal of brook trout from Bear Creek should be accomplished by the most effective means possible while ensuring water quality protection for downstream users.

Discussion: Brook trout occur in Emerald Lake near the headwaters of the East Fork Jarbidge River and in Bear Creek, a tributary to the West Fork Jarbidge River. Due to the potential for future illegal transplants elsewhere in the subbasin, these local sources of nonnative fish should be eliminated. Both brook trout populations likely originated from historical stockings.

Emerald Lake is in the Jarbidge Wilderness, so treatment options will be limited by its remote location and Wilderness restrictions on motorized equipment and mechanical transport. Emerald Lake is a destination point for guided pack trips and other recreationists. When brook trout are removed, the associated fishing pressure (39 angler days/year) may be displaced to nearby waters, including bull trout spawning and rearing habitat (Johnson *in press* 2003a cited in USFWS 2004). It may be appropriate under these circumstances to consider options for providing a different fishery in Emerald Lake that does not threaten bull trout through potential hybridization.

Problem 11: Current fisheries management goals and objectives for the Jarbidge watershed are inconsistent with bull trout recovery and implementation practices defined in the recently released Jarbidge River Core Area recovery plan (USFWS 2004).

Aquatic Objective 11A. Develop and implement state fisheries management plans, specifically for the Jarbidge River watershed, that integrate adaptive management concepts.

Strategies:

11A1. Facilitate development and implementation of coordinated fisheries management plans for bull trout in the Jarbidge River Core Area in the Idaho and Nevada. Plans should be based on scientifically directed adaptive management concepts, emphasizing ongoing integration of bull trout research and monitoring results.

11A2. Evaluate effectiveness. Evaluate the effectiveness of coordinated State fisheries management in meeting bull trout recovery goals and objectives and make adaptive changes to management plans, as necessary.

Aquatic Objective 11B. Evaluate and minimize illegal harvest and incidental angling mortality of bull trout in the Jarbidge River Core Area.

Strategies:

11B1. Implement angler surveys. Survey active anglers, outfitter guides, and appropriate license holders (e.g., trout stamp purchase) to obtain updated local information on fishing pressure, species identification, bull trout capture rates and sizes, effective gear types, and fish health upon release. Surveys may include interviews with anglers and voluntary submissions of survey cards mailed to license holders and outfitters or available at local recreation sites.

11B2. Promote public awareness of angling regulations and low impact angling techniques to ensure compliance with regulations. Continue to inform anglers about bull trout identification, special regulations agency management of ESA-listed fish species, and techniques to reduce hooking mortality of bull trout caught incidentally in recreational fisheries. Information sources include items such as signs, fliers, state fishing

regulation brochures, and agency websites. Also, ensure angler compliance with state and federal regulations for bull trout through increased enforcement presence in high-use areas.

11B3. Coordinate and evaluate scientific research. The Jarbidge River Recovery Team should coordinate scientific research involving bull trout in the Jarbidge Core Area to ensure that recovery needs will be met. The Recovery Team should evaluate research objectives, survey protocols, and impacts of concurrent or consecutive research projects and identify overlapping research. Use of standardized sampling protocols and marking for bull trout in the Jarbidge River Core Area will be required. A federal permit under section 10 of the ESA is currently required for intentional take of bull trout for scientific purposes such as fish surveys and genetic sampling.

Aquatic Objective 11C. Evaluate effects of existing and proposed angling regulations on bull trout in the Jarbidge River Core Area.

Strategies:

11C1. Evaluate the impacts of current angling regulations on bull trout and recommend any appropriate modifications to the regulations. Incidental take of bull trout by angling in the Jarbidge River watershed is not currently authorized under the ESA. The states of Idaho and Nevada have also prohibited bull trout harvest. However, bull trout occupied waters are not closed to recreational fishing, and angling under existing state regulations may result in unintentional mortality of bull trout through catch-and-release fishing or species misidentification.

Discussion: Existing regulations should be examined to determine whether incidental capture and potential mortality of bull trout associated with other fisheries can be further reduced. For example, evaluate 1) open seasons and open areas relative to bull trout seasonal distribution and life history, as well as angler accessibility; 2) bull trout susceptibility to the authorized gear types (e.g., bait, lures, flies) and associated hooking mortality; 3) fishing pressure levels; and 4) harvest limits for other fish species. Based on these evaluations, managers should recommend that state agencies adopt any modifications of angling regulations that will minimize incidental capture and mortality of bull trout.

Problem 12: The necessary characterization of bull trout genetic diversity and gene flow among local populations in the Bruneau subbasin is inadequate to allow for scientifically based conservation management.

Aquatic Objective 12A: Incorporate conservation of genetic and phenotypic attributes of bull trout into recovery tasks and fisheries management plans for the Jarbidge River Core Area.

Strategies:

12A1. Conduct genetic inventory of resident and migratory bull trout. Collate information on genetic samples already collected, standardize sample preservation analysis techniques, and complete a coordinated genetic inventory of all trout local populations and the migratory life history form in the Jarbidge River watershed.

12A2. Integrate genetic inventory. Use the genetic inventory defined in strategy 11A1 to determine whether or not there appears to be any metapopulation structure within the Jarbidge River Core Area.

Aquatic Objective 12B: Maintain and improve opportunities for gene flow among local bull trout populations in the Jarbidge River Core Area.

Strategies:

12B1. Manage local populations (numbers and life forms) to maintain long-term viability. Once local populations are verified, they should be managed accordingly to conserve genetic diversity.

Discussion: Long-term viability of bull trout in the Jarbidge River Core Area will be ensured by maintaining suitable habitat conditions for connectivity and maintaining adequate numbers of migratory individuals.

Problem 13: Current research and monitoring programs in the Bruneau subbasin do not incorporate an adaptive management approach and, therefore, lack necessary feedback loops to evaluate the effectiveness of site-specific bull trout recovery efforts.

Aquatic Objective 13A. Design and implement a standardized monitoring program to assess the effectiveness of recovery tasks affecting bull trout and their habitats within the Jarbidge River Core Area.

Strategies:

13A1. Develop and implement a standardized, statistically sound bull trout population monitoring program. Analyze existing bull trout survey data to identify information gaps and monitoring needs in the Jarbidge River Core Area. The Jarbidge Bull Trout Recovery Team recommends using available peer-reviewed protocols for bull trout surveys in the Jarbidge River distinct population segment, specifically those used by Peterson et al. (2001, cited in USFWS 2004) for determining presence/absence and potential habitat suitability for juvenile and resident bull trout. The Jarbidge River Recovery Team will also adopt monitoring program products developed by the multi-agency bull trout Recovery Monitoring and Evaluation Technical Group for bull trout monitoring within the Jarbidge River distinct population segment. Monitoring programs must be able to detect statistical differences in abundance (population trends) and

result in statistically based determinations of presence and absence (population distribution).

13A2. Assess habitat restoration techniques. The Jarbidge River Recovery Team will evaluate the effectiveness of different active and passive habitat restoration techniques in restoring watershed function and enhancing local populations of bull trout.

Aquatic Objective 13B. Conduct research that evaluates relationships among bull trout distribution and abundance, habitat, and recovery tasks.

Strategies:

13B1. Determine seasonal movement patterns and habitat use of migratory bull trout. This research will provide important information on the downstream extent of distribution and upstream spawning locations of migratory bull trout as well as to document any overlapping habitat use with resident fish. As part of this task, develop a coordinated bull trout marking and tracking strategy (e.g., standardized fin clips, PIT tags, and radio tag implant frequencies) throughout the Jarbidge River watershed so that marked fish are recognized and reported whenever captured. Weirs should continue to be operated periodically (e.g., every 3 to 5 years) to index migratory bull trout abundance. The Jarbidge River Recovery Team has identified this task as a priority research need.

13B2. Locate and assess bull trout spawning habitats. Develop a comprehensive map of existing and potential bull trout spawning reaches for all local populations in the Jarbidge River Core Area based primarily on redd surveys, in combination with water temperature, substrate, flow, and stream gradient data. This map would be used to delineate areas for focusing habitat protection and restoration efforts. The highest priority stream for assessment is Dave Creek, but documentation and mapping of all local populations is needed for recovery.

13B3. Assess suitability of known, degraded and unoccupied habitat for expanding distribution and abundance of bull trout. Evaluate habitat for potential expansion of bull trout distribution and abundance within the Jarbidge River Core Area. Existing local populations and occupied streams considered to have potential for increased productive capacity and bull trout abundance include Dave Creek, Jack Creek, Slide Creek, and the East and West Forks of the Jarbidge River. These increases will be accomplished through implementation of recovery tasks to reduce stream temperatures (e.g., Dave Creek, East and West Forks of the Jarbidge River) and sedimentation (e.g., Dave Creek, Slide Creek, East and West Forks of the Jarbidge River) and increase large woody debris and pools (e.g., Dave Creek, East and West Forks of the Jarbidge River), as well as natural habitat recovery from flood damages *(e.g.,* Jack Creek).

13B4. Assess suitability of lesser-known, degraded, and unoccupied habitat for expanding distribution and abundance of bull trout. Based on outcome from strategy 5B3, identify any other potentially suitable, unoccupied habitat for bull trout in the Jarbidge River watershed. Specifically, evaluate the suitability of Deer Creek, where bull trout have been observed occasionally, followed by Buck Creek and the Robinson and Jim Bob creeks complex that have no bull trout records to date.

13B5. Develop list of factors limiting expansion efforts. Based on outcome from strategies 13B3 and 13B4, develop a comprehensive list of factors preventing or limiting use by bull trout (e.g., barriers, diversions, water temperature, sediment, etc.) for consideration by the Jarbidge River Recovery Team. The Recovery Team will determine whether expansion of bull trout in these areas will contribute to recovery and, if necessary, identify recovery tasks to improve habitat suitability.

13B6. Determine range of temperature tolerances for bull trout life stages and life history forms. Using ongoing bull trout temperature tolerance studies in other bull trout distinct population segments and local population habitat use data, evaluate water temperature as a potential limiting factor for recovery of bull trout in the Jarbidge River distinct population segment. Incorporate results from this task into recommended revisions of State water quality standards for occupied streams in the Jarbidge River distinct population segment.

Aquatic Objective 13C: Develop and conduct research and monitoring studies to improve information concerning the distribution and status of bull trout in the Jarbidge River distinct population segment.

Strategies:

13C1. Increase bull trout surveys. Increase the frequency and extent of population monitoring using a standardized monitoring program to determine seasonal movement and habitat use by resident adult and juvenile bull trout in local populations. Coordinate with surveys for migratory bull trout. Also, periodically monitor for presence/absence of bull trout in any identified potentially suitable habitat.

Aquatic Objective 13D: Identify evaluations needed to improve understanding of relationships among genetic characteristics, phenotypic traits, and local populations of bull trout.

Strategies:

13D1. Determine basic life history characteristics. For both fluvial and resident bull trout, determine age- and size-specific fecundity, age, and size at first spawning, longevity, repeat- or alternate-year spawning frequency, survival rates, and other basic life history characteristics. Due to low

population numbers for both life history forms in the Jarbidge River Core Area, research should primarily be nonlethal (e.g., blood samples, tagging) or opportunistic as specimens become available through incidental mortality rather than intentional sacrifice. This research will also incorporate data from bull trout populations in other distinct population segments.

Discussion: As with other implementation activities, the appropriate mechanisms to evaluate the effectiveness of actions taken to improve or recover bull trout populations need to be in place to assess whether or not to continue restoration activities or whether stated goals and objectives have been achieved. The monitoring program needs to be standardized to ensure that appropriate evaluation occurs throughout the life of the activity and for comparison purposes across other distinct population segments.

Tier 3 "action effectiveness evaluations" would be one mechanism to facilitate this need. Section 4 defines a potential format from which researchers could track progress of bull trout recovery actions using Tier 3 RM&E. Tier 3 research and monitoring assesses, in the form of explicitly posed experiments, the effectiveness of specific recovery actions (CBFWA 2004). This type of monitoring is implemented at the spatiotemporal scale of the recovery actions, comparing the impact of the action as measured by fish-based response variables to reference or control conditions. Effectiveness is defined as an increase in life stage survival, life cycle survival, or fish condition.

3.2.2.3 Freshwater Mollusks

Problem 14: Freshwater mollusks have declined in distribution and abundance throughout the Bruneau subbasin, due primarily to habitat alteration.

Aquatic Objective 14A: Support freshwater mollusk conservation and recovery through habitat restoration, groundwater and surface water conservation, and continued research of environmental factors limiting mollusk growth, survival, and reproduction.

Strategies:

14A1. Establish conservation areas. Pursue the establishment of conservation areas on springs and spring-fed tributaries of the Bruneau River in conjunction with local, state, and federal habitat improvement programs for the benefit of trust aquatic and wildlife resources and the people of Idaho.

14A2. Enable water conservation agreements. Pursue the opportunities for water conservation through water rental programs, water banks, and the acquisition of permanent non-use water rights for the benefit of trust aquatic and wildlife resources and the people of Idaho.

14A3. Support recovery criteria. Support the attainment of recovery criteria for threatened and endangered mollusks through cooperative agreements with private, state, and federal resource managers for the benefit of ESA-listed freshwater mollusks.

14A4. Improve water quality. Restore the high water quality (i.e., cool and clear) that previously existed in the Bruneau subbasin through riparian habitat restoration for the benefit of trust aquatic and wildlife resources and the people of Idaho.

14A5. Restore habitats. Develop and implement a habitat restoration program within the recovery area for the benefit of the Bruneau hot springsnail and the people of Idaho.

Discussion: The distribution and abundance of the Idaho springsnail and the Bruneau hot springsnail are poorly delineated and potentially underestimated due to limited survey extent (Lysne 2003). Factors such as water temperature, turbidity, velocity, spring discharge, and habitat availability are thought to influence occurrence, survival, density, and reproductive success of these species. However, limited data are available to critically assess the influence these variables have on population persistence. Continued monitoring and survey efforts for both springsnail species, as well as geothermal springs, should be established across a broader geographical extent and include estimates of relative abundance (Lysne 2003). Such monitoring and surveying would facilitate more accurate estimates of rangewide abundance and population trends, as well as aid the identification of key habitat associations.

Although both springsnail species have unique habitat requirements, their recovery depends on the conservation of the same resource: water (USFWS 1995a, USFWS 2002a). Ensuring both the quantity and quality of water resources through conservation agreements, habitat restoration projects, and management of hydropower operation and development will be instrumental to the conservation of these species. There have been no active Conservation Reserve Program agreements in Owyhee County since 1999; consequently, geothermal waters currently irrigate much of the private land that had been temporarily removed from agricultural production. This situation has resulted in reduced geothermal spring occurrence, discharge, and extent (USFWS 2002a). Data from monitoring wells suggest that regional aquifer water levels are the lowest since monitoring began in 1991, approximately 5 feet lower than the established Bruneau hot springsnail recovery level. Continuation and expansion of geothermal spring, groundwater, and springsnail surveys, as well as studies of important habitat associations, represent a high priority in better understanding the persistence of these species and their habitats.

3.2.3 Terrestrial Objectives

Problem 15: The loss and degradation of riparian and wetland areas in the Bruneau subbasin have negative effects on fish and wildlife species that use these habitats. Grazing, roads, and water use have been identified as the primary factors limiting the quality of this habitat type in the subbasin.

Terrestrial Objective 15A: Minimize grazing effects in riparian and wetland habitats.

Strategies:

15A1. Adhere to the *Idaho Standards for Rangeland Health and Guidelines for Livestock Grazing Management* (BLM 1997).

15A2. Protect existing riparian and wetland areas that support habitat requirements of aquatic and terrestrial riparian-associated terrestrial species.

15A3. Protect riparian and wetland habitat through land acquisition, conservation easements, and purchasing/retiring animal unit months (AUMs).

15A4. Restore riparian and wetland areas that support habitat requirements of aquatic- and riparian-associated terrestrial species (e.g., designing grazing schedules that meet vegetative needs, fencing, providing alternative water sources for cattle, replanting native vegetation).

15A5. Monitor and evaluate effects of grazing in riparian and wetland habitats. Incorporate new information into strategies 15A1 through 15A4 through the adaptive management process.

Terrestrial Objective 15B: Minimize adverse effects of roads in riparian and wetland habitats.

Strategies:

15B1. Avoid construction of new roads in or near riparian and wetland habitats.

15B2. Mitigate road effects by considering location, design, construction, and operation of roads that currently exist in or are unavoidably built near riparian and wetland habitats.

15B3. Monitor and evaluate the effects of roads in riparian and wetland habitats. Incorporate new information into strategies 15B1 and 15B2 through the adaptive management process.

Terrestrial Objective: 15C. Maintain and restore the hydrologic regime in riparian and wetland habitats.

Strategies:

15C1. Restore beaver to riparian areas (e.g., Marys Creek, Sheep Creek).

15C2. Restore stream channels to natural condition (PFC).

15C3. Ensure adequate flows exist in stream channels and minimize losses from structurally inadequate diversions.

15C4. Promote water conservation in the Bruneau subbasin.

15C5. Monitor and evaluate hydrologic conditions of riparian and wetland habitats in the Bruneau subbasin. Incorporate new information into strategies 15C1 to 15C3 through the adaptive management process.

Discussion: In arid and semiarid landscapes of the western United States, riparian and wetland habitats are centers of biological diversity. The area represented by riparian and wetland habitats is likely disproportionate to those habitats' potential importance to aquatic and terrestrial species, hydrologic functions, and socioeconomics in the Bruneau subbasin. The primary factors identified by the Technical Team as limiting riparian and wetland habitats were livestock grazing, roads, and water use.

Livestock congregate in riparian and wetland habitats which exacerbates the effects of grazing in these areas (Fleischner 1994). Because the BLM is the primary land manager in the Bruneau subbasin (≅ 70% of subbasin), the future condition of riparian and wetland habitats relies on adherence to the Idaho Standards for Rangeland Health and Guidelines for Livestock Grazing Management, at a minimum. Not only do these guidelines support multiple uses of the public lands, they are intended to provide a landscape with proper nutrient cycling, hydrologic cycling, and energy flow. Future conditions of riparian areas in the Bruneau subbasin could also benefit from The Wildlife Habitat Incentives Program, which is a voluntary program that assists private landowners with wildlife habitat development and improvement.

In addition to implementing livestock management techniques that include manipulation of season, duration (time), and intensity of use, reducing the negative impacts of roads to riparian and wetland habitat will contribute to the functioning condition of these areas. Adverse effects of roads in riparian and wetland habitats include alteration of the physical environment, alteration of the chemical environment, habitat fragmentation, increased rates of wildlife mortality due to collisions with vehicles, modification of animal behavior, and spread of invasive exotic species (Findlay and Bourdages 2000, Trombulak and Frissell 2000). Protection of high-quality habitat and mitigation for necessary road construction and maintenance will minimize cumulative effects to riparian and wetland habitats.

Water is a valuable resource for aquatic and terrestrial communities in the Bruneau subbasin. Stream channels in proper functioning condition dissipate energy of high water flows and transport sediment. In addition to the influence on aquatic species, hydrologic regime affects terrestrial species and communities. Amphibians are sensitive to losses of small, temporary wetlands (< 4.0 ha) and may experience incomplete larval metamorphosis (early pond drying if hydroperiod is shortened), increased predation (hydroperiod lengthened or connections made with fish-infested water bodies), and decline in genetic diversity (increased distance between wetlands decreases dispersal) (Semlitsch 2000). Protection and restoration efforts targeted to benefit amphibians (e.g., Columbia spotted frog) have four relevant measures of success: 1) emergence of metamorphs from ponds (initial success), 2) return of adults to breed for the first time (intermediate success), 3) continuation of breeding for 5 years (complete success), and 4) failure of adults to return after 5 to 10 years (failure) (Semlitsch 2002). Other taxa negatively associated with livestock grazing include riparian plants and avifauna (Taylor 1986, Dobkin et al. 1998). In addition to the recovery of experimentally protected plant and bird communities, responses in exclosure areas include a rise in the water table and an expansion of the hyporheic zone laterally from the stream channel (Dobkin et al. 1998). Monitoring terrestrial communities should be based on the level of threat imposed to habitats and species. For example, if limiting factors can be eliminated, less intensive monitoring will be required.

Some areas of the Bruneau subbasin (e.g., Marys Creek, Sheep Creek) could benefit from restoration of beavers to riparian areas. Protection and restoration of areas to proper functioning condition will provide valuable water resources to wildlife, livestock, and humans in the subbasin. Incorporating water conservation into the remaining outlined strategies will foster a multiple-use, sustainable landscape in the Bruneau subbasin.

Problem 16. Degradation, fragmentation, and loss of native shrub-steppe/dwarf shrub-steppe habitats in the Bruneau subbasin adversely affect associated terrestrial species. Grazing, fire, noise pollution, nonnative invasive plants and noxious weeds have been identified as the primary factors limiting the quality of this habitat type and terrestrial species in the subbasin.

Terrestrial Objective 16A: Minimize impacts of livestock grazing to native shrub-steppe/dwarf shrub-steppe habitats and terrestrial species within the Bruneau subbasin.

Strategies:

16A1. Protect shrub-steppe/dwarf shrub-steppe habitat through land acquisition, conservation easements, and purchasing/retiring AUMs.

16A2. Adjust season of use and stocking rates of livestock grazing to maintain vegetative structure and composition and minimize soil compaction, erosion, and nonnative invasive plant/noxious weed propagation in shrub-steppe/dwarf shrub-steppe habitat.

16A3. Ensure viability of sage grouse populations—In known sage grouse source and key habitats (see Bruneau Subbasin Assessment section 2), implement grazing management practices that would maintain habitat criteria for breeding, brood rearing, and wintering (Connelly et al. 2000, see Bruneau Subbasin Assessment section 2). Implement Owyhee and Jarbidge Sage Grouse Working Group management plans.

16A4. Protect known slickspot peppergrass sites—Exclude cattle from known occupied slickspot peppergrass sites during periods of high soil moisture (spring thaw or following significant moisture events any time of the year). Locate cattle water troughs more than 1 mile from known occupied slickspot peppergrass sites.

16A5. Support core adaptive management projects and other research and monitoring recommendations for slickspot peppergrass outlined in the *Candidate Conservation Agreement*.

16A6. Adhere to recommendations and guidelines of existing state and federal management plans for bighorn sheep (IDFG, Nevada Department of Wildlife, BLM).

16A7. Maintain existing designated big game winter range—Develop grazing management strategies to protect big game winter range (see Bruneau Subbasin Assessment section 2). Refine winter range designations by collecting data on big game herds that move between Idaho and Nevada. Implement no grazing after July 1 in designated mule deer winter range.

16A8. Maintain habitat in high-priority survey areas for pygmy rabbits. Collect information on presence and population status of pygmy rabbits in the Bruneau subbasin.

16A9. Support the development and implementation of effective restoration methods in shrub-steppe/dwarf shrub-steppe plant communities.

16A10. Research, monitor, and evaluate impacts of livestock grazing to native shrub-steppe/dwarf shrub-steppe habitat and terrestrial species within the Bruneau subbasin. Incorporate new information into strategies 16A1 to

16A9 and develop new strategies, as necessary, through the adaptive management process.

Terrestrial Objective 16B: Reduce the intensity, frequency, and size of wildfire in shrub-steppe/dwarf shrub-steppe habitats of the Bruneau subbasin.

Strategies:

16B1. Support the BLM's fire suppression priorities to protect areas identified as biologically important.

16B2. Develop and fund effective restoration methods and work to restore areas damaged by fire to native vegetative communities, through the reduction of cheatgrass densities and seeding with native plant species.

16B3. Establish and fund native nurseries for post-wildfire rehabilitation.

16B4. Monitor and evaluate the protection and restoration efforts of shrub-steppe habitat impacted by wildfire in the Bruneau subbasin. Incorporate new information into strategies 16B1 and 16B2 through the adaptive management process.

Terrestrial Objective 16C: Limit noise disturbance to shrub-steppe wildlife species.

Strategies:

16C1. Limit military training disturbance (e.g., people, aircraft, and emitter sites) of sage grouse and bighorn sheep by adhering to avoidance actions and seasonal restrictions outlined in the *Integrated Natural Resource Management Plan for Mountain Home Airforce Base* (CH2M HILL 2004).

16C2. Research, monitor, and evaluate noise impacts to wildlife species in the Bruneau subbasin. Incorporate new information into strategy 16C1 through the adaptive management process.

Terrestrial Objective 16D: Reduce the prevalence of crested wheatgrass in the shrub-steppe habitats of the Bruneau subbasin.

Strategies:

16D1. Work to restore high-quality shrub-steppe habitat in areas currently dominated by crested wheatgrass. Prioritize areas where sagebrush connectivity could be established or expanded (e.g., lower Clover Creek).

16D2. Develop and support methods promoting the establishment of native plant species in areas dominated by crested wheatgrass.

16D3. Monitor and evaluate the prevalence of crested wheatgrass in the Bruneau subbasin. Incorporate new information into strategies 16D1 and 16D2 through the adaptive management process.

Terrestrial Objective 16E: Protect existing high-quality shrub-steppe/dwarf shrub-steppe plant communities while reducing the extent and density of nonnative invasive plant species and noxious weeds in the Bruneau subbasin.

Strategies:

16E1. Identify and prioritize shrub-steppe/dwarf shrub-steppe habitats for protection from nonnative invasive plant species and noxious weeds.

16E2. Control cheatgrass invasion and expansion—Develop methods for cheatgrass eradication and restoration of these areas with native plant species.

16E3. Prevent reproduction—Minimize ground-disturbing activities in shrub-steppe habitats highly susceptible to invasion by nonnative plant species and noxious weeds.

16E4. Prevent seed dispersal—Encourage the use of weed-free seeds and feeds.

16E5. Prevent seed dispersal—Develop and implement programs and policies designed to limit the transportation of weed seeds from vehicles and livestock.

16E6. Increase public participation—Develop education and awareness programs in noxious weed identification, spread prevention, and treatment.

16E7. Prevent establishment—Minimize establishment of new invasives by supporting early detection and eradication programs.

16E8. Prioritize for treatment—Identify and prioritize areas for treatment of nonnative invasive plants and noxious weeds.

16E9. Treat areas infested with nonnative invasive plants and noxious weeds—Implement the most economical and effective treatment methods for reducing densities or eliminating populations of nonnative invasive plants and noxious weeds.

16E10. Encourage best practices—Where appropriate encourage the use of biological control agents as a long-term control strategy without the potentially negative financial and environmental impacts of widespread herbicide use.

16E11. Organize, develop, and support Cooperative Weed Management Area(s) (CWMAs) within the Bruneau subbasin (*Idaho's Strategic Plan for*

Managing Noxious Weeds) that will facilitate cooperative partnerships and probability of success for strategies 16E1 through 16E6.

16E12. Monitor and evaluate the effort to protect shrub-steppe/dwarf shrub-steppe communities from nonnative invasive plants and noxious weeds.

16E13. Incorporate new information into strategies 16E1 to 16E12 through the adaptive management process.

Discussion: Approximately 78% of the land cover in the Bruneau subbasin is comprised of shrub-steppe and dwarf shrub-steppe habitats. Due to their extensive coverage, these habitats are important for wildlife, plants, and livestock. Grazing, fire, noise pollution, nonnative invasive plants, and invasive exotic plants have been identified as the primary factors limiting the quality of these habitat types and the number of terrestrial species in the Bruneau subbasin. Through proper grazing management practices, habitat protection, and restoration, shrub-steppe and dwarf shrub-steppe habitats will continue to meet the needs of terrestrial species. Because there are high-profile species dependent on these habitats (e.g., sage grouse, slickspot peppergrass), objectives and strategies for populations have been previously established by working groups and outlined in candidate conservation agreements and species management plans (see the subbasin assessment). The development and improvement of wildlife habitat on private lands can be accomplished through the Wildlife Habitat Incentives Program of Idaho. Building on these foundations and addressing data gaps for less-studied species will refine the overall management of shrub-steppe communities.

Livestock grazing modifies habitat components and directly affects terrestrial species. Indirect effects of grazing on wildlife species include changes in water and nutrient cycling, which facilitates the spread of invasive species and, ultimately, alters fire and disturbance regimes. To date, most research addressing avian responses to habitat change suggests that population dynamics of birds in sagebrush habitats are impacted by the cumulative effects of local habitat changes (Knick et al. 2003). Grazing management presents numerous opportunities for experimental research, which is necessary to supplement the life history information that is available for many terrestrial species. Long-term studies incorporating a widespread system of exclosures and ability to control treatment levels are a primary research need. Through determining cause and effect relationships, land management (e.g., grazing, fire, military training) decisions will be based on science and less likely to negatively impact the viability of shrub-steppe communities.

Fragmentation of shrub-steppe habitats significantly influences the presence of shrub-obligate species (Knick and Rotenberry 1995). Alien plant invasions, coupled with increased fire frequencies, have irrevocably altered native shrub-steppe plant communities of the Snake River Plain and Northern Great Basin (Whisenant 1990). Crested wheatgrass has been extensively replanted in shrub-steppe habitat after wildfire to prevent expansion and encroachment of cheatgrass. Areas with crested wheatgrass may exhibit significant reductions in plant species diversity along with significant reductions in the diversity and density of nesting birds (Reynolds and Trost 1981). Research and development of restoration in these and other degraded areas are critical for the future condition of shrub-steppe and

dwarf shrub-steppe habitats in the Bruneau subbasin and across the western United States. Through the protection of areas with native plant communities and low numbers of invasive exotics, restoration in the Bruneau subbasin will follow a "build from strength" principle in which high-quality habitat serves as a potential native seed source, provides refugia for shrub-steppe species, and decreases spread of wildfire.

Problem 17: Desert playa habitats have lost native grasses and undergone structural changes. Excessive browsing/grazing, noxious weeds, and roads have been identified as limiting factors for desert playa habitats.

Terrestrial Objective 17A: Encourage maximum plant performance in desert playa habitats.

Strategies:

17A1. Identify and prioritize high-quality desert playa habitats for management and protection that encourages maximum plant performance.

17A2. Maintain fourwing saltbush for livestock and wildlife—Ensure that grazing by wildlife and livestock does not exceed 40% of the total annual growth during the growing period; 50%, during the plant dormancy period (NRCS 2003). Or allow livestock to graze fourwing saltbush only during winter (dormancy period) (Smoliak et al. 2003).

17A3. Monitor and evaluate the effort to protect desert playa communities. Incorporate new information into strategies 17A1 and 17A2 through the adaptive management process.

Terrestrial Objective 17B: Reduce livestock-facilitated invasions of nonnative invasive species and noxious weeds into desert playa habitat.

Strategies:

17B1. Prioritize and protect high-quality desert playa habitat.

17B2. Identify and prioritize desert playa habitat for enhancement or restoration with native plant species.

17B3. Monitor and evaluate the condition and restoration efforts of desert playa habitats and plant communities. Incorporate new information into strategies 17B1 and 17B2 through the adaptive management process.

Terrestrial Objective 17C: Minimize adverse effects of roads in desert playa habitat.

Strategies:

17C1. Avoid construction of new roads in desert playa habitat.

17C2. Mitigate road effects by considering location, design, construction, and operation of roads that are unavoidably built in proximity to desert playa habitat.

17C3. Rehabilitate roadsides—Promote native plant species and prevent erosion in disturbed road areas (i.e., cutbanks) by planting fourwing saltbush.

17C4. Monitor and evaluate the condition of desert playa habitats, plant communities, and rehabilitation efforts. Incorporate new information into strategies 16C1 through 16C3 through the adaptive management process.

Discussion: Desert playa habitat contributes to landscape diversity and heterogeneity in the Bruneau subbasin. Excessive browsing/grazing, invasive exotic plants, and roads are factors limiting this habitat type. Although desert playa represents only 5% of the subbasin, it contributes forage for wildlife and livestock. Identification and prioritization of high-quality desert playa habitats for management and protection should be incorporated into grazing prescriptions and habitat management for big game. Maintenance of appropriate grazing and browsing levels will foster the continued sustainability of these areas. While grazing season of use and intensity are simultaneously managed, degradation of desert playa habitat can be further avoided through proper road construction and operation practices. Rehabilitation of desert playas and their roadsides with native species such as fourwing saltbush will reduce erosion while providing positive benefits to livestock and wildlife (for further discussion, see Bruneau Subbasin Assessment section 2).

Problem 18: Habitat condition of western juniper and mountain mahogany woodland habitats is influenced by the presence of nonnative invasive plants/noxious weeds, fire suppression, and grazing.

Terrestrial Objective 18A: Provide habitat for big game and other wildlife species—Maintain vegetative composition and structure of western juniper and mountain mahogany woodland habitats in the Bruneau subbasin.

Strategies:

18A1. Implement strategies to prevent and control nonnative invasive plant species and noxious weeds (see terrestrial objective 16E).

18A2. Monitor and evaluate the condition of western juniper and mountain mahogany woodland habitats of the Bruneau subbasin. Incorporate new information into strategy 18A1 and the management and protection of these habitats through the adaptive management process.

Discussion: Western juniper and mountain mahogany woodland habitats in the Bruneau subbasin are found mostly around the Idaho–Nevada border and comprise a small portion (<1%) of the terrestrial habitat types within the subbasin. Because of their recognized importance for big game and other wildlife species, maintaining these habitats should not be

disregarded. Threats to these habitats include nonnative invasive plants/noxious weeds, fire suppression, and grazing. Although at present western juniper and mountain mahogany woodland habitats are not at risk in the Bruneau subbasin, continued monitoring and evaluation will ensure their persistence for wildlife species and grazing.

Problem 19: Changes in species composition and structure of aspen habitats in the Bruneau subbasin have had negative effects on wildlife species. Fire suppression and grazing have been identified as the primary factors limiting the quality of this habitat type in the subbasin.

Terrestrial Objective 19A: Reduce the impacts of livestock grazing on aspen habitats in the subbasin.

Strategies:

19A1. Implement annual grazing practices in which livestock crop no more than 50 to 60% of the palatable forage within aspen stands (Debyle and Winokur 1985).

19A2. Protect small, isolated aspen stands with exclosures during the growing period.

19A3. Monitor and evaluate the effects of livestock grazing in upland aspen habitat. Incorporate new information into strategies 19A1 and 19A2 through the adaptive management process.

Terrestrial Objective 19B: Maintain viable stands of aspen through management practices encouraging and/or emulating natural fire processes.

Strategies:

19B1. Maintain aspen stands with a variety of size classes across the landscape through treatments (clearcuts or burns) 40 to 240 acres (15–100 ha) in size (Debyle and Winokur 1985).

19B2. Prevent conifer encroachment—Implement fire management in upland aspen that promotes moderately intense fires with rotations of 40 to 80 years.

19B3. Monitor and evaluate the effects of fire in the maintenance of a mosaic of upland aspen habitat. Incorporate new information into strategies 19B1 and 19B2 through the adaptive management process.

Terrestrial Objective 19C: Retain viable stands of aspen for native terrestrial species associated with upland aspen habitats.

Strategies:

19C1. Protect northern goshawk nesting territories from timber harvest.

19C2. Monitor and evaluate northern goshawk populations and their associated prey species in the Bruneau subbasin.

19C3. Monitor condition and composition of aspen stands in the Bruneau subbasin. Incorporate new information into strategies 19C1 and 19C2 through the adaptive management process.

Discussion: Aspen groves are widespread across North America. But they are a minor type in the Bruneau subbasin (2% of total), found in the uplands in the Humboldt–Toiyabe National Forest in Nevada. Aspen stands are ecologically important because they provide food and cover for wildlife species, as well as high-quality water. They can act as living firebreaks for the more flammable coniferous types and provide fire protection for the surrounding landscape (DeByle and Winokur 1985).

Fire suppression and grazing have been identified as the primary factors limiting the quality of aspen in the Bruneau subbasin. Careful planning is required to successfully manage aspen stands with understory forage resources. Grazing practices that eliminate the understory can be harmful to the long-term welfare of the stand (Debyle and Winokur 1985). If regenerating suckers are removed each year by grazing and browsing, the aspen stand will eventually disappear. Implementing strategies that reduce the impacts of livestock grazing on aspen habitats in the subbasin will facilitate the establishment and retention of aspen and contribute to habitat viability for the wildlife and livestock that depend on these areas. In addition to management of grazing, restoring and/or emulating natural fire processes in aspen habitat is necessary for maintaining aspen across the landscape. Following the management prescriptions outlined by Debyle and Winokur (1985), aspen habitat can provide benefits for a variety of uses.

In addition to vegetation assessment, monitoring associated wildlife species in aspen habitat will contribute to the quantitative evaluation of aspen viability. Grazing has been identified as a factor jeopardizing the northern goshawk in the Southwest (Fleischner 1994). Projects that are designed to monitor and evaluate northern goshawk populations and their associated prey species will contribute to the long-term management of aspen habitat in the Bruneau subbasin.

Problem 20: Limited understanding of the composition, population trends, and habitat requirements of the terrestrial communities (wildlife and plants) of the Bruneau subbasin limits the ability to effectively manage or conserve these species.

Terrestrial Objective 20A: Increase understanding of the composition, population trends, habitat requirements, and impacts of management activities on terrestrial communities of the Bruneau subbasin.

Strategies:

20B1. Collect data—Develop a subbasinwide survey program and database for terrestrial focal, ESA-listed, Neotropical migrant, culturally important, amphibian, bat, and rare plant species.

20B2. Improve the documentation and data-sharing efforts of the Idaho Conservation Data Center and the Nevada Natural Heritage Program within the subbasin.

20B3. Continue existing and expand research on the population dynamics and habitat requirements of the terrestrial species of the Bruneau subbasin. Focus research on focal, ESA-listed, and culturally important species and their interrelationships.

20B4. Continue existing and expand research on natural processes (e.g., fire regimes, hydrology, plant community dynamics) that influence the terrestrial communities of the subbasin.

20B5. Continue existing and expand research on the biotic interactions and key ecological functions (KEFs) of the terrestrial communities of the subbasin (e.g., big game–livestock interactions).

20B6. Monitor and evaluate research needs in relation to limiting factors as implementation of habitat projects continues. Apply research and growing information base to management.

Discussion: Increasing the amount of data collection on terrestrial species will improve our understanding and ability to manage these species. Establishing a strong baseline understanding of current habitat conditions, ecosystem functions and population numbers will allow managers to evaluate the affects of future management activities and swiftly adapt them if necessary.

3.2.4 Socioeconomic Objectives

These social and economic objectives are designed to provide operational guidance for implementing the terrestrial and aquatic protection and restoration objectives and strategies outlined in the *Bruneau Subbasin Management Plan*. These are operational objectives and strategies essential to the short- and long-term success of overall efforts in the subbasin. The problem statements and socioeconomic objectives were developed to address factors limiting the successful implementation of the vision in the Bruneau subbasin (Section 2.1). They are not meant to be optional, nor are they to be implemented to the detriment of aquatic and terrestrial objectives and strategies. Instead, they are to be integrated into the implementation process and addressed whenever possible as part of all planning and implementation activities. These objectives address important aspects of the socioeconomic context for aquatic and terrestrial

protection and restoration. The successful management of fish and wildlife in the subbasin is partially dependent on implementing the strategies detailed in this section.

Problem 21: Management of both public and private lands in the Bruneau subbasin impacts local communities and their economies. Historically, socioeconomic needs have not been adequately balanced with fish and wildlife needs.

Objective 21A: Balance fish and wildlife needs with socioeconomic needs and limitations (Appendix E: Socioeconomic Data).

Strategies:

21A1. Develop a list of available programs and resources for funding.

21A2. Develop a list of community needs.

21A3. Integrate information from strategies 1 and 2 with local watershed protection, restoration, and management planning.

21A4. Develop low-cost tools for assessing economic impacts and benefits of fish and wildlife projects.

21A5. Involve communities in finer-scale efforts (e.g., reach or watershed) of subbasin planning and in program and project planning.

21A6. Coordinate plan implementation with federal, tribal, state, local, and other interests and avoid program and project duplication.

21A7. Seek formal local support for programs and project proposals.

Discussion: Economic and social factors play an important role in determining the effective and efficient implementation of habitat-related improvement or protection strategies. When they are not considered as part of protection and restoration activities, they can undermine success and reduce implementation effectiveness. When seeking funding, it is important to balance socioeconomic needs with fish and wildlife needs. The end result should be to consider socioeconomic impacts, as well as biological impacts, when seeking solutions to the problems.

The Planning Team recommends targeting projects with the greatest fish and wildlife benefit and the least adverse economic effects. The hope is that the activities undertaken to achieve habitat improvement are as beneficial as possible to local economies while having a minimum of negative impacts. As a step toward this integration of protection and restoration activities with community needs and local economies, a list of ongoing programs relevant to aquatic and terrestrial habitats and wildlife must be developed and maintained. The inventory volume of this subbasin plan represents a starting point for this effort. The inventory will need to be updated and expanded over time as programs and activities change or are developed. A new list should be developed, similar to the inventory, that outlines community needs that could be addressed, either directly or secondarily, through

implementation of activities outlined in this plan. The next step is to look for programs that match identified needs, where possible, and then to develop new projects and programs with community needs in mind.

Specific social and economic factors important to gauging benefits and impacts of restoring and protecting fish and wildlife in the Bruneau subbasin need to be further defined. In addition, low-cost tools for use at the subbasin scale need to be developed. This analysis must be targeted toward specific economic and social factors affecting resource decision making. This information should be integrated into subbasin prioritization efforts. All subbasins have this same need for useful, low-cost economic and social analysis tools. The Planning Team recommends that the NPCC fund a single basinwide project to develop these tools for use in the Bruneau and all other subbasins within the Columbia Basin.

Additional planning and prioritization needs to occur at finer scales than the subbasin scale. Experience shows that long-term program implementation is more successful where projects are developed in cooperation with local entities. The local communities in the Bruneau subbasin should be involved in this planning to enable understanding and encourage commitment to the activities needed. Involvement of parties throughout the subbasin will enable the development and implementation of collaborative strategies and actions. While it is important to involve stakeholders from outside the subbasin where possible, involvement and collaboration of subbasin residents is most important to restoration and protection plans and projects.

The variety of programs and activities represented in the inventory indicate the potential for duplicate or conflicting activities between agencies active in the Bruneau subbasin. An ongoing forum needs to be developed where programs and activities can be presented and coordinated to enable the most strategic use possible of limited resources.

One way to integrate local communities and governments into subbasin planning is to request formal support for proposals and programs, thereby involving them in the process. Presenting projects and programs to local governments and groups, as well as asking for their endorsement, engages governments and groups with the issues involved and stimulates the processes that lead to local buy-in. This approach also provides a forum for local feedback into planning and implementation activities.

Objective 21B: Maximize socioeconomic benefits as much as possible while implementing the *Bruneau Subbasin Management Plan*.

Strategies:

21B1. Where possible utilize labor forces, contractors, and suppliers from local and surrounding areas when implementing habitat improvement projects.

21B2. Minimize negative impacts of management activities on local communities when possible.

21B3. Maximize economic benefits of plan—For land purchases or easements, efforts should be made to minimize loss of local government revenues.

21B4. Minimize impacts on surrounding community culture and custom.

Discussion: Future projects and activities need to involve labor forces, contractors, and suppliers from local and surrounding areas during implementation. This practice is constrained by the bidding process of a number of agencies, but when possible, local resources should be used. This approach encourages direct participation in the process while providing work and economic benefits to local areas. Restoration activities in the Bruneau subbasin have the potential to provide significant economic benefits to the area.

When private lands are converted to protected or federal status, their designation on county tax rolls changes, and the annual tax paid to the county for converted land is reduced or eliminated. This practice can negatively impact counties and local services. Future projects that have these types of impacts need to address this loss of revenue. Payment in lieu of taxes and other tools should be used to address this problem.

It is important that management activities be seen as beneficial to local communities. Most often, the conflicts that occur during aquatic and terrestrial protection and restoration arise from a perceived loss of economic resources resulting from management activities. Activities in this subbasin must consider the context of local communities and economies, with conscious effort made to identify and, wherever possible, minimize negative economic impacts. Local culture and custom are also important considerations, and related issues need to be integrated into planning and implementation activities.

Problem 22: As reflected in the inventory, numerous agencies and entities are implementing programs and projects in the subbasin. Lack of coordination and integration limit the economic, social, cultural, and biological benefits of aquatic and terrestrial protection and restoration in the subbasin.

Objective 22A: Increase coordination and consistency of implementation of this plan by forming a group in the Bruneau subbasin focused on fish and wildlife planning and implementation to coordinate and prioritize activities.

Strategies:

22A1. Identify an entity to initiate this group.

22A 2. Involve user groups in finer-scale subbasin planning efforts and in program and project planning.

22A3. Organize project goals and implementation strategies and coordinate plan implementation with federal, tribal, state, local, and other interests to avoid program and project duplication.

22A4. Prioritize and make recommendations to funding sources about project proposals for the subbasin.

22A5. Include or inform entities with vested interest in the subbasin in fish and wildlife planning and implementation.

22A6. Promote stewardship of natural resources through enhanced local involvement and support.

22A7. Promote stewardship of natural resources with off road vehicle users and groups and other recreational groups impacting the Bruneau subbasin.

22A8. Implement information and education actions identified in this management plan.

22A9. Provide opportunities for subbasin-wide information distribution, such as periodic public meetings, newsletters, websites, etc.

22A10. Develop ongoing public involvement process.

22A11. Facilitate networking of groups with technical assistance in the subbasin.

Discussion: Coordination of programs and plans in the subbasin will achieve benefits beyond the value of an individual program or project and promote the application of ecosystem management principles. Existing programs and projects are listed in the subbasin inventory. Better integration of efforts will require further involvement of communities in subbasin planning. This integration will enable the coordination of local efforts with subbasin-scale efforts and allow the development of as many projects as possible to provide cultural, social, and economic benefits to local communities.

Implementation of the subbasin plan will require efforts at multiple scales including subbasin, population, watershed, and finer scales. In areas with no local efforts, additional groups need to be fostered. Technical expertise needs to be available for participation in finer-scale efforts. This will help achieve continuity and consistency in local efforts as well as informing subbasin-scale efforts. The most efficient and practical way of achieving continuity and consistency is to hire a coordinator to organize and implement these tasks over the long run.

Implementing this plan will be a complex and time-intensive task requiring efforts at multiple scales and in multiple political and funding forums. To be successful over the long run, a coordinator will be needed to spearhead the effort. No existing group is fulfilling this role for the Bruneau subbasin. The Planning Team expressed the need to identify or establish an organization to represent a broad cross section of stakeholders, agencies, and tribes active in the Bruneau subbasin. The Resource Conservation and Development (RC&D) coordinators already provide a forum for the integration of efforts at federal, state, tribal, and local levels. The RC&D could conduct this subbasin-scale organization, facilitate the process of seeking funding and hiring a coordinator, and organize and coordinate efforts across the subbasin. The subbasin-scale organization will provide a forum for prioritization,

recommendations for funding and will coordinate the technical and financial resources necessary to implement this plan. The Southwest Idaho RC&D has offered to start developing this group and seeking funding for this effort. The Planning Team recommends that the RC&D spearhead the effort to form the subbasin-scale organization. Once a coordinator is hired, that person will continue to develop the group and coordinate its activities. This group will include but not be limited to representatives of tribes, local, federal, and state agency representatives, private individuals, local interest groups, landowners, watershed advisory groups, soil conservation districts, and the Owyhee County Natural Resources Committee. Everyone needs to be involved throughout the process to avoid conflicts later. The Owyhee County Natural Resources Committee operates as a liaison between county government and state and federal agencies. Their efforts will be essential in making decisions about the Bruneau subbasin and implementing the *Bruneau Subbasin Plan*.

The soil conservation districts have the ability to implement many portions of this plan. Soil conservation districts are locally led, nonregulatory, and accepted by landowners in the Bruneau subbasin. The coordinator will work with the soil conservation districts to implement the plan, raise money for implementation, and serve as liaison between the broader subbasin group and localized implementation efforts. The coordinator will also serve as liaison between the Bruneau subbasin and the NPCC, BPA, and other major national and regional agencies and organizations that provide funding and oversight of fish and wildlife management in the Columbia Basin.

Over the long run, a broad public understanding and commitment is essential to fish and wildlife efforts in the Bruneau subbasin. This effort needs to involve individuals as well as agencies. Primary local groups need to coordinate with the subbasin-scale effort, and vice versa. Information and resources from the agencies, tribes, and subbasin-scale efforts need to be provided to local groups, while local data, information, and priorities need to be integrated into the subbasin-scale effort. A sustained, long-term effort to provide information to communities and residents of the subbasin must be maintained indefinitely. If a single organization can't spearhead this effort, then it should be woven into projects and programs when possible. If possible, multiple roles and efforts should be underway at once.

Problem 23: Many important cultural uses of the Bruneau subbasin are impacted by fish and wildlife activities. Indian tribes are continually losing opportunities to practice long-standing traditions that keep their cultures alive, traditions related to and contingent on responsible natural resource management (Appendix D: Statements of Loss). Traditional uses, hunting, fishing, and gathering are important uses that need to be protected and enhanced.

Non-Indian users also face difficulty in maintaining cultural uses. Hunting and fishing, river floating, back packing, and other activities are uses important throughout the subbasin. Local industries that support these users suffer or benefit from impacts on these uses.

Objective 23A: Protect and foster both Indian and non-Indian cultural uses of natural resources in the Bruneau subbasin.

Strategy:

23A1. Integrate information and education on important Indian and non-Indian culture, treaty rights, and historic and current resource use into project selection and implementation. Provide such information to land managers, regulatory agencies, policymakers, and the public.

Discussion: Healthy habitats and fish and wildlife populations provide cultural survival and continuity for tribes, as well as economic and other cultural benefits to users of the Bruneau subbasin. The Bruneau subbasin is part of the homeland of the Shoshone-Paiute Tribes, which maintain unrelinquished land title and rights to hunt and fish. The economy of the Bruneau subbasin depends considerably on natural resources, although this dependency has changed over time. In the past, the focus was on natural resources, while more recently, recreation and other uses have increased enough to closely balance with continued natural resource use. The Planning Team believes protecting and fostering continued natural resource use into the future is important to the subbasin. This need provides context for fish and wildlife planning and implementation.

In addition to economics, social values need to be incorporated when implementing activities. The protection of unrelinquished rights is a key component of public land management. The living culture of the Indian tribes and nontribal citizens in the Bruneau subbasin relies heavily on continued opportunities to harvest the natural resources managed on public and private lands. General changes to natural resource and public land management in the Bruneau subbasin impact traditions and cultural uses. Abuse of private lands by outside users has led to the posting of lands and loss of access. This situation will continue until recreationists develop a respect for private and public lands that eliminates current abuse.

The Owyhee County Natural Resource Committee operates as a recognized liaison between the county and its residents and federal and state agencies active in the county. The committee will be involved in discussions of federal and state natural resource issues in the Bruneau subbasin. This group needs to be involved in decisions that affect cultures, customs, and recreation issues in the Bruneau subbasin.

4 Research, Monitoring, and Evaluation Plan

This section describes the specific conditions and situations identified in the Bruneau subbasin that will require research, monitoring, and evaluation (RM&E) studies to aid in resolving management questions and data gaps. The RM&E section was developed from the aquatic and terrestrial limiting factors identified in the *Bruneau Subbasin Assessment* and associated vision, problem statements, objectives, and strategies sections of the *Bruneau Subbasin Management Plan*. The RM&E activities were formulated based on the assessment process and a series of meetings with technical personnel representing various tribal, federal, state, and county agencies involved in the management of aquatic and terrestrial resources in the Bruneau subbasin.

The RM&E proposal presented below is not intended to be a field-ready program; rather, it represents a baseline in program development. The focus is on the strategy level and not on the project level. Current or ongoing RM&E programs (as described in the *Bruneau Subbasin Inventory*) incorporate some of the RM&E needs identified in this section. Therefore, development of any new plans should be coordinated with existing programs to maximize effectiveness and reduce redundancy.

The vision for the Bruneau subbasin is for a "sustainable ecosystem with abundant, productive, and diverse aquatic and terrestrial species, which will support sustainable resource-based human activities." This RM&E section was developed from the objectives and strategies of this management plan, which promote the vision for the Bruneau subbasin.

The Bruneau Technical and Planning Teams attempted to develop an integrated and iterative monitoring and evaluation plan that is consistent with the three-tiered system advocated by the ISRP (2003) and the Columbia Basin Fish and Wildlife Authority's (CBFWA) Collaborative Systemwide Monitoring and Evaluation Project (CSMEP; CBFWA 2004) (Figure 1).

Tier 1 monitoring and research will provide broad-scale evaluation of aquatic and terrestrial focal species' distributions and trends across the subbasin. In addition, general assessments of the status of focal habitats in the subbasin are included in this tier. Data gaps identified in the objectives and strategies largely represent this level of monitoring in the subbasin (Table 7).

Addressing the data gaps will provide a strong foundation for the design of research (Table 8) and monitoring (Appendix B-C) projects. These efforts are to be based on statistical sampling and encompass Tier 2. Determining the status of focal species and their habitats will require establishing sampling frequencies, sampling protocols, and experimental designs that are appropriate for the questions regarding species and habitats of interest. Objectives and strategies, their indicators, and the expected biological outcomes provide a guide for future research and monitoring efforts in the Bruneau subbasin. Incorporation of Tier 2 activities into Tier 1 will contribute to an overall assessment of conditions and trends in the subbasin and, potentially, ecosystem.

The effectiveness of specific actions (strategies) and research will be measured in the evaluation component (Tier 3). The strategies incorporate an adaptive management component, which facilitates integration of new information and incorporation of evaluation results into future management actions.

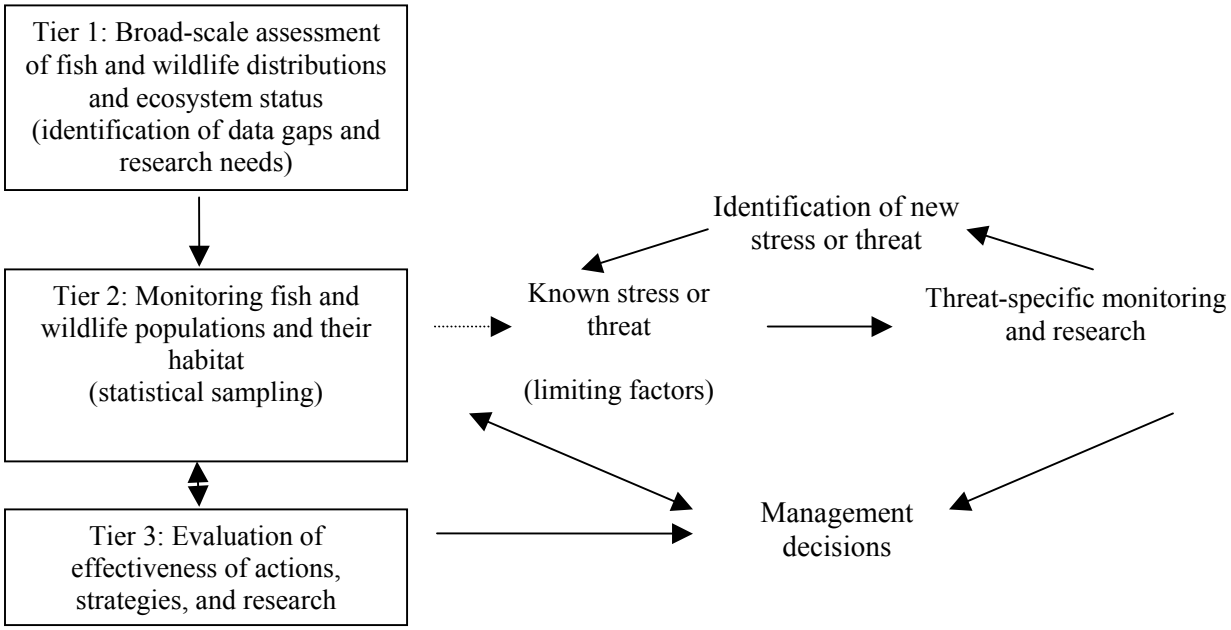

Figure 1. Ecological framework for research, monitoring, and evaluation in the Bruneau subbasin.

Table 7. Data gaps for aquatic and terrestrial species and associated habitats of the Bruneau subbasin.

Objectives	Strategies	Methods	Outcome
Aquatic			
Aquatic Objective 2A: In areas not highly influenced by geothermal inputs, work to restore stream temperatures to levels meeting state criteria.	Inventory and protect coldwater inflows.	Use standard water quality monitoring procedures as well as Forward Looking Infrared Radar (FLIR) or Light Detection And Ranging (LIDAR) to detect areas of cold spring inflows	Protection of thermal refugia and sources of cold water
Aquatic Objective 5D: Within the next five years, conduct a subbasinwide fish barrier inventory.	Cooperate with ongoing efforts (i.e., IDFG barrier assessment) and expand where necessary. Develop a subbasinwide database identifying structural, thermal, and hydrologic migration barriers to all focal species	Coordinate inventory efforts with ongoing programs that implement a standardized, regionally-recognized fish barrier assessment protocol (*e.g.*, http://fisheries.fws.gov/FWSMA/FishPassage/) Archive geospatial data into a common database (*e.g.*, http://www.streamnet.org/)	Improved population connectivity allowing for increased opportunities for genetic exchange, population refounding, thermal refuge, spawning and rearing habitat availability, and expression of various life history forms.

Objectives	Strategies	Methods	Outcome
Aquatic Objective 6A: Conduct research, monitoring, and evaluation to identify and address point and nonpoint pollutant sources and to determine associated impacts on various life history stages of aquatic focal species	Determine water quality	Establish monitoring sites at treatment and control sites Use continuous water quality samplers at monitoring sites to obtain necessary water quality information Collect fish and macroinvertebrate data in conjunction with water quality data	Obtain a better understanding of the effects contaminants (thermal and organic pollutants) are having on focal species
Aquatic Objective 7A: Within the next 10 years, increase riparian cover and stream shading in high-priority restoration HUCs to levels consistent with the proper functioning condition and site capability.	refine HUC-level restoration designations and	Use existing stream inventory data to define specific reaches where riparian restoration activities should occur.	Refined riparian restoration priorities

Objectives	Strategies	Methods	Outcome
Aquatic Objective 8A: Ensure that systematic redband habitat and population inventories are conducted on a regular basis so that critical factors limiting populations can be defined and subsequent management can occur.	Enhance data availability	Archive geospatial data into a common database (*e.g.*, http://www.streamnet.org/)	An improved understanding of factors limiting redband populations
Aquatic Objective 8D. Assess the impact (or lack thereof) that northern pikeminnow and nonnative game species (such as smallmouth bass) have on redband trout distribution and abundance.	Relate distribution patterns of northern pikeminnow, smallmouth bass, and redband trout	Supplement recently collected species distribution data with new (ongoing) information	Improve our understanding of where and when target species overlap occurs
	Assess piscivory	Induce regurgitation of target species using approaches such as electrofishing, or other approaches that stress the piscivore severely	Provide an assessment of predation-related mortality of redband
	Assess competitive interactions	Infer competition through the analysis of fish scale annuli collected from redband in areas occupied by competitors and from areas void of competitors to assess differences in growth rates	Provide an assessment of differences in condition factors of fish competing for resources and fish not competing for resources

Objectives	Strategies	Methods	Outcome
Aquatic Objective 9A. Determine the degree of genetic purity of redband trout populations and the degree of genetic variability among and within populations of redband trout.	Develop genetic markers to distinguish between native redband trout and nonnative rainbow trout from hatchery origin	Using non-lethal measures, obtain redband fin clips (if not already available) to provide DNA of sufficient quality for molecular studies	Allow for the design of management strategies involving water allocation, supplementation, harvesting, and habitat usage that will ensure the continued survival of redband trout
	Determine the degree of genetic differentiation between populations of desert redband trout and between desert and montane redband trout.	Using non-lethal measures, obtain redband fin clips (if not already available) to provide DNA of sufficient quality for molecular studies	
Aquatic Objective 12A: Incorporate conservation of genetic and phenotypic attributes of bull trout into recovery tasks and fisheries management plans for the Jarbidge River Core Area	Conduct genetic inventory of resident and migratory bull trout	Using non-lethal measures, obtain bull trout fin clips (if not already available) to provide DNA of sufficient quality for molecular studies	Allow for the design of management strategies involving water allocation, supplementation, harvesting, and habitat usage that will ensure the continued survival of redband trout
	Integrate genetic inventory. Use the genetic inventory defined in strategy 11A1 to determine whether or not there appears to be any metapopulation structure within the Jarbidge River Core Area		

Objectives	Strategies	Methods	Outcome
Aquatic Objective 13D: Identify evaluations needed to improve understanding of relationships among genetic characteristics, phenotypic traits, and local populations of bull trout	Determine basic life history characteristics	Use non-lethal specimen collection (*e.g.*, blood samples, tagging) or opportunistic approaches	Assist in the management and conservation of bull trout
Terrestrial			
16A: Minimize impacts of livestock grazing to native shrub-steppe/dwarf shrub-steppe habitats and terrestrial species within the Bruneau subbasin.	16A8. Maintain habitat in high-priority survey areas for pygmy rabbits. Collect information on presence and population status of pygmy rabbits in the Bruneau subbasin.	Standard survey protocol in high-priority survey areas, e.g., line transects, track counts in winter, and live-trapping.	Ability to effectively manage, develop research, and monitor status of pygmy rabbit populations
16E: Protect existing high-quality shrub-steppe/dwarf shrub-steppe plant communities while reducing	16E1. Identify and prioritize shrub-steppe/dwarf shrub-steppe habitats for protection from nonnative invasive plant species and noxious weeds.	GIS mapping, aerial photo interpretation, range condition surveys, and expert opinion; incorporation of ICBEMP and TNC analyses (see Bruneau Subbasin Assessment)	Protection of existing high-quality shrub-steppe/dwarf shrub-steppe plant communities

Objectives	Strategies	Methods	Outcome
the extent and density of nonnative invasive plant species and noxious weeds in the Bruneau subbasin.	16E2. Develop methods for cheatgrass eradication and restoration of these areas with native plant species.	Prescribed fire, herbicide application, reseeding; create fire breaks (e.g., green-stripping) to protect restored areas	Increased habitat for native plant communities and decreased horizontal fuel connectivity
	16E8. Identify and prioritize areas for treatment of nonnative invasive plants and noxious weeds	GIS mapping, aerial photo interpretation, range condition surveys, and expert opinion; incorporation of ICBEMP and TNC analyses (see Bruneau Subbasin Assessment)	Restoration of shrub-steppe/dwarf shrub-steppe plant communities
17A. Encourage maximum plant performance in desert playa habitats.	17A1. Identify and prioritize high-quality desert playa habitats for management and protection that encourages maximum plant performance.	GIS mapping, aerial photo interpretation, habitat surveys, and expert opinion; incorporation of ICBEMP and TNC analyses (see Bruneau Subbasin Assessment)	Minimized loss of native grasses and structural changes in desert playa habitats

Objectives	Strategies	Methods	Outcome
17B. Reduce livestock facilitated invasions of nonnative invasive species and noxious weeds into desert playa habitat.	17B2. Identify and prioritize desert playa habitat for enhancement or restoration with native plant species.	GIS mapping, aerial photo interpretation, habitat surveys, and expert opinion; incorporation of ICBEMP and TNC analyses (see Bruneau Subbasin Assessment)	Restoration of desert playa plant communities
20A. Increase understanding of the composition, population trends, habitat requirements, and impacts of management activities on terrestrial communities of the Bruneau subbasin.	20B1. Collect data—Develop a subbasinwide survey program and database for terrestrial focal, ESA-listed, Neotropical migrant, culturally important, amphibian, bat, and rare plant species.	Standard survey protocols and a central database (e.g., Microsoft Access relational database)	Ability to effectively manage, develop research, and monitor status of terrestrial populations of the Bruneau subbasin

4.1 Research

Some sources of uncertainty in our understanding of aquatic and terrestrial species and their habitats can be addressed experimentally. Through experiments and research, explicit uncertainties are addressed, and the development of management is scientifically based. Experimental design of manipulative research (i.e., one or more treatment applied) should follow the general design identified by Hurlbert (1984) and contain the following: 1) controls against which treatment(s) are compared, 2) treatments that control for effects of the procedure and for temporal changes in experimental units, 3) spatial and temporal replication, 4) interspersion of treatment units in time or space, 5) randomization of treatment to experimental units, and 6) statistically independent experimental units. Experiments should be designed in which there is a high probability that an effect that actually exists can be detected (high statistical power). An alternative to this classical approach to hypothesis testing is provided by Bayesian statistical methods, which allow managers and scientists to explore the "probability" that a hypothesis is true and addresses the likelihood of different hypotheses being true (Berger 1985). These methods apply to research in which scientific input (prior expectations) is incorporated and may be useful in large-scale field experiments that prohibit spatial replication. Ultimately, an experimental research program for the Bruneau subbasin will have strong tests of hypotheses, reduce the number of alternative explanations of resulting observations, and result in reduced uncertainty regarding the effects of past and current management practices.

To balance conservation and information gathering through stress treatments, certain criteria should be considered. When one or more of the following criteria are true, "precautionary" experimental management designs should be considered: 1) endangered species or remnant habitats could be stressed, 2) the amount of remaining resource is a small proportion to that of estimated pristine levels, 3) the knowledge of biotic associations is inadequate to predict indirect effects on interdependent species, 4) low potential for reversibility of ecological changes caused by management experiments, or 5) the degree of resiliency in the resource is considered low (Okey and Harrington 1999). Resource conservation and information gathering can occur simultaneously when experimental treatments are protective.

Classical hypothesis testing may not be the appropriate approach in addressing all research needs. Research that explores relationships and not necessarily cause/effect associations through experimental manipulation may be more adequately addressed through statistical modeling. For example, to investigate relationships between landscape-level habitat attributes and maximum recruitment of Chinook salmon, Thompson and Lee (2002) employed information-theoretic methods in a modeling process. The basic steps of modeling include developing a set of predictor variables and *a priori* candidate models that are ecologically meaningful. Models are selected through a ranking process, for which the highest-ranking models are those that best fit the data with the fewest parameters (Burnham and Anderson 2002).

Identified research needs of the Bruneau subbasin (Table 8) can be addressed at the subbasin scale with stratification, in many cases, by watershed. These efforts may be coordinated and combined with out-of-subbasin research to examine questions across the Snake River basin. Short-term research questions (3–5 years) provide opportunities for graduate research at the PhD level. Long-term working relationships between university faculty, agency personnel, and other cooperators will permit research that covers an extended temporal scale (10–15 years). Research

results should be incorporated into the design of ongoing monitoring and management decisions (Figure 1).

Table 8. Research needs for aquatic and terrestrial species and habitats of the Bruneau subbasin.

Research Needs	Management Application	Project Duration
Aquatic		
2A3. Assess the extent that temperature is a limiting factor in the distribution and abundance of focal species such as redband trout and whitefish	Obtain an improved understanding of limitations affecting focal species distribution and habitat utilization	8 years
5B1. Evaluate the impacts of the Grassmere diversion on the Louse Creek redband population.	Obtain an improved understanding of limitations affecting redband trout distribution and habitat utilization	5 years
5B2. If impacts exist, determine ways to mitigate for the [Grassmere] diversion. Suggested options include returning flow to the channel depending on annual storage needs		
6A3. Assess pollutant effects on focal species. Using a combination of literature reviews, in situ laboratory experiments, and field observations, determine the degree to which identified thermal and chemical pollutants may be affecting the various life history stages of bull trout, redband trout, mountain whitefish, and mollusks.	Allow managers to more effectively control toxicants in areas where they pose a limiting factor to focal species	5 years
6A5. Assess groundwater and/or hyporheic influence. If possible, determine the degree to which groundwater or hyporheic flows ameliorate or enhance organic and thermal pollutants (e.g., groundwater discharge from the Gray Rock, Norman, Pavlak, and 4M Mine sites on the West Fork Jarbidge River may be contributing pollutants). Use available techniques (e.g., FLIR, wells, continuous water quality monitoring stations, etc.) to make determinations.	Provide resource managers with a better understanding of where to prioritize protection actions	5 years
8B1. Conduct paired-drainage studies examining riparian influences. Conduct paired-drainage studies, similar to that completed by Zoellick (2004), using systems with intact riparian areas versus those lacking vegetation to examine differences in redband abundance, biomass, and distribution. Assess differences in stream temperature.	Provide managers with the information needed to make cost-effective, ecologically beneficial restoration decisions	10 years (annual – ongoing)
8B2. Conduct paired-drainage studies, similar to that completed by Zoellick (2004), using systems with augmented base flows versus those that have not been augmented to examine differences in redband abundance, biomass, and distribution. Ensure that riparian area composition and function in both treatment and control drainages are similar. Assess differences in stream temperature		

Research Needs	Management Application	Project Duration
8C1. Assess importance of thermal refugia. Using information provided through aquatic objective 6A (strategy 6A5), determine the influence of cool water discharge (e.g., springs, seeps, hyporheic flows) on seasonal redband trout distribution, abundance, and habitat use.	Provide resource managers with a better understanding of where to prioritize redband trout protection actions	5 years
8C2. Assess redband redistribution mechanisms. Using radio telemetry, determine at which point high stream temperatures elicit redband redistribution and assess response effectiveness.	Refine our understanding of redband tolerance levels, which will allow for more efficient prioritization of restoration and protection actions	8 years
8C3. Assess physiological adaptations. Using radio telemetry or snorkel surveys, determine the proportion of fish that are able to withstand extreme temperatures (i.e., those that either don't move or are unable to move out of excessively warm stream reaches) so as to assess their physiological adaptations to thermal extremes		
8D1. Relate distribution patterns. Using recent and ongoing inventory data, determine relationships between the distribution of northern pikeminnow and nonnative game species (such as smallmouth bass) and redband trout.	Provide managers with the information they need to enact fishery management actions designed to protect redband trout	5 years
8D2. Assess piscivory. Collect stomach samples from potential piscivores (e.g., northern pikeminnow, smallmouth bass) to determine composition of diet comprising redband trout.		
8D3. Assess competitive interactions. Where redband (and mountain whitefish) occur with target species (e.g., northern pikeminnow, smallmouth bass) determine (using available methods such as snorkel surveys) whether competition for the same limited resource is occurring. Assess competition mechanisms (e.g., interference competition versus exploitation competition).		
9A1. Develop genetic markers to distinguish between native redband trout and nonnative rainbow trout from hatchery origin	Allow for the design of management strategies involving water allocation, supplementation, harvesting, and habitat usage that will ensure the continued and/or improved survival of redband trout	8 years
9A2. Determine the degree of genetic differentiation between populations of desert redband trout and between desert and montane redband trout.		
9A3. Considering the extreme habitat conditions aquatic organisms in the Bruneau drainage are exposed to on an almost yearly basis, determine the genotypic or phenotypic uniqueness of focal species such as redband trout and whitefish in the Bruneau drainage, compared to other areas where they exist		

Research Needs	Management Application	Project Duration
12A1. Conduct genetic inventory of resident and migratory bull trout. Collate information on genetic samples already collected, standardize sample preservation analysis techniques, and complete a coordinated genetic inventory of all trout local populations and the migratory life history form in the Jarbidge River watershed.	more accurately delineate local populations and quantify spawning site fidelity and straying rates.	10 years
13A2. Assess habitat restoration techniques. The Jarbidge River Recovery Team will evaluate the effectiveness of different active and passive habitat restoration techniques in restoring watershed function and enhancing local populations of bull trout.	Provide managers with the information they need to enact cost- and biologically-effective restoration actions designed to sustain bull trout populations	8 years
13B1. Determine seasonal movement patterns and habitat use of migratory bull trout.	This research will provide important information on the downstream extent of distribution and upstream spawning locations of migratory bull trout as well as to document any overlapping habitat use with resident fish.	15 years (sample bull trout at weirs once every 3 to 5 years)
13B2. Locate and assess bull trout spawning habitats. Develop a comprehensive map of existing and potential bull trout spawning reaches for all local populations in the Jarbidge River Core Area based primarily on redd surveys, in combination with water temperature, substrate, flow, and stream gradient data. This map would be used to delineate areas for focusing habitat protection and restoration efforts. The highest priority stream for assessment is Dave Creek, but documentation and mapping of all local populations is needed for recovery.	Information obtained from this research will assist managers in prioritizing habitat for restoration and protection.	5 years
13B3. Assess suitability of known, degraded and unoccupied habitat for expanding distribution and abundance of bull trout.	This research will guide restoration implementation activities designed towards improving bull trout population connectivity and refounding potential and will allow for strategically based efforts at enhancing distribution	10 years
13B4. Assess suitability of lesser-known, degraded, and unoccupied habitat for expanding distribution and abundance of bull trout.		
13B5. Develop list of factors limiting expansion efforts. Based on outcome from strategies 13B3 and 13B4, develop a comprehensive list of factors preventing or limiting use by bull trout (e.g., barriers, diversions, water temperature, sediment, etc.) for consideration by the Jarbidge River Recovery Team. The Recovery Team will determine whether expansion of bull trout in these areas will contribute to recovery and, if necessary, identify recovery tasks to improve habitat suitability		

Research Needs	Management Application	Project Duration
13B6. Determine range of temperature tolerances for bull trout life stages and life history forms. Using ongoing bull trout temperature tolerance studies in other bull trout distinct population segments and local population habitat use data, evaluate water temperature as a potential limiting factor for recovery of bull trout in the Jarbidge River distinct population segment. Incorporate results from this task into recommended revisions of State water quality standards for occupied streams in the Jarbidge River distinct population segment.	Refine our understanding of redband tolerance levels, which will allow for more efficient prioritization of restoration and protection actions	8 years
Terrestrial		
16A5. Support core adaptive management projects and other research and monitoring recommendations for slickspot peppergrass outlined in the *Candidate Conservation Agreement*.	Elucidation of causal relationships between land management activities and their potential effects on slickspot peppergrass and their habitat, as well as determining effectiveness of conservation agreement	1–10 yrs
16A7. Refine winter range designations by collecting data on big game winter range habitat use for herds that move between Idaho and Nevada	Management of habitat and tag quotas for big game species	3–5 yrs (research) 10–15 yrs (monitoring and evaluating research results)
16A8. Research pygmy rabbit distribution, habitat associations, and population demographics in the subbasin	Management of habitat for pygmy rabbits	3–5 yrs (research) 10 yrs (population trends)
16A10. Research the responses of rangeland vegetation and wildlife to grazing management prescriptions	Design of sustainable grazing prescriptions (rates, intensity, and season of use)	10–15 yrs (long-term research)
16C2. Research wildlife responses to human and noise disturbance from military activities	Continued coexistence of sage grouse with military activities	3–5 yrs (research) 10–15 yrs (population trends)
16E10. Research biological control agents for long-term control of nonnative invasive plant species and noxious weeds	Increased effectiveness in management of invasive plant species and noxious weeds	10–15 yrs (research development and monitoring)
19B3. Continue existing and expand research on the population dynamics and habitat requirements of the terrestrial species of the Bruneau subbasin. Focus research on focal, ESA-listed, and culturally important species and their interrelationships.	Science-based conservation and management of terrestrial species	3–5 yrs
19B4. Continue existing and expand research on natural processes (e.g., fire regimes, hydrology, plant community dynamics) that influence the terrestrial communities of the subbasin.	Effective land and species management based on an increased understanding of natural landscape processes	10–15 yrs
19B5. Continue existing and expand research on the biotic interactions and key ecological functions (KEF) of the terrestrial communities of the subbasin (e.g., big game–livestock interactions)	Manage landscape for multiple uses minimizing negative effects to terrestrial communities	3–5 yrs

4.2 Monitoring and Evaluation

Aquatic and terrestrial monitoring and evaluation programs in the Bruneau subbasin will be most effective provided there is collaboration between university scientists and relevant entities (e.g., county, state, federal, and tribal agencies and private landowners) so as to establish consistency in sampling design, selection of indicators that will be measured, and setting of performance standards. Because the scope of this plan is broad, we believe that experts in the relevant fields are most qualified to design individual projects addressing the monitoring objectives. For well-studied habitats and species (e.g., sage grouse), performance standards may be available in the peer-reviewed literature. When available, this information is included in the discussions of focal species and habitats in the *Bruneau Subbasin Assessment*. We encourage building upon the foundation of knowledge established across the range of a focal habitat or species, when possible.

4.2.1 Aquatic M&E

Aquatic monitoring and evaluation recommendations are provided in Section 7.2, Appendix B. The format used is based on that provided in CBFWA (2004) and incorporates implementation effectiveness indicators presented in USFS (2004). The framework represents a regionally recognized approach at effectiveness monitoring of aquatic and riparian resources within the range of the Inland Fish Strategy (INFISH) and incorporates objectives directed by the Biological Opinions for salmon, steelhead, and bull trout.

It is important to recognize that the proposed M&E framework in Appendix B is intended to provide a template from which more detailed plans can be derived. The Bruneau M&E uses the implementation strategies presented in Section 3.2.1 (Aquatic QHA-Based Problem Statements, Objectives, and Strategies) and in Section 3.2.2 (Aquatic Biologically Based Problem Statements, Objectives, and Strategies) to structure the series of tables.

Rather than presenting a separate table for each action item, strategies that address a common objective were often combined in a single table. This format provides a general direction to facilitate development of future project-specific, and/or strategy-specific M&E plans. It is also important to note that the location of action and spatial scale of implementation is often at the HUC 6 resolution, which is the scale used throughout the assessment. The coarseness of this scale therefore prohibits a reach-level definition of implementation, yet is fine enough to provide guidance from which future project development can be framed.

4.2.2 Terrestrial M&E

Terrestrial objectives and strategies that entail a monitoring component are outlined in Appendix C. A short list of indicators and the expected biological outcome was developed by the Terrestrial Technical Team for the Bruneau subbasin. This list is intended to serve as a guide in monitoring efforts but is not an exhaustive list of all possible indicators that may be utilized in future monitoring efforts.

For each terrestrial objective outlined in this plan, success may be evaluated by two primary metrics: 1) implementation monitoring and 2) effectiveness monitoring. Evaluating implementation monitoring is a straightforward process in which actions (strategies) taken to achieve objectives are assessed. Secondly, effectiveness monitoring will determine whether or not actions are achieving their intended objectives. Agencies that manage public lands and fish and wildlife species will be responsible for reacting to triggers (indicators) and adaptively modify management accordingly.

4.3 Data and Information Archive

Data management and information dissemination are critical elements of an effective monitoring program. StreamNet and the Idaho Conservation Data Center serve as central repositories and providers of information on aquatic and rare terrestrial species. For many of the monitoring objectives, they will most effectively serve as the main archive for data. Monitoring projects will likely span multiple jurisdictions and cover objectives that do not exclusively pertain to rare species. For these species and habitats, the development of an interagency database would facilitate consistency in data entry and allow access by multiple stakeholders to monitoring data. In the Pacific Northwest, the Interagency Species Management System (ISMS) was developed to "achieve efficiencies in implementing the Northwest Forest Plan by facilitating the sharing of species data among survey & manage, watershed analysis, monitoring, and other cooperating agency programs" (see http://www.reo.gov). This database can serve as a model for the development of a central database for the Bruneau and other Snake River subbasins. In the development of all research and monitoring projects, technical reports and peer reviewed publication preparation should be included in the budgets and timelines. Availability and on-the-ground application of research and monitoring results are the ultimate measure of success for this RM&E.

4.4 Adaptive Management

Two key components of adaptive management are 1) to conduct management as an experiment with sound experimental design and 2) maintain a direct feedback loop between science and management (Aldridge et al. 2004). The result is the incorporation of the scientific method (experiments) into a management framework (policy decisions), a substantial step above traditional trial-and-error or learn-as-you-go management. A major flaw that often leads to a failure in adaptive management is the breakdown of progress from the development stage to the design and implementation of field experiments (Aldridge et al. 2004).

The need for adaptive management, monitoring, and evaluation of project implementation was recognized during the development of objectives and strategies for the subbasin. Each objective has a set of strategies to either gain further understanding of limiting factors or take actions toward correcting these factors. Objectives also have a strategy focused on evaluating the effectiveness of implementation strategies in achieving desired objectives, modifying where necessary. A short list of indicators was developed for each monitoring strategy that will prompt action by management agencies and facilitate a feedback loop into the design of monitoring and management decisions.

5 Coordination with Existing Programs

The status of ESA listed species and of water quality conditions are discussed in the *Bruneau Subbasin Assessment* (section 2). Planning must be reflective of, and integrated with, recovery plans for listed species within the subbasins, performance measures described in the Federal Columbia River Power System Biological Opinion, and the Water Quality Management Plan of the state (NPCC 2001). Following is a description of ESA and CWA considerations and of how recommended objectives and strategies conform to these federal guidelines.

5.1 Endangered Species Act Considerations

The Bruneau subbasin contains two endangered aquatic snail species, one threatened fish species, and three threatened wildlife species listed under the Endangered Species Act (ESA) (16 U.S.C. §§ 1531–1544). The ESA, amended in 1988, establishes a national program for the conservation of threatened and endangered species of fish, wildlife, and plants and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with the U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Fisheries Service (NOAA Fisheries), as appropriate, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or to adversely modify or destroy their designated critical habitats.

Section 7 of the ESA describes that all federal agencies participate in the coordination of programs that involve endangered species. Under this provision, federal agencies often enter into partnerships and memoranda of understanding with the USFWS for implementing and funding conservation agreements, management plans, and recovery plans developed for listed species. The development of these partnerships is encouraged as such planning efforts enable proactive approaches for managing listed species.

USFWS has developed recovery plans for four of the six species listed under the ESA in the Bruneau subbasin (Table 9). Actions called for in this management plan should be coordinated, consistent, and integrated with USFWS recovery plans as well any applicable performance measures from the Federal Columbia River Power System Biological Opinion (BiOp) (NPCC 2001).

Table 9. ESA listed species in the Bruneau subbasin and recovery plan status.

Federal Status	Common Name	Recovery Plan Stage
Endangered	Bruneau hot springsnail	Final Plan
Endangered	Idaho springsnail	Final Plan
Threatened	Bull trout	Draft Plan
Threatened	Bald eagle	-
Threatened	Snowy plover	Draft Plan
Threatened	Lynx	-

5.1.1 Consistency with applicable performance measures in BiOp.

The *Bruneau Subbasin Plan* should be coordinated with habitat actions and ecological objectives in the Federal BiOp (N. Berwick, NOAA Fisheries, personal communication, April 4, 2004). Habitat actions described in the BiOp are intended to accelerate efforts to improve survival in priority areas in the short term, while laying a foundation for long-term strategies through subbasin assessment and planning (NMFS 2000). The long term habitat strategy in the BiOp has three overarching objectives: 1) protect existing high quality habitat, 2) restore degraded habitats on a priority basis and connect them to other functioning habitats, and 3) prevent further degradation of tributary habitats and water quality. These are consistent with rules developed by technical team members during subbasin planning prioritization exercises as well as objectives for focal habitats in the Bruneau subbasin.

The following objectives were more specifically described in the BiOp (NMFS 2000) as necessary for tributary habitat improvement efforts benefiting the Bruneau subbasin aquatic focal species. Related objectives and associated strategies in this plan include:

- Water quantity--increase tributary water flow to improve fish spawning, rearing, and migration (*refer to* Aquatic Objectives 1A, 1B, and 1C).

- Water quality--comply with water quality standards, first in spawning and rearing areas, then in migratory corridors (*refer to* Aquatic Objectives 2A, and 6A).

- Passage and diversion improvements—address in-stream obstructions and diversions that interfere with or harm listed species (*refer to* Aquatic Objective 5A, 5B, 5C, and 5D).

- Watershed health—manage both riparian and upland habitat, consistent with the needs of the species (*refer to* Aquatic Objectives 7A).

In the long term, habitat recovery and watershed restoration for non-federal public, tribal, and private lands require state and local stewardship. An overall framework for this stewardship can be created through subbasin plans and recovery plans which establish goals, objectives, and priority actions that are coordinated across Federal and non-Federal ownerships and programs (NMFS 2000). The *Bruneau Subbasin Plan* provides an important context for classifying and prioritizing areas for protection and restoration. The Plan also provides a foundation for ESA recovery planning.

Performance standards and measures are described in the "All H Strategy" (Habitat, Hatcheries, Harvest, Hydropower), which is the "umbrella" under which the BiOp falls (Federal Caucus 2000), and in the aquatics RM&E section (*see* section 4). Of the 4 H's,

coordination with habitat standards and measures in the BiOp is of primary importance as development of strategies to address habitat concerns is a major objective of subbasin planning. Habitat performance standards are: 1) prevent habitat degradation, 2) restore high quality habitat, and 3) restore/increase habitat complexity (Federal Caucus 2000). Associated performance measures as described in the "All H Strategy" include (and are presented in the aquatics RM&E section in this document):

• Increased stream miles meeting water quality standards (temperature and sediments) (*refer to* Aquatic Objectives 2A and and 6A and Aquatics Environmental Monitoring Objectives 2A1, 3A1-3A2, 6A2, and 6A6).

• Increased stream miles with adequate instream flows (*refer to* Aquatic Environmental Objectives 1A, 1B, 1C and 8B and Aquatics Monitoring Objective 1C2-1C4).

• Increased stream miles opened to fish access (*refer to* Aquatic Environmental Objectives 5A, 5B, 5C and Aquatics Monitoring Objectives 5A1, 5A3-5A4).

• Increased acres and/or stream miles of habitat protected or restored (*refer to* Aquatic Environmental Objectives 1C, 4A, 5A, 7A and Aquatic Monitoring Objective 5A1, 5A4, 14A4, 14A5).

The ultimate performance standard for habitat is fish productivity (Federal Caucus 2000). However, this will be difficult to establish as survival improvements from habitat actions cannot be measured in the short term. Even in the long term, measuring progress toward a biologically based standard will be challenging and expensive. Based on our current understanding of the associations between ecosystem processes and salmonid populations, four habitat factors will influence performance measures throughout the basin (Federal Caucus 2000):

- In-stream flows;
- Amount and timing of sediment inputs to streams;
- Riparian conditions that determine water temperature, bank integrity, wood input, maintenance of channel complexity; and
- Habitat access

The *Bruneau Subbasin Management Plan* addresses each of these measures with detailed objectives and strategies (*see* Plan Section 3) as well as a research, monitoring, and evaluation plan (*see* Plan Section 4).

5.1.2 Consistency with ESA listed species

5.1.2.1 Aquatic species

Bruneau Hot Springsnail

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.

Recovery of the Bruneau Hot Springsnail "is contingent upon conserving the geothermal aquifer and increasing the number of geothermal spring habitats within the recovery area…while acknowledging that geothermal groundwater can continue to be managed to fulfill other beneficial uses" (USFWS 2002a). Aquatic Objective 14A (Plan Section 3) is to support freshwater mollusk conservation and recovery through habitat restoration, ground and surface water conservation, and continued research of environmental factors limiting mollusk growth, survival, and reproduction. This objective is consistent and coordinated with the recovery objectives and strategies outlined in the Bruneau Hot Springsnail Recovery Plan.

Idaho Springsnail

On December 14, 1992, five aquatic snails from the Snake River in south central Idaho were added to the federal list of threatened and endangered wildlife (Federal Register 57 FR 59244). One of the five (Idaho Springsnail) is listed as endangered and is found within the Bruneau subbasin (*see* Assessment Section 2.3: Aquatic Focal Species Selection and Characterization). Presently, the Idaho Springsnail occurs mainly in the remaining free-flowing reaches of the Snake River or spring alcove habitats of the Snake River (USFWS 1995).

The short-term objectives for recovery are to protect known live colonies of listed snails by eliminating or reducing known threats. The long-term objectives are to restore viable, self-reproducing colonies of the 5 listed snail species within their specific geographic ranges to the point they are delisted (see USFWS 1995 for detailed description species range and recovery criteria).

The habitat requirements of Idaho Springsnails include cold, clean, well-oxygenated flowing water of low turbidity (USFWS 1995). The actions needed to initiate recovery are: 1) ensure water quality standards for cold-water biota are met, 2) develop and implement conservation management plans that include measures to protect cold-water spring habitats occupied by the listed species, 3) stabilize the Snake River Plain aquifer to protect discharge levels of cold-water springs, 4) evaluate the effects of non-native flora and fauna on the listed snail species (USFWS 1995).

Aquatic Objective 14A (Plan Section 3) is to support freshwater mollusk conservation and recovery through habitat restoration, ground and surface water conservation, and continued research of environmental factors limiting mollusk growth, survival, and reproduction. This objective is consistent and coordinated with ESA recovery planning.

Bull Trout

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). 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).

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 2002). The *Bruneau Subbasin Plan* provides mechanisms to reduce factors limiting bull trout. Aquatic Objective 5C (Plan Section 3.2) is to identify and address barriers to bull trout migration in the Jarbidge River Core Area. Aquatic Objectives that would enhance habitat components are to achieve adequate temperatures (Aquatic Objective 2A) and habitat complexity (Aquatic Objective 7A) for bull trout. Additional objectives are to develop state fisheries management plans consistent with bull trout recovery plan goals (Objectives 11A-11C), characterize bull trout genetic diversity and gene flows in the Bruneau subbasin (Objectives 12A and 12B), and evaluate effectiveness of recovery actions through an adaptive management approach (Objectives 13A-13D).

5.1.2.2 Terrestrial species

The Bruneau subbasin may contain habitat for three terrestrial species listed as threatened under the ESA including the bald eagle, snowy plover, and Canada lynx. Although the subbasin is within the potential range (or historical range) of these species, it does not serve as an important area for breeding or wintering (see species descriptions *in* Bruneau Assessment section 2.4.2.1). No proposed research, monitoring and evaluation activities would conflict with the recovery goals of these listed species.

Improvement of wetland and riparian areas will benefit fish and wildlife species, including bald eagles (Terrestrial Objectives 15A-C). Potential prey for bald eagles will also benefit from the improvement of shrub-steppe habitats through a reduced influence of grazing, altered fire regime, and invasive exotic plant species (Terrestrial Objectives 16A-E). Potential nesting habitat of snowy plovers will benefit through the maintenance and improvement of desert playa habitats in the Bruneau subbasin (Terrestrial Objective 17A-C). If the occurrence of these species were to increase within the Bruneau subbasin, objectives of the *Bruneau Management Plan* would facilitate actions to increase understanding of the composition, population trends, habitat requirements, and impacts of management activities on these species in the Bruneau subbasin (Terrestrial Objective 20A).

5.2 Clean Water Act Considerations

Formed in 1970, the U.S. Environmental Protection Agency (USEPA) administers the federal Clean Water Act (CWA), requiring enforcement of water quality standards by states. These standards are segregated into *point* and *nonpoint* source water pollution, with point sources requiring permitting. Although controversial, this segregation means that most farming, ranching, and forestry practices are considered nonpoint sources and thus do not require permitting by the USEPA. A TMDL, or Total Maximum Daily Load, is a tool for implementing water quality standards where impairment of beneficial uses exists (USEPA 2004). The USEPA provides funding through Section 319 of the CWA for TMDL implementation projects. Section 319 funds are administered by ODEQ in Oregon (USEPA 2004).

5.2.1 Consistency with Idaho State's Water Quality Management Plan

The revised 1999 Idaho Nonpoint Source Management Program Plan outlines the state's strategy to meet the EPA's revised Clean Water Act 319 program guidance dealing with nonpoint source pollution (IDEQ 1999). The primary purpose of the Nonpoint Source Assessments and Management Programs is to provide the states and tribes with a new blueprint for implementing integrated programs to address priority nonpoint source water quality problems. The focus is needed in order to identify innovative funding opportunities and to effectively direct limited resources toward the highest priority issues and waterbodies.

The Idaho Nonpoint Source Management Program (1999) seeks to incorporate nine elements identified as necessary components for nonpoint source programs:

1. Explicit short and long-term goals, objectives and strategies to protect surface and groundwater.

2. Strong working partnerships and collaboration with appropriate state, tribal, regional, and local entities, private sector groups, citizens' groups, and federal agencies.

3. A balanced approach that emphasized both statewide nonpoint source programs and on-the-ground management of individual watersheds where waters are impaired or threatened.

4. The program (a) abates known water quality impairments resulting from non-point source pollution, and (b) prevents significant threats to water quality from present and future activities.

5. An identification of waters and watersheds impaired or threatened by nonpoint source pollution and a process to progressively address these waters.

6. The State reviews, upgrades, and implements all program components required by §319 of the Clean Water Act and establishes flexible, targeted, interactive approaches to achieve and maintain beneficial uses of waters as expeditiously as practicable.

7. Identification of federal lands and objectives which are not managed consistently with state program objectives.

8. Efficient and effective management and implementation of the state's nonpoint source program, including necessary financial management.

9. A feedback loop whereby the state reviews, evaluates, and revises its nonpoint source assessment and its management program at least every five years.

Incorporating these elements developed general long-term goals. These goals were meant to focus implementation efforts and measures identified in approved TMDL and Watershed Restoration Action Strategies (WRAS) to protect and restore beneficial uses. Additional efforts were to prevent significant threats from present and future activities from degrading water quality. Finally, long-term goals were to target nontraditional partners and incorporate their roles into planning and implementation activities, such as the Idaho Cattle Association, irrigation and canal districts, etc. (IDEQ 1999). The following are goals for nonpoint source management in Idaho (IDEQ 1999):

1. Develop and implement coordinated restoration and water quality improvement plans (TMDL/WRAS/ or other implementation plans) which include appropriate BMP design, implementation, monitoring, and maintenance schedules for nonpoint source impacted surface and ground waters that help to restore, protect, or remediate (where appropriate) existing or designated beneficial uses of the state's surface and ground waters (#/yr).

2. Implement nonpoint source BMPs to meet approved TMDLs, TMDL implementation plans, and ground water standards.

3. Provide technical assistance in the development of surface and ground water BMPs and pollution prevention strategies for nonpoint source categories which are not currently listed as approved in the water quality standards.

4. Confirm that all agencies are implementing the nonpoint source management feedback loop in a manner consistent with the nonpoint source management program and, where appropriate, are revising and/or maintaining BMP catalogs and effectiveness protocols.

5. Support ground or surface water monitoring efforts which provide needed data for contaminant transport modeling and investigation work.

6. Integrate ground and surface water quality concerns within basins and watersheds to provide for better protection and restoration (where appropriate) of ground and surface water beneficial uses.

7. Develop and implement pollution trading approaches.

8. Implement measures to protect drinking water from the effects of nonpoint source activities.

9. Update and maintain the Nonpoint Source umbrella Memorandum of Understanding and appendices.

The vision of the Idaho Nonpoint Source Management Program is that all long-term goals and short-term objectives be implemented in a manner to protect or restore (where possible) the beneficial uses of the state's surface and ground water (IDEQ 1999). The continuing focus for the state of Idaho within the foreseeable future will be to develop and implement TMDLs/WRASs for §303(d) listed water bodies. The state of Idaho has committed to the completion of TMDL implementation plans within an 18 month period following the EPA approval of a TMDL (IDEQ 1999).

5.2.1.1 303(d) Listed Segments

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 10 and Figure 2). 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 and delist stream segments when conditions warrant. 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 (NDEP 1998).

Table 10. 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

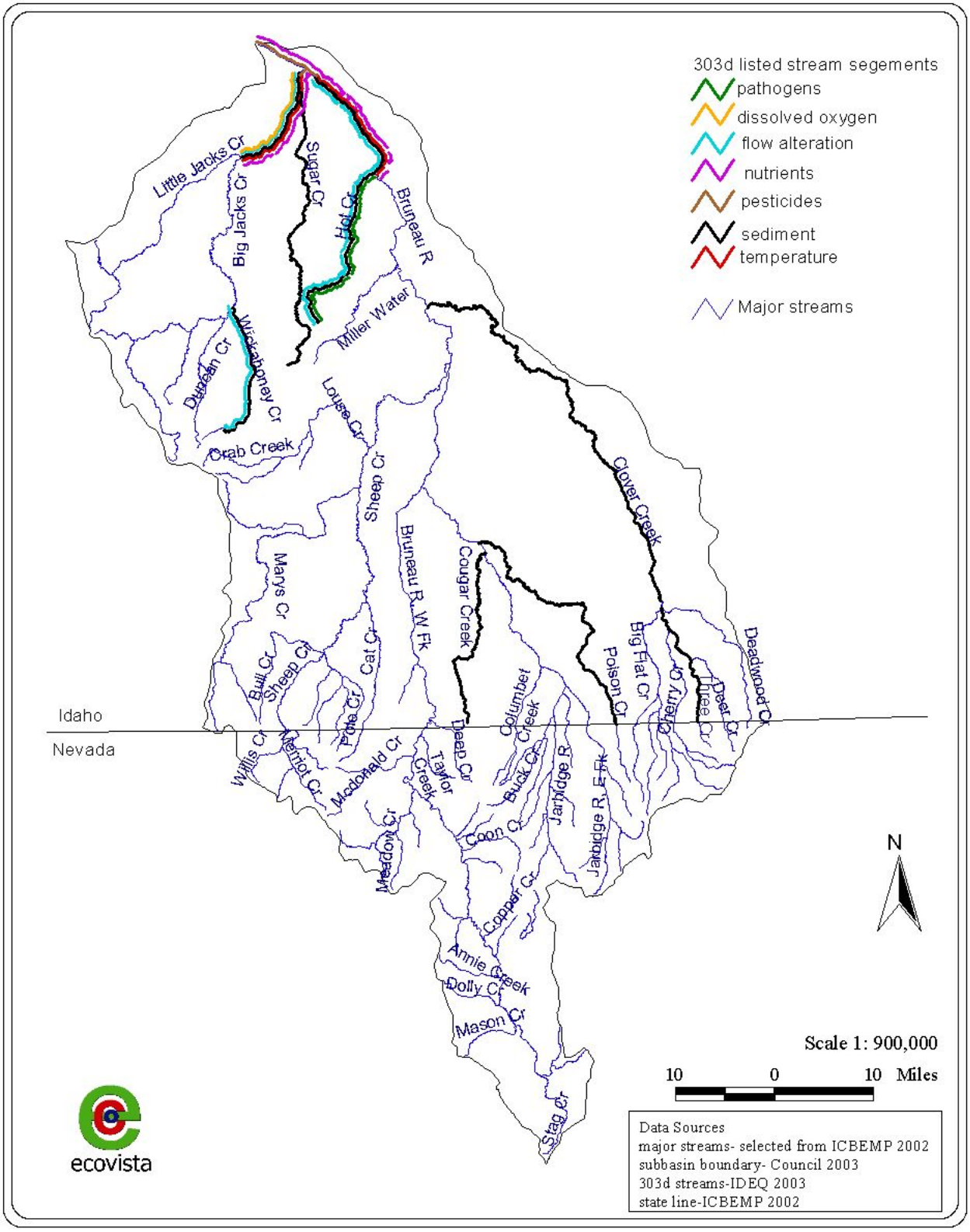

Figure 2. Location of 303(d)-listed stream segments, Bruneau subbasin.

5.2.2 TMDLs in Bruneau subbasin

Water quality standards are set by states, territories, and tribes. They identify the uses for each water body—for example, drinking water supply, contact recreation (swimming), and aquatic life support (fishing)—and the scientific criteria to support those uses. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The calculation must include a margin of safety to ensure that the water body can be used for the purposes that the state has designated. The calculation must also account for seasonal variation in water quality. The CWA, section 303, establishes the parameters for water quality standards and TMDL programs. The 1996 303(d) list for the state of Idaho included 16 segments occurring within the region designated as the Bruneau River Subbasin. Nine segments remain on the 1998 303(d) list. The Bruneau River Subbasin Assessment and Total Maximum Daily Load (SBA-TMDL) for surface waters of the Hydrological Unit Code 17050102 (Lay and IDEQ 2000) describes those nine water bodies and 19 pollutants that are listed on the 1998 303(d) list prepared by the state of Idaho. In addition, two additional pollutant water body combinations are included in the SBA-TMDL.

5.3 Coordination of Plan Implementation

The Resource and Conservation Development (RC&D) councils may play a special role in subbasin plan implementation:

> Resource Conservation and Development (RC&D) councils are federally recognized nonprofit 501(c)3 organizations playing an important role in the conservation, development, and utilization of natural resources. RC&D councils work to improve the general level of economic activity and to enhance the environment and standard of living in all communities. RC&D councils provide a system of rural development to encourage the wise use of natural resources and to improve the quality of life in America.
>
> Congress created this public/private partnership as a way of engaging local leaders to promote their local economy by leveraging limited federal dollars. Councils provide a focal point of local leadership and bring together private citizens and local, state and federal agencies to improve the economic, social and environmental well-being of their area. RC&D councils have proven ability and strength of leadership to engage and accomplish projects from the local to the national level (NARC&DC 2003).

RC&D council members are locally elected officials such as mayors, soil conservation district board members, and county commissioners. American Indian tribes and other community leaders are also members. All RC&D council members serve as volunteers. Such councils activate community support for over 180 million people in 2,614 counties in all 50 states, the Caribbean, and Pacific Basin. RC&D councils successfully leveraged the RC&D appropriation 5 to 1 to directly support conservation and economic development in local communities across the nation. All RC&D councils have area plans that they have developed defining their goals and objectives. RC&D councils serve as a conduit for

federal, state, local, and private foundation programs that assist in area plan implementation.

The Natural Resources Conservation Service (NRCS) administers this U.S. Department of Agriculture (USDA) program by providing a full-time coordinator for each authorized RC&D council. Although the USDA RC&D program is national in scope, projects are identified and implemented at the local level through the RC&D council.

To implement projects at the local level, RC&D sponsors identify needs and opportunities and then present assistance needs to the RC&D council. This request is then evaluated for its relationship to the RC&D area plan goals and objectives. If the project fits within these parameters, it is adopted. Adopting a project provides authorization for the RC&D council, coordinator, and assistant to dedicate the time and resources necessary to assist the sponsor in completing the project.

The Southwest Idaho RC&D area encompasses the entire Bruneau subbasin. This council has coordinated, facilitated, and/or administered numerous natural resource and socioeconomic projects throughout the area. Project implementation has required partnership development with federal, state, and local agencies and other private and public interests. The council is listed on Dun & Bradstreet, on Central Contractor Registration, and with the Defense Logistics Agency—all required for specific project fund administration. The RC&D councils provide an opportunity to utilize an existing structure that is appropriate for managing and facilitating projects in subbasin planning. The RC&D has volunteered to begin the process of coordinating the implementation of this subbasin plan.

6 Conclusions and Recommendations

The purpose of the subbasin management plan is to utilize an assessment of existing natural resources for fish and wildlife and the gaps in current efforts to determine a plan of recommended actions over the next 5 years that will mitigate and improve conditions. The species of importance, along with ESA and CWA considerations, have been detailed. Limiting factors in the subbasin have been identified, as well as the gaps in existing management that do not address these factors. The following is a prioritization of needed actions, followed by recommendations for implementing the actions.

6.1 Prioritization

6.1.1 Aquatic

6.1.1.1 Multi-species prioritization

A final synthesis component is presented in Table 11, Table 12, and Figure 3. 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 don't occur with any of the other focal species (*e.g.,* Idaho spring snail) or only overlap redband migratory habitat (*e.g.,* Bruneau spring snail). Mountain whitefish represent a species with comparatively widespread distribution throughout 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 must be taken into account when considering the 'overall' picture.

Based on the previous limiting factors analysis and the multi-species matrix, several common denominators emerge. First, when considering where and which 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 11).

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).

Despite its apparent 'Properly Functioning Condition', portions of the Jarbidge watershed are in need of restoration. As shown in Figure 3 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), its 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.

Table 11. Sixth-field HUCs within which redband trout (RB), bull trout (BT), mountain whitefish (MW), and Bruneau spring snail (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 spring snail 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] EF Jarbidge 1 (1601) [2] EF Jarbidge 2 (1602) Jarbidge 2 (1801) [2] Jarbidge 3 (1802) [2]	Bruneau 4 (0402) Bruneau 11 (2101)		
Priority: Protection/Restoration			Bruneau 2 (0102)[1] 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 12. Multi-species prioritization of restoration, protection, and protection/restoration activities in the Bruneau 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 S. Snail				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)

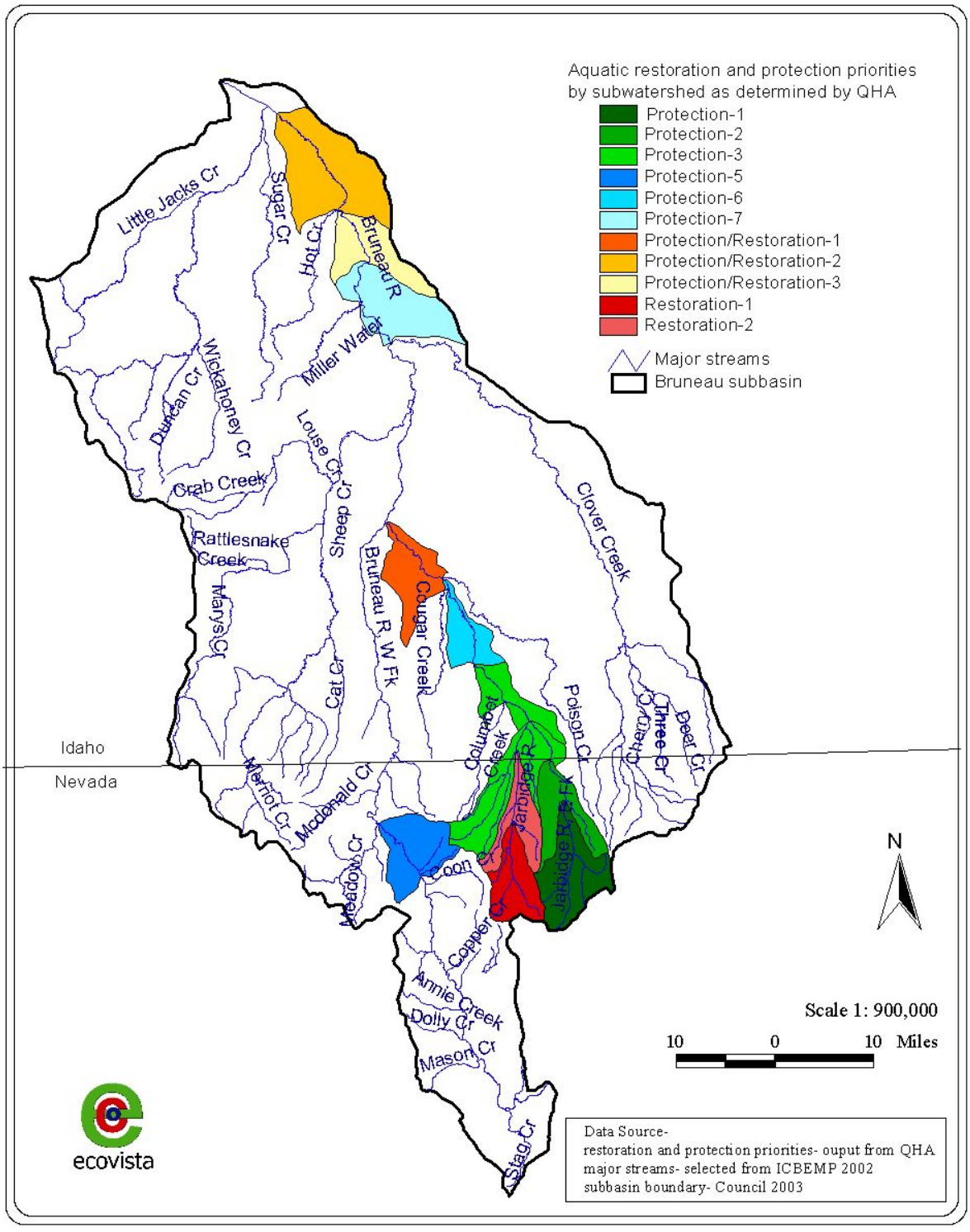

Figure 3. Multi-species representation of restoration, protection, and protection/restoration areas in the Bruneau subbasin

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.

6.1.1.2 Species-Specific Prioritization

Redband Trout

Based on the assessment and management plan, the following actions should occur so as to address critical uncertainties for redband trout in the Bruneau subbasin:

- Determine the impacts of predaceous species on redband
- Collect sufficient genetics data to determine the degree of genetic purity of redband trout populations and the degree of genetic variability among and within populations
- Obtain a better understanding of factors limiting redband populations

Based on QHA output, high priority 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). 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.

Redband habitat protection efforts should be focused in the Jarbidge watershed (including migration corridors), in the Little Jacks Creek watershed, and in migration corridors. Habitat components most commonly in need of protection include pollutants, obstructions, and oxygen.

Bull Trout

Based on the assessment and management plan, the following actions should occur so as to address critical uncertainties for bull trout in the Bruneau subbasin:

- Incorporate conservation of genetic and phenotypic attributes of bull trout into recovery tasks and fisheries management plans for the Jarbidge River Core Area

- Identify evaluations needed to improve understanding of relationships among genetic characteristics, phenotypic traits, and local populations of bull trout

Based on QHA output, high priority restoration efforts are primarily associated with headwater habitats in the Jarbidge watershed. 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. Habitat components that are considered to be functioning appropriately include water quality (pollutants) and streamflow.

Mountain Whitefish

Based on the assessment and management plan, the following actions should occur so as to address critical uncertainties for mountain whitefish in the Bruneau subbasin:

- Determine the impacts of predaceous species on mountain whitefish
- Obtain additional population parameter data (natality, survival, mortality rates, distribution, movements)
- Assess thermal tolerance

Based on QHA output, 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. Specific habitat components that should be protected include water quality (pollutants) and channel form.

Bruneau Springsnail

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.

Because of its limited distribution (currently present in only two sixth field HUCs – 0102 and 0201), spatial habitat restoration and protection priorities are equally important. Based on the QHA analysis, fine sediment ranked highest in terms of habitat restoration priorities. Insufficient flows are also high restoration priorities. Although stochastic events can and do occur, high flows appear to be among the least problematic habitat components affecting the Bruneau

springsnail and warrant high protection prioritization. Also in need of protection is the Bruneau springsnail's habitat diversity. Idaho Springsnail

Based on the assessment and management plan, the following actions should occur so as to address critical uncertainties for the Idaho springsnail in the Bruneau subbasin:

- Determination of population relative abundance and density
- Collection of demographic data to assess productivity and provide an estimate of population stability
- Additional distribution surveys

Habitat restoration priorities for the Idaho springsnail include improvements to water quality (*e.g.,* decreased temperatures, fine sediment/turbidity and pollutants), and water quantity. Competition for resources from exotic species also threatens the persistence of the Idaho springsnail.

6.1.2 Terrestrial

The Terrestrial Team applied the following rules in determining research and monitoring priorities for the Bruneau subbasin:

Build from strength. Efforts to improve the status of aquatic and terrestrial populations in the subbasin should protect habitat that supports existing populations that are relatively healthy and productive. Next, efforts should expand to adjacent habitats that have been historically productive or have a likelihood of sustaining healthy populations by reconnecting or improving habitat.

Prioritize objectives and strategies that implement ESA recovery goals and species conservation agreements or work to prevent the need for listing other species. Protecting strongholds should not be done at the expense of protecting areas where populations are in rapid decline or habitat is critically degraded.

Prioritize for multiple species and benefits. Projects that benefit multiple species in single or multiple habitat types should receive priority.

Maximize overlap between terrestrial and aquatic benefits. Efforts should address areas and limiting factors that provide the greatest benefit to both terrestrial and aquatic species and habitats.

Prioritize by importance of limiting factors to be addressed. Efforts should address limiting factors with the greatest overall influence in the subbasin.

Prioritize areas for restoration by focal habitat type. Habitat types critical for preserving biodiversity and/or are the most imperiled should be considered in prioritization of objectives.

Prioritize projects that benefit local communities in addition to aquatic and terrestrial populations. When selecting among objectives that offer similar biological benefits, choose projects that provide the most benefit to local communities.

Throughout development of the *Bruneau Subbasin Assessment* and *Bruneau Subbasin Management Plan*, focal species and habitats served to guide development of future research and monitoring efforts in the subbasin. Representative habitat types were addressed because of their importance to aquatic and terrestrial species. Focal species were selected due to their population status (e.g., ESA listing, BLM sensitive, heritage rank), cultural importance, and feasibility of monitoring. Although strategies were outlined for focal species, this outline should not preclude research and monitoring of other species whose importance may be recognized after completion of this plan. The following prioritization of future research and monitoring efforts is based on limiting factors with the most influence on terrestrial focal species and their habitats in the Bruneau subbasin.

Priority Objectives for Terrestrial Species of the Bruneau Subbasin

Minimize grazing effects to focal habitats and species.

Long-term studies incorporating a widespread system of grazing exclosures and ability to control treatment levels are a primary research need for aquatic and terrestrial communities. Monitoring the responses of a suite of focal species, habitats, and their indicators will help to establish grazing prescriptions with the lowest impacts to aquatic and terrestrial communities.

Protect existing high-quality shrub-steppe/dwarf shrub-steppe plant communities while reducing the extent and density of nonnative invasive plant species and noxious weeds.

In addition to supporting the development and implementation of control measures for invasive exotic plant species, high-quality shrub-steppe habitat should be further identified and protected to serve as a stronghold for threatened, endangered, declining, rare, and other species of importance. The extension of *Idaho's Strategic Plan for Managing Noxious Weeds* into the subbasin (through the creation of a Cooperative Weed Management Area) will facilitate cooperative partnerships and increase the probability of success for other strategies that address invasive exotic plant species. Controlling invasive exotics will also aid in reducing the negative impacts of wildfire.

Reduce the intensity, frequency, and size of wildfire in focal habitats of the Bruneau subbasin.

Fire suppression should be prioritized in critical habitat for threatened and endangered species as well as in areas adjacent to human settlement. Support of native nurseries and the development of post-wildfire restoration methods are important strategies for the focal habitats and species of the subbasin, except for aspen.

The qualitative assessment of limiting factors by focal habitats in the Bruneau subbasin provided the foundation for prioritizing terrestrial protection and restoration objectives. With the knowledge of habitat conditions within the subbasin and specific threats to focal species, the Technical Team for the Bruneau subbasin followed the above rules to outline spatial prioritization of habitat protection and restoration within the subbasin (Table 13 and Figure 2).

Table 13. Spatial prioritization of protection and restoration efforts in the Bruneau subbasin.

Action	Terrestrial Groups	Rationale
Protection	5,6	Sage grouse stronghold
	3	Sage grouse stronghold, bighorn sheep habitat, pygmy rabbit high-priority survey area, low-influence limiting factors
	11,13	Low-influence limiting factors, Columbia spotted frog habitat, overlap with TNC portfolio site, overlap of aquatic and terrestrial benefits
Restoration	12, 7, 9	Sage grouse stronghold and isolated populations, slickspot peppergrass range, overlap with TNC portfolio site
	8	Pygmy rabbit high-priority survey area, moderate-influence limiting factors

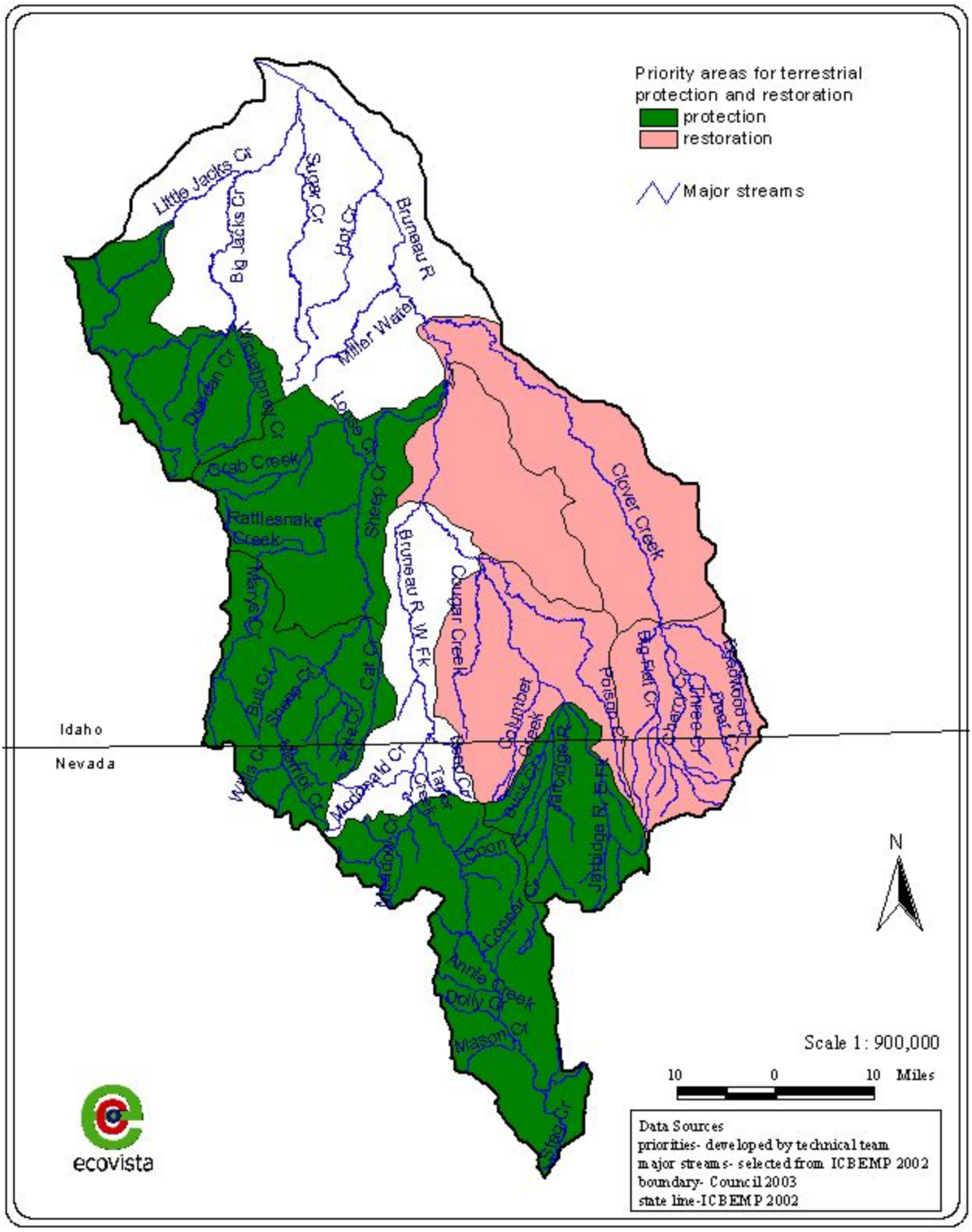

Figure 4. Spatial representation of terrestrial habitat protection and restoration priorities in the Bruneau subbasin.

6.2 Recommendations

The Planning Team developed the following recommendations to help guide implementation of this plan for aquatic and terrestrial species and habitats for the Bruneau subbasin.

The purpose of this plan is to achieve the vision for the Bruneau subbasin, which "is a healthy ecosystem with abundant, productive, and diverse aquatic and terrestrial species, which will support sustainable resource-based human activities" (Bruneau Vision Statement).

The Planning Team believes that implementing this plan will provide opportunities for sustainable natural resource-based economies to recover in concert with aquatic and terrestrial species. Critical to the successful implementation of this plan is the increase in local participation and contribution to information, education, problem solving, and subbasinwide conservation efforts. It is important to promote the understanding and appreciation of healthy and properly functioning ecosystems with residents and stakeholders in the subbasin. The team recognizes the importance of respecting and honoring tribal and private property rights and public lands, as well as the current local conditions, values, and priorities of the subbasin. The Planning Team believes in the importance of fostering ecosystem protection, enhancement, and restoration that result in stewardship of natural resources, recognizing all components of the ecosystem, including the human component.

The Planning Team also believes a scientific foundation is needed to diagnose ecosystem problems and design, prioritize, monitor, and evaluate management to achieve plan objectives. The *Bruneau Subbasin Plan* provides a next step in the process, but the short time frame and funding restraints limited the ability of this iteration of subbasin planning to provide a thorough scientific foundation and integrate that foundation throughout the planning process. This information will also provide the scientific basis for the public involvement and education activities also called for in this plan.

Some data and professional judgment exist to give direction on near-term implementation projects, but the many data gaps need to be filled before a complete, holistic implementation can occur. The Research, Monitoring and Evaluation section of this plan provides an initial outline of information needed before a more comprehensive iteration of an implementation plan can be developed.

This plan needs to be understood in the context of existing and ongoing fish and wildlife plans, the Snake River Basin Adjudication, the Federal Energy Regulatory Commission relicensing of hydropower dams, ESA recovery plans, the Owyhee Initiative, TMDL implementation plans, and the many other planning efforts and documents affecting the subbasin. All these plans provide the context, and in many cases direction, for implementing the *Bruneau Subbasin Plan.*

6.3 Summary of Plan Conclusions

Problem statements were developed with the Aquatic and Terrestrial Technical Teams, and made available for review by the Planning Team, using factors defined as limiting the potential of focal species or habitats in the Assessment (Assessment Section 4: Identification and Analysis of Limiting Factors). Socioeconomic problem statements were developed by the Planning Team to

address potential factors limiting successful implementation of this plan. Objectives and associated strategies were then developed to address each problem statement.

Problem Statements, Objectives, and Strategies (Plan Section 3) were designed to address the biological and environmental needs of focal species and focal habitats. Socioeconomic Objectives (Plan Section 3.2.4: Socioeconomic Components) are designed to provide operational guidance for implementing the terrestrial and aquatic protection and restoration objectives and strategies outlined in the plan.

Research, Monitoring, and Evaluation activities (Plan Section 4) are closely related to the vision, objectives and strategies described in sections 2 and 3 of this plan. This section summarizes additional research, monitoring, and evaluation (RM&E) activities needed to aid in resolving management uncertainties. Data gaps and research needs were outlined by the TT. Monitoring and evaluation activities were described as well as the expected short- and long-term outcomes. Adaptive management is emphasized in this plan. To achieve each objective, strategies require a feedback loop for integration of additional information and modification of future activities.

Grazing and altered fire regime were identified as the factors most limiting for terrestrial species and their habitats in the Bruneau subbasin. The Terrestrial Technical Team determined that shrub-steppe habitats and riparian/wetland/spring habitats are the most important to protect and restore in the Bruneau subbasins. In addition, projects benefiting ESA species or their habitats, or those that work to keep critically imperiled species from being listed, should be prioritized over projects that do not.

6.4 Social Impact Conclusions

The Planning Team desires to implement this plan in a way that minimizes adverse impacts to stakeholders and maximizes local public support. Maintaining a viable, natural resource-based economy is critical to sustaining a local population in the subbasin, which is an important value to the Planning Team.

A number of terrestrial and aquatic objectives include recommendations that impact grazing practices. The goal of the plan is to not drastically change grazing practices as they now exist. Grazing is an important natural resource use in the subbasin, with important economic and multigenerational cultural traditions. An example of a best management practice would be to shift use away from key habitats or other strategies that do not reduce the forage resource for livestock and wildlife, but that shift impacts into vegetation that can better support cattle use.

The general goals of altering season of use and stocking practices are widely accepted as a general strategy, but how they are implemented can cause concern among ranchers in the subbasin. The goals need to be realistic and achievable. They need to be developed in concert with ranchers with enough time in the process to allow successful transitions without major operational impacts. By and large ranchers are not opposed to proper grazing practices, they are opposed to rapid, sudden required shifts that do not allow time to adjust operations with minimum disruption and economic consequences.

Livestock operations, including those on public and private lands; dairy operations; and irrigated forage operations provide the economic base of the counties in the Bruneau subbasin. Recreation is an important use of the subbasin but provides little input into the tax base of the counties in the area. Maintaining a viable ranching community is critical to sustaining a local population in the subbasin, which is an important value to the Planning Team and local governments.

Reducing impacts of catastrophe wildfire on forage resources is important to maintaining stable local agriculture. These fires destroy the forage base and provide an avenue for cheatgrass invasion. They have economic impacts by reducing short-term forage resources and, through weed invasion, reducing long-term forage.

Noxious weeds invade habitats after fire and other disturbances. This invasion is a big problem in the subbasin. A need exists for more effective management of noxious weed problems in the subbasin. More intense noxious weed problems tend to correspond to poor land-use practices. The entire scale of the current noxious weed control efforts needs to be grown; such efforts need more funding, more projects, and more programs and activities to address current problems.

ATV use is a recreational use that needs to be controlled in all areas of the Bruneau subbasin. This recreational use is one that provides little benefit to the subbasin and creates problems on both private and public lands. ATV use in general reflects a lack of consideration and a lack of an ethic that respects private property rights and habitat and wildlife values.

Groundwater issues are important in portions of the Bruneau subbasin. The groundwater around the area of Bruneau is part of a groundwater management area that controls the withdrawals and attempts to maintain the groundwater resource. The Bruneau hot springsnail is one of the species that is controlled by outflows from the groundwater system. Considerable effort on these issues is occurring in the forum of the groundwater management district, and efforts in the subbasin planning forum need to integrate and support activities being taken to address these problems in the groundwater management district. Recovery efforts, such as for the Bruneau hot springsnail, are underfunded nationwide. The hot springsnail recovery efforts need additional funding to be successful. Whenever possible, surface water will be substituted for groundwater. This substitution may lead to potential conflicts between efforts to recover fish and snails and will need to be monitored for multiple benefits and impacts.

6.4.1 Final Comments

Implementation in the Bruneau subbasin needs to integrate the other major subbasins integral to this area. Fish and wildlife are not always restricted to subbasin boundaries. Future work needs to integrate the results of multiple subbasin planning and implementation efforts to address these multiple subbasin issues.

The Planning Team is concerned because it is unclear how future comments will be addressed and the plan revised. Review comments and revisions need to be addressed through a process that includes Planning Team involvement and oversight. This process will include funding for Planning Team involvement, facilitation, and review and update of the plan. The timeline for this process has been too limited. Planning Team members had very little time to review assessment and plan products. Insufficient time existed for this process to be a fully integrated

planning process that allowed policy makers and the public to integrate with the technical committees.

We recognize that the Bruneau subbasin and the Duck Valley Indian Reservation both include areas in Idaho and Nevada. Historically, Nevada has not been represented in the NPCC's process. This lack of funding limited involvement of stakeholders and interests from Nevada. The Nevada portion of the subbasin also requires funding and needs to be represented in the funding process.

The Planning Team believes that this process has provided positive interaction with stakeholders and resulted in information to direct future implementation activities in the subbasin. This plan provides the rationale for increasing BPA funding to activities in the Bruneau and other subbasins in the middle Snake River area. This plan provides an adequate foundation for prioritization and implementation of activities in the subbasin, while pointing toward the need to develop additional information and planning to refine future activities.

The Planning Team intends that this plan will provide a structure for implementation and future research and planning in the Bruneau subbasin. This plan will streamline the process for project selection and implementation. The Planning Team also thinks that BPA funds should be more equitably distributed among subbasins, a distribution that would result in more BPA funding for the Bruneau subbasin. Since the Bruneau is upstream of the Hells Canyon Dam, which blocks passage for anadromous species with related impacts on terrestrial species, it is one of the subbasins that has been the most impacted but the least compensated for impacts of the hydropower system on anadromous aquatic species.

The Planning Team requests that funding be directed to implement the objectives and strategies as outlined and prioritized in this plan.

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Technical Appendices

7.1 Appendix A: Participation Summary

7.1.1 Planning Team Recruitment and Participation

The Northwest Power & Conservation Council (NPCC) directed that subbasin planning include local elected officials, property owners and land managers from the private sector along with the federal, state and tribal fish and wildlife managers.

As part of the public involvement process, the Idaho Council on Industry and Environment actively recruited a wide variety of stakeholders and local elected officials to participate in the process as members of the planning team. In addition, the technical teams also welcomed participation by the private sector. Both technical team and planning team meetings were open to the public, as well.

ICIE used mail, fax and e-mail invitations to recruit planning team members.

- County commissioners within the Bruneau subbasins received a letter asking that they participate as a member of the planning team and a packet of introductory material on the subbasin planning process with the date and location of the first meeting.

  Counties included portions of Owyhee County, Idaho County, and Elko County.

- ICIE identified a number of groups, associations, landowners, and businesses who would be interested in subbasin planning and requested names of individuals who might serve on the planning team.

  Groups, associations, and businesses included: Idaho Association of Soil Conservation Districts, Idaho Water Users Association, Idaho Cattle Association, Idaho Farm Bureau Federation.

- ICIE also identified sportsmen groups and environmental groups with members in the Bruneau subbasin and requested participation.

  These included: Idaho Conservation League, Idaho Rivers United, the Nature Conservancy, Idaho Wildlife Federation, Concerned Sportsmen of Idaho, Ducks Unlimited, Idaho Chapter of the Sierra Club, The Wilderness Society, Foundation for North American Wild Sheep, Idaho Snowmobile Association, the Idaho Chapter of Safari Club.

- Federal and state agencies operating within the subbasin were contacted about participation as well.

  Agencies included: The Bureau of Reclamation, Bureau of Land Management, US Fish & Wildlife Service, Idaho Department of Fish & Game, Idaho Department of Environmental Quality, Idaho Department of Water Resources.

Many of the organizations contacted supplied names of potential members or agreed to participate on behalf of their members. Some groups simply ignored the invitation and the follow-up. Others responded with interest but stated that they did not have enough staff to participate in the project but were interested in being kept informed. ICIE developed an e-mail list that included all those who had been contacted as well as others who expressed interest in following the process.

The Wilderness Society was the only group that objected to the process, refused to participate, and asked that they be removed from e-mail lists. Attached is a letter from the Wilderness Society outlining its objections to the process and the response from ICIE on behalf of the Bruneau Planning Team.

7.1.2 Public Meetings

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.

The meetings were held in different locations in an attempt to allow access to the largest number of people possible. Overall, not many of the general public attended these meetings.

Locations for the Bruneau subbasin public meetings were Bruneau and Mountain Home, Idaho.

The meetings were announced through local media and 200 post cards mailed to individuals as well as announcements in various association newsletters. ICIE also notified all those on its subbasin planning lists and broader e-mail list of 600 names across the state.

Daily and weekly newspaper, radio and television stations were notified in Boise, Mountain Home, Glenns Ferry, Homedale, Hagerman and Buhl. For the final meeting, flyers were sent to 350 individuals in an attempt to increase the attendance by explaining the subbasin planning process, which were not possible using postcards. In addition, Pat Barclay and Lisa Jim did a radio interview with a news organization, which was distributed to 12 radio stations in the region.

Public Meeting #1: The purpose of the first public meeting was to introduce subbasin planning to local people living, working, and using land in various ways within the subbasin. In addition, the meeting facilitator sought and documented comments and opinions on the subbasin plan. The comments were taken to the planning team and considered in management plan development.

On December 15, 2003, the first public meeting for the Bruneau subbasin was held in Bruneau, Idaho. Attendance at the meeting included area farmers and ranchers and an Idaho state legislator. Questions about the definition of key species, the area included in the subbasin and whether or not this process would draw on previous work done in the area were also asked. There was also discussion of the drought conditions and how people could follow the process without getting directly involved on the planning team.

Public Meeting #2: The purpose of the second public meeting was to present the draft subbasin assessment and solicit comment from local land and natural resource users. The comments were used in the draft subbasin assessment.

The second public meeting was held in Mountain Home, Idaho on March 15, 2004. Attendance at this meeting was limited to two local people who were not familiar with the process.

Public Meeting #3: The purpose of the third public meeting was to present the entire subbasin plan (assessment, inventory, and management plan) and obtain comments from local people and resource managers. The comments were documented and presented to the planning team for incorporation into the draft subbasin plan.

The third public meeting was held in Mountain, Idaho on April 22, 2004. This meeting was attended by a member of the local groundwater advisory committee and a candidate for the Idaho State Legislature as well as a one of the local State Representatives. Discussion during this meeting was about the sorts of projects that might be funded and the scope of the projects approved by the NPCC. There was concern expressed that the plan did not take into account the people in the area who would be impacted.

Overall, attendance at the public meetings remained small, in part because this process was not controversial. There was not enough time to educate people in the rural communities about their stake in this process. The NPCC is very well known among the tribes, groups such as electric cooperatives, federal and state fish and wildlife agencies and some sportsmen groups; however, the general public seems to have little knowledge of the Council's programs—especially in the areas like the Bruneau subbasin which does not have anadromous fish.

7.2 Appendix B: Monitoring and Evaluation Framework for Aquatic Species in the Bruneau Subbasin

<table>
<tr><th>Strategy #(s)</th><th>Action</th><th colspan="7">Idaho/Nevada, Middle Snake Province, Bruneau Subbasin</th></tr>
<tr><td>1C2-1C4</td><td>Flow augmentation</td><td colspan="7">Hydro Actions: Augment flows through the use of vegetation manipulation, drift fence construction, and beaver reintroduction (headwater areas only)</td></tr>
<tr><td colspan="2">Reference</td><td colspan="7">Shoshone-Paiute Tribe (2004) Bruneau Subbasin Management Plan (specific entities/individuals to be determined)</td></tr>
<tr><td colspan="2">Location of action and spatial scale of implementation

(represents ‘low-flow’ limited HUCs based on QHA analysis)</td><td colspan="7">Location:
502 503 801 802 1001 1002
1003 1004 1101 1602 1702 1801
1802 2202 2203 2302 2501 2602
2701 2801 2803 2901 2903 2904
3101 3401 3501 3601 3602 4401
4402
Scale of Implementation: HUC_6 (project-specific delineation of reaches within the HUC is anticipated)</td></tr>
<tr><td colspan="2">Time span over which action was / will be implemented</td><td colspan="7">Monitoring flow augmentation actions should occur over a time period specific to the action implemented. For example, monitoring may be instituted immediately following vegetation manipulation, whereas it may be instituted two-three years following reintroduction of beaver into headwater reaches. Monitoring efforts should occur over a minimum 10-year period.</td></tr>
<tr><td colspan="2" rowspan="2">Performance measures available to evaluate action</td><td colspan="3">Possible Treatment Area(s) and Times</td><td colspan="3">Possible Control Area(s) and Times</td></tr>
<tr><td>42:46:16N 115:43:10W Bruneau River nr Hot Springs, ID; gage #13168500</td><td>Sample daily, pre implementation</td><td>Sample daily, post implementation</td><td>41:23:56N 115:25:40W (provided reactivation of gage #13162225)</td><td>Sample daily, pre implementation</td><td>Sample daily, post implementation</td></tr>
<tr><td colspan="2">Habitat performance measures:</td><td colspan="7">Hydrographs (peak flow, frequency, etc.), length of perennial stream (ratio to intermittent), ground water condition, W:D ratio, lg. pool freq., residual pool depth, floodplain interactions/connectivity, tributary connectivity</td></tr>
<tr><td colspan="2">Fish performance measures:</td><td colspan="7">Fish/wildlife population parameters (natality, survival, mortality rates, movements for priority species), fish/wildlife distribution/ abundance/ connectivity, genetic diversity/similarity, fish health, angler/hunter surveys</td></tr>
</table>

<table>
<tr><th>Strategy #(s)</th><th>Action</th><th colspan="6">Idaho/Nevada, Middle Snake Province, Bruneau Subbasin</th></tr>
<tr><td>2A1</td><td>Use intensive livestock management practices as the primary method to improve riparian habitat condition and decrease instream temperatures.</td><td colspan="6">Habitat Actions: (a) Change the present grazing systems in riparian areas to rest rotation, deferred grazing, or exclusion, (b) Reduce livestock stocking rates in riparian pastures, (c) Limit the season of use to accommodate vegetative regrowth, (d) Redistribute cattle away from riparian areas through the use of raised juniper structures placed perpendicular to the stream. Require the placement of salt away from riparian areas through license stipulations, (e) Increase water developments away from streams</td></tr>
<tr><td colspan="2">Reference</td><td colspan="6">Shoshone-Paiute Tribe (2004) Bruneau Subbasin Management Plan (specific entities/individuals to be determined)</td></tr>
<tr><td colspan="2">Location of action and spatial scale of implementation</td><td colspan="6">Location:
502 503 801 802 1001 1002
1003 1004 1101 1202 1501 1601
1602 1701 1801 1802 2302 2501
2602 2701 2801 2803 3401 3501
4402

Scale of Implementation: HUC_6 (project-specific delineation of reaches within the HUC is anticipated)</td></tr>
<tr><td colspan="2">Time span over which action was / will be implemented</td><td colspan="6">This action should occur immediately (2004). Increased riparian growth (vigor) should be evident the first spring following implementation</td></tr>
<tr><td colspan="2" rowspan="2">Performance measures available to evaluate action</td><td colspan="3">Possible Treatment Area(s) and Times</td><td colspan="3">Possible Control Area(s) and Times</td></tr>
<tr><td>Location of Measurements: Identified HUCs in Jarbidge Resource District</td><td>Sampling Frequency pre-implementation: Seasonal (10 years)</td><td>Sampling Frequency post-implementation: Seasonal (10 years)</td><td>Location of Measurements: Identified HUCs in USFS Huboldt-Toiyabe NF</td><td>Sampling Frequency pre-implementation: Seasonal (10 years)</td><td>Sampling Frequency post-implementation: Seasonal (10 years)</td></tr>
<tr><td colspan="2">Habitat performance measures (USFS 2004):</td><td colspan="6">Direct measures of changes in stream temperature, canopy closure over stream and riparian, presence/distribution of special thermal habitats (cool pools, hot springs, etc.), length of perennial stream, ratio to intermittent</td></tr>
<tr><td colspan="2">Fish performance measures (USFS 2004)::</td><td colspan="6">Fish/wildlife population parameters (natality, survival, mortality rates, movements for priority species), fish/wildlife distribution/ abundance/ connectivity, genetic diversity/similarity, fish health, angler/hunter surveys</td></tr>
</table>

<table>
<tr><th>Strategy #(s)</th><th>Action</th><th colspan="6">Idaho/Nevada, Middle Snake Province, Bruneau Subbasin</th></tr>
<tr><td>3A1-3A2</td><td>Ensure regular occurrence of road maintenance and repair

Repair, relocate, close, and/or decommission roads</td><td colspan="6">Habitat Actions: (3A1) Road maintenance activities should be conducted on a regular basis and should adhere to best management practices (e.g., where immediately proximal to stream channels, minimize side-cast material from grading). Special attention should be paid to the repair and maintenance of culverts and other associated stream crossings. (3A2) Roads and culverts in disrepair should be repaired, closed or decommissioned, depending on their importance to the transportation infrastructure</td></tr>
<tr><td colspan="2">Reference</td><td colspan="6">Shoshone-Paiute Tribe (2004) Bruneau Subbasin Management Plan (specific entities/individuals to be determined); (USFS 2003, cited in USFWS 2004)</td></tr>
<tr><td colspan="2">Location of action and spatial scale of implementation</td><td colspan="6">Location: 503 801 802 1001 1202 1601
1602 1701 1702 1801 1802 2501
2502 2701 2801 2803 2903 3401
3501 3602 3802 4402

PRIORITY AREAS: Jarbidge Road extending between Pine Creek Campground and Murphy Hot Springs, Idaho; West Fork Jarbidge River from the Jarbidge Road, as identified in the U.S. Forest Service’s road management plan; Dave Creek (T47N, R58E, sections 24 and 25)
Scale of Implementation: HUC_6 and prioritized road segments</td></tr>
<tr><td colspan="2">Time span over which action was / will be implemented</td><td colspan="6">Road maintenance and closure actions should initiate immediately. Reconditioning, and/or decommissioning should occur following appropriate assessment actions, but should be implemented within the next 3-5 years.</td></tr>
<tr><td colspan="2" rowspan="2">Performance measures available to evaluate action</td><td colspan="3">Possible Treatment Area(s) and Times</td><td colspan="3">Possible Control Area(s) and Times</td></tr>
<tr><td>Location of Measurements: Established survey transects in mainstem/trib. reaches</td><td>Sampling freq. pre-implementation: twice annually</td><td>Sampling freq. post-implementation: twice annually</td><td>Location of Measurements: Established survey transects in mainstem/trib. reaches</td><td>Sampling freq. pre-implementation: twice annually</td><td>Sampling freq. post-implementation: twice annually</td></tr>
<tr><td colspan="2">Habitat performance measures:</td><td colspan="6">Instream – chnnel sediment measures (coring); channel morphology, slope erosion indicators</td></tr>
<tr><td colspan="2">Fish performance measures:</td><td colspan="6">Fish/wildlife population parameters (natality, survival, mortality rates, movements for priority species), fish/wildlife distribution/ abundance/ connectivity, genetic diversity/similarity, fish health, angler/hunter surveys</td></tr>
</table>

<table>
<tr><th>Strategy #(s)</th><th>Action</th><th colspan="7">Idaho/Nevada, Middle Snake Province, Bruneau Subbasin</th></tr>
<tr><td>3B2-3B4</td><td>(3B2) Manage grazing
(3B3) Stabilize streambanks
(3B4) Reduce overland erosion</td><td colspan="7">*Habitat Actions:* (3B2) Manage grazing: (a) Change the present grazing systems in riparian areas to rest rotation, deferred grazing, or exclusion, (b) Reduce livestock stocking rates in riparian pastures, (c) Limit the season of use to accommodate vegetative regrowth, (d) Redistribute cattle away from riparian areas through the use of raised juniper structures placed perpendicular to the stream. Require the placement of salt away from riparian areas through license stipulations, (e) Increase water developments away from streams; (3B4) Revegetate riparian areas to stabilize streambanks; (3B4) Minimize overland erosion by returning the stream to its original channel (below the road crossing);</td></tr>
<tr><td colspan="2">Reference</td><td colspan="7">*Shoshone-Paiute Tribe (2004) Bruneau Subbasin Management Plan (specific entities/individuals to be determined)*</td></tr>
<tr><td colspan="2">Location of action and spatial scale of implementation</td><td colspan="7">*Location*: 503 801 802 1001 1202 1601
1602 1701 1702 1801 1802 2501
2502 2701 2801 2803 2903 3401
3501 3602 3802 4402

Scale of Implementation: HUC_6 (project-specific delineation of reaches within the HUC is anticipated)</td></tr>
<tr><td colspan="2">Time span over which action was / will be implemented</td><td colspan="7">List years over which action was implemented and significant milestones which influence the “strength” of the treatment signal (e.g., little erosion control benefit would be expected in first 2 years of reforestation).</td></tr>
<tr><td colspan="2" rowspan="2">Performance measures available to evaluate action</td><td colspan="3">Possible Treatment Area(s) and Times</td><td colspan="3">Possible Control Area(s) and Times</td></tr>
<tr><td>Location of Measurements:

Established survey transects in mainstem/trib. reaches</td><td>Sampling freq. pre-implementation:

twice annually</td><td>Sampling freq. post-implementation:

twice annually</td><td>Location of Measurements:

Established survey transects in mainstem/trib. reaches</td><td>Sampling freq. pre-implementation:

twice annually</td><td>Sampling freq. post-implementation:

twice annually</td></tr>
<tr><td colspan="2">Habitat performance measures:</td><td colspan="7">Instream – chnnel sediment measures (coring); channel morphology, slope erosion indicators</td></tr>
<tr><td colspan="2">Fish performance measures:</td><td colspan="7">Fish/wildlife population parameters (natality, survival, mortality rates, movements for priority species), fish/wildlife distribution/ abundance/ connectivity, genetic diversity/similarity, fish health, angler/hunter surveys</td></tr>
</table>

<table>
<tr><th>Strategy #(s)</th><th>Action</th><th colspan="6">Idaho/Nevada, Middle Snake Province, Bruneau Subbasin</th></tr>
<tr><td>4A1-4A5</td><td>(4A1) Retard downcutting
(4A2) Improve floodplain interaction
(4A3) Implement bioengineering approaches
(4A4) Implement passive restoration approaches
(4A5) Address headcuts</td><td colspan="6">Habitat Actions: (4A1) In areas of high channel incision, install low-head rock weir structures to encourage sediment accrual and raise the elevation of the streambed; (4A2) Identify and treat areas where road encroachment has limited stream channel interaction with the floodplain and implement road relocation, reengineering, or removal actions; (4A3) With the assistance of geomorphologists and hydrologists, work with local contractors to modify channel form so as to improve width:depth ratios, sinuosity, and bank stability; (4A4) Where channel form and riparian problems occur in the same “high restoration” HUC, plant riparian vegetation and place rootwads or pieces of LWD in the stream channel; (4A5) Where there are headcuts, conduct restoration activities to stop upstream progression</td></tr>
<tr><td colspan="2">Reference</td><td colspan="6">Shoshone-Paiute Tribe (2004) Bruneau Subbasin Management Plan (specific entities/individuals to be determined)</td></tr>
<tr><td colspan="2">Location of action and spatial scale of implementation</td><td colspan="6">Location: 1202 1501 1602 1701 1702 1801
2302 2501 2502 2602 2701 2801
2901 2903 2904 3101 3802 4201
4402

Location of 4A4: 1202 1501 1702 1801 2502 2801
Scale of Implementation: HUC_6 (project-specific delineation of reaches within the HUC is anticipated)</td></tr>
<tr><td colspan="2">Time span over which action was / will be implemented</td><td colspan="6">Actions should occur immediately (2004-05) and conclude within the next 10 years (2014-15). Measurable response should be evident within 5 years.</td></tr>
<tr><td colspan="2" rowspan="2">Performance measures available to evaluate action</td><td colspan="3">Possible Treatment Area(s) and Times</td><td colspan="3">Possible Control Area(s) and Times</td></tr>
<tr><td>Location of Measurements:

Established survey transects (USFS/BLM) in mainstem/trib. reaches</td><td>Sampling freq. pre-implementation:

twice annually</td><td>Sampling freq. post-implementation:

twice annually</td><td>Location of Measurements:

Established survey transects (USFS/BLM) in mainstem/trib. reaches</td><td>Sampling freq. pre-implementation:

twice annually</td><td>Sampling freq. post-implementation:

twice annually</td></tr>
<tr><td colspan="2">Habitat performance measures:</td><td colspan="6">bank stability/root density, habitat mapping (fast/slow water); W:D ratio, lg. pool freq., longitudinal profiles, residual pool depth, bank angles, shore depth, substrate, slope erosion indicators</td></tr>
<tr><td colspan="2">Fish performance measures:</td><td colspan="6">Fish/wildlife population parameters (natality, survival, mortality rates, movements for priority species), fish/wildlife distribution/ abundance/ connectivity, genetic diversity/similarity, fish health, angler/hunter surveys</td></tr>
</table>

<table>
<tr><th>Strategy #(s)</th><th>Action</th><th colspan="6">Idaho/Nevada, Middle Snake Province, Bruneau Subbasin</th></tr>
<tr><td>5A1; 5A3-5A4</td><td>(5A1) Remove/replace Wickahoney culvert;
(5A3) Reconstruct the “Davidson A” irrigation diversion structure on the West Fork Bruneau River (Nevada)
(5A4) Restore connectivity between McDonald Creek and the mainstem Bruneau River by addressing the culvert blockage</td><td colspan="6">Habitat Actions: (5A1) Improve/restore connectivity to headwater habitats through culvert removal on Wickahoney Creek; (5A3) Improve the design of the “Davidson A” irrigation diversion structure on the West Fork Bruneau River (Nevada) so as to improve (ensure) redband passage to upstream spawning habitats; (5A4) Improve/restore connectivity to headwater redband spawning and rearing habitats through culvert removal on McDonald Creek</td></tr>
<tr><td colspan="2">Reference</td><td colspan="6">Shoshone-Paiute Tribe (2004) Bruneau Subbasin Management Plan (specific entities/individuals to be determined)
Gary Johnson, Nevada Department of Wildlife < gjohnson@ndow.org>; Bruce Zoellick, BLM <bruce_zoellick@blm.gov></td></tr>
<tr><td colspan="2">Location of action and spatial scale of implementation</td><td colspan="6">Location: (contact Gary Johnson and Bruce Zoellick for specific restoration locations)
Scale of Implementation: reach level implementation</td></tr>
<tr><td colspan="2">Time span over which action was / will be implemented</td><td colspan="6">The actions to reconnect habitats should occur immediately (2004-05) and should conclude within the next five years. Demonstrable results should be immediate upon implementation.</td></tr>
<tr><td colspan="2" rowspan="2">Performance measures available to evaluate action</td><td colspan="3">Possible Treatment Area(s) and Times</td><td colspan="3">Possible Control Area(s) and Times</td></tr>
<tr><td>Location of Measurements: Fish surveys should occur above action area</td><td>Pre-implementation sampling freq.: Twice annually</td><td>Post-implementation sampling freq.: Twice annually</td><td>Location of Measurements Fish surveys should occur below action area</td><td>Pre-implementation sampling freq.: Twice annually</td><td>Post-implementation sampling freq.: Twice annually</td></tr>
<tr><td colspan="2">Habitat performance measures:</td><td colspan="6">W:D ratios, longitudinal profiles, substrate, bank angles, residual pool depth, bank stability</td></tr>
<tr><td colspan="2">Fish performance measures:</td><td colspan="6">focal species distribution/abundance/connectivity, focal species movements, redd surveys, population parameters (natality, survival, mortality rates, etc.)</td></tr>
</table>

<table>
<tr><th>Strategy #(s)</th><th>Action</th><th colspan="6">Idaho/Nevada, Middle Snake Province, Bruneau Subbasin</th></tr>
<tr><td>6A2</td><td>Determine water quality</td><td colspan="6">Habitat Actions: Using appropriate water quality monitoring protocol (e.g., MacDonald et al. 1991; USFS 1994), establish monitoring sites above and below affected areas, as well as at sites in similar, but undisturbed drainages containing similar fauna.</td></tr>
<tr><td colspan="2">Reference</td><td colspan="6">Shoshone-Paiute Tribe (2004) Bruneau Subbasin Management Plan (specific entities/individuals to be determined)</td></tr>
<tr><td colspan="2">Location of action and spatial scale of implementation</td><td colspan="6">Location: 1501 1602 1702 2203 2501 2502
2602 4201
Scale of Implementation: HUC_6 (project-specific delineation of reaches within the HUC is anticipated)</td></tr>
<tr><td colspan="2">Time span over which action was / will be implemented</td><td colspan="6">Water quality monitoring is currently occurring in the subbasin by IDEQ and NDEP, but should be expanded to include appropriate parameters and reaches within the identified HUCs. The expansion of efforts should occur immediately (2004-05) and extend until problem is resolved (likely a 5 to 7 year duration)</td></tr>
<tr><td colspan="2" rowspan="2">Performance measures available to evaluate action</td><td colspan="3">Possible Treatment Area(s) and Times</td><td colspan="3">Possible Control Area(s) and Times</td></tr>
<tr><td>Location of Measurements: (see above HUCs)</td><td>Sampling Frequency: Continuous</td><td>Sampling Frequency: Continuous</td><td>Location of Measurements (see above HUCs)</td><td>Sampling Frequency: Continuous</td><td>Sampling Frequency: Continuous</td></tr>
<tr><td colspan="2">Habitat performance measures:</td><td colspan="6">Chemical and nutrient content of water, invertebrate community structure, primary productivity/algal community</td></tr>
<tr><td colspan="2">Fish performance measures:</td><td colspan="6">Fish health, population strucutre, community composition/integrity metrics</td></tr>
</table>

<table>
<tr><th>Strategy #(s)</th><th>Action</th><th colspan="6">Idaho/Nevada, Middle Snake Province, Bruneau Subbasin</th></tr>
<tr><td>6A6</td><td>Implement [water quality] restoration</td><td colspan="6">Habitat Actions: Based on the outcome from assessment and associated laboratory studies, treat point and nonpoint pollution sources using appropriate actions; If pollutants are mine-related thermal, consider 1) reclaiming inoperational mine sites by removing debris and potentially hazardous materials, 2) stabilizing, removing, recontouring, and/or revegetating mine tailings formerly deposited in stream channels and floodplains, 3) revegetating irrigation ditches; 4) providing tertiary treatment of water used for miscellaneous consumptive purposes. If identified pollutants are organic (e.g., nitrogen or phosphorus), consider 1) modifying grazing practices in allotments, 2) working with willing landowners to identify and repair any leaking domestic sewage disposal systems, and 3) assisting willing landowners in managing confined animal feedlot operation (CAFO) runoff</td></tr>
<tr><td colspan="2">Reference</td><td colspan="6">Shoshone-Paiute Tribe (2004) Bruneau Subbasin Management Plan (specific entities/individuals to be determined)</td></tr>
<tr><td colspan="2">Location of action and spatial scale of implementation</td><td colspan="6">Location: 1501 1602 1702 2203 2501 2502 2602 4201
Scale of Implementation: HUC_6 (project-specific delineation of reaches within the HUC is anticipated)</td></tr>
<tr><td colspan="2">Time span over which action was / will be implemented</td><td colspan="6">Actions should initiate immediately upon accurate identification of source areas. Response of affected environment should be evident within 1 year following treatment</td></tr>
<tr><td colspan="2" rowspan="2">Performance measures available to evaluate action</td><td colspan="3">Possible Treatment Area(s) and Times</td><td colspan="3">Possible Control Area(s) and Times</td></tr>
<tr><td>Location of Measurements: Install continuous H_2O sampler below treatment</td><td>Pre-implementation sampling freq.: continuous (annual)</td><td>Post-implementation sampling freq.: continuous (annual)</td><td>Location of Measurements: Install continuous H_2O sampler above treatment</td><td>Pre-implementation sampling freq.: continuous (annual)</td><td>Post-implementation sampling freq.: continuous (annual)</td></tr>
<tr><td colspan="2">Habitat performance measures:</td><td colspan="6">Chemical and nutrient content of water, invertebrate community structure, primary productivity/algal community</td></tr>
<tr><td colspan="2">Fish performance measures:</td><td colspan="6">Fish health, population strucutre, community composition/integrity metrics</td></tr>
</table>

<table>
<tr><th>Strategy #(s)</th><th>Action</th><th colspan="6">Idaho/Nevada, Middle Snake Province, Bruneau Subbasin</th></tr>
<tr><td>10A1</td><td>Implement brook trout removal</td><td colspan="6">Harvest Actions: Conduct brook trout eradication efforts in Bear Creek. Removal actions include selective electrofishing, angler harvest, chemical treatments, and snorkel spearing. Although there is concern by downstream consumptive uses relative to the effects of chemical treatments, this approach is often the only effective means by which to permanently remove brook trout from waterways.</td></tr>
<tr><td colspan="2">Reference</td><td colspan="6">Shoshone-Paiute Tribe (2004) Bruneau Subbasin Management Plan (specific entities/individuals to be determined)</td></tr>
<tr><td colspan="2">Location of action and spatial scale of implementation</td><td colspan="6">Location: Emerald Lake and Bear Creek, NV.
Scale of Implementation: drainage</td></tr>
<tr><td colspan="2">Time span over which action was / will be implemented</td><td colspan="6">Eradication efforts should commence immediately (2004-05). Some efforts may be suspended (i.e. chemical treatment), pending a thorough assessment of treatment side effects. Biological response should be evident the year following treatment.</td></tr>
<tr><td colspan="2" rowspan="2">Performance measures available to evaluate action</td><td colspan="3">Possible Treatment Area(s) and Times</td><td colspan="3">Possible Control Area(s) and Times</td></tr>
<tr><td>Location of Measurements: Bear Creek</td><td>Pre-implementation sampling freq.: twice yearly</td><td>Post-implementation sampling freq.: twice yearly</td><td>Location of Measurements: Proximal drainage not containing brktrt.</td><td>Pre-implementation sampling freq.: twice yearly</td><td>Post-implementation sampling freq.: twice yearly</td></tr>
<tr><td colspan="2">Habitat performance measures:</td><td colspan="6">N/A</td></tr>
<tr><td colspan="2">Fish performance measures:</td><td colspan="6">Fish population parameters (natality, survival, mortality rates, movements), genetic diversity/similarity, fish health</td></tr>
</table>

<table>
<tr><th>Strategy #(s)</th><th>Action</th><th colspan="6">Idaho/Nevada, Middle Snake Province, Bruneau Subbasin</th></tr>
<tr><td>11B1-
11B3</td><td>(11B1) Implement angler surveys
(11B2) Promote public awareness</td><td colspan="6">Harvest Actions: (11B1) Survey active anglers, outfitter guides, and appropriate license holders (e.g., trout stamp purchase) to obtain updated local information on fishing pressure, species identification, bull trout capture rates and sizes, effective gear types, and fish health upon release; (11B2) Continue to inform anglers about bull trout identification, special regulations agency management of ESA-listed fish species, and techniques to reduce hooking mortality of bull trout caught incidentally in recreational fisheries. Also, ensure angler compliance with state and federal regulations for bull trout through increased enforcement presence in high-use areas.</td></tr>
<tr><td colspan="2">Reference</td><td colspan="6">Shoshone-Paiute Tribe (2004) Bruneau Subbasin Management Plan (specific entities/individuals to be determined)</td></tr>
<tr><td colspan="2">Location of action and spatial scale of implementation</td><td colspan="6">Location: Jarbidge watershed, NV.
Scale of Implementation: watershed</td></tr>
<tr><td colspan="2">Time span over which action was / will be implemented</td><td colspan="6">Angler surveys and public awareness actions are currently ongoing, but need to be increased. Actions should occur during the 2004-05 angling season and continue indefinitely, or until adequate harvest data has been collected and angling-induced mortality is negligible</td></tr>
<tr><td colspan="2" rowspan="2">Performance measures available to evaluate action</td><td colspan="3">Possible Treatment Area(s) and Times</td><td colspan="3">Possible Control Area(s) and Times</td></tr>
<tr><td>Location of Measurements: Jarbidge watershed</td><td>Pre-implementation sampling freq.: Seasonal</td><td>Post-implementation sampling freq.: Seasonal</td><td>Location of Measurements: Jarbidge watershed</td><td>Pre-implementation sampling freq.: Seasonal</td><td>Post-implementation sampling freq.: Seasonal</td></tr>
<tr><td colspan="2">Habitat performance measures:</td><td colspan="6">N/A</td></tr>
<tr><td colspan="2">Fish performance measures:</td><td colspan="6">bull trout population parameters (natality, survival, mortality rates, movements), bull trout health, bull trout population distribution/abundance/connectivity, angler surveys</td></tr>
</table>

<table>
<tr><th>Strategy #(s)</th><th>Action</th><th colspan="6">Idaho/Nevada, Middle Snake Province, Bruneau Subbasin</th></tr>
<tr><td>11C1</td><td>Evaluate the impacts of current angling regulations on bull trout and recommend any appropriate modifications to the regulations</td><td colspan="6">Harvest Actions: Incidental take of bull trout by angling in the Jarbidge River watershed is not currently authorized under the ESA. The states of Idaho and Nevada have also prohibited bull trout harvest. However, bull trout occupied waters are not closed to recreational fishing, and angling under existing state regulations may result in unintentional mortality of bull trout through catch-and-release fishing or species misidentification.</td></tr>
<tr><td colspan="2">Reference</td><td colspan="6">Shoshone-Paiute Tribe (2004) Bruneau Subbasin Management Plan (specific entities/individuals to be determined); USFWS 2004</td></tr>
<tr><td colspan="2">Location of action and spatial scale of implementation</td><td colspan="6">Location: Jarbidge watershed, NV.
Scale of Implementation: watershed</td></tr>
<tr><td colspan="2">Time span over which action was / will be implemented</td><td colspan="6">Evaluation of angler impact on bull trout populations needs to be implemented immediately. Population response should not be expected to occur until appropriate angler regulations/restrictions occur.</td></tr>
<tr><td colspan="2" rowspan="2">Performance measures available to evaluate action</td><td colspan="3">Possible Treatment Area(s) and Times</td><td colspan="3">Possible Control Area(s) and Times</td></tr>
<tr><td>Location of Measurements: Jarbidge watershed</td><td>Pre-implementation sampling freq.: Seasonal</td><td>Post-implementation sampling freq.: Seasonal</td><td>Location of Measurements: Jarbidge watershed</td><td>Pre-implementation sampling freq.: Seasonal</td><td>Post-implementation sampling freq.: Seasonal</td></tr>
<tr><td colspan="2">Habitat performance measures:</td><td colspan="6">N/A</td></tr>
<tr><td colspan="2">Fish performance measures:</td><td colspan="6">bull trout population parameters (natality, survival, mortality rates, movements), bull trout health, bull trout population distribution/abundance/connectivity, angler surveys</td></tr>
</table>

<table>
<tr><th>Strategy #(s)</th><th>Action</th><th colspan="6">Idaho/Nevada, Middle Snake Province, Bruneau Subbasin</th></tr>
<tr><td>12B1</td><td>Manage local populations (numbers and life forms) to maintain long-term viability</td><td colspan="6">Management Actions: Use results from genetic inventories to define local bull trout populations so that appropriate management actions may occur. Actions include protecting unique populations from fragmentation, ensuring connectivity between and within populations, ensuring adequate protection from harvest and exotic species, and restoring/protecting critical bull trout spawning and rearing areas</td></tr>
<tr><td colspan="2">Reference</td><td colspan="6">Shoshone-Paiute Tribe (2004) Bruneau Subbasin Management Plan (specific entities/individuals to be determined); USFWS 2004</td></tr>
<tr><td colspan="2">Location of action and spatial scale of implementation</td><td colspan="6">Location: Jarbidge watershed, NV.
Scale of Implementation: watershed</td></tr>
<tr><td colspan="2">Time span over which action was / will be implemented</td><td colspan="6">Current management of local bull trout populations is inadequate due to incomplete or missing genetic inventories. Upon collection and analysis of such data, local populations will be defined, and appropriate management actions will ensue.</td></tr>
<tr><td colspan="2" rowspan="2">Performance measures available to evaluate action</td><td colspan="3">Possible Treatment Area(s) and Times</td><td colspan="3">Possible Control Area(s) and Times</td></tr>
<tr><td>Location of Measurements: Jarbidge watershed</td><td>Pre-implementation sampling freq.: Seasonal</td><td>Post-implementation sampling freq.: Seasonal</td><td>Location of Measurements: Jarbidge watershed</td><td>Pre-implementation sampling freq.: Seasonal</td><td>Post-implementation sampling freq.: Seasonal</td></tr>
<tr><td colspan="2">Habitat performance measures:</td><td colspan="6">N/A</td></tr>
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</table>

<table>
<tr><th>Strategy #(s)</th><th>Action</th><th colspan="6">Idaho/Nevada, Middle Snake Province, Bruneau Subbasin</th></tr>
<tr><td>14A4</td><td>Improve water quality for mollusks</td><td colspan="6">Habitat Actions: Restore the high water quality (i.e., cool and clear) that previously existed in the Bruneau subbasin through riparian habitat restoration for the benefit of trust aquatic and wildlife resources and the people of Idaho</td></tr>
<tr><td colspan="2">Reference</td><td colspan="6">Shoshone-Paiute Tribe (2004) Bruneau Subbasin Management Plan (specific entities/individuals to be determined);</td></tr>
<tr><td colspan="2">Location of action and spatial scale of implementation</td><td colspan="6">Location: 101 102 201
Scale of Implementation: HUC_6</td></tr>
<tr><td colspan="2">Time span over which action was / will be implemented</td><td colspan="6">Water quality improvement actions for endangered mollusks in the Bruneau needs to occur immediately. Population response should be evident within the first year of implementation</td></tr>
<tr><td colspan="2" rowspan="2">Performance measures available to evaluate action</td><td colspan="3">Possible Treatment Area(s) and Times</td><td colspan="3">Possible Control Area(s) and Times</td></tr>
<tr><td>Location of Measurements: The thermal aquifer along the 5.5-mile reach of the lower Bruneau River</td><td>Pre-implementation sampling freq.: Continuous (annually)</td><td>Post-implementation sampling freq.: Continuous (annually)</td><td>Location of Measurements: Thermally-influenced reaches not containing mollusks</td><td>Pre-implementation sampling freq.: Continuous (annually)</td><td>Post-implementation sampling freq.: Continuous (annually)</td></tr>
<tr><td colspan="2">Habitat performance measures:</td><td colspan="6">Chemical and nutrient content of water, invertebrate community structure, primary productivity/algal community, direct measures of changes in stream temperature, canopy closure over stream and riparian, presence/distribution of special thermal habitats (cool pools, hot springs, etc.), length of perennial stream, ratio to intermittent</td></tr>
<tr><td colspan="2">Fish performance measures:</td><td colspan="6">mollusk population parameters (natality, survival, mortality rates, movements), mollusk health, mollusk population distribution/abundance</td></tr>
</table>

<table>
<tr><th>Strategy #(s)</th><th>Action</th><th colspan="6">Idaho/Nevada, Middle Snake Province, Bruneau Subbasin</th></tr>
<tr><td>14A5</td><td>Restore habitat quality for mollusks</td><td colspan="6">Habitat Actions: maintenance of instream flows, compliance with water quality standards (alteration of grazing practices and reduction of sediment through road closures), improved riparian conditions (alternation of grazing practices and active stream restoration)</td></tr>
<tr><td colspan="2">Reference</td><td colspan="6">Shoshone-Paiute Tribe (2004) Bruneau Subbasin Management Plan (specific entities/individuals to be determined); Steve Lysne, USFWS < Steve_Lysne@fws.gov></td></tr>
<tr><td colspan="2">Location of action and spatial scale of implementation</td><td colspan="6">Location: 101 102 201
Scale of Implementation: HUC_6</td></tr>
<tr><td colspan="2">Time span over which action was / will be implemented</td><td colspan="6">Habitat improvement actions for endangered mollusks in the Bruneau needs to occur immediately. Population response should be evident within the first year of implementation</td></tr>
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<tr><td colspan="2">Fish performance measures:</td><td colspan="6">mollusk population parameters (natality, survival, mortality rates, movements), mollusk health, mollusk population distribution/abundance</td></tr>
</table>

7.3 Appendix C: Monitoring and Evaluation Framework for Terrestrial Species in the Bruneau Subbasin

Objectives	Strategies	Potential Indicators	Biological Outcome
15A: Minimize grazing effects in riparian and wetland habitats.	15A1. Adhere to the *Idaho Standards for Rangeland Health and Guidelines for Livestock Grazing Management* (BLM 1997).	Vegetation composition, height, cover, and density	Proper functioning condition of riparian and wetland habitats
	15A2. Protect existing riparian and wetland areas that support habitat requirements of aquatic and terrestrial riparian-associated species.	Presence of threatened, endangered, sensitive, or focal species	Increased habitat for aquatic and terrestrial species
	15A3. Protect riparian and wetland habitat through land acquisition, conservation easements, and purchasing/retiring AUMs.	Acres of land acquired or under conservation easements, # AUMs purchased or retired	Protection and increased riparian and wetland habitat for aquatic and terrestrial species
	15A4. Design grazing schedules that meet riparian and wetland vegetative needs.	Vegetation composition, height, cover, and density	Protection and restoration of riparian and wetland habitats
15B: Minimize adverse effects of roads in riparian and wetland habitats.	15B1. Avoid construction of new roads in or near riparian and wetland habitats.		Decreased fragmentation and degradation of riparian and wetland habitats
	15B2. Mitigate road effects by considering location, design, construction, and operation of roads that currently exist in or are unavoidably built near riparian and wetland habitats.	Road location, design, construction and operation	Decreased degradation of riparian and wetland habitats

Objectives	Strategies	Potential Indicators	Biological Outcome
15C: Maintain and restore the hydrologic regime in riparian and wetland habitats.	15C1. Restore beaver to riparian areas (e.g., Marys Creek, Sheep Creek).	Number of aquatic structures (e.g. dams, lodges), gravel embeddedness, temperature, channel width, variation in stream flow rates	Increased water availability for aquatic and terrestrial species
	15C2. Restore stream channels to natural condition (PFC).	Presence/absence of a defined stream channel, width to depth ratio, frequency of large pools, longitudinal profiles, residual pool depth, bank angles, shore depth, substrate, native community mosaic composition, soil quality (e.g., moisture, compaction)	Stream channels and wetland habitats in proper functioning condition
	15C4. Promote water conservation in the Bruneau subbasin.	Water supply and usage, groundwater condition	Riparian and wetland habitat conditions are preserved for aquatic and terrestrial species
16A. Minimize impacts of livestock grazing to shrub-steppe/dwarf shrub-steppe habitats and terrestrial species within the Bruneau subbasin.	16A1. Protect shrub-steppe/dwarf shrub-steppe habitat through land acquisition, conservation easements, and purchasing/retiring AUMs.	Acres protected, AUMs	Increased habitat quantity and connectivity for terrestrial species
	16A2. Adjust season of use and stocking rates of livestock grazing to maintain vegetative structure and composition	Soil compaction, erosion, nonnative invasive plants/noxious weeds; plant species composition, abundance, and survival	Increased habitat quality for terrestrial species
	16A3. In known sage grouse source and key habitats, implement grazing practices that would maintain habitat criteria for sage grouse breeding, brood rearing, and wintering; implement Owyhee and Jarbidge Sage Grouse Working Group management plans.	height and % canopy of sagebrush and grass–forb vegetation; sage grouse nesting and brood rearing success	Increased production of sage grouse populations

Objectives	Strategies	Potential Indicators	Biological Outcome
	16A4. Exclude cattle from known occupied slickspot peppergrass sites during periods of high soil moisture (spring thaw or following significant moisture events any time of the year).	Slickspot peppergrass presence/absence, abundance, productivity, survival, presence and abundance of nonnative invasive plants/noxious weeds	Protection and sustainability of known slickspot peppergrass sites
	16A5. Support core adaptive management projects and other research and monitoring recommendations for slickspot peppergrass outlined in the *Candidate Conservation Agreement*.		
	16A6. Adhere to recommendations and guidelines of existing state and federal management plans for bighorn sheep (IDFG, Nevada Department of Wildlife, BLM).	Bighorn sheep diet quality, productivity, movements, and habitat use	Decreased conflicts between livestock and bighorn sheep
	16A7. Develop grazing management practices to protect big game winter range.	Diet quality, food availability, survival, productivity, abundance, and population trends	Viable big game populations
	16A8. Maintain habitat in high-priority survey areas for pygmy rabbits.	Sagebrush % cover and height, soil depth; pygmy rabbit productivity, survival, population growth rate (λ), movements, and habitat use	Viable pygmy rabbit populations
	16A9. Support the development and implementation of effective restoration methods in shrub-steppe/dwarf shrub-steppe plant communities.	Nonnative invasive plants/noxious weeds, plant composition, and diversity	Vegetation communities that support multiple uses (e.g., terrestrial species and grazing)

Objectives	Strategies	Potential Indicators	Biological Outcome
16B. Reduce the intensity, frequency, and size of wildfire in shrub-steppe/dwarf shrub-steppe habitats of the Bruneau subbasin.	16B1. Support the BLM's fire suppression priorities to protect areas identified as biologically important.	Fire frequency, intensity, size	Protection of biologically important areas
	16B2. Develop and fund effective restoration methods and work to restore areas damaged by fire to native vegetative communities, through the reduction of cheatgrass densities and seeding with native plant species.	Cheatgrass abundance, reseeding success	Restoration of native vegetation communities
	16B3. Establish and fund native nurseries for post-wildfire rehabilitation.	Affordable and available native seed	Restoration of native vegetation communities
16C. Limit noise disturbance to shrub-steppe wildlife species.	16C1. Limit military training disturbance (e.g., people, aircraft, and emitter sites) of sage grouse by adhering to avoidance actions and seasonal restrictions outlined in the *Integrated Natural Resource Management Plan for Mountain Home Airforce Base* (CH2M HILL 2004).	Sage grouse movements, habitat use, survival, and productivity in areas of military training vs. nontraining	Viable sage grouse populations
16D. Reduce the prevalence of crested wheatgrass in the shrub-steppe habitats of the Bruneau subbasin.	16D1. Work to restore high-quality shrub-steppe habitat in areas currently dominated by crested wheatgrass. Prioritize areas where sagebrush connectivity could be established or expanded (e.g., lower Clover Creek)	Crested wheatgrass abundance, native vegetation abundance	Restoration of native vegetation communities

Objectives	Strategies	Potential Indicators	Biological Outcome
16E. Protect existing high-quality shrub-steppe/dwarf shrub-steppe plant communities while reducing the extent and density of nonnative invasive plant species and noxious weeds in the Bruneau subbasin.	16E3. Minimize ground-disturbing activities in shrub-steppe habitats highly susceptible to invasion by nonnative plant species and noxious weeds.	Abundance of nonnative plant species and noxious weeds, plant community species diversity	Protection of existing high-quality shrub-steppe/dwarf shrub-steppe plant communities
	16E4. Encourage the use of weed-free seeds and feeds.	Abundance of nonnative plant species and noxious weeds, plant community species diversity	Prevention of nonnative invasive plant and noxious weed seed dispersal
	16E5. Develop and implement programs and policies designed to limit the transportation of weed seeds from vehicles and livestock.	Public participation, local policy	Prevention of nonnative invasive plant and noxious weed seed dispersal
	16E6. Develop education and awareness programs in noxious weed identification, spread prevention, and treatment.	Public participation, success of education programs	Expedient identification of problem plants, prevention of nonnative invasive plant and noxious weed seed dispersal, and treatment of infestations
	16E9. Treat areas infested with nonnative invasive plants and noxious weeds.	Abundance of nonnative plant species and noxious weeds	Restoration of shrub-steppe/dwarf shrub-steppe plant communities
	16E11. Organize, develop, and support Cooperative Weed Management Area(s) (CWMAs) within the Bruneau subbasin (*Idaho's Strategic Plan for Managing Noxious Weeds*) that will facilitate cooperative partnerships and probability of success for strategies 15E1 through 15E6.		Cooperative partnerships and increased probability of success for protection and restoration of shrub-steppe/dwarf shrub-steppe habitat

Objectives	Strategies	Potential Indicators	Biological Outcome
	17A2. Ensure that grazing by wildlife and livestock does not exceed 40% of the total annual growth during the growing period; 50%, during the plant dormancy period (NRCS 2003). Or allow livestock to graze fourwing saltbush only during winter (dormancy period) (Smoliak et al. 2003).	Annual growth and abundance of fourwing saltbush	Maintenance of fourwing saltbush for livestock and wildlife
17A. Encourage maximum plant performance in desert playa habitats.	Minimize livestock use of high-quality desert playa habitat	Abundance of nonnative plant species and noxious weeds, plant species composition, and diversity	Protection of high-quality desert playa habitat
17B. Reduce livestock-facilitated invasions of nonnative invasive species and noxious weeds into desert playa habitat.	17C1. Avoid construction of new roads in desert playa habitat.		Decreased fragmentation and degradation of desert playa habitat
17C. Minimize adverse effects of roads in desert playa habitat.	17C2. Mitigate road effects by considering location, design, construction, and operation of roads that are unavoidably built in proximity to desert playa habitat.	Road location, design, construction and operation	Decreased degradation of desert playa habitat
	17C3. Rehabilitate roadsides in disturbed areas with fourwing saltbush and other native plant species.	Erosion, plant species composition	Promotion of native plant communities and prevention of erosion in disturbed road areas
	18A1. Implement strategies to prevent and control nonnative invasive plant species and noxious weeds (see terrestrial objective 15E).	See shrub-steppe/dwarf shrub-steppe indicators (terrestrial objective 15E)	Habitat is provided for big game and other wildlife species

Objectives	Strategies	Potential Indicators	Biological Outcome
18A. Maintain vegetative composition and structure of western juniper and mountain mahogany woodland habitats in the Bruneau subbasin.	19A1. Implement annual grazing practices in which livestock crop no more than 50 to 60% of the palatable forage within aspen stands (Debyle and Winokur 1985).	Density of palatable forage (no more than 50–60% cropped annually)	Aspen habitat is available for terrestrial species
19A. Reduce the impacts of livestock grazing on aspen habitats in the subbasin.	19A2. Protect small, isolated aspen stands with exclosures during the growing period.	Density of palatable forage, ground cover, number of aspen saplings	Small stands of aspen remain viable and will be available for wildlife species
	19B1. Maintain aspen stands with a variety of size classes across the landscape through treatments (clearcuts or burns) 40 to 240 acres (15–100 ha) in size (Debyle and Winokur 1985).	Aspen stand age and size class and how these vary across the landscape	Maintenance of aspen stands with a variety of size classes across the landscape to mimic natural processes
19B. Maintain viable stands of aspen through management practices encouraging and/or emulating natural fire processes.	19B2. Implement fire management in upland aspen that promotes moderately intense fires with rotations of 40 to 80 years.	Stand age, fire history	Prevention of conifer encroachment
	19C1. Protect northern goshawk nesting territories from timber harvest.	Goshawk territorial defense behavior, nest	Nesting habitat for northern goshawks
19C. Retain viable stands of aspen for native terrestrial species associated with upland aspen habitats	19C2. Monitor and evaluate northern goshawk populations and their associated prey species in the Bruneau subbasin.	Abundance (population trends), productivity, survival, movements, habitat use	Evaluation of terrestrial communities associated with upland aspen habitats (northern goshawks, small mammals, avifauna)
	20B2. Improve the documentation and data-sharing efforts of the Idaho Conservation Data Center and the Nevada Natural Heritage Program within the subbasin.	Ease and accessibility of subbasin specific data	Efficient management of rare terrestrial species and communities

Objectives	Strategies	Potential Indicators	Biological Outcome
20A. Increase understanding of the composition, population trends, habitat requirements, and impacts of management activities on terrestrial communities of the Bruneau subbasin.			

7.4 Appendix D: Statements of Loss

Shoshone-Paiute Tribes of the Duck Valley Indian Reservation

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 (2004) 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.

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

Walker, Deward E. 2004. Fishing Research for the Shoshone-Paiute of the Duck Valley Indian Reservation Relating to Subbasin Planning. Boulder, Colorado.

7.5 Appendix E: Socioeconomic Data

7.5.1 Demographic Comparison by State

The Bruneau subbasin lies within the States of Idaho and Nevada. Idaho ranks 39th among the states in population and 11th in size. The projected population of Idaho in 2025 is approximately 1.7 million, compared to 2.3 million in Nevada (Figure 5) (U.S. Census Bureau 2000a). The human population in the subbasin is very low. Bruneau, the largest town in the area, has a population of approximately 300 people (Berenbrock 1993). In the Jarbidge River watershed, the population peaked at 1200 people in 1911 during the mining boom. With the decline of mining, the population began a slow decline until the last commercial mine closed in 1932 (Parrish 1998). Less than 50 full-time residents currently live in the town of Jarbidge (Parrish 1998). Steep topography, frequent flooding, and isolation from public services have limited urban development (Parrish 1998).

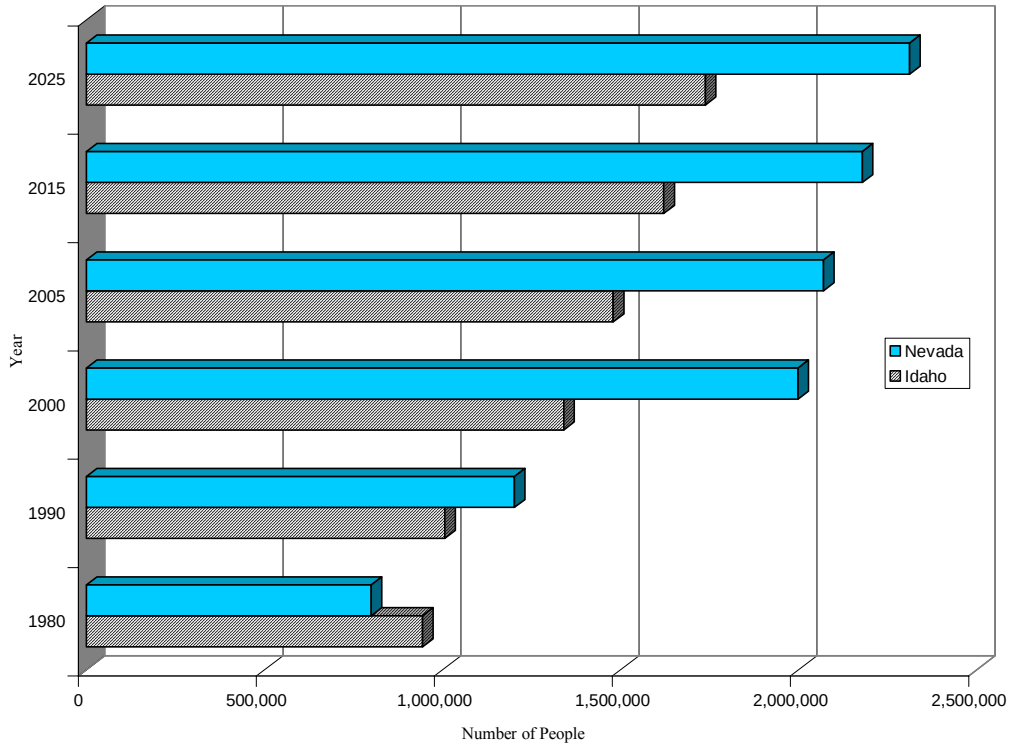

Figure 5. Past and projected populations of Idaho and Nevada.

7.5.2 Demographic Comparison by County

Two counties lie within the Bruneau subbasin, Owyhee County in Idaho and Elko County in Nevada. Owyhee County occupies the majority of the land (75.8%) within the subbasin.

Although Owyhee County contributes the 75.8 percent of the land base in the Bruneau subbasin, Elko County is currently over 4 times more populated (Figure 6) (US Census 2000a).

Although Elko's population is higher than Owyhee's, the major population centers of Elko (such as the City of Elko) lie outside of the Bruneau subbasin. The town of Jarbridge is the only population center in Elko County that lies within the subbasin. The towns of Bruneau, Hot Springs and Grasmere in Owyhee County are all within the Bruneau subbasin.

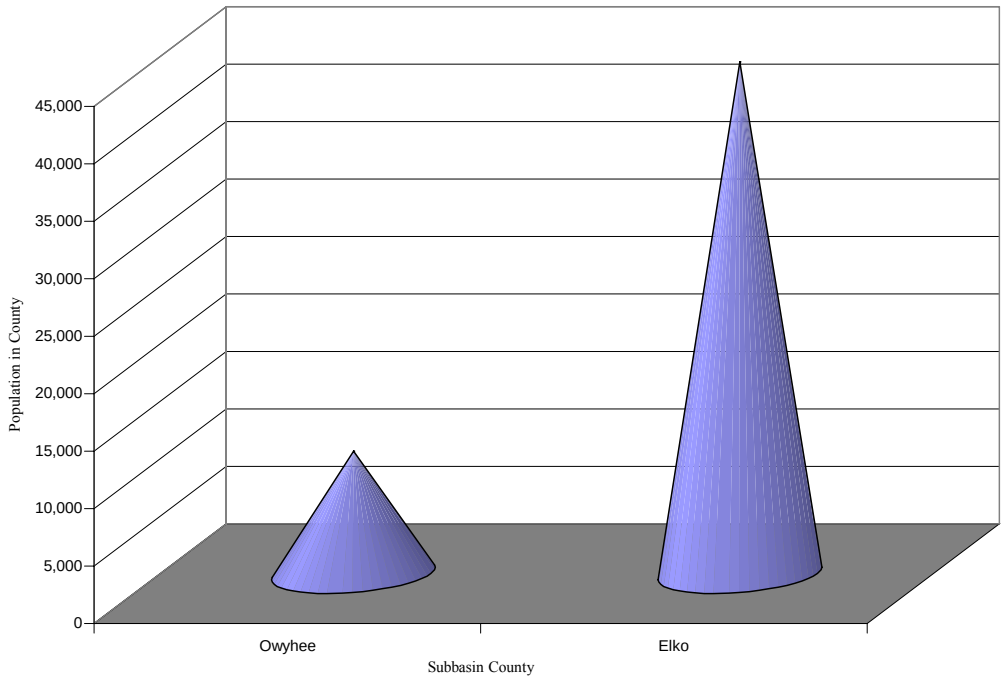

Figure 6. Population of counties (Owyhee, ID, and Elko, NV) in the Bruneau subbasin in 2002 (figures represent entire county populations as calculated by US Census (2002a).

Owyhee County had a relatively low population growth rate from 1980 to 2002 in comparison to Elko County (Figure 7) (WSU 2003, IDOC 2003). From 1980 through 2002, Elko's population grew from approximately 17,000 to over 44,000. The population of Owyhee grew by 2,500 (8,100 to 10,600), a growth rate of 31%. There was no corresponding increase in business and industry in Owyhee County. The growth can most likely be attributed to people who moved to Owyhee County but continued to work in neighboring Canyon County.

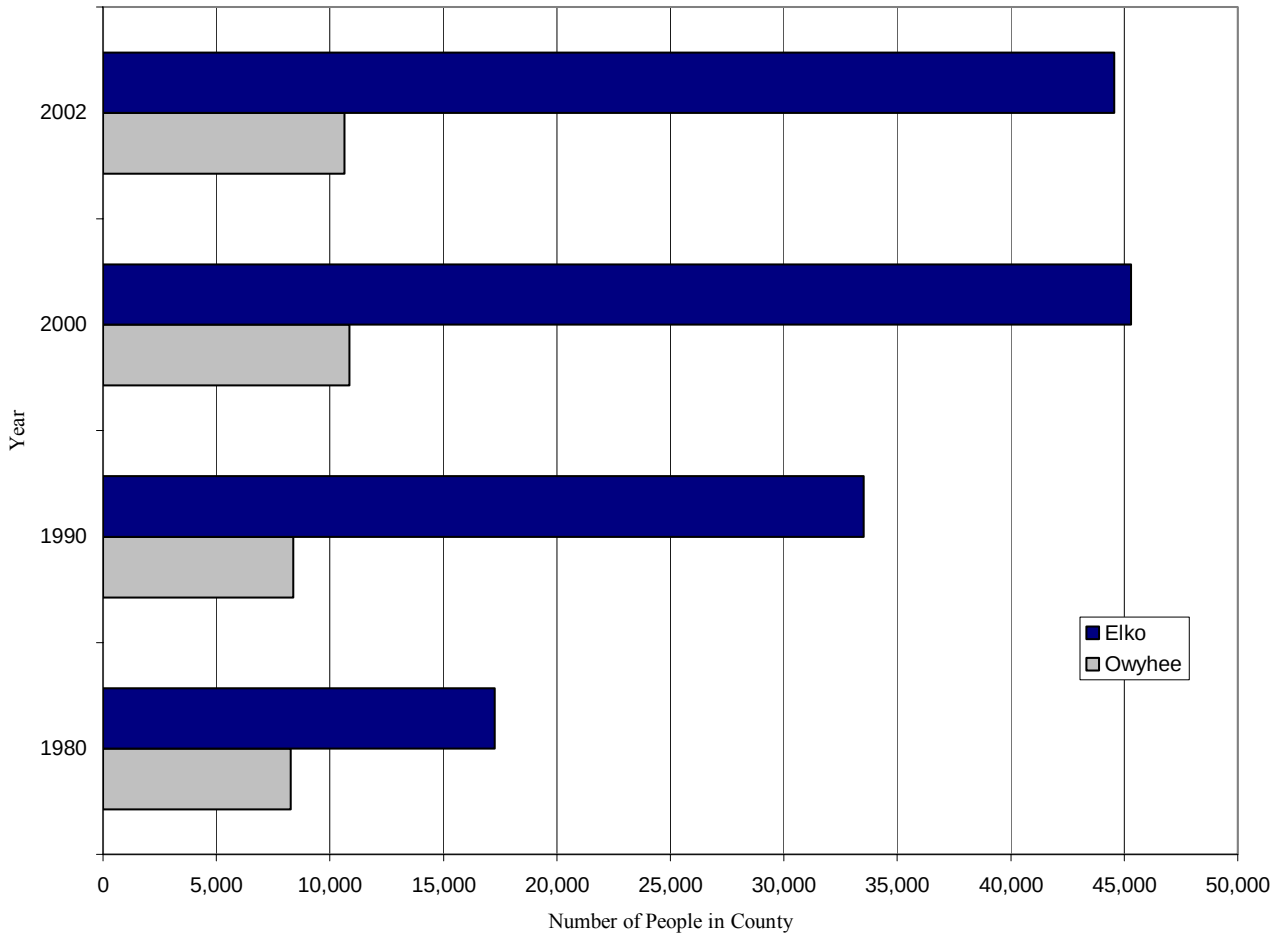

Figure 7. Population of Counties (Owyhee, ID, and Elko, NV) in the Bureau subbasin from 1980 to 2002.

Forest and rangeland make up 79.7 percent of the land in Idaho. Agricultural land makes up 14.6 percent of the land mass in the state, while urban land use is only .4 percent. However, in heavily populated counties like Ada and Canyon, agricultural land is being developed as land values when used for development increase at a substantially higher rate than the values when the land is used for agriculture.

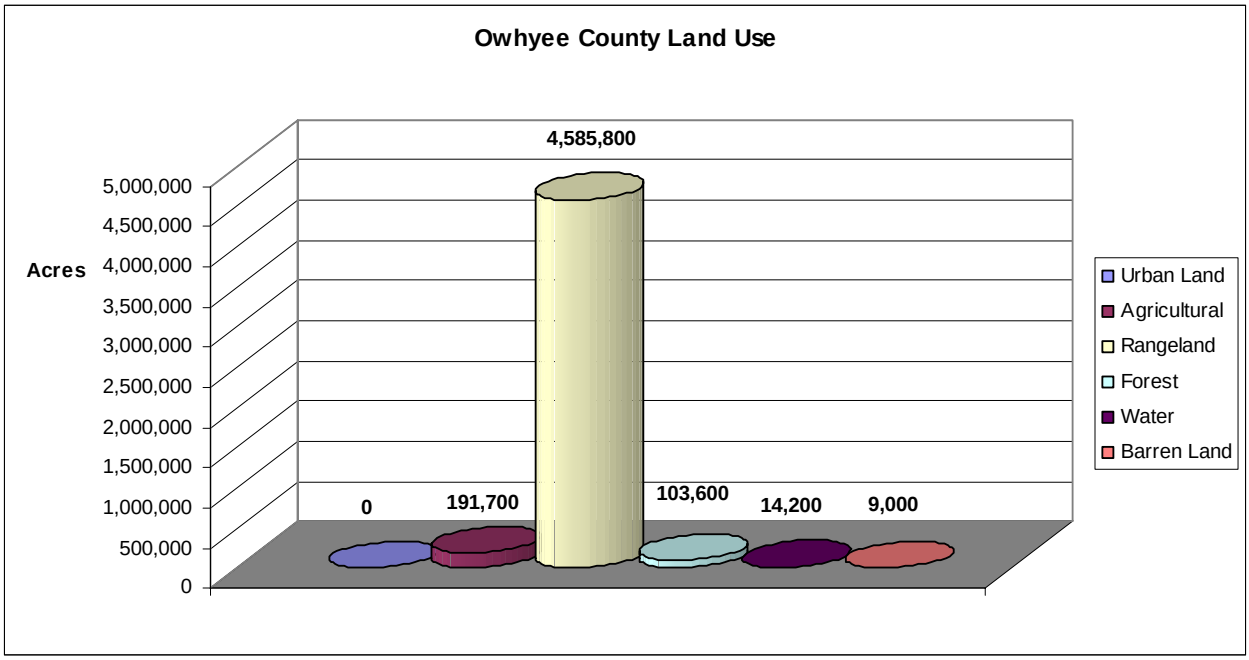

Figure 8. Owyhee County Land Use

Owyhee County is located in southwestern Idaho, bordering Oregon and Nevada. It ranks 25th among Idaho counties in population and 2nd in area, with approximately 76% of land federally owned. The primary use of land in Owyhee County is used for rangeland.

7.5.3 Division of Land

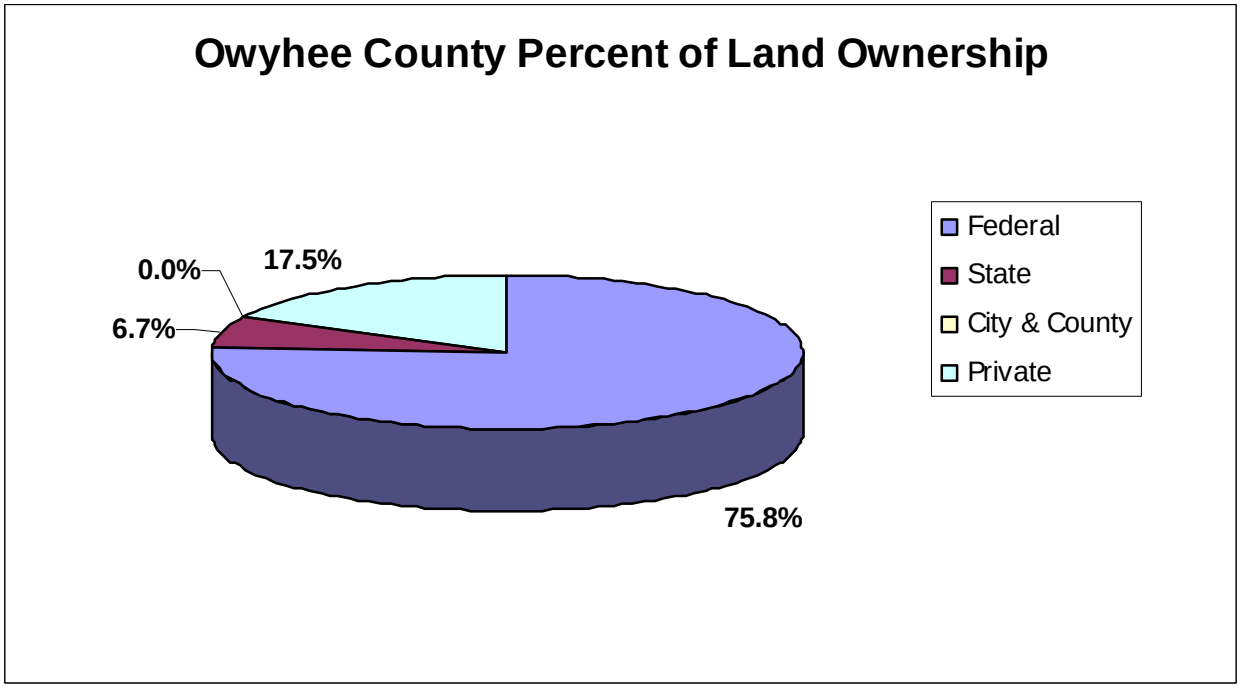

Figure 9. Owyhee County Land Ownership

Approximately 76 percent of Owyhee County is federally owned. Private ownership accounts for 17.5 percent.

7.5.4 Economics

7.5.4.1 Employment by Industry

The major source of employment in Owyhee County has historically been agriculture. Currently, agriculture remains the largest employment sector (1,100 employees), followed by the service-oriented industries such as state and local government (610); services (500); retail trade (460); construction (250); transportation, communication, and utilities (200); and manufacturing (160). However, there has been a trend over the past several decades of a decline in the agriculture sector and an increase in the services sectors (Figure 10) (IDOC 2003).

In contrast to the historic and as yet important agriculture sector of Owyhee County, the service sector is the largest sector in Elko County (over 10,000 employees).

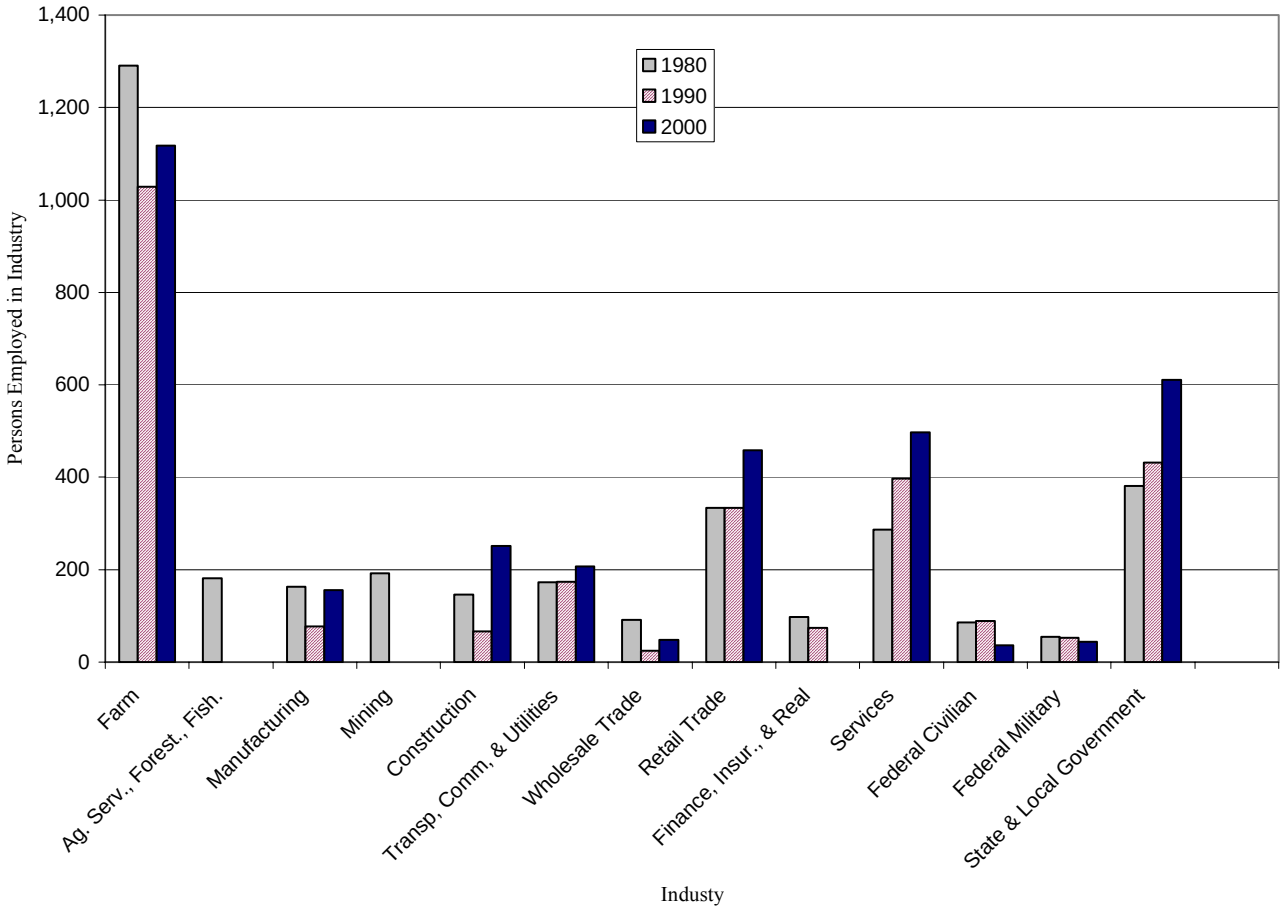

Figure 10. Employment by industry in Owyhee County, which represents 76% of the Bruneau subbasin's employment.

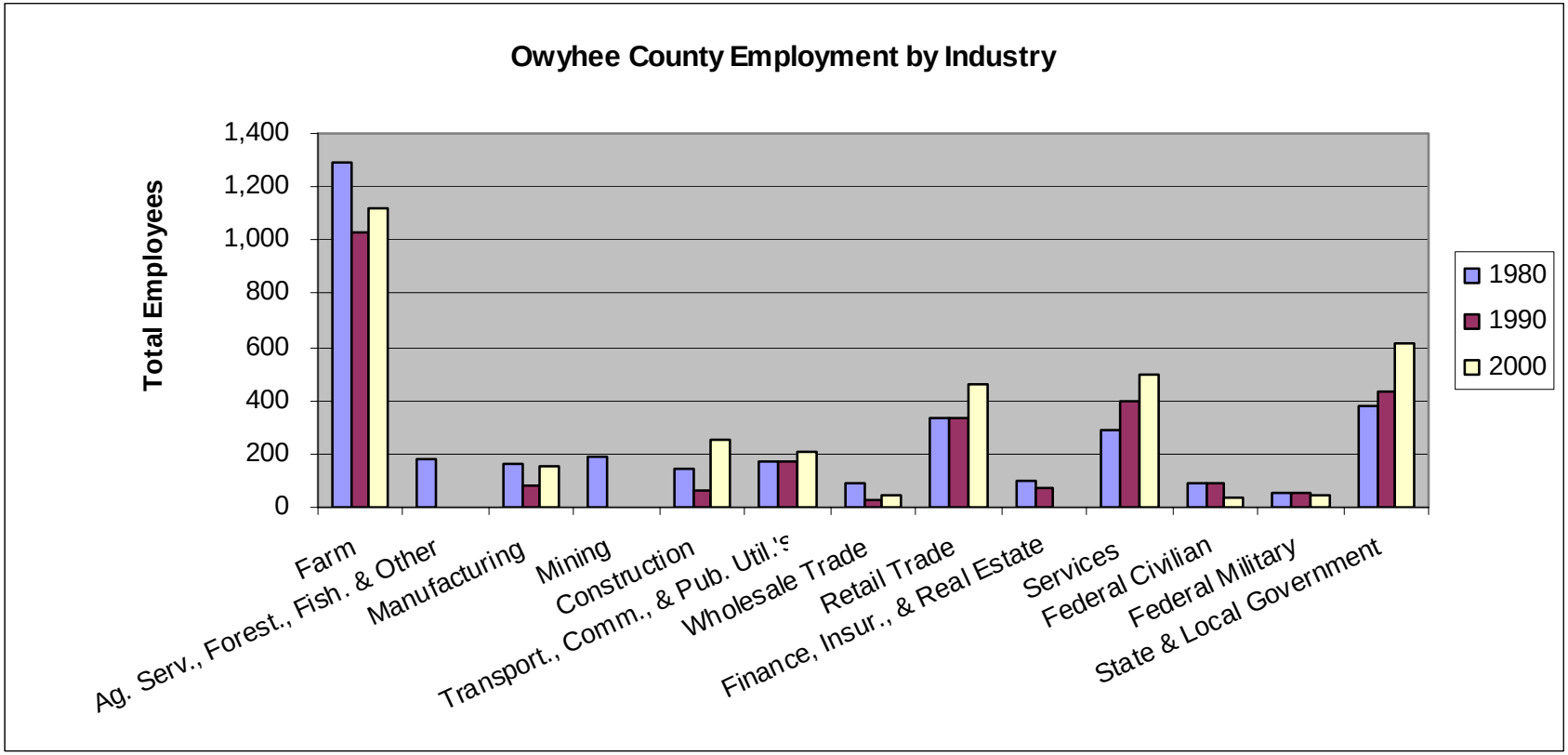

Figure 11. Owyhee County Employment by Industry

Agriculture along the Snake and Bruneau Rivers forms the economic base, and government and trade provide additional employment. Major employers include Filler King Company, J.R. Simplot Company, Marsing Farm Labor Sponsoring Community, Paul's Market, Vance Dairy Construction, Homedale and Marsing School Districts, U.S. Ecology – Idaho, Owyhee County Government, and Owyhee Health & Rehabilitation.

7.5.5 Employment by Recreation and Tourism

The recreation and tourism industry is hard to measure on a county basis. The State of Idaho has a travel and convention room tax, which can be used to measure the use of motels and hotels in a county; however, that includes business travel as well as recreational travel. It does not provide any figures for the number of people who recreate without using hotels or motels. The counties with the largest collection of this tax tend to be those like Ada and Canyon Counties with convention facilities or resort areas such as those in Blaine County with Sun Valley or Kootenai County with the Coeur d'Alene Resort (Figure 12).

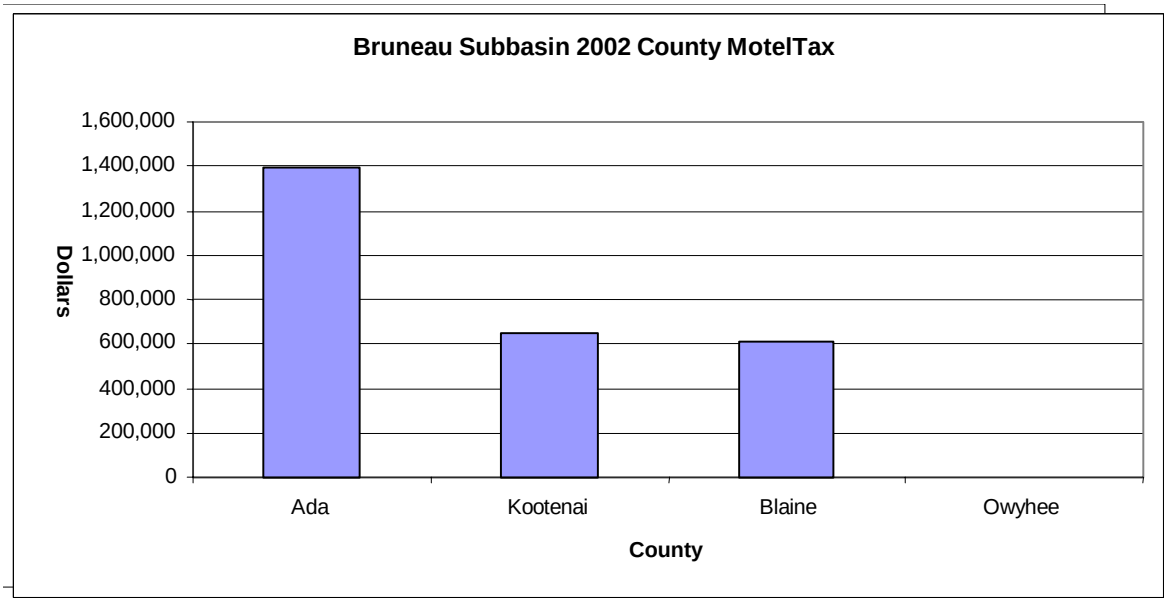

Figure 12. Comparison of travel and convention tax amounts.

In 2000, Owyhee County only collected $1,534 in travel and convention room tax.

The *2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation* (USFWS 2003) report is based on "interviews with U.S. residents about their fishing, hunting and other wildlife-related recreation." The survey sampled enough people to make statistically sound estimates. Those sampled are asked to estimate the amount of money spent on hunting, fishing and wildlife related activities in two areas: equipment purchases and trip expenditures. The 2001 survey found a total of 868,000 U.S. residents participated in wildlife-associated recreation in Idaho in 2001, spending a total of $982 million. Trip-related expenditures were $296 million and equipment purchases totaled $552 million with $134 million spent on "licenses, contributions, land ownership, leasing and other items and services."

Fishing: According to the survey, 261,000 Idaho residents and 155,000 non-residents (16 and older) fished in Idaho in 2001. Residential and non-residential fishermen spent $310,872,000 on

equipment and trips. The average per angler was $718 that included average trip expenditures of $29 per day.

Hunting: There where 151,000 Idaho residents and 46,000 non-residents who hunted in the state in 2001. Residential and non-residential hunters spent $230,841,000 on equipment and trips. The average per hunter was $1,136 that included average trip expenditures of $40 per day.

Wildlife Watching: This category includes those activities whose primary purpose was observing, photographing or feeding wildlife. There were 388,000 Idaho residents and 255,000 non-residents who participated in wildlife watching in Idaho in 2001. Total expenditures were $227,470,000, which averaged $354 per participant for equipment and trips. Idahoans spent $32,813,000 for wildlife watching activities out-of-state while non-residents spent $88,757,000 for equipment and trips in state.

According to the survey, "the sum of anglers, hunters, and wildlife watchers exceeds the total number of participants in wildlife-related recreation because many individuals engaged in more than one wildlife activity."

The International Association of Fish and Wildlife Agencies modeled the survey data (Southwick Associates 2001) and estimated the number of jobs created in Idaho from all hunting activities 6,197. The number of jobs created from all fishing activities was not modeled, but higher expectations could be made based on the higher percentage of fishing expenditures (57%) in comparison to hunting expenditures in Idaho. However, some of the jobs could be related to both hunting and fishing. Rural community economies are generally considered to benefit from hunting and fishing activities, while some are highly dependent on it (Southwick Associates 2001).

A summary of 2002 resident hunting and fishing license sales by county illustrates the areas where most sportsmen live in the subbasin (assuming people buy licenses in the county of their residence). Elko County had a higher number of license sales in 2002 than Owyhee County (

Figure 13. Resident hunting and fishing license sales in 2002 for counties in the Bruneau subbasin.

) (IDFG 2003, NDOW 2003).

The *1991 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation: Idaho* found 49% of all hunters and 52% of freshwater anglers traveled less than 25 miles to the sites they used most often (

Figure 13. Resident hunting and fishing license sales in 2002 for counties in the Bruneau subbasin.

) (USFWS and U.S. Census Bureau1993).

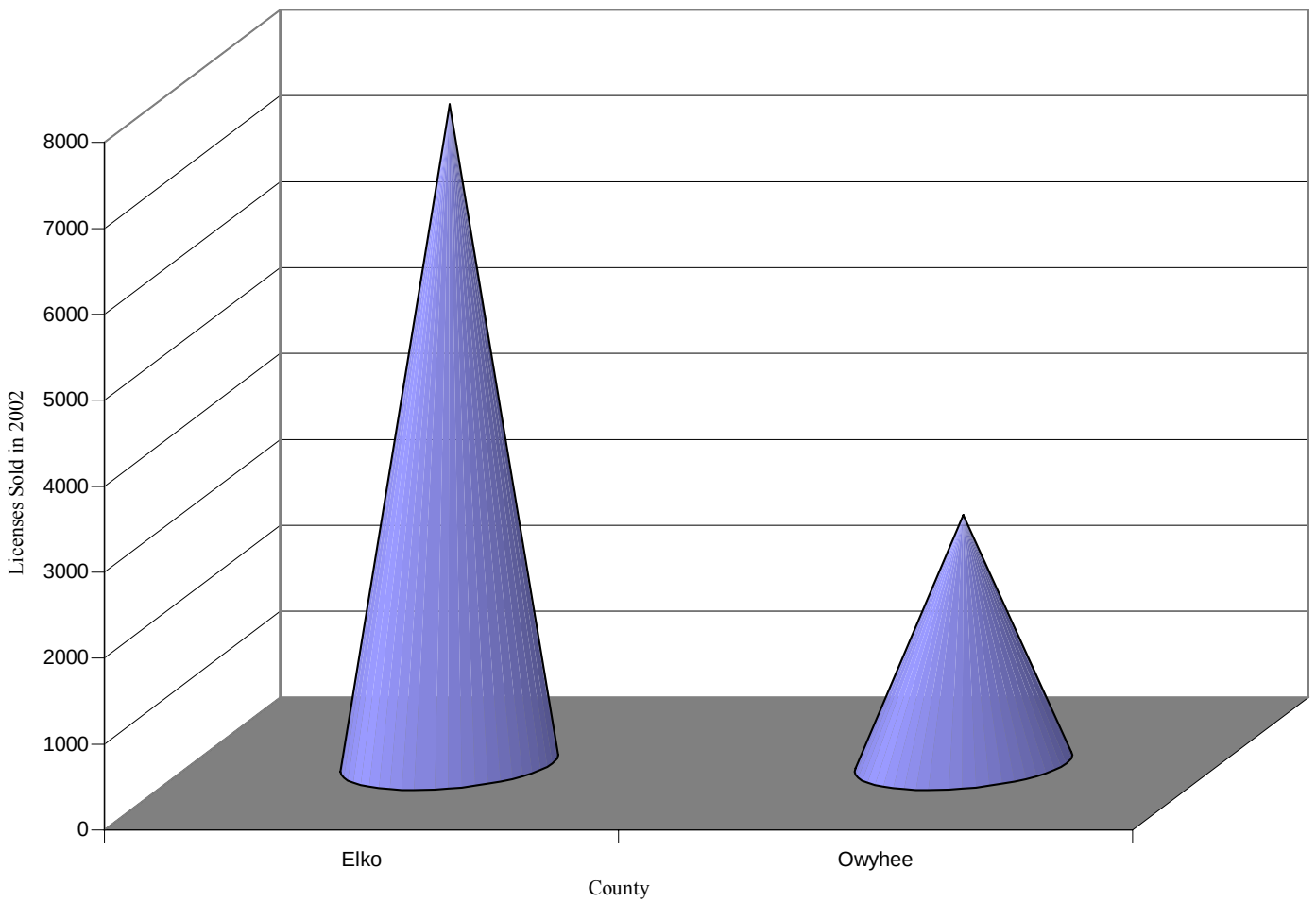

Figure 13. Resident hunting and fishing license sales in 2002 for counties in the Bruneau subbasin.

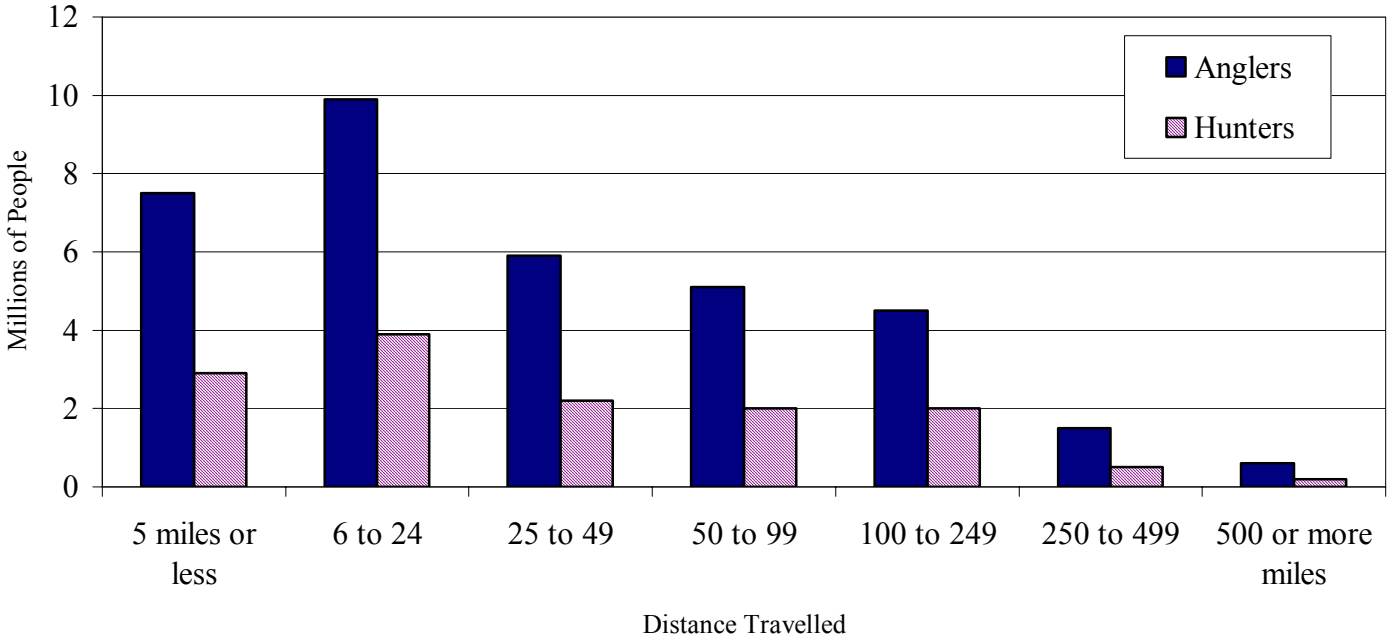

Figure 14. Distance traveled one way to sites used most often by hunters and anglers.

Income

Per capita income currently ranks highest in Nevada when compared to the United States, the State of Idaho, and an average of counties in the Bruneau subbasin (WSU 2003, US Census Bureau 2000b). The average per capita income in the subbasin was higher than the United States in 1980 and 1990, but fell below by the year 2000. The Bruneau subbasin tends to follow the per capita income trend in Idaho more closely than income and growth experienced in Nevada (Figure 15).

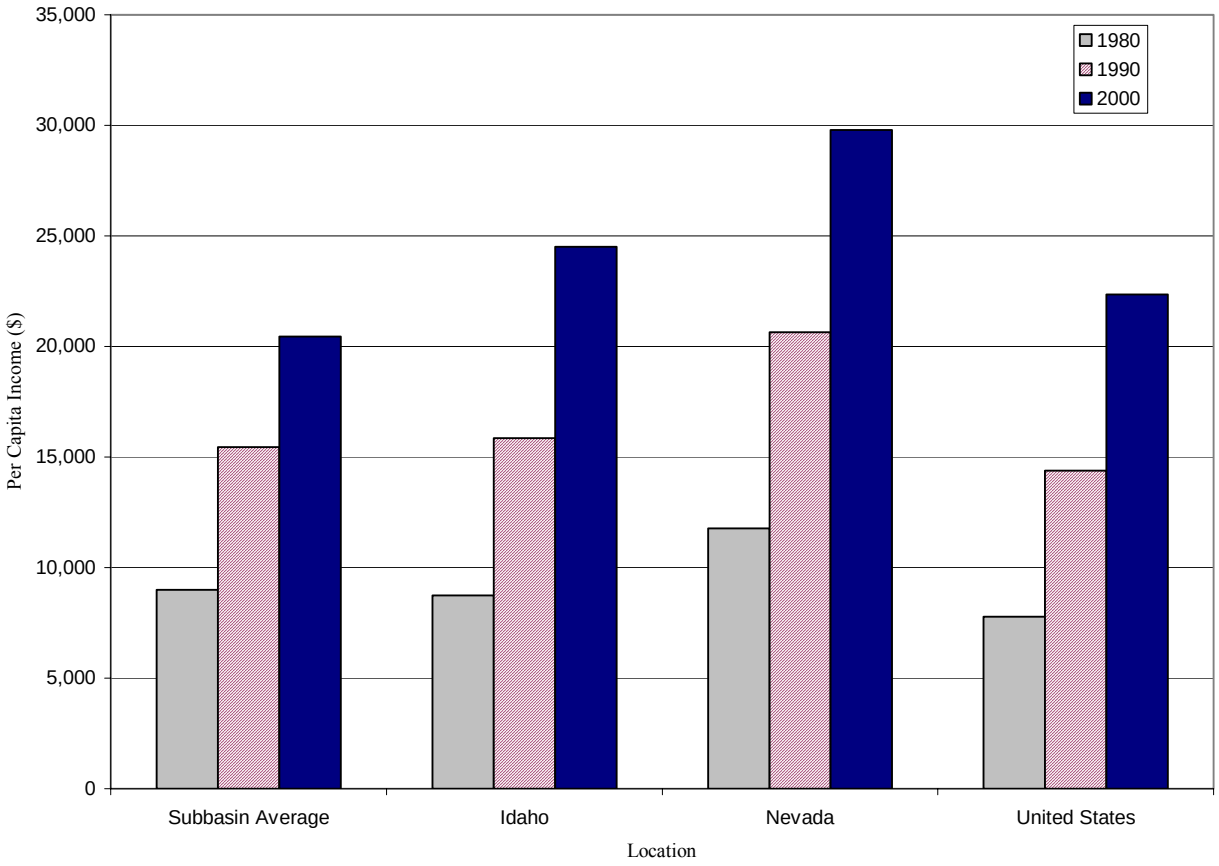

Figure 15. Per capita income trends from 1980–2000 in the the Bruneau subbasin, Idaho, Nevada, and the United States

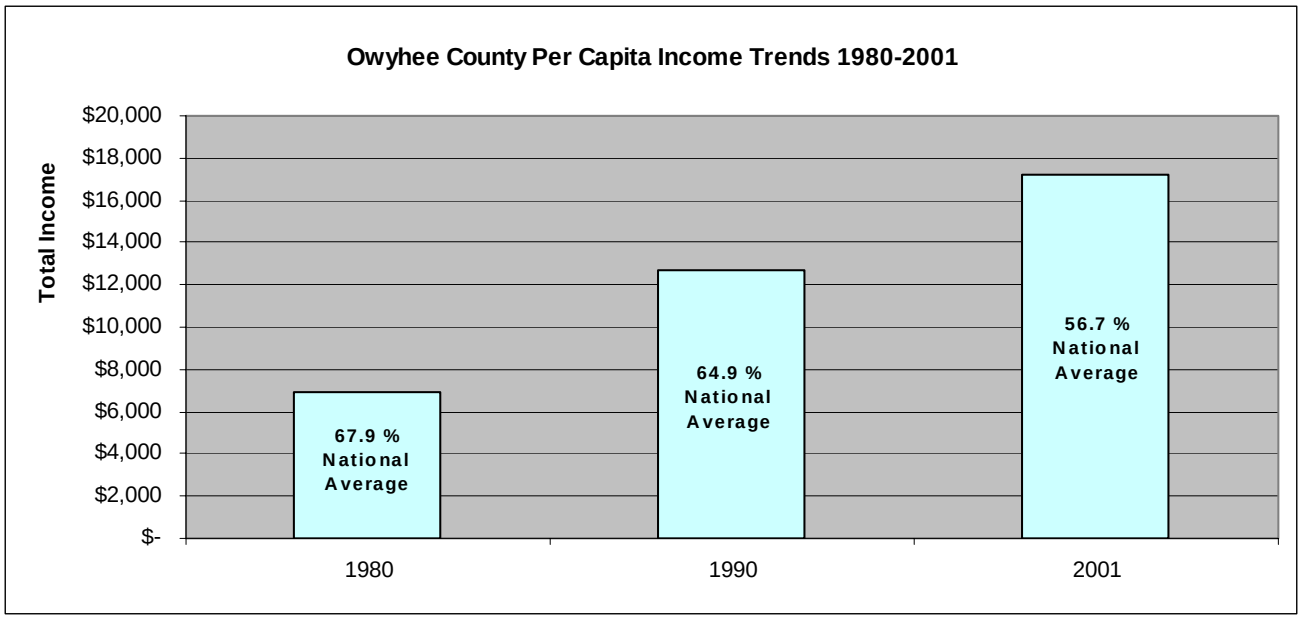

Figure 16. Owyhee County per capita income trends 1980-200, including a comparison with the national average

Unemployment

The civilian labor force unemployment rate decreased from 1980 to 2000 in the United States, Nevada, Idaho and counties in the Bruneau subbasin (Figure 16). In 1980, unemployment was highest in Idaho and lowest in the Bruneau subbasin.

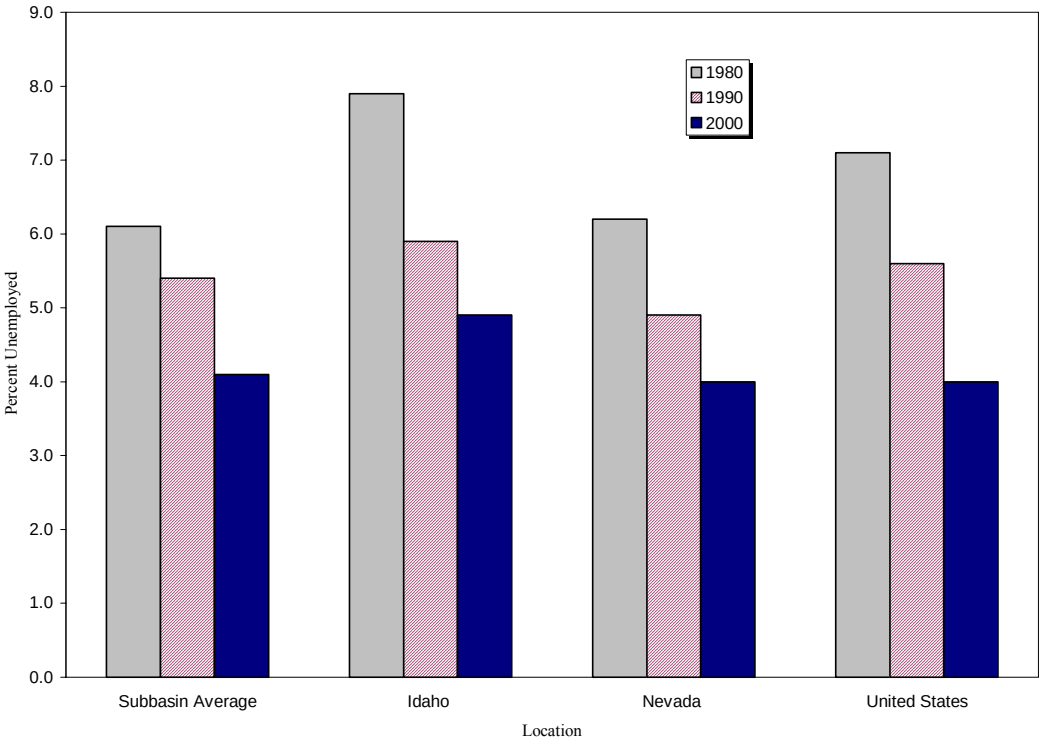

Figure 17. Percent civilian labor force unemployment trends from 1980–2000 in the Bruneau subbasin, Idaho, Nevada, and the United States.

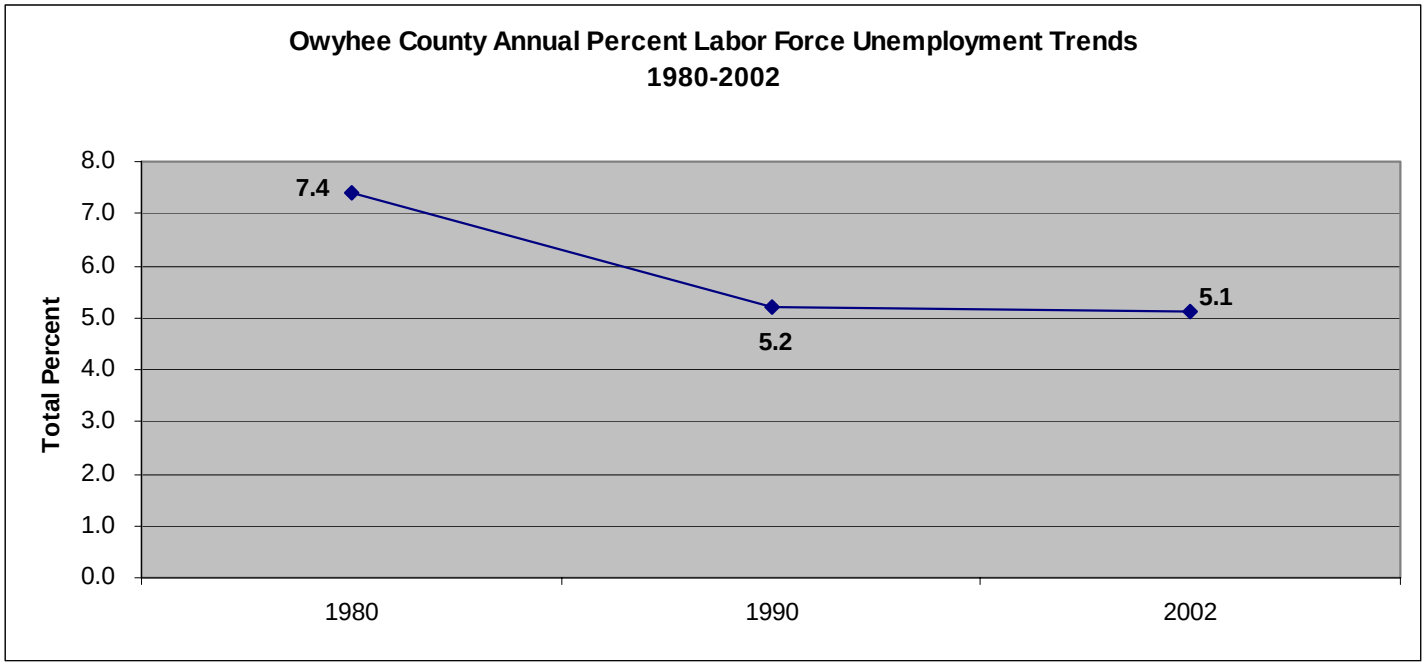

Figure 18. Owyhee County annual percent unemployment trends 1980-2002.

Poverty

The percentage of people below the poverty level in 1999 was highest in counties within the Bruneau subbasin (12.9%), closely followed by the United States (12.4%). In Idaho, 11.5% of the population lived below the poverty level, while in Nevada only 10.5% did (Figure 18) (U.S. Census Bureau 2000b, IDOC 2003).

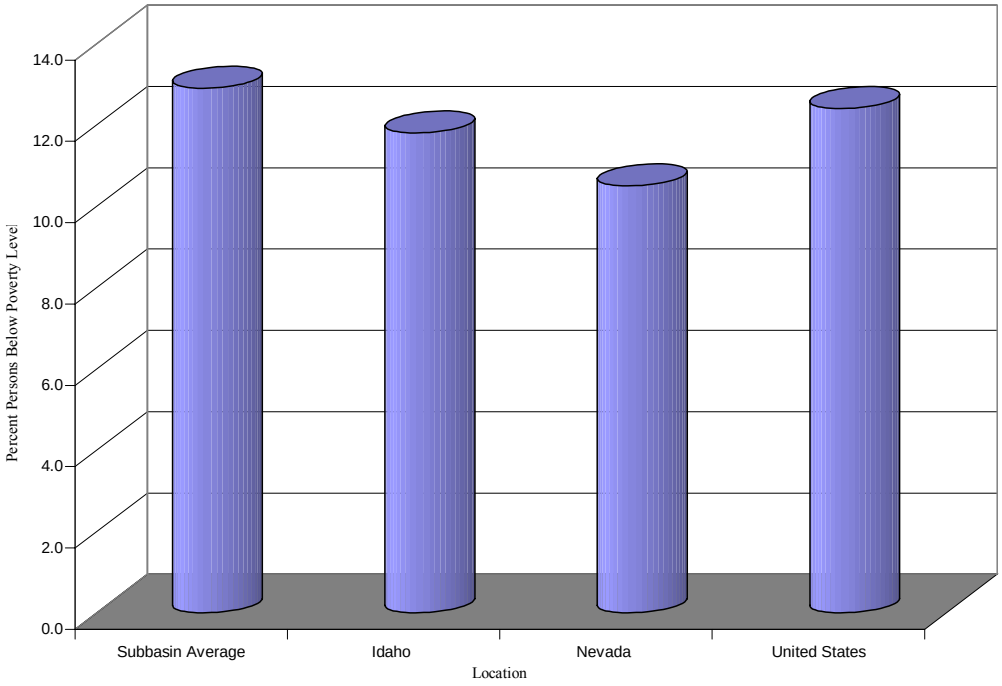

Figure 19. Percentage of people below the poverty level (1999) in the Bruneau subbasin, Idaho, Nevada, and the United States.

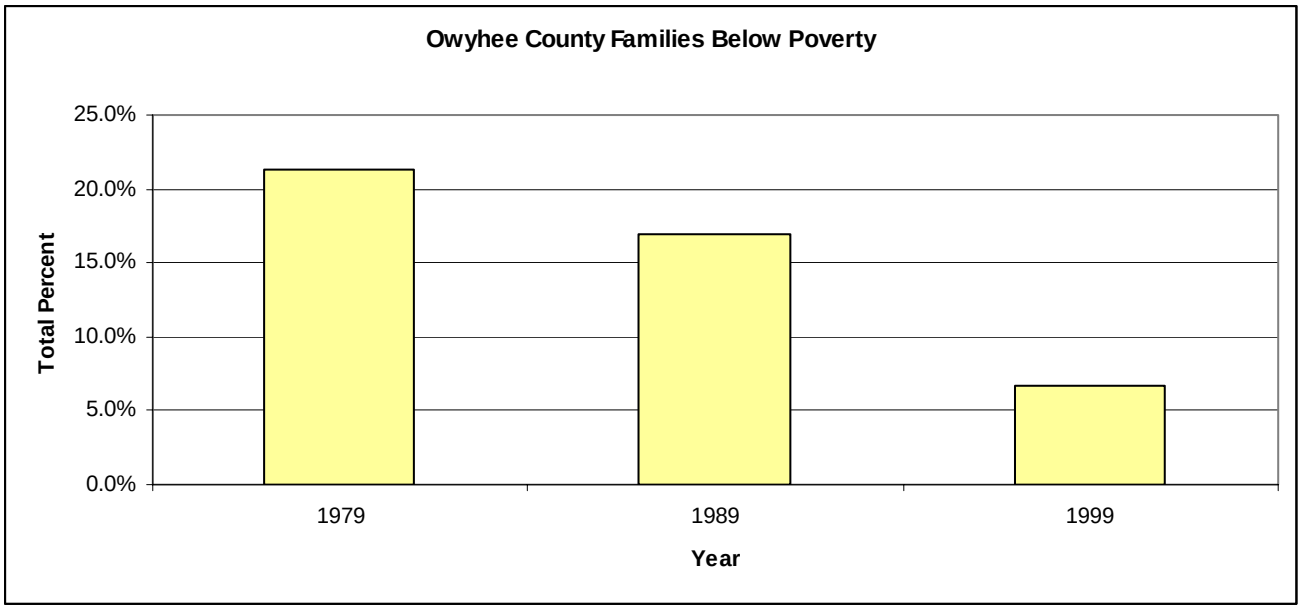

Figure 16. Owyhee County families below poverty trends

In conclusion, unemployment is below the United States average in Idaho and above the United States average in Nevada. The State of Idaho is less populated and has lower per capita incomes than the State of Nevada. Owyhee County in Idaho has a traditionally agricultural economy, but like many western Counties is experiencing a rise in the service sector. The service industries are the most important in Elko County, Nevada, and are on the rise.