4 Inventory/Synthesis

4.1 Inventory

The project inventory section provides a list of fish and wildlife restoration activities being conducted in each watershed in the Snake Snake Headwaters, Upper Snake, and Closed Basin subbasins, along with information about who is responsible for funding projects. Inventory information was collected from technical and planning team participants, from websites of funding and implementation agencies, and through interviews with nonparticipants. Due to the size of the Upper Snake province and the number of agencies, nonprofit organizations, and private parties actively engaged in fish and wildlife restoration activities, it is unlikely that all activities that have taken place in the last five years have been captured. However, the information provided is believed to be representative of the types of activities taking place.

4.1.1 Existing Protection

The Upper Snake province contains roadless and other protected areas, including land under wilderness and National Park designations and some unique areas such as Craters of the Moon National Monument and Idaho National Engineering and Environmental Laboratory (discussed in section 1.6.4 of this assessment). The Snake Headwaters subbasin contains the largest amount of protected area, estimated at one-third of the total area of the subbasin. The Upper Snake subbasin has an estimated 10% of its total area protected, with the largest portion associated with Idaho National Engineering and Environmental Laboratory and Craters of the Moon National Monument. Protected areas in the Closed Basin subbasin are primarily inventoried roadless areas.

4.1.2 Existing Management Plans and Programs

Existing management plans, programs, and initiatives with significance to fish, wildlife, water resources, riparian areas, and/or upland areas for subbasins within the Upper Snake province were reviewed in the respective subbasin summary documents (NPPC 2002a, Snake Headwaters, p. 206–221; NPPC 2002b, Upper Snake, p. 100–104; NPPC 2002c, Henrys Fork, p. 76–86; NPPC 2002d, Closed Basin, p. 102–113, NWPPC 2002e).

An important and ongoing management program includes mitigation for the Palisades and Minidoka federal hydropower projects under the Southern Idaho Wildlife Mitigation Project. The project cooperators, including the Idaho Department of Fish and Game (IDFG), Shoshone-Bannock Tribes, and Shoshone–Paiute Tribes, implement the project under authority of the Northwest Power and Conservation Council (NPCC, formerly the Northwest Power Planning Council or NPPC) as funded by the Bonneville Power Administration (BPA).

In 1984, the BPA funded an analysis of impacts on wildlife and wildlife habitat as a result of construction and operation of the U.S. Bureau of Reclamation's Palisades Project in eastern Idaho. The Habitat Evaluation Procedure (HEP) was used to evaluate pre-and post-construction habitat conditions of the Palisades Project. Eight evaluation species were selected, and losses were expressed in the number of habitat units (HUs). One HU is equivalent to one acre of prime habitat. The evaluation estimated that a loss of 2,454 HUs of mule deer habitat, 2,276 HUs of mink habitat, 2,622 HUs of mallard habitat, 18,565 HUs of bald eagle breeding and wintering habitat, and 1,336 and 704 HUs of forested and scrub-shrub wetland habitat for nongame species, respectively, occurred as a result of the project. A comparison of

pre- and post-construction flow conditions on the South Fork Snake River below the dam could not substantiate the claims that water releases from the dam were causing more Canada goose nest losses than flow in the river prior to construction (Martin and Hansen 1993). In 1986, under direction of the NPPC, the Conservation Act of 1980, and the subsequent NPPC Columbia River Basin Fish and Wildlife Program, projects were developed to mitigate the losses of wildlife habitat and annual production due to development and operation of the Palisades Project. A modified Habitat Evaluation Procedure (HEP) was used to assess the benefits of the preferred mitigation plan to wildlife. A total of 37,068 HUs were estimated to have been lost as a result of inundating the Palisades Reservoir area. Through a series of protection and enhancement projects, the intent of the preferred mitigation plan was to provide benefits of an estimated 37,070 HUs. Target species to be benefited by this mitigation plan included bald eagle, mule deer, elk, mallard, Canada goose, mink, yellow warbler, black-capped chickadee, ruffed grouse, and peregrine falcon (Sather-Blair and Preston 1985). The mitigation plan identified 18 potential projects in Idaho and Wyoming to mitigate losses for all target species. The South Fork Snake River proposal, which included the protection and enhancement of 3,200 acres of bald eagle and other wildlife habitat below Palisades Reservoir, was ranked highest of the proposals in Idaho.

In early 1990, the NPPC and IDFG developed a public review document that included a summary of the Palisades Project's wildlife losses and mitigation goals and objectives. It was distributed statewide and announced in local newspapers, local government publications, and the NPPC monthly newspaper. During the Columbia Basin Fish and Wildlife Authority and BPA implementation planning process, the South Fork Snake River area was ranked as the top priority mitigation project in Idaho. In late 1990, the NPPC and BPA approved funding of the project to protect and improve bald eagle and other wildlife habitat along 65 miles of the South Fork Snake River riparian corridor, from Palisades Dam to the confluence with the Henrys Fork (IDFG 1993).

In 1995, an interagency work group was established to define and prioritize potential mitigation projects. Then in 1996, IDFG and the Shoshone-Bannock Tribes signed a Memorandum of Agreement to implement wildlife mitigation projects in the Palisades watershed. Accomplishments between 1997 and 2000 include the purchase of 11,376 acres of acquisitions and conservation easements, which provide up to 14,887 HUs toward Palisades wildlife mitigation. Mitigation for wildlife impacts of this federal hydropower project has not yet been completed.

The Minidoka project was initiated in 1903 and includes all the dams, reservoirs, and irrigation works from the Milner-Gooding Canal headworks upstream to Jackson Lake and Island Park dams. In 1989, an interagency work group assessed the impacts of the Minidoka Project on wildlife (Martin and Meuleman 1989). The interagency work group used the equal replacement (equal trade-off) method to credit benefits to certain wildlife species. This method weights the value of each wildlife species equally. The interagency work group's assessment of impacts to wildlife species showed a net loss of 5,374 HUs in the Minidoka project area. Estimated habitat losses included 181 acres of emergent wetlands, 396 acres of scrub-shrub wetlands, 3,215 acres of riverine habitat, and 7,736 acres of sagebrush-grassland. Wetland habitat losses in the project area were partially offset by an improvement in the quality of emergent wetland habitat and the gain of a

lacustrine area that supports an estimated 4,376 acres of submerged plant beds.

Although some aspects of the Minidoka project had been positive, the overall impact was found to be negative. As a result, the interagency work group agreed that a mitigation plan should be developed, with the goal of compensating for losses identified in the study area.

In 1991, a wildlife protection, mitigation, and enhancement plan was developed for the Bureau of Reclamation's Minidoka Dam and Reservoir in south-central Idaho, under the direction of the Conservation Act of 1980, the NPPC, and the Columbia River Basin Fish and Wildlife Program. Specific objectives of the plan included 1) developing protection, mitigation, and enhancement goals and objectives for target wildlife species; 2) identifying potential protection, mitigation, and enhancement opportunities to achieve the mitigation objectives; and 3) coordinating project activities with agencies, tribes, and the public. Mitigation efforts were directed toward wildlife species that were negatively impacted by the Minidoka Dam and Reservoir. The prioritized mitigation goals are 2,993 river otter HUs in riparian/river habitat, 3,755 greater sage-grouse HUs in shrub-steppe (sagebrush-grassland) habitat, 3,413 mule deer HUs in shrub-steppe habitat, and 342 yellow warbler HUs in deciduous scrub-shrub wetland habitat (Meuleman et al. 1991).

The following is a list of other planning and management efforts initiated or completed since completion of the subbasin summaries:

- *State of Idaho Strategic Plan for Management of Invasive Exotics* (ISDA 1999). This strategic plan recommends statewide formation of cooperative weed management areas and application of integrated weed management practices to reduce ecological, economic, and social impacts of noxious weeds on the state's human and natural resources. To accomplish these objectives, supporters and cooperators incorporate resources, priorities, and strategies of federal, state, and county agencies into a unified approach to halt or slow the spread of noxious weeds across Idaho (ISDA 1999).

http://www.agri.state.id.us/PDF/Animal/Strategic%20Plan.pdf

- *Idaho BLM's Abandoned Mine Lands Plan (AML)*

http://www.id.blm.gov/aml/program.htm

- *Craters of the Moon National Monument and Preserve Draft Management Plan and environmental impact statement (EIS)*

http://www.nps.gov/crmo/pphtml/documents.html

- Great Basin Restoration Initiative

http://www.fire.blm.gov/gbri/

- *Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Idaho*

http://www.id.blm.gov/publications/data/SGFinal.pdf

- *Pocatello Resource Management Plan and EIS*

http://www.id.blm.gov/planning/pocrmp/brfpkt.pdf

- *Medicine Lodge Resource Management Plan*

http://www.id.blm.gov/offices/idahofalls/mlrmp/

- *Upper Snake River District Fire, Fuels and Related Vegetation Management Direction Plan*

http://www.id.blm.gov/planning/usrd_fmda/data/brfpkt.pdf

- *IDFG Wolf Management Plan*

http://fishandgame.idaho.gov/wildlife/plans/wolf_plan.pdf

- *State of Idaho, Yellowstone Grizzly Bear Management Plan*

- *Elk–Bison EIS*

http://www.nps.gov/yell/technical/planning/bison%20eis/summary.htm

- Fire Management Plan (FMP) and environmental assessment

http://www.nps.gov/crmo/firemp/fmp_ea.htm

- *Transportation plan EIS*

http://www.itd.idaho.gov/planning/reports/plan20yr/plantoc.html

- *Winter-use plans, Yellowstone and Grand Teton National Parks EISs*

http://www.nps.gov/grte/winteruse/intro.htm

- *Yellowstone Wildland Fire Management Plan*

http://www.nps.gov/yell/technical/fire/FirePlan/fireplan.htm

- *Yellowstone National Park Strategic Plan*

http://www.nps.gov/yell/publications/pdfs/strategicplan.pdf

- *Caribou National Forest Plan Revision and EIS*

http://www.epa.gov/fedrgstr/EPA-IMPACT/2001/October/Day-09/i25190.htm

- *Ririe Reservoir Resource Management Plan*

http://www.usbr.gov/pn/programs/ririe_rmp/pdf/EA/CH1_EA.pdf

- *Minidoka North Side Resource Management Plan*

http://www.usbr.gov/pn/programs/minidoka_rmp/pdfs/Mndka_Cover.pdf

- *Amended Biological Assessment for Bureau of Reclamation Operations and Maintenance in the Snake River Basin Above Brownlee Reservoir*

http://www.usbr.gov/pn/programs/UpperSnake/UpperSnakeBA.htm

- *Idaho Drought Plan* with federal water-related drought-response programs

http://www.idwr.state.id.us/about/issues/Drought%20Plan.pdf

- Idaho Water Resources Board water resources planning

Federal planning cycles typically incorporate an adaptive management scheme where pertinent objectives and strategies "evolve" as new information is collected and incorporated into the decision-making process. The information presented in this assessment is founded on information used in existing management plans, as well as more site-specific information. This building of information should enhance future planning, prioritization, and implementation efforts.

The direction and focus of existing management plans and ongoing management programs are based on many of the same issues that we have identified in this Upper Snake provincial assessment. However, lack of implementation of existing plans due to

funding, legal, and political constraints inhibits the protection and restoration of fish and wildlife resources. Furthermore, habitat restoration efforts may take years before effects are fully realized.

4.1.3 Restoration and Conservation Projects

The inventory identified 184 projects with objectives targeting a variety of species and/or habitat management issues. Of these, 31 projects were identified in the Snake Headwaters subbasin, 127 in the Upper Snake subbasin, and 26 in the Closed Basin subbasin. There were no habitat restoration projects reported for the Greys–Hoback or Gros Ventre watersheds. Projects were classified into the following activity categories based on project descriptions:

- wetland restoration
- upland habitat protection
- riparian fencing
- water conservation
- stream structure
- road/trail work
- access management
- fish passage
- grazing management
- riparian restoration
- diversions
- channel restoration
- miscellaneous

Criteria used to classify projects are summarized in

Table 4-1. If a project included numerous activities, the project was credited in all applicable categories. The values represent numerical tallies of project categories. Funding summaries are based on project counts only, not on funding levels. Projects identifying multiple funding groups are classified for all organizations involved. Project information is located in Appendix 4-1.

Funding for projects in the Snake Headwaters subbasin is primarily federal, with 28% of reported projects federally funded. Nonprofit (13%) and local (17%) groups also funded a substantial portion of the projects in the Snake Headwaters subbasin (Figure 4-1). Funding for projects in the Upper Snake subbasin was also primarily federal, with 22% of projects reporting some type of federal funding (Figure 4-2). Funding for projects in the Closed Basin subbasin was primarily through IDFG, with over 32% of projects reporting some type of IDFG funding (Figure 4-3).

Table 4-1. Project activity categories and criteria for habitat restoration projects identified in the Upper Snake province.

Project Activity	Criteria for Classification
Wetland restoration	Specifically mentioned purpose of “wetland restoration”
Upland habitat protection	Identified protection of habitat other than riparian or stream
Riparian fencing	Provided riparian habitat with natural (passive) recovery opportunity
Water conservation	Discussed diversion consolidation, conversion to more efficient methods, or retiring of the water right
Stream structure	Mentioned placement of structures (bank barbs, drop structures) to prevent erosion or protect/create habitat
Road/trails	Involved modification, moving, or closing of roads and trails to reduce sediment or protect habitat

Project Activity	Criteria for Classification
Access management	Pertained to recreation access (campgrounds, boat ramps) designed to reduce sediment or protect habitat
Fish passage	Allowed or increased fish movement (culvert replacement, dam modification)
Grazing management	Designed to protect habitat while allowing limited grazing typically in riparian areas
Riparian restoration	Discussed active work on riparian areas including vegetation planting
Diversion	Modified existing water diversion structure including fish screening or consolidation
Channel restoration	Reconnected side channels or eliminated stream crossings
Miscellaneous	Included projects that were unclassifiable

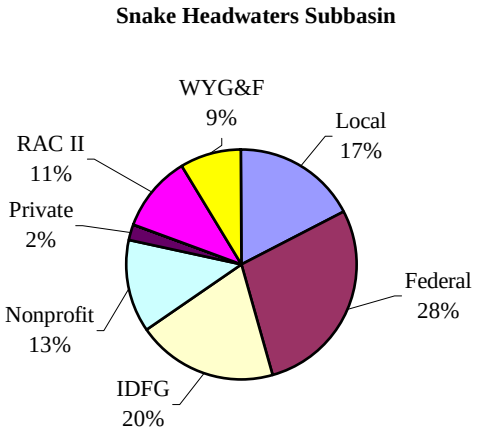

Figure 4-1. Funding breakdown for habitat restoration projects in the Snake Headwaters subbasin identified during the assessment process. WYG&F = Wyoming Game and Fish Department; Local = City or County; Federal = U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service, and Bureau of Reclamation; IDFG = Idaho Department of Fish and Game; Nonprofit =not for profit and nongovernmental organizations; Private = private business or citizens, RAC II = Resource Advisory Committees.

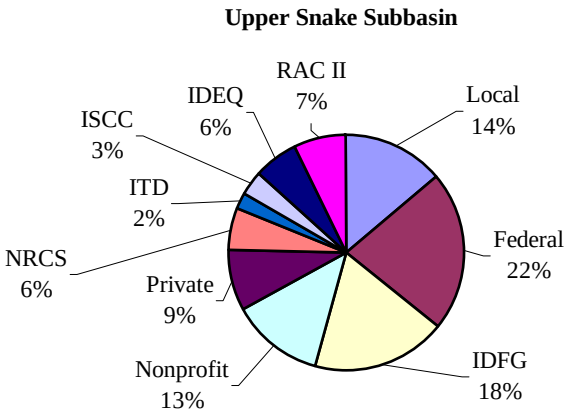

Figure 4-2. **Funding breakdown for habitat restoration projects in the Upper Snake subbasin identified during the assessment process. Local= City or County, Federal= U.S Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service, and Bureau of Reclamation, IDFG= Idaho Department of Fish and Game, Nonprofit= not for profit and nongovernmental organizations, Private= private business or citizens, NRCS= Natural Resources Conservation Service, ITD= Idaho Department of Transportation, ISCC= Idaho Soil Conservation Commission, IDEQ= Idaho Department of Environmental Quality, RAC II= Resource Advisory Committees.**

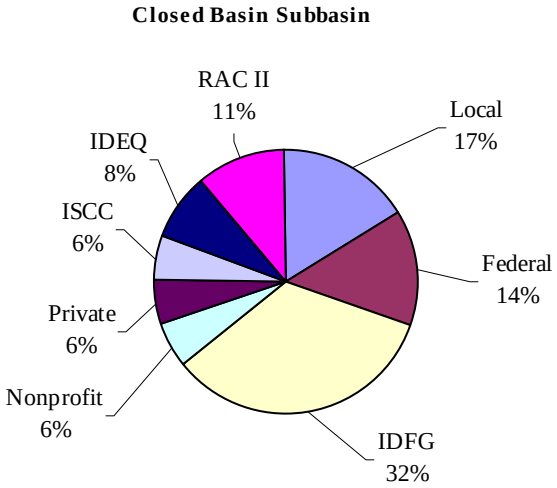

Figure 4-3. **Funding breakdown for habitat restoration projects in the Closed Basin subbasin identified during the assessment process. Local = City or County; Federal = U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service, and Bureau of Reclamation; IDFG = Idaho Department of Fish and Game; Nonprofit =not for profit and nongovernmental organizations; Private = private business or citizens; ISCC = Idaho Soil Conservation Commission; IDEQ = Idaho Department of Environmental Quality; RAC II = Resource Advisory Committees.**

4.1.3.1 Snake Headwaters Subbasin

Habitat Restoration Activities—We identified 31 projects designed to restore fish and wildlife habitat in the Snake Headwaters subbasin (Figure 4-4). We were unable to identify any habitat restoration projects for the Greys–Hoback and Gros Ventre watersheds. Upland habitat protection, water diversion modification, fish passage, and water conservation were the most common restoration activities reported in the Snake Headwaters subbasin. We identified 8 habitat restoration activities for the Palisades watershed, with grazing management the most common restoration activity reported. Habitat restoration projects categorized by watershed in the Snake Headwaters subbasins are presented in Table 4-2.

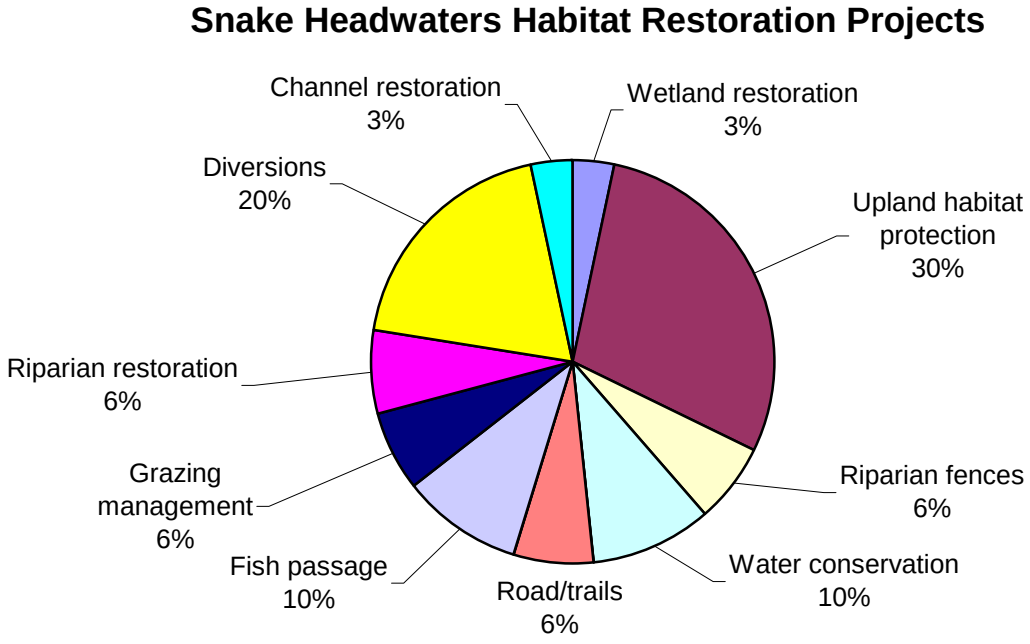

Figure 4-4. Summary of 31 habitat restoration activities in the Snake Headwaters subbasin identified during the assessment process.

Table 4-2. Number of habitat restoration projects by watershed in the Snake Headwaters subbasin identified for the 12 project activity categories.

Project Activity Category	Watershed				
	Snake Headwaters	Gros Ventre	Greys–Hoback	Palisades	Salt
Wetland restoration	1				
Upland habitat protection	3			3	3
Riparian fences				2	
Water conservation	3				
Stream structure					
Road/trails					2

Project Activity Category	Watershed				
	Snake Headwaters	Gros Ventre	Greys–Hoback	Palisades	Salt
Access management					
Fish passage	2			1	
Grazing management				2	
Riparian restoration	1				1
Diversions	6				
Channel restoration	1				
Totals	**17**	**0**	**0**	**8**	**6**

4.1.3.2 Upper Snake Subbasin

Habitat Restoration Activities—We identified 127 projects designed to restore fish and wildlife habitat in the Upper Snake subbasin (Figure 4-5). The Upper Snake subbasin had a diverse list of habitat restoration projects reported, covering all 12 habitat restoration categories. Overall, upland habitat protection, riparian restoration, water conservation, and wetland restoration were the most common activities reported in the Upper Snake subbasin (Table 4-3). In the Upper Snake–Rock watershed, we identified one wetland restoration and one upland habitat protection project. Of the five projects identified in the Goose watershed, upland habitat protection was the most common (Figure 4-5). We identified 12 projects in the Lake Walcott watershed, with diversion modification, water conservation, and upland habitat protection the most commonly reported activities (Table 4-3).

All restoration projects identified for the American Falls watershed were for upland habitat protection.

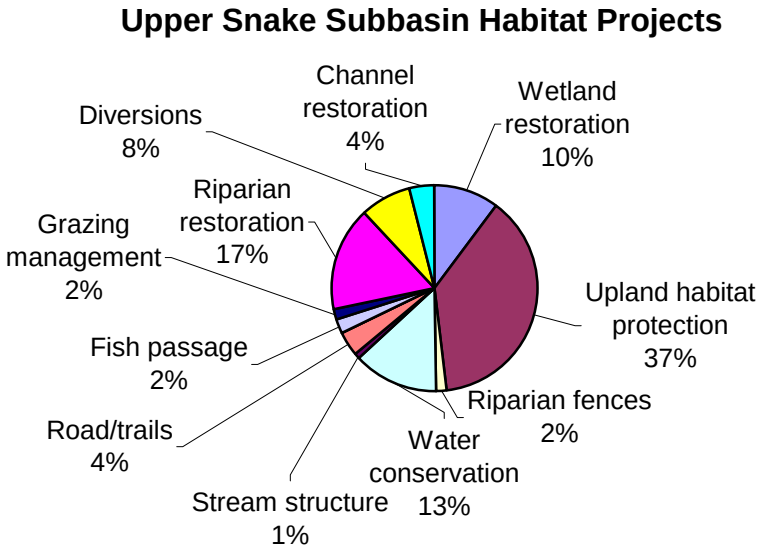

Figure 4-5. Summary of 127 habitat restoration activities in the Upper Snake subbasin identified during the assessment process.

Table 4-3. Number of habitat restoration projects by watershed in the Upper Snake subbasin identified for the 12 project activity categories.

Project Activity Category	Watershed[a]											
	IFA	UHF	LHF	TET	WIL	AMF	BFT	PTF	LWT	RFT	GSE	USR
Wetland restoration				9	1				1		1	1
Upland habitat protection	4	8	11	6	3	2	4	1	3	2	3	1
Riparian fences		2										
Water conservation	1	2	2	2			2	4	3	1		
Stream structure	1											
Road/trails	2		1				2					
Access management												
Fish passage	1	1		1								
Grazing management		2										
Riparian restoration	1		4	9			2	3	1		1	
Diversions		4						1	4	1		
Channel restoration			1				2	2				
Totals	**10**	**19**	**19**	**27**	**4**	**2**	**12**	**11**	**12**	**4**	**5**	**2**

[a] See Table 1-1 for watershed acronyms.

4.1.3.3 Closed Basin Subbasin

Habitat Restoration Activities–We identified 26 projects designed to restore fish and wildlife habitat in the Closed Basin subbasin (Figure 4-6). All restoration projects identified for the Beaver–Camas and Birch Creek watersheds were for upland habitat protection (Table 4-4).

Overall, stream structure and upland habitat protection and road/trail restoration were the most common activities reported in the Closed Basin subbasin (Table 4-4). In the Big Lost watershed we identified nine habitat restoration projects, mostly in upland habitat protection. We also identified nine projects in the Medicine Lodge watershed with upland habitat protection and road/trail maintenance the most commonly reported activities (Table 4-4).

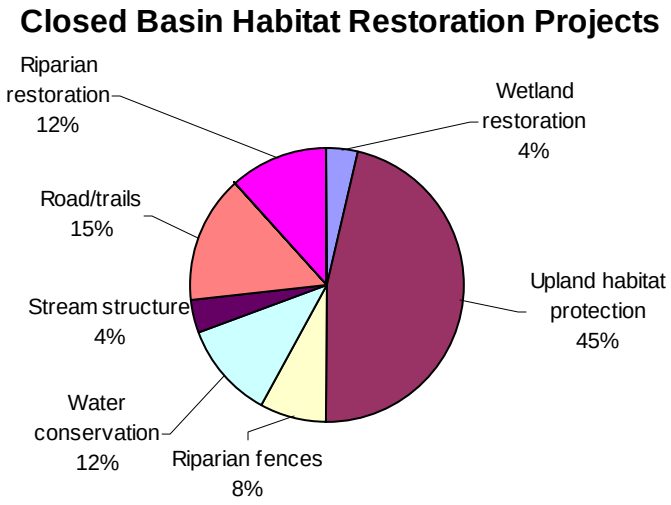

Figure 4-6. Summary of 26 habitat restoration activities in the Closed Basin subbasin identified during the assessment process.

Table 4-4. Number of habitat restoration projects by watershed in the Closed Basin subbasin identified for the 12 project activity categories.

Project Activity Category	Watershed				
	Beaver–Camas	Medicine Lodge	Birch	Little Lost	Big Lost
Wetland restoration					1
Upland habitat protection	2	3	1	2	4
Riparian fences				1	1
Water conservation		2			1
Stream structure				1	
Road/trails		3		1	
Access management					
Fish passage					
Grazing management					

Project Activity Category	Watershed				
	Beaver–Camas	Medicine Lodge	Birch	Little Lost	Big Lost
Riparian restoration		1			2
Diversions					
Channel restoration					
Totals	**2**	**9**	**1**	**5**	**9**

4.1.5 Monitoring and Evaluation Activities

4.1.5.1 Aquatics

Within the Upper Snake province, state and federal agencies, tribes, and occasionally private parties collect data on focal fish species. Where data were accessible, we presented them in section 2 of this assessment. However, because new data are constantly being collected, it is impossible to provide an assessment of all available data. Additionally, there is no central location that archives data or even a centralized location for project information. Project descriptions and accomplishments are presented in Appendix 4-1.

4.1.5.2 Terrestrial

Terrestrial research, monitoring, and evaluation activities in the Upper Snake province are limited in number and scope (Appendix 4-3). Most research, monitoring, and evaluation effort is expended on threatened, endangered, candidate, or recently delisted species (Appendix 4-3). Focal habitats have also received negligible research, monitoring, and evaluation effort, resulting in significant data gaps that inhibit the land management decision-making process. Additional information is needed for these habitats and the focal species that depend on those habitats.

4.1.6 Project Gap Assessment

4.1.6.1 Aquatics

The habitat restoration projects identified in the inventory address many of the limiting factors identified in this assessment (see section 3). A topic identified with great potential to increase habitat quality and quantity for focal fish species is the reconnection of tributaries that have been isolated from dewatering or fish passage barriers. While some progress has been made in the Upper Snake province to reconnect tributaries, there is a substantial amount of spawning and rearing habitat for fish focal species in Palisades, Lower Henrys Fork and other watersheds that is currently isolated or inaccessible.

4.1.6.2 Terrestrial

The Upper Snake and Closed Basin subbasins are unique in terms of the proportional distribution of project activity among the various habitat restoration categories. Project activities in the Snake Headwaters subbasin were less diversified, with the predominate amount of activity focused on stream diversions. All conservation activities are important, and prioritization of activities would be challenging. Currently, no prioritization protocol of project activity at watershed or provincial scales exists. Provincial coordination of conservation activities is necessary to ensure that limited funding is

distributed appropriately. Provincial coordination is discussed in detail in later sections.

4.1.6.3 Terrestrial Monitoring and Evaluation

Perhaps the greatest need for implementing fish and wildlife conservation in the Upper Snake province is status and trend information for each of the focal habitats. Current research, monitoring, and evaluation activities do not address the significant data gaps that exist regarding focal habitat quantity and quality. Watershed scale goals, objectives, and strategies with quantifiable results cannot be measured using the current information available. Undoubtedly, a tremendous amount of information has been collected at scales finer than the watershed. However, the current planning process does not allow time to compile all of the pieces into a cohesive summary. Additional research, monitoring, and evaluation effort should be spent collecting and compiling existing data regarding focal habitat structure, function, quantity, and quality.

Prescribed fire activities were not submitted during the data-collection process for the inventory. Ecosystem structure and function in the Upper Snake province is intricately tied to natural fire regimes across all focal habitats but most importantly the shrub steppe habitats. Additional research, monitoring, and evaluation pertaining to anthropogenic interference of natural fire regimes is needed to ensure that adaptive fire management strategies can be implemented across the province.

A growing body of expertise and technology is being developed for the management of invasive exotic weeds. Future research, monitoring, and evaluation efforts need to incorporate even broader coordination and collaboration due to the "out-of-basin" implications of spreading invasive exotics across the western landscape.

Altered hydrologic function at all scales has been identified as a significant cause limiting habitat quantity and function in the Upper Snake province. Based on the inventory, significant effort has been expended to address this issue in the Snake Headwaters subbasin. However, additional coordination and collaborative across multiple jurisdictions is required to begin addressing altered hydrology within the Upper Snake province.

4.2 Synthesis of Findings

4.2.1 Key Findings

Current and historic land-use activities have degraded freshwater habitat for fish in the Upper Snake province. Impacts are associated with alterations to natural hydrologic regimes, decreased function of riparian habitat associated with land use and conversion, and increased sedimentation from upland habitat impacts. Alterations to hydrologic regimes and riparian habitat also impact water temperatures, which may decrease habitat quality if impacts are severe enough.

Analyses of focal habitats in the assessment have attempted to determine not only the most significantly altered habitats, but also where they occur in the Upper Snake province, the causes of those declines, and the priority for conservation activities.

Riparian habitats in the Upper Snake province provide rich and vital resources to subbasin fish and wildlife due to their high productivity and diversity. Riparian areas contain elements of both aquatic and terrestrial ecosystems, which mutually influence each other and function as transitions between aquatic and upland

habitats. Thirty-four species of fish inhabit aquatic habitats, and more than 51% of the Upper Snake province's terrestrial vertebrate species use riparian habitats for essential life activities. Riparian habitats, in particular, are critical for maintaining instream conditions necessary for continued persistence of native fish species. Aquatic habitats are limited geographically (by definition, they are tied to water sources), and they are vulnerable to loss and degradation through human activities and land uses. Protecting riparian habitat may yield the greatest gains for fish and wildlife across the landscape while involving the least amount of area and perhaps the best cost:benefit ratio.

The analysis of key ecological functions and environmental correlates for focal habitats and species in the Upper Snake province indicated that there are areas within watersheds showing both increases and decreases in total functional diversity. However, the overall trend is a decline in total functional diversity for all focal habitats and species (with the exception of the common loon). The common loon appears to have gained some increase in total functional diversity due to increases in open water habitats. The juniper/mountain mahogany, whitebark pine, and open water habitats have all declined by as much as 81% in total functional diversity. The decline in total functional diversity for wildlife species in the Upper Snake province reduces the resilience of habitats and communities and exaggerates the effects of limiting factors identified in this assessment.

We are unable to explain why there are increases in total functional diversity for some of the focal habitats and species in the Upper Snake province. One possible explanation is that our analysis tool (IBIS) is limited by information gaps or inaccuracies. Alternatively, we know that wildlife species move within their preferred habitats, but we have very little information on focal species movements within their known ranges at the watershed scale. This lack of information may affect functional diversity measures. In addition, information on focal species population dynamics and abundance is lacking.

4.2.1.1 Snake Headwaters Subbasin—Key Findings

Following is a list of key findings for the Snake Headwaters subbasin:

1. Inundation of the Snake River by construction of Palisades Dam resulted in impacts to wildlife, including 37,070 HUs of target species habitats (bald eagle, mule deer, elk, mallard, Canada goose, mink, yellow warbler, black-capped chickadee, ruffed grouse, and peregrine falcon). Mitigation for this impact has yet to be completed.

2. Approximately 346 hectares (3.46 km^2) of free-flowing river habitat was inundated by construction of Palisades Dam and Reservoir, resulting in the loss of an estimated 70,000 Yellowstone cutthroat trout and 200,000 mountain whitefish yearly since 1957 (see Appendix 4-2 about loss assessment).

3. Migratory (fluvial/adfluvial) Yellowstone cutthroat trout populations are present in good numbers in the mainstem Snake River in the Snake Headwaters subbasin. These populations are relatively unique in the Upper Snake province.

4. Impacts to migratory Yellowstone cutthroat trout by construction of Palisades and Jackson dams are unknown.

5. Downstream of Palisades Dam, rainbow trout are a major threat to the long-term persistence of Yellowstone cutthroat trout.

6. Hybrid (Yellowstone cutthroat trout × rainbow trout) and rainbow trout are present in the Snake Headwaters subbasin above Palisades Dam, but they are not as widespread or pervasive as they are downstream of Palisades Dam.

7. Levy construction along the main Snake River downstream of Jackson Lake Dam has altered the hydrologic regimes (by preventing flushing flows) in important Yellowstone cutthroat trout spawning streams, requiring active human intervention to maintain suitable spawning gravels.

8. Levy construction along the main Snake River downstream of Jackson Lake Dam prevents water from overtopping banks, impacting cottonwood forest (riparian) habitat by preventing cottonwood regeneration.

9. Approximately 90% of the aspen habitats in the Snake Headwaters subbasin have been lost due to the effects of an altered fire regime.

10. Pine/fir forest habitats in the Snake Headwaters subbasin have greatly altered structure and function due to the effects of an altered fire regime.

11. Invasive exotics with negative impacts to biodiversity, forage, habitat and aesthetic quality, soil productivity, and biodiversity have impacted all habitats in the Snake Headwaters subbasin.

12. Approximately 95% of all whitebark pine habitats in the Snake Headwaters subbasin have been lost due to the exotic blister rust fungus and effects of an altered fire regime.

13. Legacy timber-harvest activities have impacted significant amounts of forested habitat primarily within the Salt watershed.

14. Grazing/browsing activities by sheep and cattle in the Greys–Hoback and Gros Ventre watersheds have impacted plant species composition, diversity, and density; disrupted ecosystem functioning; and altered forest dynamics.

15. Development and other land-use practices have fragmented habitats in the Greys–Hoback watershed, principally in the vicinity of the rapidly growing community of Jackson.

16. An altered fire regime is likely the most significant ecological influence affecting ecosystem structure and function in the Snake Headwaters subbasin.

17. Approximately 99% of the mountain mahogany habitat in the Greys–Hoback watershed has been lost due to the effects of an altered fire regime.

4.2.1.2 Upper Snake Subbasin—Key Findings

Following is a list of key findings for the Upper Snake subbasin:

1. Inundation of the Snake River by construction of Minidoka Dam resulted in impacts to wildlife, including 2,993 river otter HUs in riparian /river habitat, 3,755 greater sage-grouse HUs in shrub-steppe (sagebrush-grassland) habitat, 3,413 mule deer HUs in shrub-steppe habitat, and 342 yellow warbler HUs in deciduous scrub-shrub wetland habitat. Mitigation for this impact has yet to be completed.

2. Based on preliminary estimates, approximately 1,385 hectares (13.9 km^2) of free-flowing river habitat was inundated by construction of Minidoka Dam and Lake Walcott, resulting in a loss of approximately 550 Yellowstone cutthroat trout and 995,000 mountain whitefish yearly since 1906 (see Appendix 4-2 about loss assessment).

3. Strong populations of resident life history type Yellowstone cutthroat trout are present throughout the Upper Snake subbasin.

4. Migratory (fluvial/adfluvial) populations of Yellowstone cutthroat trout are present in Henrys Lake, Willow Creek, Blackfoot River, and Teton River, but they are depressed throughout most of the subbasin.

5. All watersheds except Lake Walcott have documented core or conservation status Yellowstone cutthroat trout populations.

6. All watersheds except Willow Creek have documented Yellowstone cutthroat trout × rainbow trout hybrid populations.

7. Historic Yellowstone cutthroat trout habitat, especially large river habitat, has become dominated by rainbow trout throughout most of the Upper Snake subbasin.

8. Dewatering has isolated many of the Yellowstone cutthroat trout populations located in tributary habitats.

9. Two species of ESA-listed snails exist in the Upper Snake subbasin: Snake River physa and Utah valvata. Very little is known about their current or historic distributions.

10. Listed snail species are thought of as riparian associates and therefore influenced by management of riparian zones.

11. Water management has substantially altered the Snake River, changing it from a free-flowing coldwater system to a slower-moving warmwater system based on an anthropogenic hydrologic cycle.

12. Tributary habitat quality for Yellowstone cutthroat trout has been reduced by dewatering, land use that has altered riparian habitat, and increased sedimentation in the Upper Snake subbasin.

13. To protect the genetic diversity of Yellowstone cutthroat trout in the Upper Snake subbasin, it is necessary to conserve populations within each watershed.

14. Shrub-steppe habitat structure and function has been greatly altered by recent fire history, invasive exotic weeds, and large-scale conversion to dryland and irrigated agriculture.

15. Shrub-steppe habitat quantity and quality have been impacted by the encroachment of western juniper due to an altered fire regime in portions of the subbasin.

16. Open water habitat quantity and quality are affected by water-level fluctuations resulting from multiple anthropogenic uses of water resources.

17. Pine/fir forest habitats in the Upper Henrys, Lower Henrys, and Teton watersheds have greatly altered structure and function due to the effects of an altered fire regime.

18. Approximately 60% of the aspen habitats in the subbasin have been lost due to the effects of an altered fire regime.

19. Approximately 50% of the mountain mahogany habitats in the subbasin have been lost due to the effects of an altered fire regime.

20. An altered fire regime is likely the most significant ecological influence affecting ecosystem structure and function in the subbasin.

21. Development, habitat conversion, and other land-use practices have fragmented habitats in all but the remotest areas of the subbasin. The central Snake River Plain is the area most severely impacted by these sources of disturbance.

22. Numerous water diversion structures in the subbasin have altered hydrologic processes, with significant impacts to terrestrial and aquatic resources.

23. Altered hydrologic processes have had significant impacts to riparian and herbaceous wetland habitat quantity, quality, structure, and function.

24. Grazing/browsing activities by sheep and cattle in the subbasin have impacted plant species composition, diversity, and density, and they have disrupted ecosystem functioning.

4.2.1.3 Closed Basin Subbasin—Key Findings

Following is a list of key findings for the Closed Basin subbasin:

1. Substantial declines in mountain whitefish distribution and abundance have occurred in the Big Lost River in the last 20 years.

2. Mountain whitefish declines in the Big Lost River appear to be related to altered discharge from Mackay Dam and dewatering throughout the system.

3. Migratory populations of bull trout in the Little Lost watershed are depressed, and most bull trout populations are now made up of residents.

4. Core and conservation Yellowstone cutthroat trout populations are present in the Beaver–Camas and Medicine Lodge watersheds.

5. Hybrid (Yellowstone cutthroat trout × rainbow trout) and rainbow trout are present in the Medicine Lodge watershed close to core and conservation Yellowstone Cutthroat trout populations.

6. Habitat quality for fish focal species has been reduced by dewatering, land use that has altered riparian habitat, and increased sedimentation in the Closed Basin subbasin.

7. Approximately 65% of the aspen habitats in the subbasin have been lost due to the effects of an altered fire regime.

8. Shrub-steppe habitat quantity and quality have been impacted by the encroachment of western juniper due to an altered fire regime in portions of the subbasin.

9. Approximately 96% of the mountain mahogany habitats in the subbasin have been lost due to the effects of an altered fire regime.

10. Approximately, 56% of all whitebark pine habitats in the subbasin have been lost due to the exotic blister rust fungus and the effects of an altered fire regime.

11. Altered hydrologic processes have had significant impacts to riparian and herbaceous wetland habitat quantity, quality, structure, and function, primarily in the Beaver–Camas and Medicine Lodge watersheds.

12. Numerous water diversion structures in the subbasin have altered hydrologic processes, with important ramifications for terrestrial and aquatic resources.

13. Legacy timber-harvest activities have impacted forested habitats, primarily within the Big Lost and Beaver–Camas watersheds.

14. Grazing/browsing activities by sheep and cattle in the subbasin have impacted plant species composition, diversity, and density, and they have disrupted ecosystem functioning.

15. An altered fire regime is likely the most significant ecological influence affecting ecosystem structure and function in the subbasin.

4.2.2 Reference Conditions

Reference condition is defined as the range of factors (e.g.,, meteorology, surface water and groundwater, soils, geology, vegetation, topography, channel geometry factors, and natural and human disturbances) that is representative of the watershed's recent historical values prior to significant alteration of its environment (ESA 2000). The reference condition is considered pristine, with no or very minor human impacts. The reference could represent conditions found in a relic site or a site that has had little significant disturbance. The reference condition does not necessarily represent conditions that are attainable.

The purpose of reference conditions is to establish a basis for comparing what currently exists to what has existed in recent history. Reference conditions can be obtained through actual data or extrapolated techniques such as modeling (ESA 2000). Reference sites represent high-quality assemblages of aquatic and terrestrial ecosystem components. Anthropogenic effects often coincide with landform, thereby limiting availability of pristine reference conditions for assessments. Consequently, reference conditions must be defined within a background of land use. In the context of a habitat-based assessment, a fundamental assumption is that aquatic and terrestrial focal species inhabiting reference sites are themselves reference populations. "True" reference conditions likely do not exist in the Upper Snake province at watershed scales. Certainly, at finer environmental scales, ecosystem structure and function are theorized to be operating within the assumptions of reference conditions. However, data to either quantifiably or qualitatively describe them with accuracy or precision are lacking. We have opted, in some contexts, to describe Upper Snake subbasin habitats in terms of optimal quality and quantity to avoid any misconception that might result from the use of the term reference condition.

In the Upper Snake province, terrestrial and aquatic habitat quality and quantity are optimal in the most protected, least impacted watersheds. These watersheds include the Snake Headwaters, Gros Ventre, and Greys–Hoback watersheds and the upper elevations of the Big Lost, Little Lost, Beaver–Camas, and Lower Henrys watersheds. These watersheds are subject to the least amount of impact from the anthropogenic influences identified in the assessment. However, fire suppressive policies continue to be implemented, even in the roadless managed areas, and invasive exotics have begun to

have greater impacts. Landscape characteristics resulting from the altered fire regime will continue to prevail until natural fire regimes are allowed to function within these watersheds.

4.2.2.1 Aquatic Habitat and Fish Focal Species

Snake Headwaters—The Snake Headwaters subbasin contains substantial amounts of riparian and stream habitat that would be considered to be in reference condition. Numerous small streams and the headwaters of the mainstem Snake River are located within the Yellowstone and Grand Teton National Parks and are likely candidates for consideration as reference sites. The Gros Ventre and Greys–Hoback watersheds are relatively unimpacted and should contain numerous streams that could be considered as reference sites.

Upper Snake—Within the Upper Snake subbasin, reference sites for stream systems are extremely rare. Virtually all major streams within the subbasin have been dammed and diverted, altering the hydrologic regimes. Land use has altered the riparian vegetation in many areas. Headwater areas of small streams scattered throughout roadless and wilderness portions of the subbasin are likely candidates for consideration as reference sites.

Closed Basin—Within the Closed Basin subbasin, the large rivers and streams in the Big Lost and Little Lost watersheds have been diverted or dammed. Any reference aquatic or riparian areas in the Closed Basin subbasin are likely to occur in inventoried roadless areas.

4.2.2.2 Riparian/Herbaceous wetlands

Although riparian/herbaceous wetland habitats occur throughout the Upper Snake province, these habitats are assumed to be in "proper functioning condition" within the Greys–Hoback, Gros Ventre, and Snake Headwaters watersheds. Roads and their associated impacts are less significant, and water diversions are relatively nonexistent compared with the more developed watersheds. Although not necessarily described as reference condition based on the best available data, these watersheds may contain some of the best naturally occurring riparian and herbaceous wetland habitats in the Upper Snake province.

4.2.2.3 Shrub-Steppe

Despite dramatic reductions in shrub-steppe habitats across the Upper Snake province, reference condition habitat likely occurs at the Idaho National Engineering and Environmental Laboratory and Craters of the Moon National Monument. Anthropogenic impacts within these protected areas have largely been localized and insignificant relative to the rest of the Upper Snake province. In addition, fire regime processes have been allowed to function with minimal anthropogenic interference.

4.2.2.4 Pine/Fir Forest

Pine/fir forest habitats are the predominant landscape feature in the Closed Basin and Snake Headwaters subbasins. The watersheds with the greatest forested composition are the Upper Henrys, Lower Henrys, Snake Headwaters, Gros Ventre, Greys–Hoback, Salt, Palisades, Willow, Blackfoot, and Portneuf watersheds. Based on available data, the Upper Henrys watershed is classified as having the least

amount of departure from historic fire regimes. Data about fire regime condition class are unavailable for the Snake Headwaters subbasin watersheds; however, it is assumed that fire regimes in those watersheds are similar to that of the Upper Henrys watershed. The portions of the watersheds that occur in the protected areas of the National Parks and wilderness areas are assumed to be functioning at nearly optimal condition.

4.2.2.5 Aspen

Historically, aspen habitats were broadly distributed across many of the Snake Headwaters subbasin watersheds. Elsewhere in the province, aspen habitat is a patchily distributed resource. A dramatic reduction in the amount of aspen habitat on the landscape has resulted in greater interest in understanding the causes limiting aspen habitat quantity and quality. In the Upper Snake province, aspen habitat declines have been attributed to a combination of altered fire regime, grazing and browsing, and in some cases, localized alteration of the hydrologic regime. Due to its scarcity on the landscape and difficulties in assessing it, reference condition aspen habitat has not been identified in the Upper Snake province. Reference condition habitat probably occurs in the largest blocks of remaining habitat located in the Teton, Palisades, Salt, and Greys–Hoback watersheds. However, data to support that assumption have not been collected.

4.2.3 Near-Term Opportunities

4.2.3.1 Aquatic

Snake Headwaters—Within the Snake Headwaters subbasin, protection of populations within designated wilderness waters and National Parks is high priority due to the functional riparian and aquatic habitat, though these populations currently benefit from protective land management actions. Near-term opportunities for restoration actions include management actions designed to benefit the Yellowstone cutthroat trout population and its habitat on the mainstem Snake River and tributaries downstream of Jackson Lake Dam, as well as populations in the Salt watershed.

Upper Snake—Within the Upper Snake subbasin, Yellowstone cutthroat trout populations identified as high-density core or conservation populations within each watershed should be high priority for protection. Populations within each watershed should be protected to ensure the protection of the maximum amount of genetic diversity within Yellowstone cutthroat trout populations in the Upper Snake subbasin.

Opportunities for improving habitat conditions to improve Yellowstone cutthroat trout populations exist throughout the subbasin. Populations identified as core or conservation populations at low density are likely candidates for habitat restoration efforts. Future hybridization risk should be evaluated in relation to barrier removal projects. Efforts to protect and enhance migratory populations of Yellowstone cutthroat trout should also be prioritized, as this life history form is the most impacted throughout the subbasin.

Closed Basin—Watersheds within the Closed Basin subbasin contain unique fish assemblages. Within the Big Lost watershed, mountain whitefish are the only native salmonid and should be considered high priority for restoration and for protection of the remaining individuals. Within the Little Lost watershed, ESA-listed bull trout are considered to be native. Bull trout populations are depressed in this watershed and should be considered for

restoration and protection. Within the Beaver–Camas and Medicine Lodge watersheds, no high-density core or conservation populations of Yellowstone cutthroat trout were identified, so protection and restoration efforts should focus on maintaining core and conservation populations.

4.2.3.2 Open Water

Statistically, open water habitat in the Upper Snake province is not a significant component of the landscape either historically or currently. Nevertheless, the spatial and temporal ecological significance of open water habitats in the province for numerous terrestrial and aquatic species has been thoroughly documented. Most of the open water habitat in the province is created and maintained through anthropogenic means. Thus, apart from riparian/herbaceous wetlands, no other habitat has greater potential for achieving positive impacts to aquatic and terrestrial natural resources. Coordinated management of water resources across the entire province is essential to benefit both terrestrial and aquatic resources.

The common loon is the only focal species that appears to be benefiting from the anthropogenic creation of open water habitats. Restoration of the near-shore and aquatic vegetation cover and protection of nesting sites could benefit the trumpeter swan and American avocet.

4.2.3.3 Riparian/Herbaceous Wetlands

Completion of wildlife mitigation projects, according to the Palisades mitigation plan, would benefit riparian focal habitats and species. Restoration of riparian habitats would benefit both terrestrial and aquatic focal species. Restoration of no other habitat has greater potential for collectively enhancing aquatic and terrestrial resources in the Upper Snake province.

Reintroduction of beavers and reduction of riparian grazing are two strategies to restore riparian habitats. Cooperative efforts to reintroduce beavers to areas on U.S. Forest Service lands in the Upper Snake province are ongoing and should be expanded where possible.

4.2.3.4 Shrub-Steppe

Shrub-steppe habitat cores within the Idaho National Engineering and Environmental Laboratory and Craters of the Moon Monument should be protected and maintained through fire and weed management. In addition, other shrub-steppe reference habitats in the Upper Snake subbasin should be inventoried, identified, and protected. Different species of sagebrush provide food, cover, and nesting substrate for sage-steppe obligates, such as the greater sage-grouse, and are important winter forage for big game species. Continuing or expanding research to determine how an altered fire regime affects the shrub-steppe community is necessary.

4.2.3.5 Pine/Fir Forest

Significant amounts of pine/fir forest habitat occur in the Snake Headwater and Closed Basin subbasins. Apart from legacy timber-harvest activities, altered fire regime is the driving force behind current pine/fir forest habitat structure and function. These areas most in need of protection from anthropogenic fire regimes include portions of the Big Lost and Upper Henrys watersheds. Forest areas in the Beaver–Camas and Medicine Lodge watersheds provide potential to restore pine/fir forest structure and function through changes in how fire is managed on the landscape.

Focal species for the xeric, old forest habitat in the Upper Snake province include the black-backed woodpecker, great gray owl, boreal owl, and northern goshawk. Studies are needed to further our understanding of the relationship between snag availability and population dynamics of the great gray and boreal owls. Also needed is information on the relationships between mature stand characteristics and northern goshawk distribution and population dynamics.

4.2.3.6 Juniper/Mountain Mahogany

Like aspen habitats, mountain mahogany habitat is patchily distributed, primarily in the upper elevations of the Upper Snake subbasin watersheds. The Goose and Raft watersheds have the greatest composition of juniper/mountain mahogany habitat, while the Raft watershed has experienced the greatest proportional losses. Mountain mahogany habitat quantity and quality are assumed less limited in the protected watersheds where fire regimes more closely resemble natural processes. Data to support this assumption is lacking. Significant improvement in mountain mahogany structure and function is achievable if fire processes are allowed to operate normally.

4.2.3.7 Whitebark Pine

Throughout its range, whitebark pine habitat has declined, primarily due to the blister rust fungus. The direct mortality caused by the disease agent is exacerbated by an altered fire regime that inhibits normal regenerative processes. A priority action for whitebark pine habitat structure and function is restoring natural fire regimes and allowing natural selection processes to “cull” the blister rust-susceptible trees from the landscape. Research to determine how blister rust functions in whitebark pine habitats would be beneficial.

4.2.4 Summary of Priorities

Based on this assessment, we identified several priorities for directing future fish and wildlife management, restoration, and protection activities in the Upper Snake province. These priorities are scientifically justifiable from the assessment, should be integrated into current and future planning efforts, and are realistic and achievable within the current planning horizon.

4.2.4.1 Aquatic Habitat Protection

Within the Upper Snake province migratory populations of YCT are limited and protection of these existing populations should be a priority as well as expanding opportunities for populations to express the migratory life history.

Areas within each watershed in the Upper Snake Province were identified as having high density populations of core and conservation YCT. These areas should have the aquatic habitat maintained or protected to ensure the continued existence of these populations.

4.2.4.2 Riparian/Wetland Habitat Data

Appendix 2-1 of this assessment identifies the constraints inherent with the existing data used in this assessment. From a scientific assessment perspective, the most important piece of information that is currently unavailable at the scale required for reasonable quantification is accurate and precise data regarding riparian, and herbaceous wetland habitats. If we operate under the assumption that these habitats are the critical link between the terrestrial and aquatic environments, then it becomes imperative that the data be collected to make justifiable management decisions.

4.2.4.3 Noxious and Exotic Invasive Weeds

The most important anthropogenic cause of habitat quality and quantity limitation that can be addressed by management actions is the introduction of noxious and exotic invasive weeds. Collaborative weed management efforts have been established in the Upper Snake province, but effective control of noxious and invasive weeds requires greater coordination and cooperation across multiple jurisdictions and political boundaries.

4.2.4.4 Altered Fire Regime

Based on this assessment and others, anthropogenic influences limiting natural fire regimes are the most significant impact to ecosystem processes in the Upper Snake province. Restoration of natural fire regimes in shrub-steppe and forested focal habitats is a priority.

4.2.4.5 Subbasinwide Coordination of Management Plans

The Upper Snake provincial assessment has identified, with the best available scientific data and information, the most significant anthropogenic causes that limit focal habitats, fish, and wildlife species. However, scientific information cannot make up for the fact that there are numerous state, federal, tribal, and nongovernmental entities conducting active management activities across the Upper Snake province with often minimal coordination. We encourage collaborative efforts to coordinate implementation of management plan goals and objectives in a manner that minimizes duplicated efforts, enhances logistical efficiencies, and ensures that biological objectives are achieved with increased cost effectiveness.

4.2.5 Identification of Strategic Actions to Address Highest Priorities

4.2.5.1 Aquatic and Riparian Habitat

Riparian protection and restoration actions should focus on waters with core populations of Yellowstone cutthroat trout. In addition, flooding and natural hydrologic regimes should be restored to maintain forested riparian habitats in the Snake Headwaters and Upper Snake subbasins.

Conserving water and reducing water diversions are important steps for increasing stream flow and protecting and maintaining riparian habitats. Seeking minimum streamflows would also protect and maintain riparian habitats.

Watershed-scale assessments of aquatic habitat quantity and quality are the necessary first steps for current and future iterations of management planning in the Upper Snake province. These aquatic habitat assessments would incorporate concerted research effort into replicable habitat assessment methodology and be implemented basinwide.

4.2.5.2 Noxious and Exotic Invasive Weeds

The necessary first step is collection and compilation of comprehensive distribution information about noxious and exotic invasive weeds. This information can constantly be updated, disseminated, and incorporated into weed management plans. This effort would build on existing weed management strategies, goals, and objectives and expand coordinated efforts throughout the province.

4.2.5.3 Public Education Campaign

From a subbasin assessment perspective, the technical teams believed that addressing watershed-scale fire regime issues through the BPA funding process was neither realistic nor appropriate, given the scale of the problem. However, the necessary first step is to tackle the problem of public perception with a concerted wildfire education campaign that would target not only the public but also private and public land managers.

4.2.6 Working Hypotheses

The following is the working hypothesis H_A for the entire Upper Snake province: Anthropogenic influences in the Upper Snake province and factors outside the province limit the abundance, distribution, and ecological functions of focal fish and wildlife populations and habitats.

More specific H_A hypotheses have been developed around limiting factors and their causes as identified in this assessment. These hypotheses are organized by province and subbasin.

4.2.6.1 Upper Snake Province Working Hypotheses

H_A: Human impacts to natural hydrologic regimes limit riparian and aquatic habitats and focal species populations.

H_A: Land use and conversion result in habitat fragmentation and reduce the quality and quantity of focal aquatic, riparian, and shrub-steppe habitats and their focal species.

H_A: Fire suppression in forested habitats limits resilience and health of these ecosystems and their focal habitats and increases risks to watershed integrity.

H_A: Legacy timber-harvest activities have reduced function and increased fragmentation of focal forest and aquatic habitats.

H_A: The spread of noxious weeds and other exotic invasives reduce, degrade, or eliminate terrestrial focal habitats and species in all watersheds.

H_A: Focal habitats and fish and wildlife populations within the protected areas act as refugia and reference areas useful for determining the impacts of out-of-subbasin activities and the effectiveness of restoration and conservation activities designed to benefit focal habitats and their focal species.

H_A: The status and trend of terrestrial and aquatic focal habitats and species are predictable with measurable scientific assessment and monitoring.

H_A: Old growth- and cavity-dependent wildlife species have declined as a result of legacy timber-harvest and fire suppression activities.

4.2.6.2 Snake Headwaters Subbasin Working Hypotheses

H_A: Construction of and inundation by Palisades Dam limit identified wildlife populations until mitigation is fully implemented.

H_A: Flow regulation from Jackson Lake Dam limits habitat quality and population abundance of Yellowstone cutthroat trout.

H_A: Distribution and abundance of Yellowstone cutthroat trout populations are limited by competition and hybridization with nonnative salmonids.

4.2.6.3 Upper Snake Working Hypotheses

H_A: Construction of and inundation by Minidoka Dam limits identified wildlife populations until mitigation is fully implemented.

H_A: Focal shrub-steppe habitats in the Goose, Raft, Upper Snake–Rock, Lake Walcott, American Falls, Portneuf, Lower Henrys, and Medicine Lodge watersheds are limited by noxious weeds, increasing fire frequency, and livestock grazing.

H_A: Yellowstone cutthroat trout distribution and abundance are limited by competition and hybridization with nonnative salmonids.

H_A: Habitat quality limits the distribution and abundance of Yellowstone cutthroat trout.

H_A: Isolation and fragmentation of Yellowstone cutthroat trout populations and habitats limit abundance, distribution, and life history expression.

H_A: Changes in the hydrologic regime and temperatures associated with impoundments and water diversion in the mainstem Snake River limit habitat quality for Utah valvata and Snake River physa.

H_A: Human impacts to natural hydrologic regimes reduce, degrade, and/or eliminate riparian and aquatic habitats and therefore limit focal species populations.

H_A: Land use and conversion resulting in habitat fragmentation limit the quality and quantity of focal aquatic, riparian, and shrub-steppe habitats and their focal species.

H_A: Fire suppression in forested habitats limits resilience and health of these ecosystems and their focal habitats and increases risks to watershed integrity.

H_A: Noxious weeds, fire management, and livestock grazing limit focal shrub-steppe habitat quality and quantity.

4.2.6.2 Closed Basin Subbasin Working Hypotheses

H_A: Mountain whitefish abundance and distribution are limited by habitat quality affected by altered discharge and dewatering in the Big Lost River.

H_A: Habitat quality limits bull trout abundance and distribution in the Little Lost watershed.

H_A: Yellowstone cutthroat trout distribution and abundance are limited by competition and hybridization with nonnative salmonids in the Medicine Lodge watershed.

H_A: Land use and conversion resulting in habitat fragmentation limit the quality and quantity of focal aquatic, riparian, and shrub-steppe habitats and their focal species.

H_A: Fire suppression in forested habitats limits resilience and health of these ecosystems and their focal habitats and increases risks to watershed integrity.

H_A: Focal shrub-steppe habitats in the Birch and Willow watersheds are limited by noxious weeds, fire management, and livestock grazing.