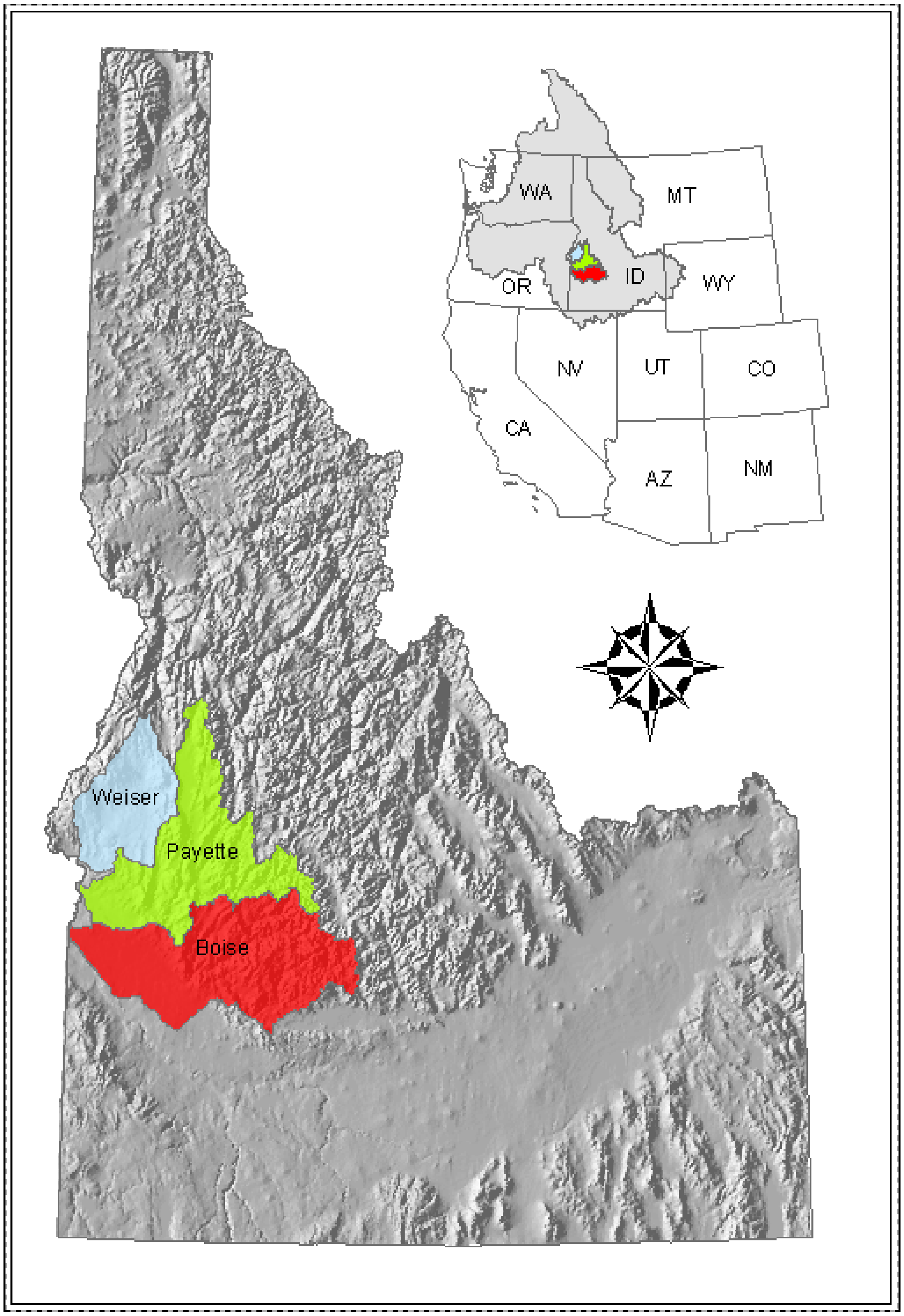
# Boise-Payette-Weiser Subbasins Assessment

Prepared for the
Northwest Power and Conservation Council




May 28, 2004

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# 1 Overview

## 1.1 Background

In 1980, Congress authorized the creation of the Northwest Power Planning Council (or NPPC, which in 2003 became the Northwest Power and Conservation Council, or NPCC) to give the states of Idaho, Montana, Oregon, and Washington a political voice in managing the federal hydropower system located in the Columbia River basin. In addition, the NPCC was directed to develop a program—the Columbia River Basin Fish and Wildlife Program—to protect, mitigate, and enhance fish and wildlife communities and populations affected by the Columbia River hydropower system.

In past years, the NPCC and the Columbia Basin Fish and Wildlife Authority (local managers of fish and wildlife resources) reviewed proposals submitted for on-the-ground projects and research. The Bonneville Power Administration then funded approved projects. Recently, independent scientific panels recommended that subbasin plans be developed to better guide the review, selection, and funding of projects that implement the NPCC's Columbia River Basin Fish and Wildlife Program. In an effort to refine this program, a new review and selection process has begun. This process includes subbasin summaries (interim information), assessments, and management plans, which provide a base of information and direction on conditions, limiting factors, and needs in the basin.

Creation of these documents is followed by a rolling review of proposals by an Independent Scientific Review Panel, the Columbia Basin Fish and Wildlife Authority, and the NPCC. Under the rolling provincial review, project proposals from a given subbasin will only be reviewed once every three years.

## 1.2 Assessment Conceptual Framework

The NPCC has outlined eight scientific principles to guide the operation of its Columbia River Basin Fish and Wildlife Program. These scientific principles also apply to subbasin documents, including the subbasin assessments, and management plans.

These principles and objectives and the null hypotheses frame the assessment of the Boise, Payette, and Weiser subbasins. The overall null hypothesis states that fish and wildlife species and their habitats are not limited in the Boise, Payette, and Weiser subbasins.

### 1.2.1 Scientific Principles

Eight scientific principles guide the operation of the NPCC's Columbia River Basin Fish and Wildlife Program. These principles served as the foundation for the fisheries and terrestrial technical teams that were formed to provide input to this technical assessment for the Boise, Payette, and Weiser subbasins. These principles are as follows:

1. The abundance, productivity, and diversity of organisms are integrally linked to the characteristics of their ecosystems.
2. Ecosystems are dynamic and resilient, and they develop over time.
3. Biological systems operate on various spatial and time scales that can be organized hierarchically.
4. Habitats develop through and are maintained by physical and biological processes.
5. Species play key roles in developing and maintaining ecological conditions.
6. Biological diversity allows ecosystems to persist despite environmental variation.

7. Ecological management is adaptive and experimental.
8. Ecosystem function, habitat structure, and biological performance are affected by human actions.

As the NPCC's scientific principles indicate, the relationships of ecosystems, habitats, and populations of fish, wildlife, and plants are very complex. In most cases, these relationships are both undefined and interrelated. Changes resulting from weather, fire, flood, disease, or habitat loss may not only directly reduce or increase fish and wildlife populations, but they may also indirectly perturb relationships and interactions between and among fish, wildlife, and their ecosystems to the same or greater extent than the direct effects.

We defined seven limiting factors, or environmental bottlenecks, that may limit fish, wildlife, and their habitats. These factors, in relation to their causes and their manifestations, provide a simplistic working picture of how we evaluated focal populations, focal habitats, and ecosystems in this assessment (Figure 1-1). These limiting factors may act exclusively, such as when a fire eliminates old growth forest habitat necessary for old growth-dependent species such as the fisher (*Martes pennanti*). Limiting factors may also act simultaneously, such as when aquatic habitat quantity is reduced by water diversion, the remaining water in the stream is reduced in quality by increased water temperatures, and population linkage between aquatic species and the amount of water in the stream is reduced or eliminated.

Each limiting factor may manifest itself differently, depending on the status of the species or habitat, the scale of the effect, and the cause of the limiting factor. For example, wolf predation of elk calves may locally limit elk population growth, especially in an area of low habitat quality but will not threaten elk range wide. In this assessment, our simplistic model suggests causes of limiting factors affecting focal species and habitats and the manifestation of the limiting factor in a focal species, habitat, or ecosystem (Figure 1-1).

Our model is scale independent. It does not represent whether invasive exotic weeds are a competitive or habitat quality limiting factor or both, and it does not imply that fish, wildlife, and ecosystem relationships are as linear and simplistic as shown.

In this assessment, we assume that each of the ecosystems, habitats, and species we assessed originated and functioned optimally prior to anthropogenic influence (Figure 1-2). Pre-anthropogenic optimum function is assumed to be resilience of fish and wildlife systems and sustainability of populations within the range of natural variability. We suggest that increasing anthropogenic effects have exaggerated the limiting factors beyond the range of natural variability and that this pressure has simplified interactions and relationships and reduced the resilience of focal habitats and species, leading to long-term decline (Figure 1-2). Ongoing declines in focal habitats or species have unknown consequences at best and lead to extinction for one or more species at worst.

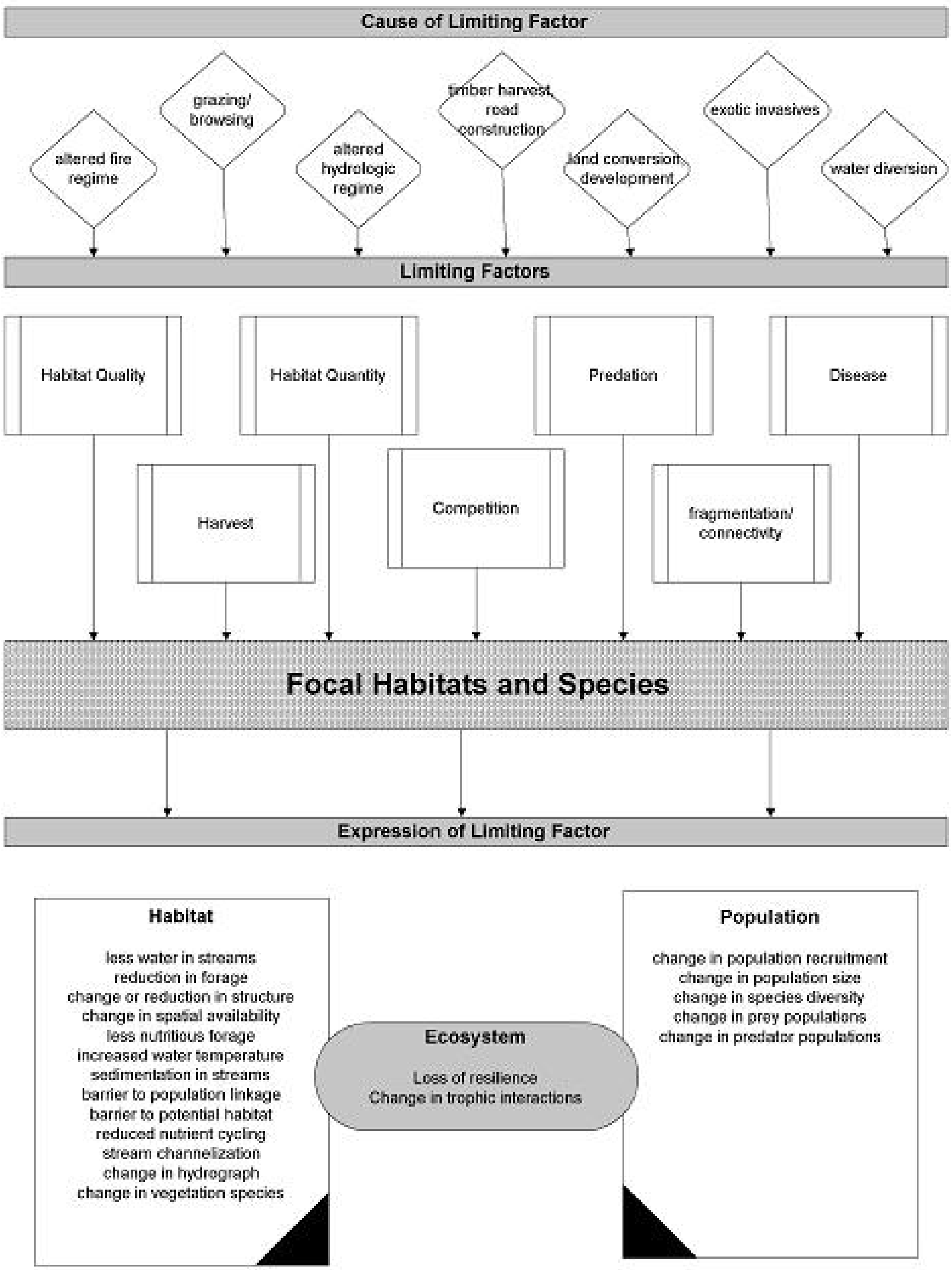
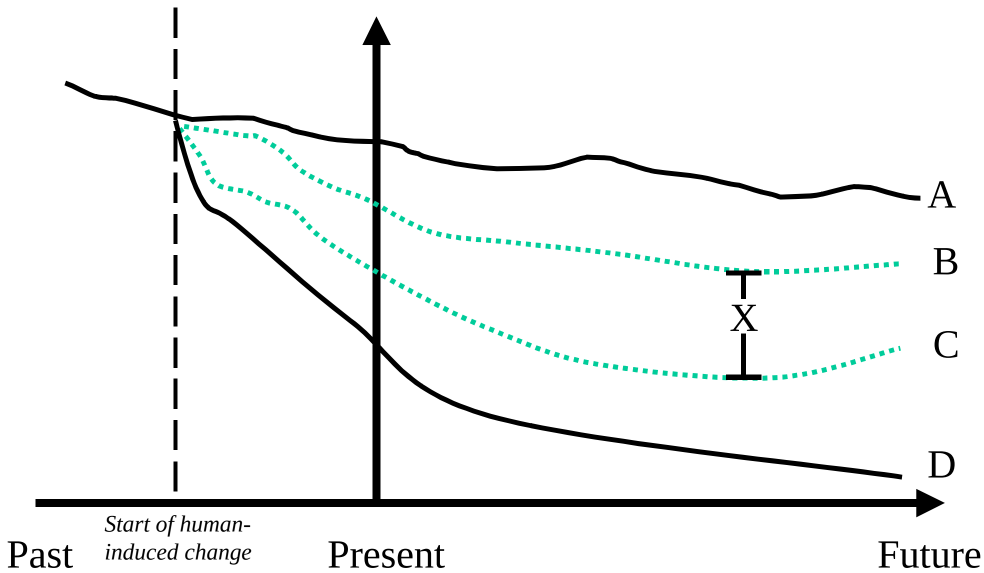



**Figure 1-1. Simple model for evaluating relationships between fish and wildlife and their ecosystems for the Boise, Payette, and Weiser subbasins, Idaho.**




A = determined by natural, physical, and biological constraints and processes
B = ideal condition that can be achieved within social and political constraints
C = minimum desirable condition for state variable (actual or social thresholds; B to C represents desirable range for state variable)
D = projected trend of focal habitat or species in ecosystem
X = area of predicted sustainability

**Figure 1-2. Schematic representation of a sustainable restoration scenario (adapted from National Academy of Sciences, 1992)**

Through definition of limiting factors and their causes, we identify strategies to relieve or eliminate the limiting factors and increase the trend and status of focal species, habitats, and ecosystems. We use the best available information to select focal species, define the status of each focal fish and wildlife species or habitat, and then synthesize this information into working hypotheses to direct the effective relief of limiting factors. Implementation of management strategies will ideally move the trend or status of focal species or habitats upward toward the acceptable and sustainable levels defined by the biological objectives in the subbasin plan. Monitoring and evaluation of strategy implementation is necessary to test the hypothesis of the management experiment, the effectiveness of the strategy, and increase learning through management actions.

### 1.2.2 Subbasin Null Hypotheses

Scientific methodology incorporates hypothesis testing by first assuming that a specified action has no effect or impact on the parameter in question. This is called the null hypothesis ($H_O$). From the subbasin assessment perspective, the broadest null hypothesis states that fish and wildlife species and their habitats are not limited in the Boise, Payette and Weiser subbasins and the broadest alternative hypothesis ($H_A$) would state that fish and wildlife species and their habitats are limited by one or more of seven identified limiting factors. More specifically, we begin our assessment with the following null hypotheses.

**Hypothesis A**

$H_O$: Habitat quality does not limit the abundance, distribution, life history, and ecological relationships of focal species and habitats.

**Hypothesis B**

$H_O$: Habitat quality does not limit the abundance, distribution, life history, and ecological relationships of focal species and habitats.

**Hypothesis C**

$H_O$: Population harvest does not limit the abundance, distribution, life history, and ecological relationships of focal species and habitats.

**Hypothesis D**

$H_O$: Competition among and between fish and wildlife species and habitats does not limit the abundance, distribution, life history, and ecological relationships of focal species and habitats.

**Hypothesis E**

$H_O$: Predation does not limit the abundance, distribution, life history, and ecological relationships of focal species and habitats.

**Hypothesis F**

$H_O$: Disease does not limit the abundance, distribution, life history, and ecological relationships of focal species and habitats.

**Hypothesis G**

$H_O$: Population and habitat fragmentation and loss of connectivity does not limit the abundance, distribution, life history, and ecological relationships of focal species and habitats.

The alternative or working hypothesis ($H_A$) is the opposite of the null hypothesis (Ho). It may be developed intuitively or be based on data and information from previous tests or assembled information. The alternative or working hypothesis refuted based on collection of data and information collected using scientific methodology during designed actions.

Our assessment is framed by beginning with seven stated null hypotheses based on our simplistic model (Figure 1-1) and ended by statement of alternative hypothesis $H_A$ developed through synthesis of the information on fish, wildlife, habitats, environmental conditions, and limiting factors we have gathered during the assessment. Monitoring strategies designed to change the influence of the identified limiting factor on focal species or habitats through change or elimination of the cause of the limiting factor can test these working or alternative hypotheses.

## 1.3 General Description and Location

The Boise, Payette, and Weiser subbasins provide habitat for approximately 365 fish and wildlife species (Rieben *et al*. 1998), but they are also subject to intensive anthropogenic water and land-use modifications. For example, anadromous fish played an important role in the Boise, Payette, and Weiser subbasins and were historically significant sources of nutrients for other fish and wildlife species, as well as for the ecosystems in which they lived (Ben-David *et al*. 1998). Currently, however, dams within and outside the Boise, Payette, and Weiser subbasins limit the abundance and distribution of anadromous fish, and consequently restrict the benefits of anadromous presence.

Water resource development and operations have resulted in the widespread loss of riparian and wetland communities (USFS 1994, USEPA 2001). Idaho's largest population centers are located in the Boise subbasin, with over 300,000 residents. Increases in human population have resulted in increased land-use conversion of natural and wilderness areas. Timber harvest and mining activities have altered aquatic ecosystems throughout the three subbasins. Cumulative impacts resulting from water-use development, increased urbanization, timber harvest, mining, and agriculture all contributed to a significant decline and loss of habitats and species within the three subbasins (see section 2 for more information).

The Boise, Payette, and Weiser subbasins are located in the southeastern region of the Columbia River basin in west-central Idaho (Figure 1-3). The subbasins extend north from the Snake River Plain, encompassing the Hitt and Cuddy mountains to the west. To the east, the Boise and Salmon River mountains form the headwaters of the Boise and Payette rivers.

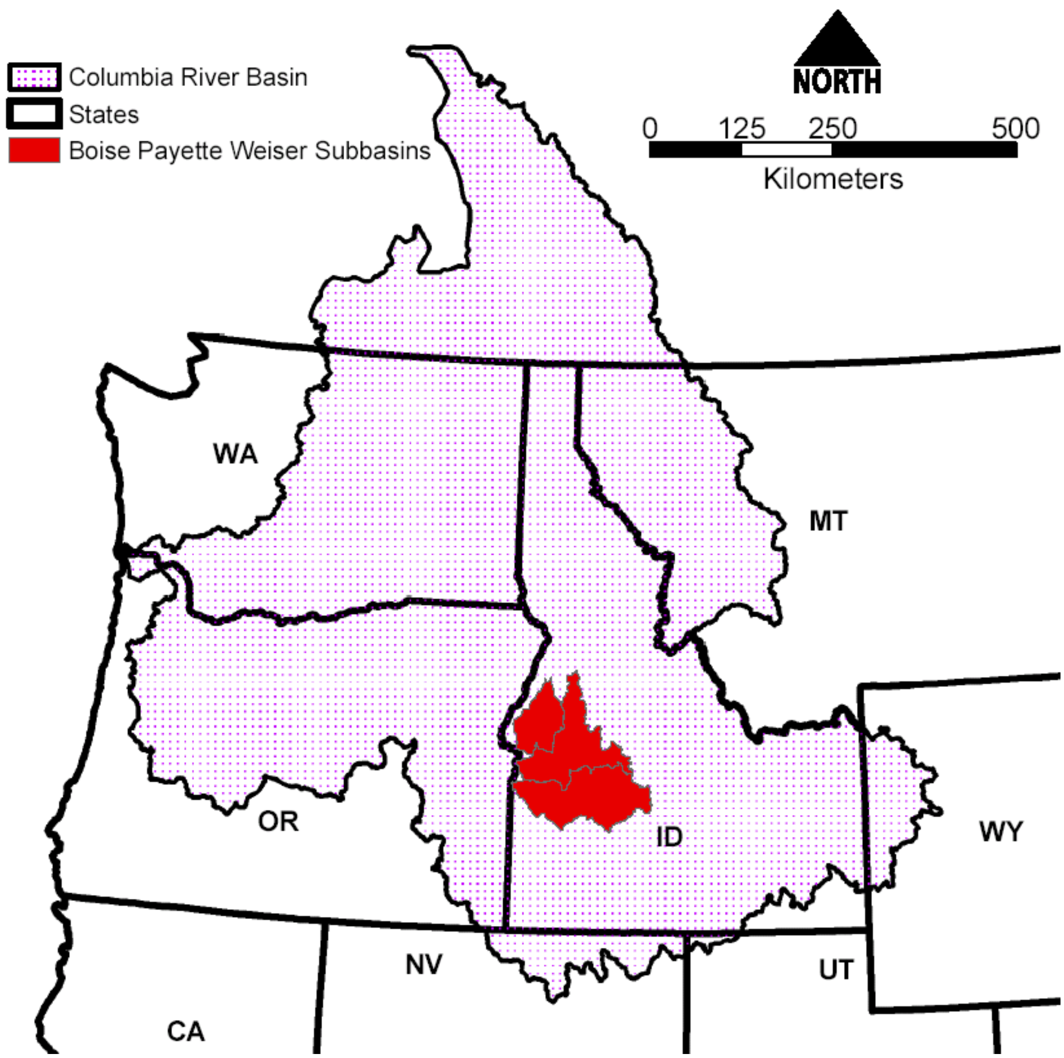



**Figure 1-3. Location of the Boise, Payette, and Weiser subbasins, Idaho, within the Columbia River basin.**

## 1.4 Physical Description

### 1.4.1 Drainage Area

The Boise, Payette, and Weiser subbasins contain a drainage area of over 2.3 million hectares (Figure 1-4). The Boise subbasin includes four watersheds: the North Fork/Middle Fork Boise (NMB), Boise–Mores Creek (BMO), South Fork Boise (SFB), and Lower Boise (LBO). The Payette subbasin includes four watersheds: the South Fork Payette (SFP), Middle Fork Payette (MFP), mainstem Payette (PAY), and North Fork Payette (NFP). The Weiser subbasin consists of a single watershed that includes the entire Weiser drainage (WEI).

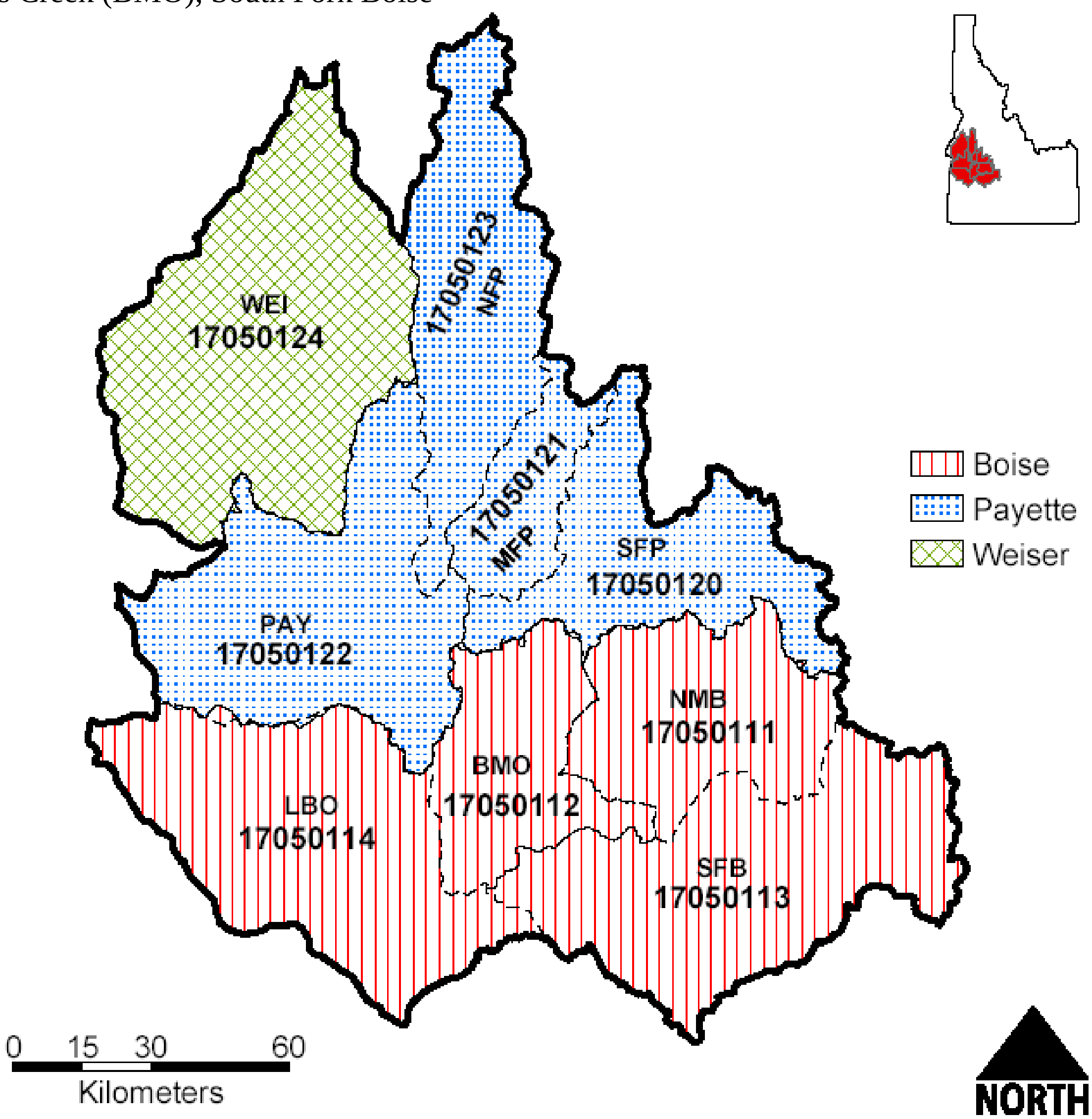



**Figure 1-4. Major hydrologic units (watersheds) within the Boise, Payette, and Weiser subbasins, Idaho.**

The Boise subbasin is the largest of the three subbasins at over one million hectares (Table 1-1). In addition, Idaho's largest population centers are located in the Lower Boise watershed (Figure 1-5). Major streams in the Boise subbasin include the mainstem Boise River, Indian Creek, Grimes Creek, South Fork Boise River, Big Smoky Creek, Little Smoky Creek, North Fork Boise River, Crooked Creek, and Middle Fork Boise River.

Approximately 279 lakes and reservoirs occur within the Boise subbasin. The larger reservoirs include Lake Lowell, Anderson Ranch, Lucky Peak, and Arrowrock. Some of the large natural lakes include Azure Lake, Big Scenic Creek Lake, Big Trinity Lake, Browns Lake, Heart Lake, Lake Ingeborg, Little Spangle Lake, Plummer Lake, and Spangle Lake.

**Table 1-1. Drainage areas, numbers of named streams, and total stream lengths for the 10 major watersheds within the Boise, Payette, and Weiser subbasins (IFWIS 2003).**

| Watershed Name | Code | Hydrologic Unit Code | Drainage Area (hectares) | Number of Named Streams | Total Stream Kilometers |
|---|---|---|---|---|---|
| **Boise Subbasin** | | | | | |
| North Fork/Middle Fork Boise River | NMB | 17050111 | 196,279 | 185 | 1,041 |
| Boise–Mores Creek | BMO | 17050112 | 160,296 | 175 | 1,173 |
| South Fork Boise River | SFB | 17050113 | 338,111 | 273 | 471 |
| Lower Boise River | LBO | 17050114 | 351,078 | 66 | 1,110 |
| Subbasin Totals | | | 1,045,764 | 699 | 3,795 |
| **Payette Subbasin** | | | | | |
| South Fork Payette River | SFP | 17050120 | 211,986 | 18 | 1,210 |
| Middle Fork Payette River | MFP | 17050121 | 88,100 | 58 | 1,394 |
| Mainstem Payette River | PAY | 17050122 | 321,709 | 139 | 1,911 |
| North Fork Payette River | NFP | 17050123 | 240,410 | 107 | 1,221 |
| Subbasin Totals | | | 862,205 | 322 | 5,736 |
| **Weiser Subbasin** | | | | | |
| Weiser River drainage | WEI | 17050124 | 435,949 | 152 | 1,807 |
| **Overall Totals** | | | **2,343,918** | **1,173** | **11,338** |

The Payette subbasin is approximately 862,000 hectares in size (Table 1-1). Major streams include Big Willow Creek, Deadwood River, Fortynine Slough, Gold Fork River, Kennally Creek, Lake Fork, Little Willow Creek, North Fork Payette River, mainstem Payette River, South Fork Payette River, and Squaw Creek. Approximately 369 lakes and reservoirs occur in the subbasin, including Cascade, Deadwood, and Paddock Valley reservoirs. Larger natural lakes include Box, Granite, Little Payette, Payette, and Upper Payette lakes.

The Weiser subbasin has the smallest area of the three subbasins at approximately 436,000 hectares (Table 1-1). Major streams include Crane Creek, Hornet Creek, Keithly Creek, Little Weiser River, Monroe Creek, North Crane Creek, Pine Creek, South Fork Crane Creek, and the mainstem Weiser River. The subbasin contains 10 reservoirs and approximately 32 lakes. The largest reservoir is Crane Creek, and Rush Lake is the only natural lake in this subbasin.

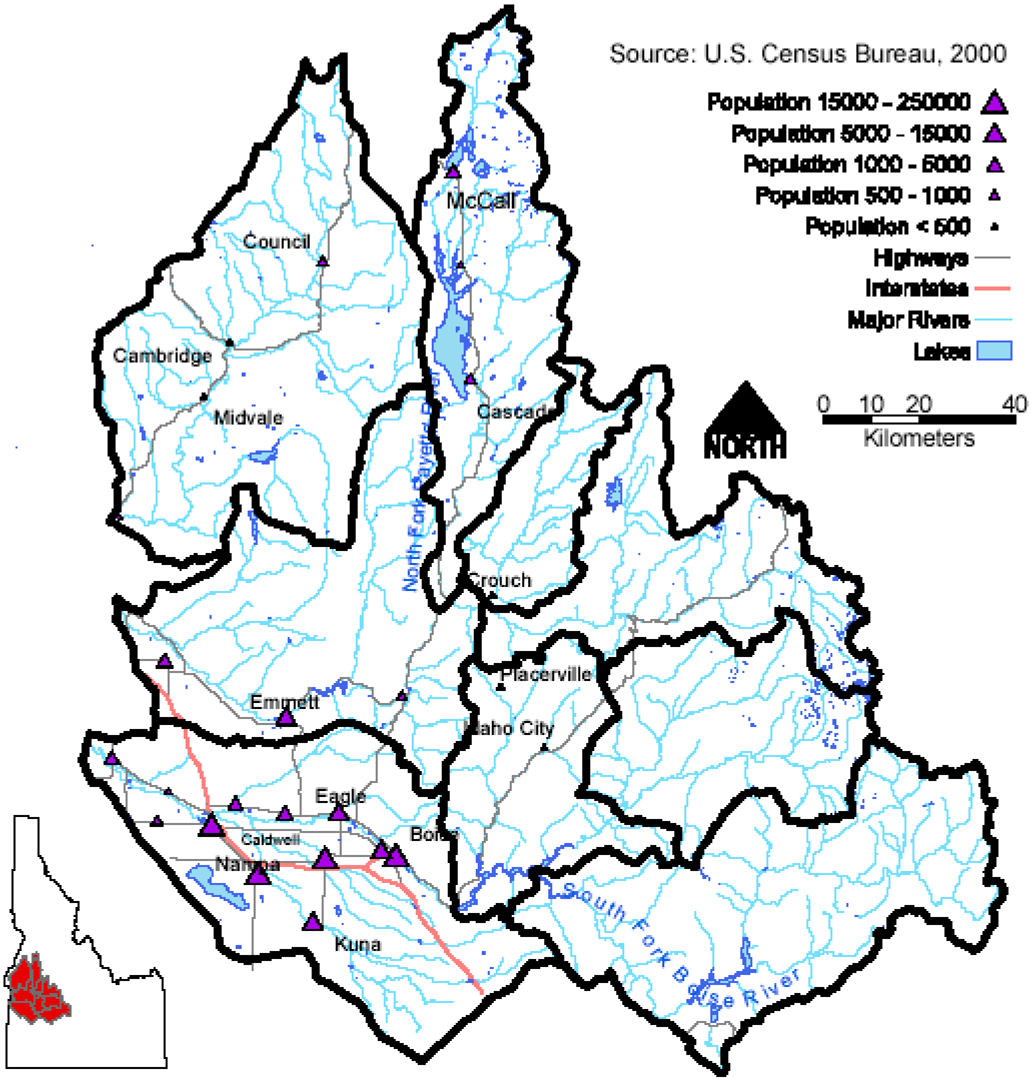



**Figure 1-5. Population centers and major roadways and rivers in the Boise, Payette, and Weiser subbasins, Idaho.**

Natural stream flow in the three subbasins is seasonally variable, but the majority of in-river flow is outflow from melting snow. The snowmelt-driven flow regimes result in low flows in fall and winter and high flows during spring and early summer (IDEQ and ODEQ 2001). In some areas and seasons, groundwater discharge is a substantial source of flow. Hydrology within the agricultural lands of the Boise, Payette, and Weiser subbasins is complex, with water diverted into fields, discharged back into the tributaries through irrigation drains and subsurface flows, and redirected onto additional lands downstream (IDEQ and ODEQ 2001).

Stream hydrographs peak from late March to May because of snowmelt runoff. High-elevation lands with deeper snowpack generate peak runoff beginning in late April and lasting until late May. Rain-on-snow events usually occur between 1,370 and 1,524 meters in elevation and are significant factors in major channel-altering flood events. The peak runoff periods are followed by warm, dry summers, during which stream flows decrease considerably.

### 1.4.2 Geomorphology

The Boise, Payette, and Weiser subbasins encompass portions of the Idaho Batholith, Blue Mountains, and Owyhee Uplands ecoregional sections (McNab and Avers 1994). The Idaho Batholith is predominant in the Boise–Mores Creek, Middle Fork Payette, North Fork Payette, North Fork/Middle Fork Boise, South Fork Boise, and South Fork Payette watersheds. Basal geology in the subbasins is complex, especially in the Boise–Mores Creek, South Fork Boise, and South Fork Payette watersheds (Figure 1-6).

Columbia River basalts are prominent in the Weiser and Payette subbasins, extending well east of the town of Horseshoe Bend, Idaho. The Lower Boise, Payette, and, to a lesser extent, South Fork Boise watersheds extend south into geologic features that are more characteristic of Snake River Plain volcanics.

Topographic relief of the subbasins is reflective of a terrain that once attained a mature erosional level and was subsequently uplifted. Pleistocene alpine glacier systems formed in the western Salmon River and Boise mountains, primarily on isolated high-elevation peaks, as evidenced by pothole lake systems and glacial cirques. Stream erosion has played the predominant role in shaping the physiography of the subbasins. In the mountainous portions of the subbasins, stream erosion since the Middle Tertiary Period has produced topography characterized by relatively narrow, V-shaped valleys, steep valley side slopes, and relatively narrow ridge systems.

The combination of the physical characteristic of Idaho Batholith and the physiographic nature of the landforms within these subbasins generates high natural potential for erosion. The Boise–Mores Creek, North Fork/Middle Fork Boise, South Fork Boise, Middle Fork Payette, North Fork Payette, and South Fork Payette watersheds are particularly subject to rapid erosion and mass wasting (Jensen *et al*. 1997).

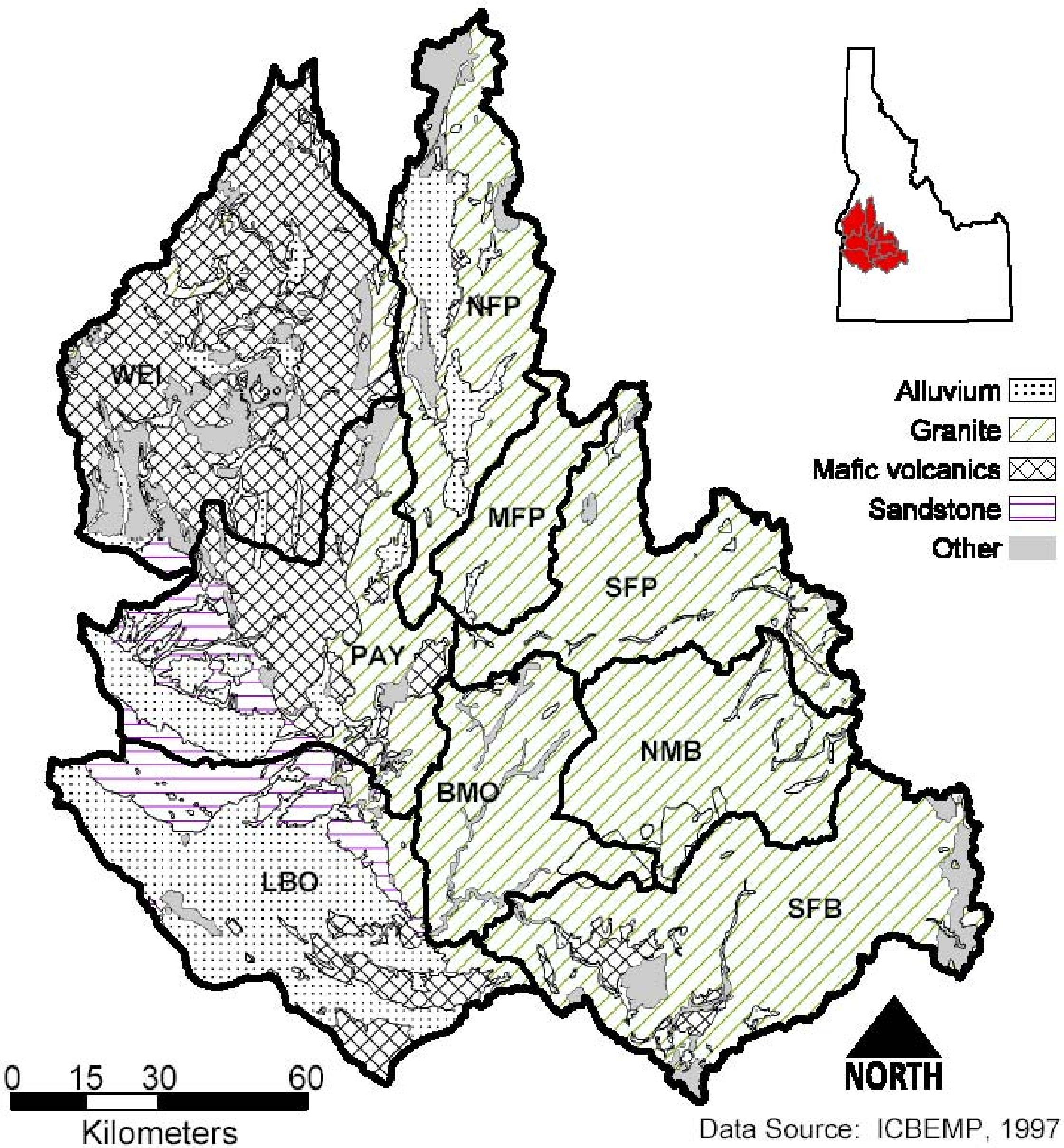



**Figure 1-6. Major geologic formations within the Boise, Payette, and Weiser subbasins.**

### 1.4.3 Climate

The subbasins encompass a strong climatic gradient, from the hot, dry climate of the Snake River Plain to the moist, windy climate of upland montane slopes and ridgecrests. These climatic regimes—characterized by cool, moist winters and warm, dry summers—are prevalent in all but the Lower Boise and mainstem Payette watersheds. Extreme climatic conditions (i.e., very hot and dry) are prominent in the low-elevation valleys of the Lower Boise and Payette watersheds.

Precipitation comes in the form of short, intense summer storms and longer, milder winter storms (IDEQ and ODEQ 2001). Precipitation is strongly seasonal, with the majority of precipitation falling in the winter as snow.

## 1.5 Biological Description

### 1.5.1 Fish Species

Fish communities in the headwater areas of the Boise, Payette, and Weiser subbasins are relatively simple, reflecting low productivity and cold water. Headwater areas are typically populated by rainbow/redband trout (*Oncorhynchus mykiss*), sculpin species (*Cottus* spp.), and the few remaining bull trout (*Salvelinus confluentus*) populations. Bull trout are the only fish species listed under the Endangered Species Act (ESA) that are currently present in the three subbasins.

Downstream fish communities are more diverse and include native species such as mountain whitefish (*Prosopium williamsoni*), northern pike minnow (*Ptychocheilus oregonensis*), redside shiner (*Richardsonius balteatus*), several sucker species (*Catostomus* spp.), and dace species (*Rhinichthys* spp.). Kokanee (*O. nerka*) are native to Payette Lake and have also been introduced into reservoirs in the Boise and Payette subbasins. Steelhead (*O. mykiss*), Chinook salmon (O. *tshawytscha*), and sockeye salmon (*O. nerka*) are listed under the ESA, but these species have been extirpated from the Boise, Payette, and Weiser subbasins. Pacific lamprey (*Lampetra*) are believed to be extirpated from the Boise, Payette, and Weiser subbasins. Table 1-2 summarizes the distribution of fish across the subbasins.

**Table 1-2. Fish species documented to historically or currently occur in the BPW subbasins, Idaho (n = native species; i = introduced species; ne = native extirpated).**

| Common Name | Scientific Name | Boise | Payette | Weiser |
|---|---|---|---|---|
| Arctic grayling | *Thymallus arcticus* | i | | |
| Banded killifish | *Fundulus diaphanous* | i | | |
| Bluegill | *Lepomis macrochirus* | i | i | i |
| Bridgelip sucker | *Catostomus columbianus* | n | n | n |
| Brook trout | *Salvelinus fontinalis* | i | i | i |
| Brown bullhead | *Ictaluras nebulosus* | | i | |
| Brown trout | *Salmo trutta* | i | | |
| Bull trout | *Salvelinus confluentus* | n | n | n |
| Channel catfish | *Ictalurus punctatus* | i | i | i |
| Chinook salmon | *Oncorhynchus tshawytscha* | ne | ne | ne |
| Chiselmouth chub | *Acrocheilus alutaceus* | n | n | n |
| Common carp | *Cyprinus carpio* | i | i | i |
| Black crappie | *Pomoxis nigromaculatus* | | i | |
| Cutthroat trout | *Oncorhynchus clarki* | i | i | |
| Grass carp | *Ctenopharyngodon idella* | i | | |
| Kokanee salmon* | *Oncorhynchus nerka* | i | i | |
| Largemouth bass | *Micropterus salmoides* | i | i | i |

| Common Name | Scientific Name | Boise | Payette | Weiser |
|---|---|---|---|---|
| Largescale sucker | *Catostomus macrocheilus* | n | n | n |
| Leopard dace | *Rhinichthys falcatus* | n | | |
| Longnose dace | *Rhinichthys cataractae* | n | n | n |
| Mottled sculpin | *Cottus bairdi* | n | n | n |
| Mountain sucker | *Catostomus platyrhynchus* | n | | |
| Mountain whitefish | *Prosopium williamsoni* | n | n | n |
| Northern pikeminnow | *Ptychocheilus oregonensis* | n | n | n |
| Oriental weatherfish | *Misgurnus anguillicaudatus* | i | | |
| Pacific Lamprey | *Lampetra tridentate* | ne | ne | ne |
| Paiute sculpin | *Cottus beldingi* | n | n | |
| Pumpkinseed | *Lepomis gibbosus* | | i | |
| Redband trout | *Oncorhynchus mykiss gairdneri* | n | n | n |
| Redside shiner | *Richardsonius balteatus* | i | i | i |
| Shorthead sculpin | *Cottus confusus* | n | | |
| Smallmouth bass | *Micropterus dolomieu* | i | i | i |
| Sockeye salmon | *Oncorhynchus nerka* | | ne | |
| Speckled dace | *Rhinichthys osculus* | n | n | n |
| Steelhead trout | *Oncorhynchus mykiss* | ne | ne | ne |
| Tadpole madtom | *Noturus gyrinus* | i | | |
| Tui chub | *Gila bicolor* | i | | |
| Warmouth | *Lepomis gulosus* | | i | |
| Western mosquitofish | *Gambusia affinis* | i | | |
| Yellow perch | *Perca flavescens* | i | i | |

*Kokanee salmon were native in Payette Lake.

### 1.5.2 Wildlife

The subbasins support diverse populations of wildlife (Figure 1-7), and some species (such as the gray wolf [*Canis lupus*]) have become uncommon or extirpated across large portions of their historical geographic ranges. For summary purposes, wildlife species have been grouped into the following categories:
1) threatened and endangered species,
2) mammals (big game, forest carnivores, and small mammals), 3) birds (raptors, upland birds, cavity nesters, and migratory birds), and 4) reptiles and amphibians.

Up to 371 vertebrate species are known to be present in the Boise, Payette, and Weiser subbasins, including some seasonal occurrences (Appendix 1-1). Of these, 368 species occur in the Boise subbasin, with the harlequin duck (*Histrionicus histrionicus*) and pygmy shrew (*Sorex hoyi*) occurring only in the Payette subbasin and the Idaho ground squirrel (*Spermophilus brunneus*) occurring only in the Payette and Weiser subbasins. A total of 343 vertebrate species occur in the Payette subbasin, and 365 occur in the Weiser subbasin. For many species in the subbasins, basic information on distribution and population trends has not been collected. Little information exists on the distribution of invertebrate species, so with a few exceptions, it is currently difficult to identify their distributions or population trends.

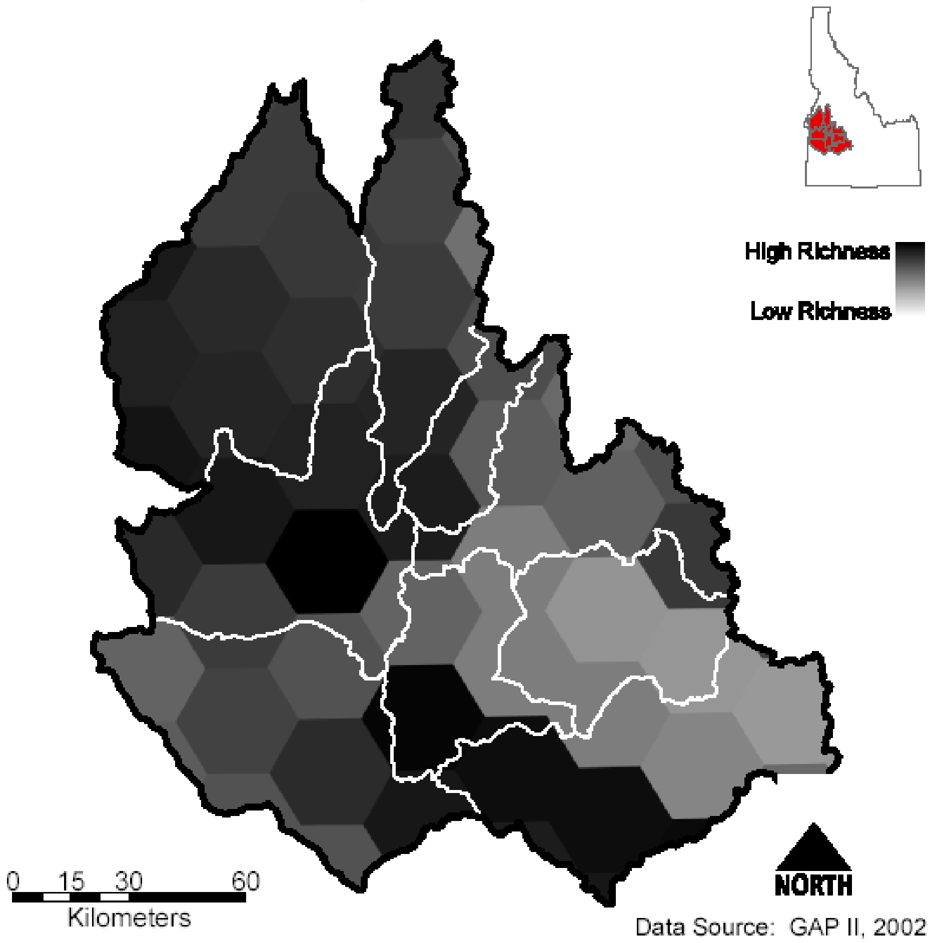



**Figure 1-7. Vertebrate species richness where richness was calculated as the number of species predicted to occur within each hexagon (GAP II, 2002).**

In the three subbasins, there are 46 wildlife species of concern and 4 federally listed threatened or endangered species, including a population of wolves federally designated as "non-essential, experimental" under section 10(j) of the ESA (Table 1-3). Threatened wildlife species include the northern Idaho ground squirrel (*Spermophilus brunneus brunneus*), bald eagle (*Haliaeetus leucocephalus*), and Canada lynx (*Lynx canadensis*). (The southern Idaho ground squirrel [*Spermophilus brunneus endemicus*] is a federal candidate species.) Documented occurrences of federally listed animals within the subbasins are depicted in Figure 1-8.

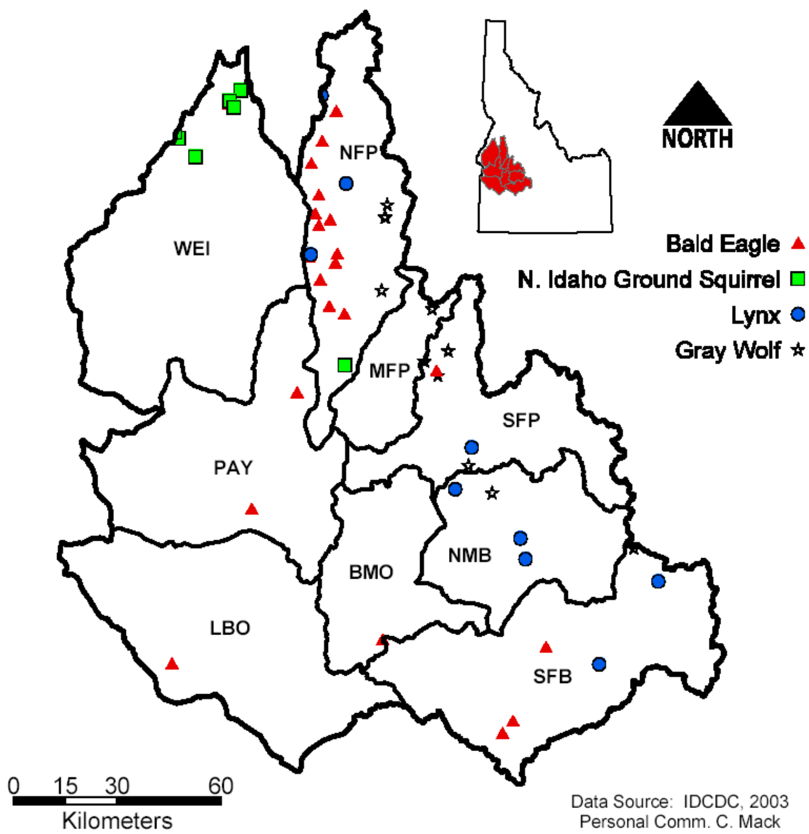



**Figure 1-8. Documented occurrences of threatened and endangered vertebrates in the Boise, Payette, and Weiser subbasin watersheds, Idaho (Idaho Conservation Data Center 2003a).**

**Table 1-3. Documented occurrences of threatened, endangered, and rare animal species within the major watersheds of the Boise, Payette, and Weiser subbasins. Federally listed species are identified in bold. Abundance of documented occurrences can be biased toward areas where there have been greater levels of research and other human activity. (See Appendix 1-1 for a complete list of vertebrate wildlife species and descriptions of global [G-rank] and state [S-rank] conservation rankings).**

| Common Name | Scientific Name | G-rank/S-rank | NMB[a] | BMO | SFB | LBO | SFP | MFP | PAY | NFP | WEI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Bald eagle** | *Haliaeetus leucocephalus* | G4/S3B,S4N | | X | X | X | X | | X | X | X |
| Barred owl | *Strix varia* | G5/S4 | | | | | | | | X | X |
| Black-backed woodpecker | *Picoides arcticus* | G5/S3 | | | | | | | | X | |
| Black-crowned night-heron | *Nycticorax nycticorax* | G5/S3B | | | | X | | | | | |
| Black-throated sparrow | *Amphispiza bilineata* | G5/S2B | | | | | | | | | X |
| Boreal owl | *Aegolius funereus* | G5/S2 | | | | | | | | X | |
| Bufflehead | *Bucephala albeola* | G5/S3B,S3N | | | | | | | | X | |

| **Common Name** | **Scientific Name** | **G-rank/S-rank** | **NMB[a]** | **BMO** | **SFB** | **LBO** | **SFP** | **MFP** | **PAY** | **NFP** | **WEI** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| California myotis | *Myotis californicus* | G5/S1? | | | | | | | | | X |
| **Canada Lynx** | *Lynx canadensis* | G5/S1 | X | | X | | X | | | X | |
| Columbian sharp-tailed grouse | *Tympanuchus phasianellus columbianus* | G4T3,S3 | | | X | | | | | | X |
| Coast mole | *Scapanus orarius* | G5/S1? | | | | | | | | | X |
| Columbia spotted frog | *Rana luteiventris* | G4Q/S2S3 | X | X | X | X | X | X | X | X | X |
| Common loon | *Gavia immer* | G5/S1B,S2N | | | | | X | | | | |
| Dwarf shrew | *Sorex nanus* | G4/S2,S3 | | | X | | | | | | |
| Ferruginous hawk | *Buteo regalis* | G4/S3B | | | | X | | | X | | X |
| Fisher | *Martes pennanti* | G5/S1 | X | X | X | | X | | | X | |
| Flammulated owl | *Otus flammeolus* | G4/S3B | | X | X | X | | | X | X | X |
| Fringed myotis | *Myotis thysanodes* | G4G5/S1? | | X | | | | | | | |
| Great gray owl | *Strix nebulosa* | G5/S3 | | | | | | | | X | X |
| **Gray Wolf** | *Canus Lupus* | G4/S1 | X | X | X | | | X | | X | |
| Lesser goldfinch | *Carduelis psaltria* | G5/S1B | | | | X | | | | | |
| Long-billed curlew | *Numenius americanus* | G5/S3B | | | | X | | | X | | X |
| Long-eared myotis | *Myotis evotis* | G5/S3? | | | | | | | | X | X |
| Long-legged myotis | *Myotis volans* | G5/S3? | | | | X | | | | X | |
| Merlin | *Falco columbarius* | G5/S1B,S2N | | | | X | | | | | |
| Merriam's shrew | *Sorex merriami* | G5/S2? | | | X | X | | | | | |
| Mojave black-collared lizard | *Crotaphytus bicinctores* | G5/S2 | | | | X | | | | | |
| Mountain quail | *Oreortyx pictus* | G5/S2 | X | X | X | X | X | X | X | X | |
| North American wolverine | *Gulo gulo luscus* | G4T4/S2 | X | X | X | | X | | X | X | X |
| Northern goshawk | *Accipiter gentiles* | G4T4/S2 | | | X | | X | | X | X | X |
| **Northern Idaho ground squirrel** | *Spermophilus brunneus brunneus* | G2T2/S2 | | | | | | | | X | X |
| Northern leopard frog | *Rana pipiens* | G5/S3 | | | X | X | | | X | | X |
| Northern pygmy-owl | *Glaucidium gnoma* | G5/S4 | | | | | X | | | | X |
| Pallid bat | *Antrozous passidus* | G5/S1? | | | | X | | | | | |
| Peregrine falcon | *Falco peregrinus anatum* | G4T3/S1B | | | | X | | | | X | |
| Pygmy nuthatch | *Sitta pygmaea* | G5/S2S3 | | X | | | | | | X | |
| Pygmy rabbit | *Brachylagus idahoensis* | G4/S3 | | | | X | | | | | |
| Red-necked grebe | *Podiceps grisegena* | G5/S3B | | | | | | | | X | |
| Ringneck snake | *Diadophis punctatus* | G5/S1? | | | | X | | | | | X |
| Southern Idaho ground squirrel | *Spermophilus brunneus endemicus* | G2T2/S2 | | | | | | | | | X |
| Three-toed woodpecker | *Picoides tridactylus* | G5/S3? | | | | | | | | X | |

| Common Name | Scientific Name | G-rank/S-rank | NMB[a] | BMO | SFB | LBO | SFP | MFP | PAY | NFP | WEI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Townsend's big-eared bat | *Corynorhinus townsendii* | G4/S2? | | | | X | | | | | X |
| Upland sandpiper | *Bartramia longicauda* | G5/S1B | | | | | | | X | X | |
| Western burrowing owl | *Athene cunicularia hypugaea* | G4TU/S3,S4 | | | | X | | | | | |
| Western grebe | *Aechmophorus occidentalis* | G5/S4B | | | | X | | | | X | |
| Western small-footed myotis | *Myotis ciliolabrum* | G5/S4? | | | | X | | | | | |
| Western toad | *Bufo boreas* | G4/S4 | X | | X | X | X | | | X | |
| White-headed woodpecker | *Picoides albolarvatus* | G4/S2B | X | X | X | | | | | | X |
| Woodhouse's toad | *Bufo woodhousii* | G5/S3? | | | | X | | | | | X |
| Yuma myotis | *Myotis yumanensis* | G5/S3? | X | | | | | | | | |

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

#### 1.5.2.1 Mammals

Ninety-six mammal species are identified as occurring within the three subbasins (Appendix 1-1), including 19 mammalian game species, 4 forest carnivores, and 54 small species. Ninety-four mammalian species are present in the Boise subbasin, 87 in the Payette subbasin, and 93 in the Weiser subbasin. Many of these species are valued for subsistence and for cultural, recreational, and economic reasons. Fourteen mammalian species are listed as sensitive species in Idaho: the Merriam's shrew (*Sorex merriami*), coast mole (*Scapanus orarius*), long-eared myotis (*Myotis evotis*), fringed myotis (*M. thysanodes*), small-footed myotis (*M. ciliolabrum*), western pipistrelle (*Pipistrellus hesperus*), spotted bat (*Euderma maculatum*), Townsend's big-eared bat (*Corynorhinus townsendii*), pygmy rabbit (*Brachylagus idahoensis*), northern and southern Idaho ground squirrels (*Spermophilus brunneus brunneus* and *S. brunneus endemicus*, lumped as *S. brunneus* in Appendix 1-1), Canada lynx (*Lynx canadensis*), wolverine (*Gulo gulo luscus*), and fisher (*Martes pennanti*) (Table 1-3).

#### 1.5.2.2 Birds

The diversity of habitats in the three subbasins supports 244 species of birds (Appendix 1-1). Many of these species are migratory and/or use the subbasins for only one part of their life histories (i.e., breeding). The subbasins support populations of raptors, an abundance of waterfowl, a remnant population of sharp-tailed grouse, greater sage-grouse, and numerous songbirds. Little information is available on the distribution and status of most avian species.

#### 1.5.2.3 Reptiles and Amphibians

There are 12 species of amphibians and 19 species of reptiles known or predicted to occur in the three subbasins (Appendix 1-1). Information on their distribution and status in the area is limited. Three amphibians—the western toad (*Bufo boreas)*, northern leopard frog (*Rana pipiens*), and the northern populations of the Columbia spotted frog (*Rana luteiventris*)—and one reptile species, the ringneck snake (*Diadophis punctatus*), have received IDFG species of special concern[1].

### 1.5.3 Vegetation and Floristic Diversity

Existing vegetation is defined as floristic composition and vegetation structure occurring at a given location at the current time (Brohman and Bryant 2003). Potential natural vegetation (PNV) is the vegetation that would become established if all successional sequences were completed without human interference under the present climatic and edaphic conditions (Brohman and Bryant 2003). Therefore, PNV classifications are based on existing vegetation, successional relationships, and environmental factors (e.g., climate, geology, soil, and other factors) considered together. PNV classification uses information on structure and composition similar to that needed for existing vegetation classification, but with greater emphasis on composition and successional relationships (Brohman and Bryant 2003). Existing vegetation classifications and maps provide much of the information needed to do the following:

- Describe the diversity of vegetation communities occupying an area.
- Characterize the effect of disturbances or management on species, including threatened and endangered species, and community distributions.
- Identify realistic objectives and related management opportunities.
- Document successional relationships and communities within PNV or ecological types.
- Streamline monitoring design and facilitate extrapolation of monitoring interpretations.
- Assess resource conditions, determine capability and suitability, and evaluate forest and rangeland health.
- Assess risks for invasive species, fire, insects, and disease.
- Conduct project planning and watershed analysis and predict activity outcomes at the project or land and resource management planning scales.
- More effectively communicate with partners, stakeholders, and neighbors.

Existing vegetation information by itself cannot answer questions about successional relationships, changes over time, historical range of variation, productivity, habitat characteristics, and responses to management actions. These questions can only be addressed by combining information about PNV, existing vegetation, and stand history (Brohman and Bryant 2003).

An existing vegetation classification inherently lacks information on the above topics because it only describes the vegetation present at one point in time. The current plant community reflects the history of a site. That history often includes geologic events, geomorphic processes, climatic changes, migrations of plants and animals in and out of the area, natural disturbances, chance weather extremes, and numerous human activities. Because of these factors, existing vegetation seldom represents the potential under current environmental conditions (Brohman and Bryant 2003).

Thirty-three PNV plant association groups occur within the Boise, Payette, and Weiser subbasins (Table 1-4 and Appendix 1-2).

[1] In March 2004, the Idaho Departmenr of Fish and Game Commission voted to eliminate the conservation category, Species of Special Concern. This change is expected to take place July 1, 2004.

Evergreen coniferous forest and evergreen shrubland ecosystems are most abundant. Dominant PNV varies widely among watersheds within these subbasins. Existing vegetative cover is grouped into 45 cover classes. The relative abundance of each class within each watershed is summarized in Table 1-5 (Appendix 1-2).

**Table 1-4. Percent representation of potential natural vegetation (PNV), by major watershed, for the Boise, Payette, and Weiser subbasins (ICBEMP 1997).**

| Potential Natural Vegetation | Percentage (%) by Major Hydrologic Unit (Watershed) | | | | | | | | | Total Area (km$^2$) |
|---|---|---|---|---|---|---|---|---|---|---|
| | NMB | BMO | SFB | LBO | SFP | MFP | PAY | NFP | WEI | |
| Dry Douglas-fir with ponderosa pine | 15 | 21 | 22 | <1 | 12 | 22 | 15 | 7 | 17 | 3,207 |
| Dry Douglas-fir without ponderosa pine | | | <1 | | | | | <1 | | 13 |
| Dry grand fir/white fir | 12 | 29 | 3 | <1 | 11 | 43 | 9 | 36 | 9 | 2,985 |
| Grand fir/white fir inland | <1 | 3 | 1 | | <1 | 6 | 2 | 9 | 11 | 958 |
| Agropyron steppe | | <1 | | <1 | | | | | | 28 |
| Alpine shrub–herbaceous | <1 | | <1 | | <1 | | | | | 5 |
| Aspen | <1 | <1 | 2 | | <1 | <1 | <1 | 1 | 1 | 196 |
| Big sagebrush steppe | | | | 35 | | | 5 | | 1 | 1,409 |
| Big sagebrush–cool | | 2 | | 2 | | | | | <1 | 116 |
| Big sagebrush–warm | | <1 | <1 | 24 | | | 12 | | 4 | 1,431 |
| Cottonwood riverine | | | | | | | | | | 0 |
| Fescue grassland | <1 | | 11 | <1 | <1 | | 2 | | <1 | 517 |
| Fescue grassland with conifer | 11 | 10 | 16 | 2 | 4 | | <1 | <1 | 5 | 1,332 |
| Juniper | | | | <1 | | | <1 | | | 17 |
| Low sagebrush–mesic | | | | <1 | | | | | | 7 |
| Low sagebrush–xeric | | | | <1 | | | | | | 31 |
| Mountain big sagebrush–mesic-west with juniper | | | | 4 | | | 2 | | <1 | 199 |
| Mountain big sagebrush–mesic-east | <1 | 8 | 11 | 4 | 2 | <1 | 34 | 6 | 37 | 3,532 |
| Mountain big sagebrush–mesic-east w/conifer | | | <1 | <1 | | | <1 | | <1 | 11 |
| Mountain big sagebrush–mesic-west | | | | | | | <1 | | | 1 |
| Mountain mahogany | | | | <1 | | | | | <1 | 4 |
| Mountain mahogany with mountain big sage | | | | | | | | | <1 | 8 |
| Salt desert shrub | | | | <1 | | | | | | 1 |
| Saltbrush riparian | | | | 24 | | | 12 | | 2 | 1,343 |
| Threetip sagebrush | | <1 | | <1 | | | | | | 5 |
| Interior ponderosa pine | 6 | 18 | 2 | <1 | 6 | 7 | 3 | <1 | 2 | 858 |
| Moist Douglas-fir | 5 | 2 | 3 | | 3 | 2 | <1 | 2 | 2 | 476 |
| Spruce–fir dry with aspen | 1 | <1 | 3 | | <1 | <1 | <1 | 3 | 2 | 301 |
| Spruce–fir dry without aspen | 21 | <1 | 8 | | 16 | 6 | 1 | 14 | 1 | 1,499 |

| Potential Natural Vegetation | Percentage (%) by Major Hydrologic Unit (Watershed) | | | | | | | | | Total Area (km²) |
|---|---|---|---|---|---|---|---|---|---|---|
| | NMB | BMO | SFB | LBO | SFP | MFP | PAY | NFP | WEI | |
| Spruce–fir wet | 12 | 1 | 5 | | 22 | 8 | <1 | 11 | <1 | 1,277 |
| Spruce–fir (lodgepole pine>whitebark pine) | 10 | 2 | 7 | | 18 | 5 | <1 | 5 | 2 | 1,141 |
| Water | | <1 | <1 | <1 | <1 | | | 5 | <1 | 141 |
| Whitebark pine/alpine larch–south | 4 | | 6 | | 2 | | <1 | <1 | 1 | 391 |

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

**Table 1-5. Percent representation of current vegetation cover types within each of the watersheds in the Boise, Payette, and Weiser subbasins (GAP II 2003).**

| Current Natural Vegetation | Major Hydrologic Unit (Watershed)[a] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | NMB | BMO | SFB | LBO | SFP | MFP | PAY | NFP | WEI | Total Area (km²) |
| Agricultural | | <1 | 1 | 37 | <1 | <1 | 14 | 10 | 6 | 2,301 |
| Alpine meadow | | | | | | | | <1 | | 2 |
| Aspen | 2 | 1 | 3 | | 2 | 2 | | | | 200 |
| Basin and Wyoming big sagebrush | 3 | 4 | 5 | 10 | 1 | <1 | 6 | | 15 | 1,497 |
| Bitterbrush | 5 | 5 | 6 | 2 | 3 | 1 | 11 | <1 | 14 | 1,498 |
| Broadleaf-dominated riparian | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | 69 |
| Deep marsh | | <1 | | <1 | | | <1 | <1 | <1 | 17 |
| Disturbed, high | | <1 | | <1 | | | | | <1 | 6 |
| Disturbed, low | <1 | <1 | <1 | <1 | | | <1 | <1 | | 8 |
| Douglas-fir | 18 | 11 | 13 | <1 | 18 | 20 | 3 | 10 | 4 | 2,035 |
| Douglas-fir/grand fir | | <1 | | | <1 | <1 | <1 | 1 | <1 | 88 |
| Douglas-fir/lodgepole pine | 1 | <1 | 2 | | 2 | 1 | | | | 147 |
| Engelmann spruce | | | | | | | | <1 | | 1 |
| Exposed rock | 1 | | <1 | | 1 | | | | | 68 |
| Foothills grassland | <1 | <1 | <1 | <1 | <1 | <1 | <1 | 2 | <1 | 79 |
| Graminoid- or forb-dominated riparian | <1 | | <1 | | <1 | <1 | | <1 | <1 | 13 |
| Grand fir | | <1 | | | <1 | 2 | <1 | 3 | 1 | 174 |
| Herbaceous burn | 7 | 7 | 8 | 2 | 2 | <1 | | 5 | <1 | 752 |
| Herbaceous clearcut | | | | | <1 | | | <1 | | 6 |
| High-intensity urban | | | | 13 | | | <1 | <1 | <1 | 478 |
| Lodgepole pine | 8 | 2 | 6 | | 15 | 6 | <1 | 4 | <1 | 853 |
| Low-intensity urban | <1 | <1 | <1 | 1 | <1 | <1 | <1 | <1 | <1 | 57 |
| Low sagebrush | <1 | <1 | <1 | <1 | <1 | <1 | 3 | <1 | 7 | 436 |
| Mixed needleleaf/broadleaf forest | <1 | <1 | <1 | | <1 | <1 | | | | 21 |
| Mixed subalpine forest | 6 | <1 | 5 | <1 | 7 | 4 | <1 | 7 | <1 | 733 |

| Current Natural Vegetation | Major Hydrologic Unit (Watershed)[a] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | NMB | BMO | SFB | LBO | SFP | MFP | PAY | NFP | WEI | Total Area ($km^2$) |
| Mixed xeric forest | 1 | 11 | 2 | <1 | 4 | 14 | 6 | 14 | 9 | 1,407 |
| Montane parklands and subalpine meadow | 1 | <1 | <1 | <1 | <1 | <1 | <1 | 3 | 1 | 225 |
| Mountain big sagebrush | 10 | 2 | 12 | <1 | 10 | 3 | 2 | 3 | 1 | 1,094 |
| Mountain low sagebrush | 2 | <1 | <1 | | 1 | <1 | | | | 83 |
| Mud flat | | <1 | | | | | <1 | <1 | <1 | 6 |
| Needleleaf-dominated riparian | <1 | <1 | <1 | | <1 | <1 | <1 | <1 | <1 | 79 |
| Perennial grass slope | <1 | 3 | <1 | 2 | 1 | <1 | 10 | <1 | 7 | 850 |
| Perennial grassland | <1 | 1 | 2 | 10 | <1 | <1 | 14 | <1 | 9 | 1,340 |
| Ponderosa pine | <1 | 16 | <1 | <1 | 3 | 19 | 7 | 12 | 10 | 1,517 |
| Rabbitbrush | | | | 3 | | | <1 | | | 99 |
| Salt-desert shrub | | | | 1 | | | <1 | | | 45 |
| Shallow marsh | | <1 | <1 | <1 | <1 | | <1 | 1 | <1 | 39 |
| Shrub-dominated riparian | 1 | 2 | 2 | <1 | 2 | 1 | 1 | 2 | 2 | 357 |
| Shrub-steppe annual grass-forb | | <1 | | 13 | | <1 | 11 | <1 | 4 | 1,020 |
| Subalpine fir | 3 | <1 | 2 | | 4 | 5 | 1 | 9 | 3 | 665 |
| Subalpine fir/whitebark pine | <1 | | <1 | | <1 | | | | | 12 |
| Subalpine pine | 2 | <1 | 2 | | 2 | <1 | <1 | 3 | <1 | 248 |
| Warm mesic shrubs | 25 | 27 | 23 | <1 | 18 | 16 | 4 | 2 | 3 | 2,544 |
| Water | <1 | <1 | <1 | <1 | <1 | <1 | <1 | 5 | <1 | 239 |
| Wet meadow | <1 | <1 | <1 | | <1 | <1 | <1 | <1 | <1 | 28 |

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

### 1.5.4 Rare and Endemic Plants Species

Twenty-seven rare plant species occur in all of the nine Boise, Payette, and Weiser subbasins watersheds, for a combined total of 157 known populations (Figure 1-9). The Idaho Conservation Data Center ranks the Indian Valley sedge (*Carex aboriginum*) as critically imperiled and especially vulnerable to extinction globally and statewide (rank G1S1). The species is known from two locations within the mainstem Weiser watershed.

The Idaho Conservation Data Center also ranks six other plant species occurring in the subbasins as globally imperiled (rank G2) because of their rarity: Mulford's milkvetch (*Astragalus mulfordiae*), Cusick's false yarrow (*Chaenactis cusickii*), silverskin lichen (*Dermatocarpon lorenzianum*), Idaho douglasia (*Douglasia idahoensis*), slick spot peppergrass (*Lepidium papilliferum*), and Douglas clover (*Trifolium douglasii*). One hundred and fourteen populations of imperiled plant species occur with relatively even distribution throughout the subbasin. Populations of Mulford's milkvetch and slick spot peppergrass occur with high frequency in the Lower Boise watershed. More details on rare vegetation in the Boise, Payette, and Weiser subbasins can be found in Appendix 1-3.

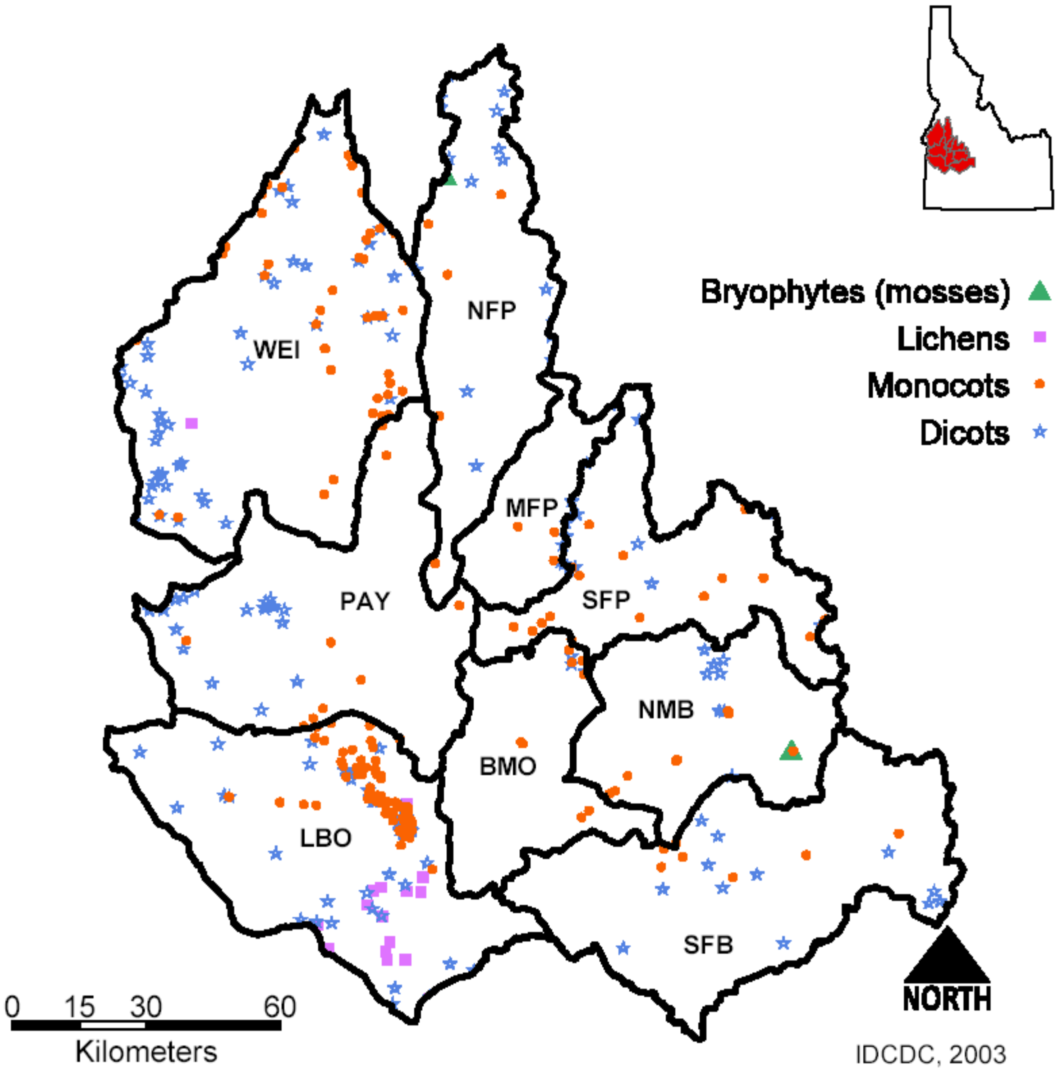



**Figure 1-9. Distribution of rare plants in the Boise, Payette, and Weiser subbasin watersheds (Idaho Conservation Data Center 2003b)**

## 1.6 Social Description

### 1.6.1 Demographics

#### *1.6.1.1 Population*

The Boise, Payette, and Weiser subbasins are composed of portions of ten counties: Adams, Washington, Payette, Canyon, Ada, Elmore, Boise, Gem, Camas, and Valley counties (Figure 1-10). These subbasins also encompass Idaho's largest human population centers. The county with the greatest population is Ada County (Table 1-6). The largest communities are Boise, with a population of 189,847; Nampa, 60,259; Meridian, 39,067; and Caldwell, 29,466 (Table 1-6).

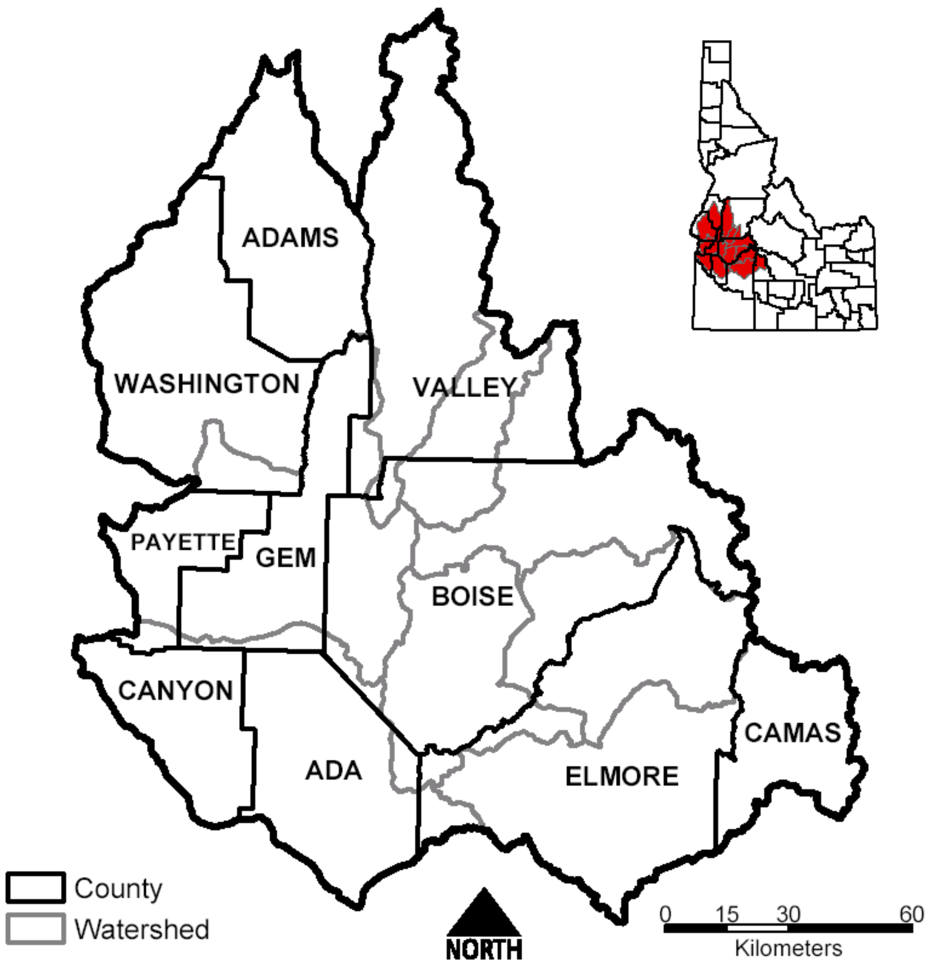



**Figure 1-10. Ten counties are combined to form the Boise, Payette, and Weiser subbasins, Idaho. Several counties comprise two or more watersheds, depicted by the lighter outlines.**

**Table 1-6. Population in the 10 counties of the Boise, Payette, and Weiser subbasins, Idaho (U.S. Census Bureau 2003).**

| County and Population Centers | July 1, 2002 Population | Census 2000 Population | 2001–2002 Percentage (%) Change in Population |
|---|---|---|---|
| **Ada County** | 319,687 | 300,904 | 2.2 |
| Boise | 189,847 | 185,787 | 0.9 |
| Eagle | 13,659 | 11,085 | 6.0 |
| Garden City | 10,985 | 10,624 | 1.1 |
| Kuna | 7,773 | 5,382 | 12.1 |
| Meridian | 39,067 | 34,919 | 4.8 |
| Star | 2,101 | 1,795 | 3.9 |
| **Adams County** | 3,448 | 3,476 | 0.9 |

| County and Population Centers | July 1, 2002 Population | Census 2000 Population | 2001–2002 Percentage (%) Change in Population |
|---|---|---|---|
| Council | 772 | 816 | –1.5 |
| New Meadows | 509 | 533 | –1.0 |
| **Boise County** | 7,067 | 6,670 | 1.9 |
| Crouch | 162 | 154 | 1.9 |
| Horseshoe Bend | 812 | 770 | 1.6 |
| Idaho City | 483 | 458 | 1.7 |
| Placerville | 61 | 60 | 0.0 |
| **Camas County** | 1,037 | 991 | 2.6 |
| Fairfield | 400 | 395 | 1.3 |
| **Canyon County** | 144,983 | 131,441 | 4.3 |
| Caldwell | 29,466 | 25,967 | 4.7 |
| Greenleaf | 873 | 862 | 0.7 |
| Melba | 501 | 439 | 10.6 |
| Middleton | 3,272 | 2,978 | 3.2 |
| Nampa | 60,259 | 51,867 | 6.1 |
| Notus | 494 | 458 | 4.4 |
| Parma | 1,804 | 1,771 | 0.5 |
| Wilder | 1,472 | 1,462 | 0.0 |
| **Elmore County** | 29,481 | 29,130 | 0.6 |
| Glenns Ferry | 1,571 | 1,611 | –0.8 |
| Mountain Home | 11,531 | 11,143 | 1.1 |
| **Gem County** | 15,495 | 15,181 | 0.4 |
| Emmett | 5,752 | 5,490 | 1.0 |
| **Payette County** | 21,007 | 20,578 | 1.1 |
| Fruitland | 3,978 | 3,805 | 1.6 |
| New Plymouth | 1,386 | 1,400 | –0.2 |
| Payette City | 7,148 | 7,054 | 0.8 |
| **Valley County** | 7,526 | 7,651 | –1.6 |
| Cascade | 962 | 997 | –2.7 |
| Donnelly | 131 | 138 | –3.0 |
| McCall | 2,110 | 2,084 | –0.3 |
| **Washington County** | 9,924 | 9,977 | –0.3 |
| Cambridge | 354 | 360 | –0.8 |
| Midvale | 177 | 176 | 1.7 |
| Weiser | 5,367 | 5,343 | –0.7 |

#### *1.6.1.2 Economy and Employment*

While urban areas thrive with retail and technologies markets, ranching and agriculture play important economic roles in the rural areas of the Boise, Payette, and Weiser subbasins. Natural resource-based industries such as mining and logging continue to sustain some areas. However, recent years have seen the decline of natural resource-based industries due to increasing environmental concerns. While rural areas still rely heavily on agricultural and ranching components of the economy, recreation and tourism are also important to the region. Whitewater rafting, boating, hunting, fishing, hiking, camping, and tourism are popular attractions, and many communities feature annual events that help boost local economies.

### 1.6.2 Ownership and Land-Use Patterns

#### *1.6.2.1 Pre-European Settlement*

Prior to Euro-American settlement, the Northern Shoshone, Northern Paiute, Nez Perce, and Bannock (a Northern Paiute subgroup) Tribes occupied a territory that extended across most of southern Idaho into western Wyoming and down into Nevada and Utah, a portion of which is today referred to as the Middle and Upper Snake Provinces of the Columbia River Basin.

The tribes moved with the seasons. The annual subsistence cycle began in the spring, when some bands moved into the mountains to hunt large game and collect roots. Other bands moved to fishing locations on the Snake and Columbia rivers. During the summer, large groups traveled to Wyoming and western Montana to hunt bison. The summer months were a time of intertribal gatherings. Tribes met along the Snake River to trade; hunt; fish; and collect seeds, nuts, and berries. Late fall was a time of intensive preparation for winter. Meats and various plant foods were cached for later use, and winter residences along the Snake River were readied.

The tribes utilized fish and wildlife resources across the subbasin. Using implements such as spears, harpoons, dip nets, seines, and weirs, they fished for Chinook salmon, steelhead, Pacific lamprey, and mountain whitefish. They hunted antelope, deer, elk, bighorn sheep, rabbits, bears, and certain types of waterfowl.

#### *1.6.2.2 Current Land-Use*

General land uses within the Boise, Payette, and Weiser subbasins include urban development, dryland and irrigated agriculture, forest and rangeland resource extraction, and recreation. Landownership patterns within the Boise, Payette, and Weiser subbasins follow those often observed in the Intermountain West: the fertile, highly productive lands are often privately held while the Bureau of Land Management (BLM) manages rangelands and the U.S. Forest Service (USFS) manages public forestlands (Figure 1-11). The majority of privately owned land is located at the lower elevations. Much of this land is used for agricultural purposes.

Approximately 61% of the land in the subbasins is publicly owned (Table 1-7). The USFS is the largest land manager, managing 47.6% of the landholdings in the subbasins. Forest- and range-related uses—such as timber harvest, mining, grazing, and recreation—are the principal land uses on federally managed public land within the subbasins. However, private land inholdings within state and public lands are extensive in the Boise–Mores Creek, Lower Boise, North Fork Payette, mainstem Payette, and Weiser watersheds. Rangeland-related uses occur primarily on private lands in the Boise, Payette, and Weiser subbasins.

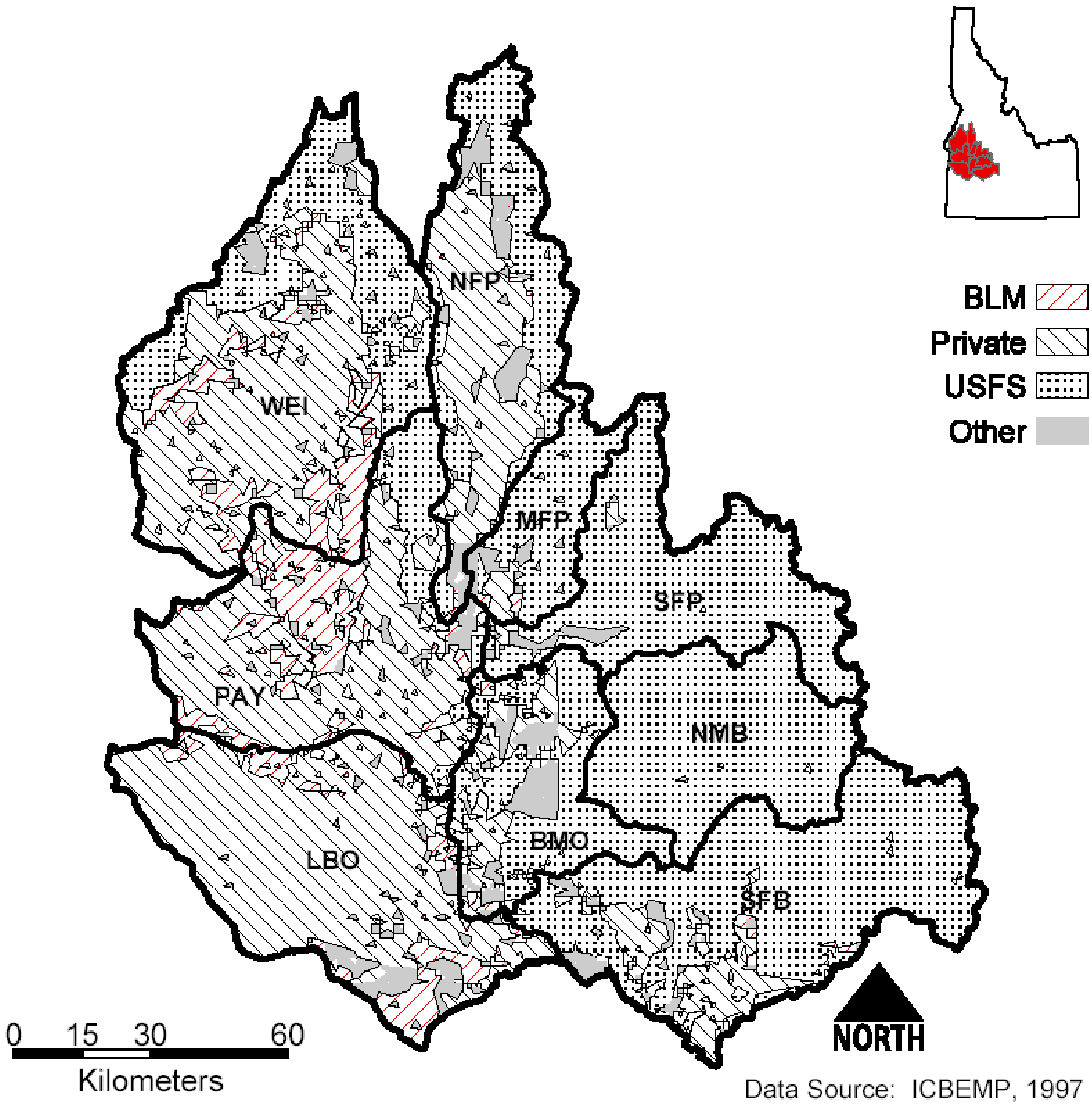



**Figure 1-11. Landownership/management within the Boise, Payette, and Weiser subbasins.**

**Table 1-7. Percentage of landownership/management in the Boise, Payette, and Weiser subbasins, by watershed and 50-m stream buffer (ICBEMP 1997).**

| Landowner/Manager | Watershed[a] | | | | | | | | | % Entire Subbasin |
|---|---|---|---|---|---|---|---|---|---|---|
| | NMB | BMO | SFB | LBO | SFP | MFP | PAY | NFP | WEI | |
| Bureau of Land Management | 0.0 | 2.3 | 0.9 | 12.5 | 0.1 | 1.9 | 20.4 | 0.7 | 13.5 | 7.6 |
| Bureau of Reclamation | 0.1 | 0.1 | 0.6 | 3.6 | 3.0 | 4.6 | 0.3 | 0.0 | 0.0 | 1.1 |
| Private/Water | 0.1 | 21.5 | 14.3 | 78.8 | 1.9 | 7.2 | 60.7 | 45.5 | 52.9 | 38.6 |
| State of Idaho | 0.0 | 15.0 | 4.0 | 4.0 | 0.4 | 3.9 | 4.4 | 11.8 | 4.4 | 5.0 |

| Landowner/Manager | Watershed with 50-m Stream Buffer | | | | | | | | | % Entire Subbasin |
|---|---|---|---|---|---|---|---|---|---|---|
| USDA Forest Service | 99.8 | 61.1 | 80.2 | 1.1 | 94.7 | 82.4 | 14.2 | 42.0 | 29.2 | 47.6 |
| Total Area ($km^2$) | 1,963 | 1,603 | 3,381 | 3,511 | 2,120 | 881 | 3,217 | 2,404 | 4,359 | 23,439 |
| | NMB | BMO | SFB | LBO | SFP | MFP | PAY | NFP | WEI | |
| Bureau of Land Management | 0.0 | 2.9 | 0.9 | 9.1 | 0.0 | 1.8 | 14.6 | 1.1 | 10.8 | 5.1 |
| Bureau of Reclamation | 0.1 | 0.1 | 0.7 | 3.1 | 5.8 | 6.8 | 0.5 | 0.0 | 0.1 | 1.4 |
| Private/Water | 0.4 | 23.7 | 13.3 | 83.4 | 2.9 | 11.0 | 65.9 | 51.4 | 51.2 | 35.2 |
| State of Idaho | 0.0 | 16.0 | 3.7 | 3.0 | 0.5 | 3.9 | 3.4 | 11.3 | 3.9 | 4.8 |
| USDA Forest Service | 99.5 | 57.3 | 81.5 | 1.3 | 90.7 | 76.5 | 15.7 | 36.2 | 34.1 | 53.6 |
| Total Area ($km^2$) | 119 | 102 | 188 | 115 | 120 | 46 | 138 | 109 | 179 | 1,118 |

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

Mining has occurred throughout the Boise, Payette, and Weiser subbasins. As the gold strikes in the Clearwater and Salmon subbasins were exhausted, prospectors worked their way south and east in search of gold. The development of the most significant gold-mining district in Idaho, the Boise Basin, occurred in 1862. A wide variety of products has been extracted, including gemstones, metals, minerals, geothermal resources, mercury, and earthen materials.

The largest mining district currently within the subbasins is the Atlanta District. The Atlanta Lode consisted largely of quartz with arsenopyrite and gold. Other old mines in the Boise subbasin include an antimony mine near Swanholm Peak and small, active gold and silver-base metal mines in several tributaries including Black Warrior Creek and Little Queens River. Commercial mining is still viable in these areas; the Atlanta Lode is the most likely to be reactivated (Idaho Mining Association 1998).

Some of the effects of mining to natural resources are variable and depend on mine size and location, mining methods, products mined, and a number of other factors. Some species (such as bats) may benefit from the creation of mines, but most are adversely affected. The most common influences of mining activities on aquatic resources involve production of acidic wastes, toxic metals, and sediment (Nelson *et al*. 1991).

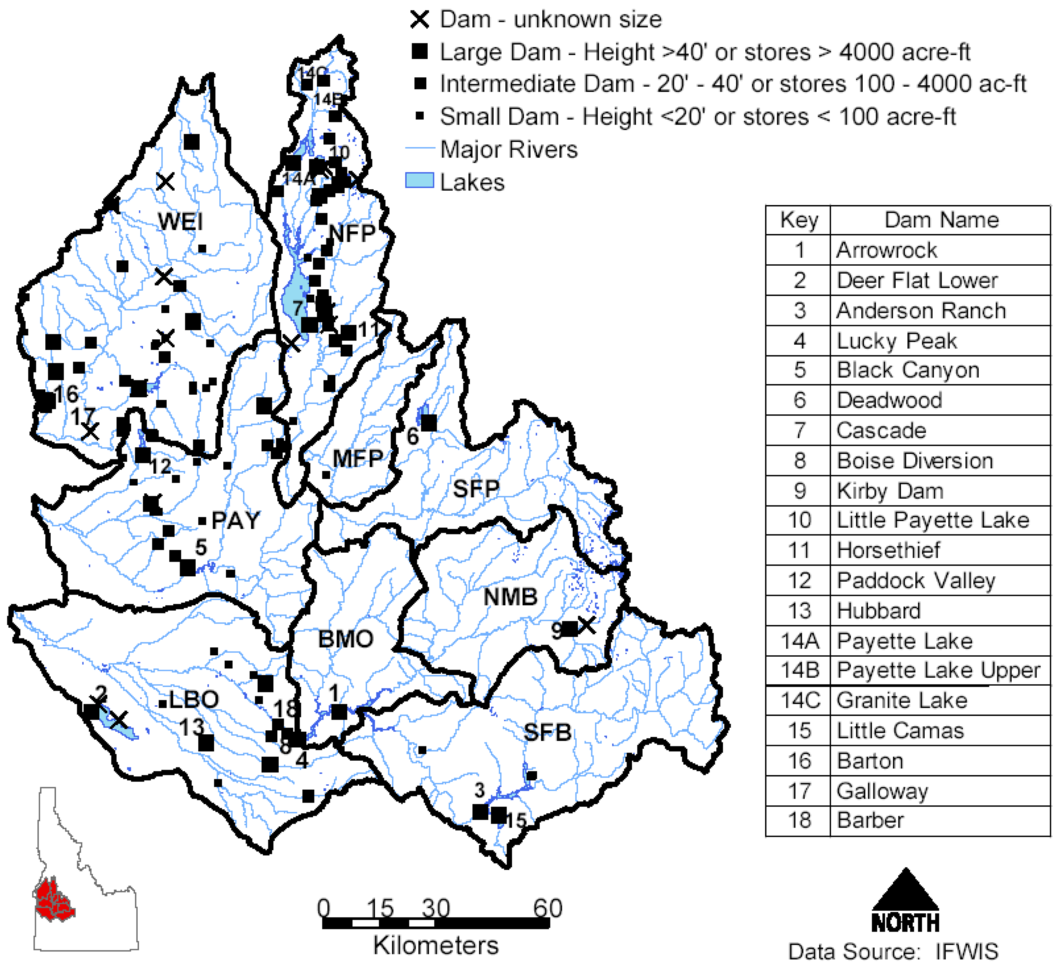
### 1.6.3 Diversions, Impoundments, and Irrigation Projects

Numerous water diversions, impoundments, and irrigation projects exist throughout the three subbasins (

Table 1-8 and Figure 1-12). Construction of irrigation dams (Arrowrock Dam on the Boise River in 1912 and Black Canyon Dam on the Payette River in 1924) completely blocked Chinook salmon and steelhead passage to most of the Boise, Payette, and Weiser subbasins (Figure 1-13). Construction of the Hells Canyon Complex (Brownlee, Oxbow, and Hells Canyon dams) by Idaho Power Company during the late 1950s and late 1960s also blocked fish passage to the subbasins. One of the first dams in the Boise subbasin was the Barber Mill Dam, which was completed in 1905. Completion of the New York Diversion Dam near Boise in 1911 eliminated fish passage. Appendix 1-4 lists all documented dams present in the three subbasins.

Water use in the Weiser subbasin is essentially unregulated (USBOR 1997), but there are at least 15 significant irrigation reservoirs in the Weiser subbasin (DuPont and Kennedy 2000). There are also many small reservoirs, most with a capacity of less than 100 acre-feet. Consumptive use of the Weiser River is primarily agricultural (USBOR 1997), and it is common for streams to be completely dry during peak irrigation periods (DuPont and Kennedy 2000). Flooding occurs along the Weiser River during above-normal water years.

Diversions are numerous and distributed throughout the three subbasins. The majority of these diversions occur in the Weiser watershed (3,400), followed by the Payette (2,000), Lower Boise (1,900), and North Fork Payette (1,350) watersheds. Diversions in mainstem waters accessible to Chinook salmon and steelhead are not screened.




| Key | Dam Name |
|---|---|
| 1 | Arrowrock |
| 2 | Deer Flat Lower |
| 3 | Anderson Ranch |
| 4 | Lucky Peak |
| 5 | Black Canyon |
| 6 | Deadwood |
| 7 | Cascade |
| 8 | Boise Diversion |
| 9 | Kirby Dam |
| 10 | Little Payette Lake |
| 11 | Horsethief |
| 12 | Paddock Valley |
| 13 | Hubbard |
| 14A | Payette Lake |
| 14B | Payette Lake Upper |
| 14C | Granite Lake |
| 15 | Little Camas |
| 16 | Barton |
| 17 | Galloway |
| 18 | Barber |

**Figure 1-12. Locations of dams in the Boise, Payette, and Weiser subbasin watersheds, Idaho (see Appendix 1-4 for more information on dams).**

**Table 1-8. List of important dams within the Boise, Payette, and Weiser subbasins, Idaho (see Appendix 1-4 for a comprehensive listing of all dams in the three subbasins).**

| Dam Name | Stream | Year | Storage Capacity (acre-feet) | Reservoir Area ($km^2$) | Ownership/ Management | Purpose |
|---|---|---|---|---|---|---|
| Arrowrock | Boise River | 1912 | 286,600 | 12.5 | U.S. Bureau of Reclamation | Domestic and irrigation, food control, and recreation |
| Deer Flat<br>Lower<br>Middle<br>Upper | Boise River (off stream) | 1911 | <br>19,000<br>Auxdam[a]<br>Auxdam | <br>39.7<br>39.7<br>39.7 | U.S. Bureau of Reclamation | Irrigation |
| Anderson Ranch | South Fork Boise River | 1950 | 493,200 | 19.2 | U.S. Bureau of Reclamation | Irrigation, power and flood control |
| Lucky Peak | Boise River | 1954 | 307,000 | 11.4 | U.S. Army Corps of Engineers | Irrigation, flood control and power |
| Black Canyon | Payette River | 1924 | 29,822 | 4.5 | U.S. Bureau of Reclamation | Irrigation, power and recreation |
| Deadwood | Deadwood River | 1931 | 161,900 | 12.1 | U.S. Bureau of Reclamation | Irrigation, power and recreation |
| Cascade | North Fork Payette River | 1948 | 703,200 | 114.5 | U.S. Bureau of Reclamation | Irrigation, flood control and power |
| Boise Diversion | Boise River | 1908 | 600 | 0.3 | U.S. Bureau of Reclamation | Irrigation and power |
| Kirby | Middle Fork Boise River | 1908 | 5 | <0.1 | Atlanta Power Company | Power and municipal supply |
| Little Payette Lake | Lake Fork Creek | 1926 | 10,300 | 5.9 | Lake Fork Irrigation District | Domestic and irrigation |
| Horsethief Basin | Horsethief and Big Creeks | 1967 | 4,900 | 0.8 | Idaho Fish And Game Department | Recreation, fish and wildlife propagation |
| Paddock Valley | Little Willow Creek | 1949 | 36,400 | 5.4 | Little Willow Irrigation District | Irrigation |
| Hubbard | Boise River (off stream) | 1902 | 4,060 | 1.8 | U.S. Bureau of Reclamation | Irrigation |
| Payette Lake Upper | North Fork Payette River | 1953 | 3,000 | 1.3 | Lake Reservoir Company | Irrigation |
| Granite Lake | Lake Creek | 1932 | 2,900 | 0.8 | Lake Reservoir Company | Irrigation |
| Little Camas | Little Camas Creek | 1912 | 18,400 | 5.9 | Mountain Home Irrigation District | Irrigation |

[a] Auxiliary dam

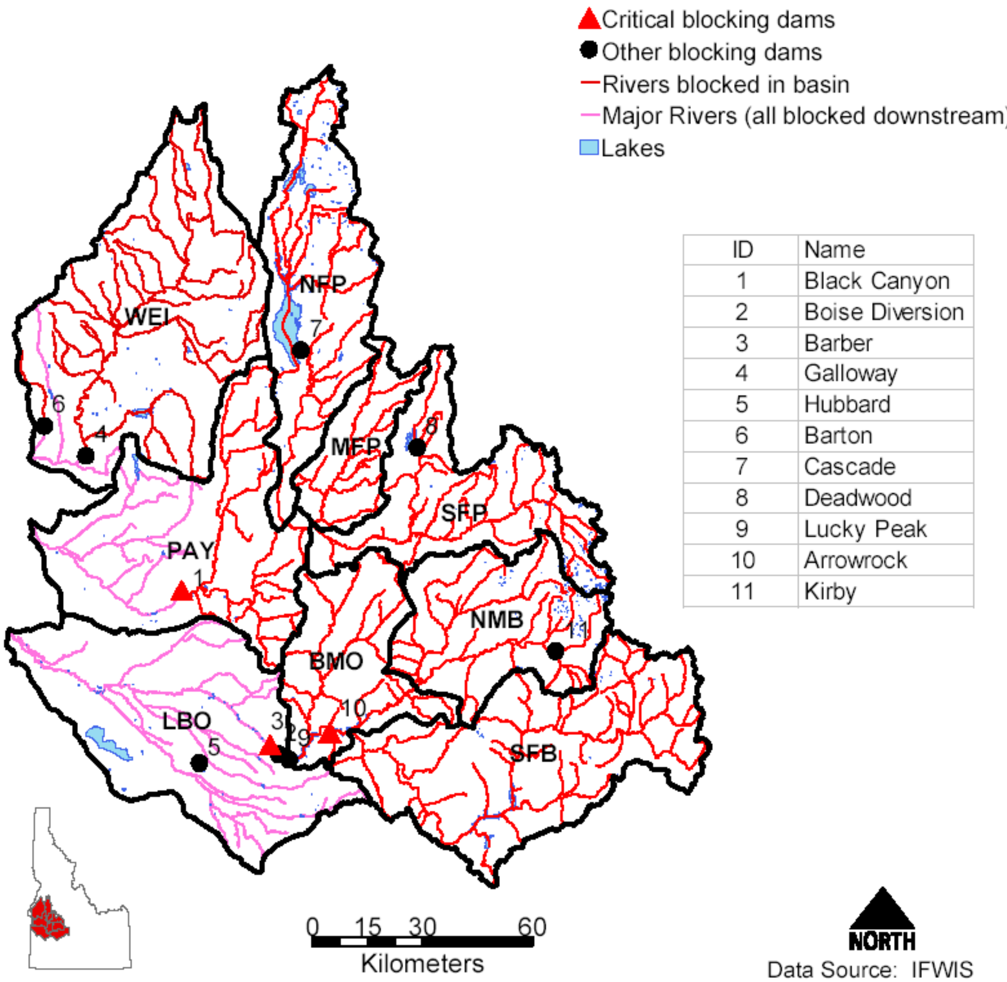



**Figure 1-13. Locations of dams that block fish passage in the Boise and Payette subbasins, Idaho (see Appendix 1-4 for more information on dams).**

### 1.6.4 Protected Areas

A diverse range of protected areas occurs within the Boise, Payette, and Weiser subbasins (Figure 1-14). These specially designated areas include roadless areas, relatively small ecological reference areas, wild and scenic rivers, national recreation areas, and fishing and hunting access areas.

Twenty-six relatively small, highly protected ecological reference areas are present within the subbasins. These include USFS Research Natural Areas and Special Interest Areas, BLM Management Research Natural Areas and Areas of Critical Environmental Concern, IDFG wildlife management areas, and The Nature Conservancy preserves. Jankovsky-Jones *et al.* (1999) provide a guide to the wetland and riparian values of conservation sites within the subbasins. Rust (2000) provides an assessment of the representation of ecological components and identifies targets for selection of new conservation sites within the subbasins.

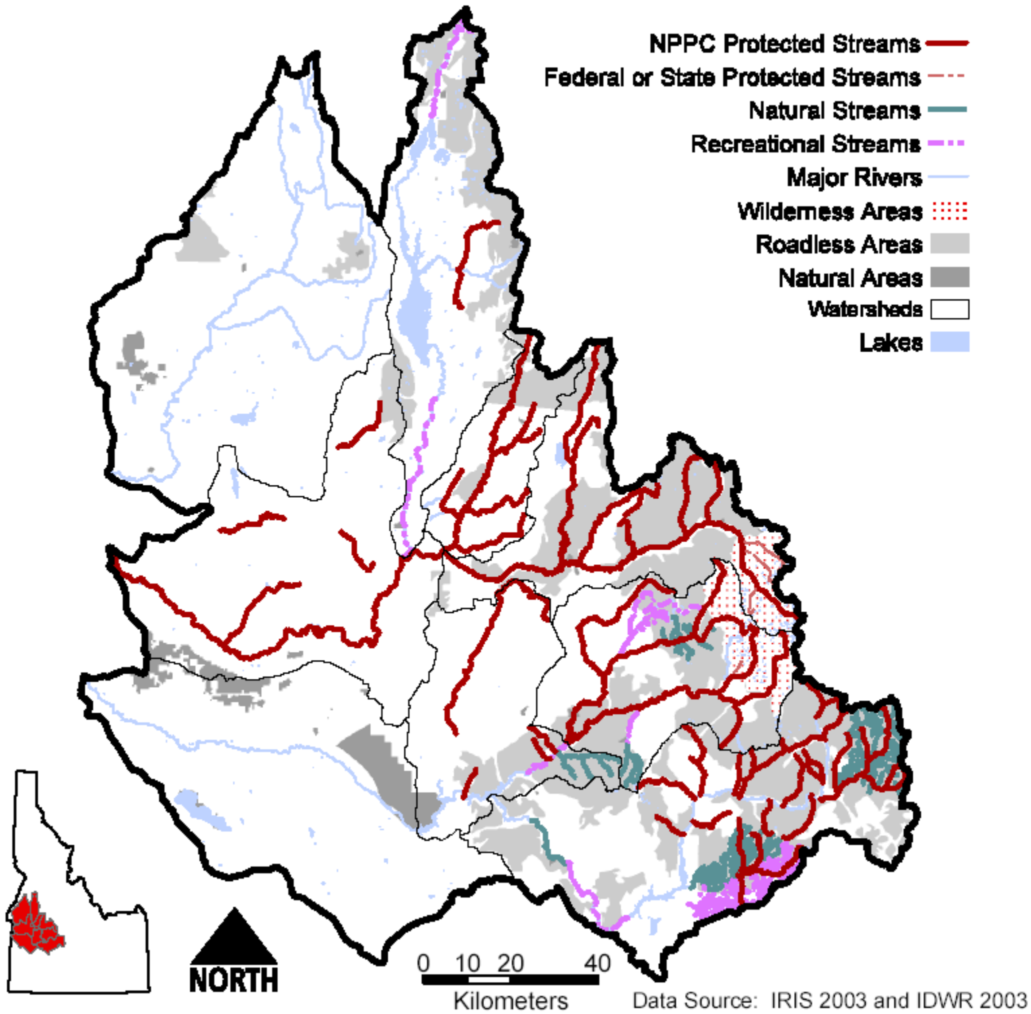



**Figure 1-14. Locations of protected areas in the Boise, Payette, and Weiser subbasins, Idaho.**

In addition, the Natural Resources Conservation Services (NRCS) Conservation Reserve Program (CRP) encourages landowners to convert highly erodible agricultural lands into wildlife habitat by planting cover crops that benefit wildlife. To date, landowners throughout the Boise, Payette, and Weiser subbasins (with the exception of areas in Ada and Boise counties) have converted approximately 8,000 hectares of agricultural land to wildlife habitat.

The Boise, Payette, and Weiser subbasins encompass 40 USFS roadless areas (Figure 1-14). These occur on the upper slopes and ridgecrests of the Boise, Salmon River, West Side, and Cuddy mountains. One BLM wilderness study area, ID-110-91A, is located in the North Fork Payette watershed. Large roadless areas tend to provide refuge for wildlife from human disturbance.

### 1.6.5 Roads

Human-developed areas have resulted in higher road densities (Figure 1-15), which can impact wildlife by acting as mortality agents, movement barriers, and vectors for noxious weeds (Trombulak and Frissell 2000, Ferguson *et al*. 2001). Roads also allow greater human access into wildlife habitat areas, which results in disturbance and can lead to increased poaching or harassment. Roads construction fragments wild and natural areas.

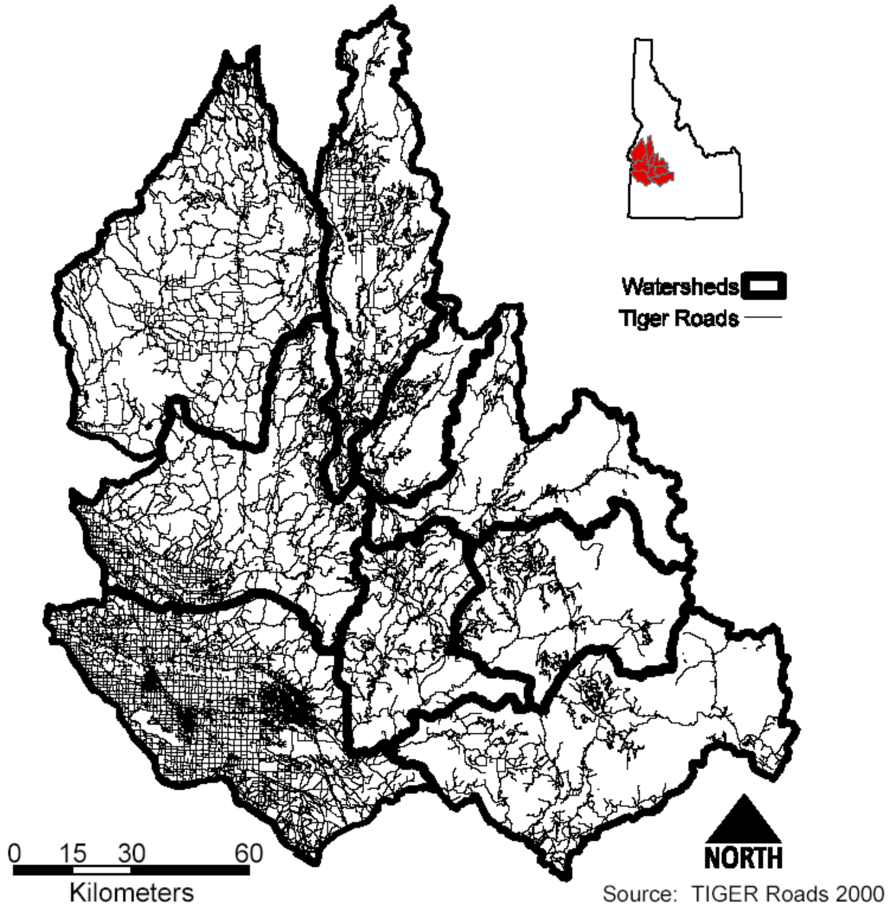



**Figure 1-15. Road densities within the Boise, Payette, and Weiser subbasin watersheds.**

## 1.7 Environmental and Biological Situation

### 1.7.1 Water Quality

Within the Boise, Payette, and Weiser subbasins, there are 62 water quality limited bodies of water (EPA 1998). These are streams (or stream segments) for which existing pollution controls or requirements are deemed inadequate to provide for the attainment and maintenance of water quality standards; that is, they are impaired or threatened by pollution. In total, nearly 1,448 km (900 miles) of rivers and streams, excluding reservoirs, are currently designated as water quality limited (Figure 1-16).

Assessments of total maximum daily loads (TMDLs) have been completed for sediment and bacteria in the lower Boise River. Sediment is the primary TMDL cause in the South Fork Boise, North Fork/Middle Fork Boise, and Boise–Mores Creek watersheds (IDEQ 1998). The lower Payette River has listed TMDL causes including temperature, nutrients, and bacteria (IDEQ 2003), while the North Fork Payette River is listed for sediment, nutrients, and flow alteration (IDEQ 1998). TMDL assessments are in review for phosphorous, sediment, bacteria, and temperature in the Weiser River. TMDL designations are reviewed and the list may be added to or reduced based on evaluation.

Highly impacted flow regimes resulting from control structures such as dams and diversions in the watersheds influence pollutant transport within the subbasin. Sediments, for example, tend to accumulate behind structures such as dams and diversions (IDEQ and ODEQ 2001). This reduces the overall concentration downstream while localizing the pollutant mass. As a result, downstream habitat may experience better water quality conditions while reservoir water quality suffers.

Impoundment structures also impact the transport and processing of nutrients and algae. Reduced flow velocities can lead to conditions under which excessive incoming nutrient and organic loads result in nuisance algae growth and dissolved oxygen depletion. Reduced dissolved oxygen, in turn, can degrade aquatic conditions, kill fish, and increase nutrients and toxins released at the interface between sediments and water (IDEQ and ODEQ 2001). In the Boise, Payette, and Weiser subbasins, 10 streams, Cascade Lake, and Lake Lowell have dissolved oxygen defined as a TMDL cause.

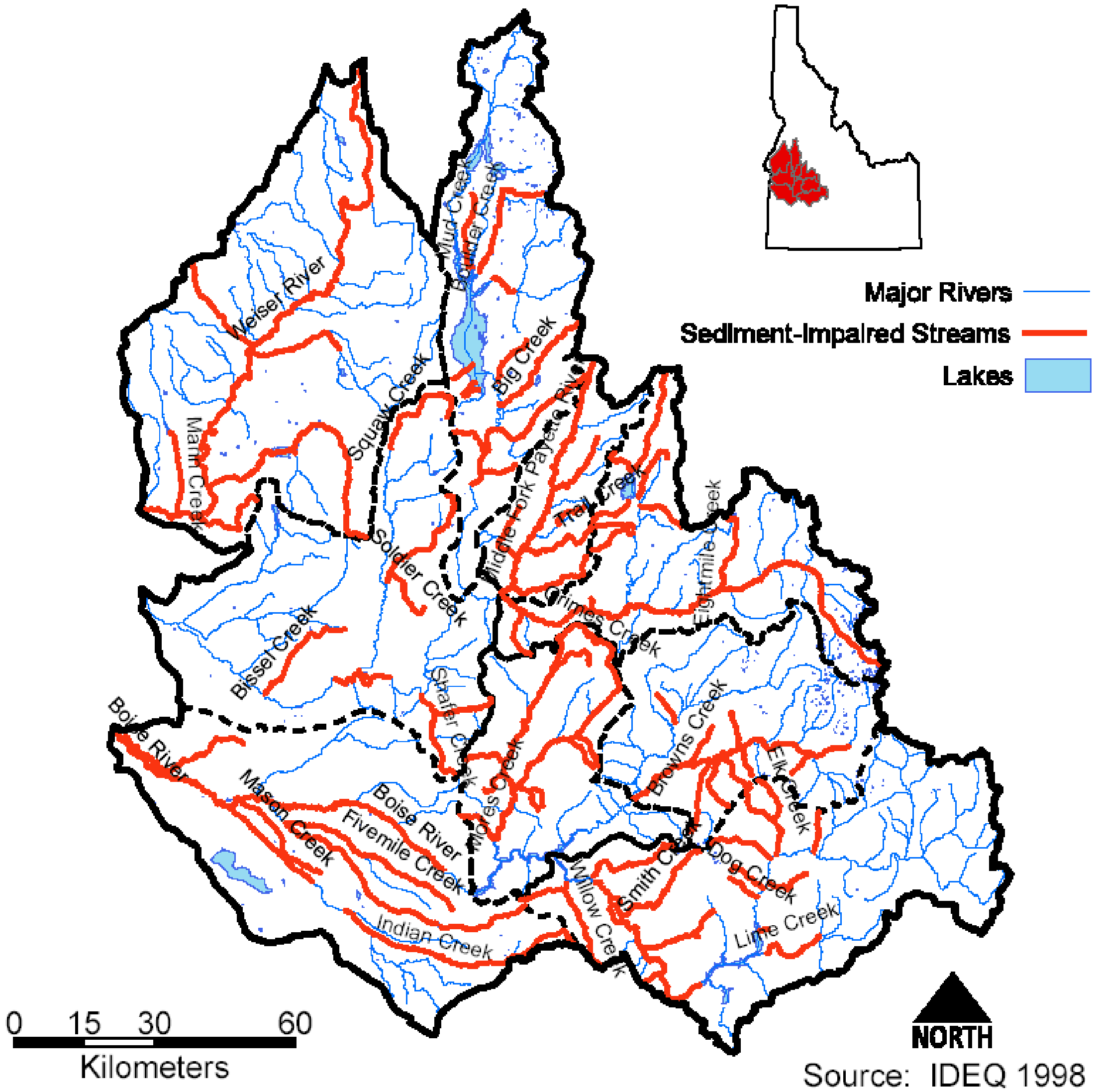



**Figure 1-16. Environmental Protection Agency-listed water quality-impaired streams (red) in the Boise, Payette, and Weiser subbasins (IDEQ 1998).**

## 1.7.2 Species Status and Constraints

### *1.7.2.1 Fish*

The cumulative effects of water systems operation (hydropower, irrigation storage and release, flood control, and others), urbanization, intensive agriculture, exotic species introductions, and poor water quality have generally depleted or extirpated native salmonids from significant reaches in the Boise, Payette, and Weiser subbasins. Mountain whitefish is typically the only native salmonid that has persisted in the altered streams. Historically, anadromous fish were significant sources of nutrients within the Boise, Payette, and Weiser subbasins and supported numerous other aquatic and terrestrial species (Rieben *et al.* 1998). The effect of this biomass loss to subbasins has not yet been quantified.

Bull trout residing in Arrowrock Reservoir are subject to impacts from reservoir operations (Flatter 2000). Bull trout become entrained below Arrowrock Dam (Figure 1-13) and are prevented from reaching suitable spawning areas unless efforts are made to trap and move the fish. It is anticipated that replacement of the dam's valves will minimize entrainment. Bull trout were also observed in the Mores Creek arm in 2000. Further investigation is needed to determine whether the fish observed in the Mores Creek arm are the progeny of the fish entrained over Arrowrock Dam.

The introduction of nonnative species has had an important influence on aquatic communities and native fish communities in the three subbasins. Most introductions of nonnative salmonids were done with the intent of creating or expanding fishing opportunities. Mountain lakes in the Boise and Payette subbasins have been stocked with hatchery-reared cutthroat trout, rainbow trout, and brook trout. Cultured strains of rainbow trout have been widely stocked in rivers and lakes in southwestern Idaho where angler harvest or habitat degradation is high and natural reproduction is low or nonexistent. Most reservoirs have been stocked with nonnative sunfish, catfish, or salmonids.

Introductions of nonnative fishes have, in some instances, led to the elimination of some native populations (Lee *et al.* 1997). In the Boise, Payette, and Weiser subbasins, competition between native and nonnative salmonids has resulted in displacement or isolation of some populations of bull trout. Brook trout threaten bull trout through hybridization. Brook trout are the dominant salmonid in a number of the subbasins' watersheds occupied or formerly occupied by bull trout and redband trout.

Historical mining within the Boise, Payette, and Weiser subbasins also significantly affected fish and wildlife habitats, especially in the Boise–Mores Creek, North Fork/Middle Fork Boise, and South Fork Boise watersheds. Of 48 well-documented mines in the Weiser subbasin, 12 are documented to be economically productive, and three are currently producing. Current and historic productions include stone, iron, copper, and miscellaneous heavy metals. Dredge mining (commercial bucket) occurred on many sections of the Middle, South, and North Fork Boise rivers. Much of the floodplains in these areas have been overturned and remain as tall piles of cobbles and dredge pools. On affected rivers, there are typically few remaining areas of older river terrace.

Recreational dredge mining was prevalent in the Boise subbasin, particularly in the North, Middle, and South Fork Boise rivers. Some suction and dredging activity still occurs on valid claims along the upper sections of the Middle Fork Boise River. Operators are regulated by permits and rules issued by the Idaho Department of Water Resources. Due to the federal listings of anadromous fish and bull trout, recreational dredge mining has been curtailed or limited throughout much of the state, including the Boise subbasin. Restrictions in the Boise subbasin were promulgated to eliminate impacts on bull trout spawning and rearing habitats. However, as mentioned above, some limited recreational dredge mining still takes place in the Middle Fork Boise River, as well as in several tributaries. The lower mainstem is a migration corridor for both bull and redband trout. Dredge mining activity generally does not occur during spawning migration for redband trout, but it does coincide with bull trout migration.

In the Payette subbasin, placer and tunnel mining were historically active in the Deadwood watershed (Jimenez and Zaroban 1998). Today, mining is very limited. The

Deadwood Mine, located immediately off the Deadwood River above Deadwood Reservoir, is draining directly into the river channel. It is unknown whether the Deadwood Mine is adversely impacting water quality and aquatic life.

#### *1.7.2.2 Wildlife*

Land-use activities have adversely affected habitat for native wildlife in the Boise, Payette, and Weiser subbasins. Losses of wetland and native species have resulted from the anthropogenic use of water and its management (i.e., urbanization, irrigation, livestock grazing, and diversions). Construction of impoundments to store and deliver irrigation water and the associated irrigation systems caused the modification and degradation of wildlife habitat throughout the Boise, Payette, and Weiser subbasins. Currently, the primary threats to existing wildlife habitat within the three subbasins are recreational and habitat conversion, water use, and the continuation of existing land management practices, including agricultural- and forest management-related activities.

The conversion and management of upland, forested, floodplain, riparian, and wetland areas for agriculture and recreation (i.e., campgrounds, trails, hunting) purposes have considerably reduced the quantity and quality of habitat available to wildlife populations in the subbasins. In addition, soil erosion has reduced the long-term productivity of the soils and their ability to support native plant and animal species.

The alteration of forest types has reduced available habitats for those species that prosper in old growth conditions such as cavity-nesting birds and woodpeckers, northern goshawk, fisher, several species of bats, and other wildlife species. Alterations of low-elevation areas, especially wetland, transitional forest and riparian corridors, have greatly reduced the availability and suitability of these areas for supporting wildlife species during critical times of the year. Riparian conversion has reduced the capabilities of these areas to provide critical breeding and rearing areas for multiple wildlife species.

### 1.7.3 Habitat Status and Constraints

Conditions less favorable to native fish populations in the subbasins are common in all major watersheds. For example, many areas have poor geomorphic or water quality integrity (Figure 1-17 and Figure 1-18). Impoundments have had a major impact on fish and wildlife resources through the direct loss of habitat (such as big game winter range and forested riparian habitats in the South Fork Boise watershed) by disrupting migration corridors and routes and changing the geophysical characteristics of stream channels below an impoundment. Further, these impoundments have also resulted in streams and water bodies with impaired water quality (Figure 1-16).

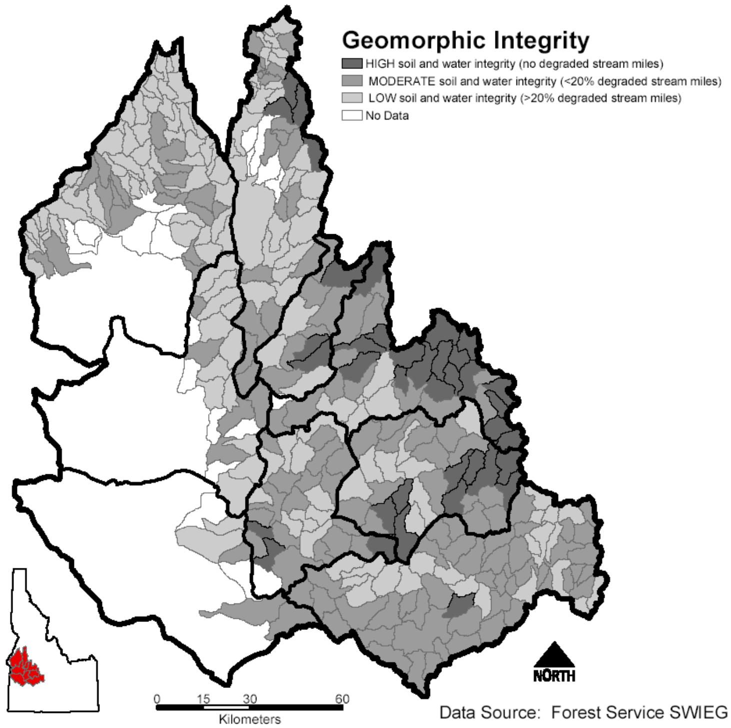



**Figure 1-17. Watershed (geomorphic) integrity within the Boise, Payette, and Weiser subbasins, Idaho.**

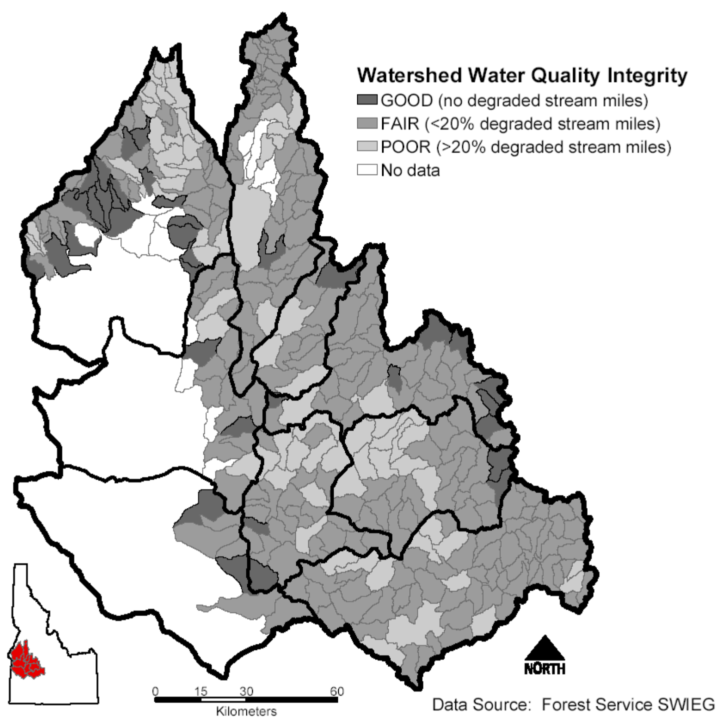



**Figure 1-18. Water quality integrity within the Boise, Payette, and Weiser subbasins, Idaho.**

#### 1.7.3.1 Boise Subbasin

From 1986 to 1994, over 2,124.6 km$^2$ burned on the Boise National Forest. USFS fishery biologists monitored fish abundance and stream habitat quality within watersheds associated with six major wildfires. These six fires were deemed uncharacteristically severe and large, and the largest of them (over 910.5 km$^2$) occurred primarily in dry forest types of ponderosa pine and Douglas-fir. About 50% of the ponderosa pine-dominated forests on the Boise National Forest were burned during this period. However, on average, only about 18% of a typical watershed was burned at high intensity historically, while most watersheds experienced predominantly low-intensity burning, and about one-third of a typical watershed did not burn at all (Burton 2000).

#### 1.7.3.2 Payette Subbasin

The Payette Lake watershed has been extensively studied. Roads were identified as contributors to sediment input to Upper Payette Lake and Payette Lake (IDEQ 1998). In a comparison with reference streams, stream habitats of watershed streams were found to have greater amounts of fine sediments, somewhat higher water temperatures, and higher than desirable width to depth ratios (IDEQ 1998). Numerous irrigation dams divide stream habitat in the North Fork Payette watershed. Granite Lake, Upper Payette Lake, and Payette Lake all have outlet structures that prohibit upstream movement of fish. Irrigation storage and diversion have altered the normal hydrograph of stream flows in the watershed.

Payette Lake is defined as oligotrophic (i.e., water is low in accumulated nutrients and high in dissolved oxygen), but it has substantial dissolved oxygen deficits in the near-bottom waters of the southwest portion of the lake (IDEQ 1998). This developing anoxia problem in the lake waters was related to lengthy water residence time, incomplete water column circulation, and long-term buildup of organic matter (IDEQ 1998). Moreover, Eurasian milfoil (*Myriophyllum spicatum*), an invasive aquatic macrophyte, was also identified in littoral areas of Payette Lake (IDEQ 1998).

The North Fork Payette River below Payette Lake was found to have limited potential for a quality trout fishery because of the lack of cover, low productivity, and streambank erosion (Janssen *et al.* 2000). The stream substrate changed noticeably from the Payette Lake outlet to the reservoir influence of Cascade Reservoir: it changed from rubble and boulder to primarily sand at the lower end (Janssen *et al.* 2000).

#### 1.7.3.3 Weiser Subbasin

Most of the Weiser subbasin has been altered by human activities. Agriculture, livestock grazing, human developments, and road construction have affected the lower portions of the watersheds. The upper reaches have been affected by road construction, livestock grazing, and timber harvest (DuPont and Kennedy 2000). Numerous barriers occur in the forms of stream crossings, irrigation diversions, dams, unsuitable water temperatures, and degraded habitat. To help increase the probability of persistence of bull trout and other native species, connectivity must be restored (DuPont and Kennedy 2000). Many stream reaches of the Weiser River drainage are included on the Idaho 303(d) list of streams for excess nutrients and sediment (IDEQ 1998).

### 1.7.4 Disturbance

The Boise, Payette, and Weiser subbasins have some areas of relatively pristine wildlife habitat in addition to other areas that are in altered or heavily altered conditions. Large tracts of high-quality habitat occur within the core of wilderness and roadless areas in the subbasins. Wildlife habitats tend to be more modified or degraded in the major watersheds with broad valleys and easier human access.

According to Meuleman *et al*. (1986), over 1,942 hectares of upland habitat and 22.5 km of free-flowing Boise River were eliminated when Anderson Ranch Dam was completed. Fifteen kilometers of free-flowing Payette River and its associated upland habitat were eliminated when Black Canyon Dam was completed (Meuleman *et al*. 1986). Nineteen and 29 km of free-flowing Boise River and its associated upland habitats were eliminated when Lucky Peak and Arrowrock dams, respectively, were completed. Although on a smaller scale, completion of the Boise Diversion Dam eliminated an additional 2.6 km of free-flowing Boise River (Meuleman *et al*. 1986). Given the location of these reservoirs, it would be safe to assume that much of terrain with southerly aspects provided habitat for wintering big game animals. Other species impacted by inundation from reservoir construction oinclude mink, mallards, ruffed grouse, black-capped chickadee, yellow warbler, ring-necked pheasent, Canada geese, and yellow-rumped warblers (BPA 1986).

The quality, quantity, spatial distribution, and ecological function of wildlife habitats have changed throughout the subbasin as a result of several mechanisms. Fire suppression and historic timber-harvest management, as well as catastrophic wildfire and insect outbreaks, have altered the plant community composition of forest and rangeland habitats. Historical records from the turn of the nineteenth century show that the density of ponderosa pine measuring 30 cm or greater in diameter at breast height (dbh) ranged from 8 to 51 trees per acre (Woolsey 1911). The forests were characterized as open and parklike, with diverse grasses, forbs, and shrubs in the understory. Numbers of trees in different age classes were evenly distributed, with approximately equal numbers of young, middle-aged, and old trees. Today’s ponderosa pine forests are crowded with small-diameter ponderosa pines, leaving little room for the diversity of plant species that once flourished in the understory. Total tree densities now often exceed 1,000 trees per acre (Allen 1998). The majority of the trees are young (50 to 100 years old) with diameters of 8 to 15 cm dbh. There are few trees in the 15- to 23-cm class and even fewer in the 23- to 30-cm dbh class. Fire-resistant trees (those over 30 cm dbh) are relatively uncommon (Allen 1998).

Significant reductions in mean stand age leave limited quantities of large, standing dead trees for cavity-dependent species. Extensive road networks associated with timber management contribute to increased year-round disturbance of wildlife.

The quality of shrub-steppe habitats within the subbasins has also been highly degraded. In the Great Basin, juniper and pinyon are relatively long-lived species (approximately 1,000 and 600 years, respectively). Fire-return intervals have increased from 12 to 25 years to over 100 years. It is now estimated that 66 to 90% of individual trees are less than 130 years old (Perryman *et al*. 2003). As a result, juniper and pinyon woodland acreages have increased ninefold since the late 1800s (Miller and Tausch 2001).

Conversion of land use to irrigated agriculture and suburban development, as well as extensive wildfires, has had the greatest impact. Livestock grazing has contributed to changes in plant community composition and the dominance of exotic annual plant species that make much of the remaining shrub-steppe habitat extremely vulnerable. Encroachment by humans has increased disturbance effects to further reduce the effectiveness of ungulate winter range and increase exposure to risk of fire and exotic plant introductions.

Riparian and wetland habitats have been adversely impacted due to reduced risk of annual flooding on the lower Boise River and introduction of nonnative wetland plants. Industrial, suburban, and recreational development has displaced floodplain wetlands and riparian areas. Livestock grazing, vegetation control, and drainage for agriculture have further reduced the quality and quantity of these habitats in all watersheds.

### 1.7.5 Noxious Weeds

Introduced plant species reduce the suitability of wildlife habitat. Elk tend to use areas infested with spotted knapweed less frequently than uninfested areas (Sheley and Petroff 1999). Because it completes its growth and dries early in the season, cheatgrass provides less nutrition to herbivorous wildlife species than native species do (Quigley and Arbelbide 1997). Eurasian watermilfoil (*Myriophyllum spicatum*) is a perennial aquatic that grows from 10 to 30 cm a day and tolerates large variations in environmental conditions. This invasive weed has the potential to severely impact the subbasins' waterways (Daniel 2001).

Noxious weed and exotic plant species are spreading within the Boise, Payette, and Weiser subbasins (Figure 1-19). Noxious weeds have infested grasslands and transportation corridors in the three subbasins and can negatively impact plant and animal biodiversity, natural ecological processes (fire, hydrology, soil development), and the quality and availability of livestock and wildlife forage (Olson 1999). They may also invade riparian areas, competing with desirable vegetation. Human disturbance, roads and trails, and rivers act as primary conduits for their spread and establishment. The rapid rate of noxious weed spread and establishment is due to a lack of natural population-control agents in new environments, prolific seed production, physiological advantages over native species, and a strong ability to become established. Site vulnerability to invasion by noxious weeds varies with productivity and similarity to the native habitat of the invader.

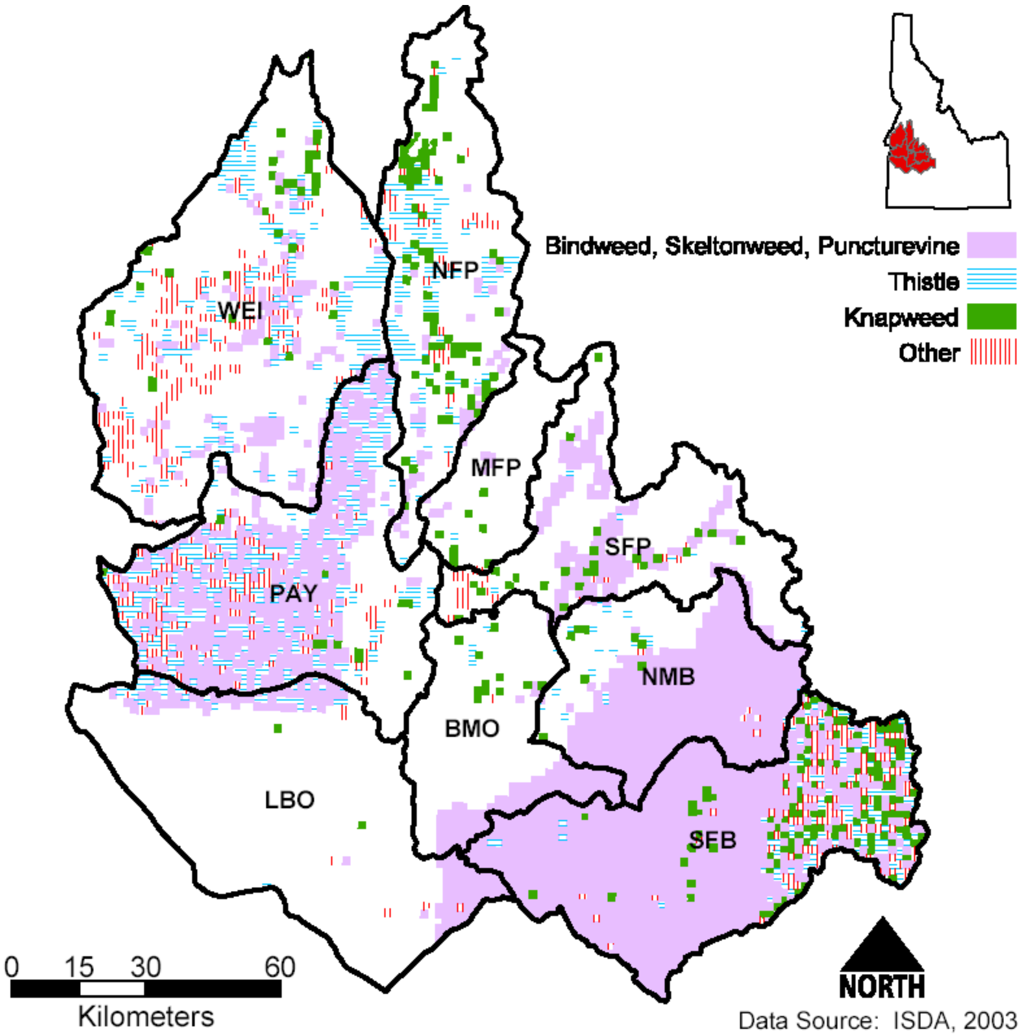



**Figure 1-19. Documented distribution of noxious weeds in the Boise, Payette, and Weiser watersheds (see Appendix 1-2 for more information on the spatial distribution and spatial bias of noxious weeds).**

Twenty-three noxious weed species are known to occur within the Boise, Payette, and Weiser subbasins (Table 1-9). Current location data on species occurrences within the subbasins are limited and only allow identification to county. A number of species are relatively widespread within the subbasins, including jointed goatgrass (*Aegilops cylindrica*), Russian knapweed (*Acroptilon repens*), yellow toadflax (*Linaria vulgaris*), diffuse knapweed (*Centaurea diffusa*), poison hemlock (*Conium maculatum*), puncturevine (*Tribulus terrestris*), purple loosestrife (*Lythrum salicaria*), spotted knapweed (*Centaurea maculosa*), Canada thistle (*Cirsium arvense*), dalmatian toadflax (*Linaria dalmatica*), field bindweed (*Convolvulus arvensis*), rush skeletonweed (*Chondrilla juncea*), and Scotch thistle (*Onopordum acanthium*) (Table 1-9). Noxious weed species of emerging concern include Johnsongrass (*Sorghum halepense*), Scotch broom (*Cytisus scoparius*), silverleaf nightshade (*Solanum elaeagnifolium*), tansy ragwort (*Senecio jacobaea*), common crupina (*Crupina vulgaris*), dyer's woad (*Isatis tinctoria*), perennial sowthistle (*Sonchus arvensis*), black henbane (*Hyoscyamus niger*), and orange hawkweed (*Hieracium aurantiacum*).

**Table 1-9. Noxious weeds, their known distribution, and total area occupied among the nine major watersheds of the Boise, Payette, and Weiser subbasins (ISDA 2003).**

| Species | | Major Hydrologic Unit (Watershed)[a] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | NMB | BMO | SFB | LBO | SFP | MFP | PAY | NFP | WEI |
| Canada thistle | *Cirsium arvense* | X | X | X | X | X | X | X | X | X |
| Cheatgrass[b] | *Bromus tectorum* | X | X | X | X | X | X | X | X | X |
| Dalmation toadflax | *Linaria dalmatica* | X | X | | | X | | X | X | X |
| Diffuse knapweed | *Centaurea diffusa* | X | | X | X | X | X | X | | X |
| Dyer's woad | *Isatis tinctoria* | | | | | | | X | | X |
| Eurasian watermilfoil | *Myriophyllum spicatum* | X | | | X | | | X | X | |
| Field bindweed | *Convolvulus arvensis* | X | X | X | X | X | | X | X | X |
| Hoary cress | *Cardaria draba* | X | | X | X | | | X | | X |
| Jointed goatgrass | *Aegilops cylindrica* | | | | | | | X | | X |
| Leafy spurge | *Euphorbia esula* | | | X | | X | X | X | X | X |
| Musk thistle | *Carduus nutans* | X | | | | | | | | |
| Orange hawkweed | *Hieracium aurantiacum* | X | | | | | | | X | |
| Perennial pepperweed | *Lepidium latifolium* | | | | | | | X | | X |
| Poison hemlock | *Conium maculatum* | | | | X | | | X | X | X |
| Puncture vine | *Tribulus terrestris* | X | X | X | X | X | | X | | X |
| Purple loosestrife | *Lythrum salicaria* | | | | | X | | X | | X |
| Rush skeletonweed | *Chondrilla juncea* | X | X | X | X | X | X | X | X | X |
| Russian knapweed | *Acroptilon repens* | | | X | X | | | X | | |
| Scotch thistle | *Onopordum acanthium* | | | X | X | X | | X | X | X |
| Spotted knapweed | *Centaurea maculosa* | X | | X | | X | X | X | X | X |
| Tansy ragwort | *Senecio jacobaea* | | | | | | | | X | |
| Yellow star-thistle | *Centaurea solstitialis* | | | | | | | X | | X |
| Yellow toadflax | *Linaria vulgaris* | X | | | | X | | X | X | X |

[a] See Table 1-1 for watershed acronyms.
[b] Cheatgrass is not currently recognized as a noxious weed by the State of Idaho, but it is included in this list because it is a widespread invasive weed.

### 1.7.6 Fire Ecology

Frequent, low-intensity fire is a key factor in maintaining the open canopies characteristic of the Boise, Payette, and Weiser subbasins in ponderosa pine-dominated tree stands. Fire disturbance in these low to moderately productive plant associations functions to reduce tree encroachment into grassland and thin understory tree regeneration. These functions favor the structural and compositional dominance of ponderosa pine or Douglas-fir, especially in the eastern portion of the subbasins, and reduce the development of pole-sized ladder fuels (Fischer and Bradley 1987).

The fire disturbance regime functions to thin understory tree regeneration, favoring the structural and compositional dominance of large-diameter ponderosa pine in the overstory and establishing a patchy mosaic of understory shrub, grass, and herb cover. Fire suppression has resulted in the accumulation of surface and ladder fuels. These changes threaten the viability of ponderosa pine-dominated old growth forest habitats as pre-settlement low- and moderate-severity fire regimes transition to present-day moderate- and high-severity fire regimes (Hann et al. 1997). As ground and ladder fuels accumulate during fire-free periods, these stands become increasingly susceptible to stand-replacing fire.

North-facing and mid-elevations are characterized by naturally mixed fire frequency communities, including Douglas-fir and grand fir. These stands have a complex history of low- and high-intensity fires that result in stand replacement over time periods of 100 years or more. Similarly, higher-elevation lodgepole pine, alpine fir, and spruce stands have fires characterized by stand replacement on a fire interval of more than 100 years. Such fires are common over large acreages in central Idaho.

# 2 Subbasin Biological Resources

Although the emphasis of the Boise, Payette, and Weiser subbasins assessment is on aquatic species, we evaluated how direct and indirect changes in aquatic systems affect terrestrial species and habitats. Therefore, the assessment reflects the complexity of linkages in environmental systems, the multiple roles of each species in the environment, and the consequences of the elimination or decrease of one habitat type and/or species on other habitat types and species. This assessment adopts an approach developed by the Interactive Biodiversity Information System (IBIS 2003) to evaluate the ecological functions of species. We provide working hypotheses of the ecological roles of fish and wildlife in the Boise, Payette, and Weiser subbasins and focus on habitats and species chosen by the subbasin assessment technical teams and the causes of limiting factors affecting those habitats and species within the subbasins.

This assessment focuses on five habitat types and their associated focal species (Figure 2-1 and Table 2-1). Although the discussions are sometimes separated, we recognize the hierarchical relationships between focal habitats, focal vegetation species, and focal wildlife species that depend, either directly or indirectly, on the focal vegetation species.

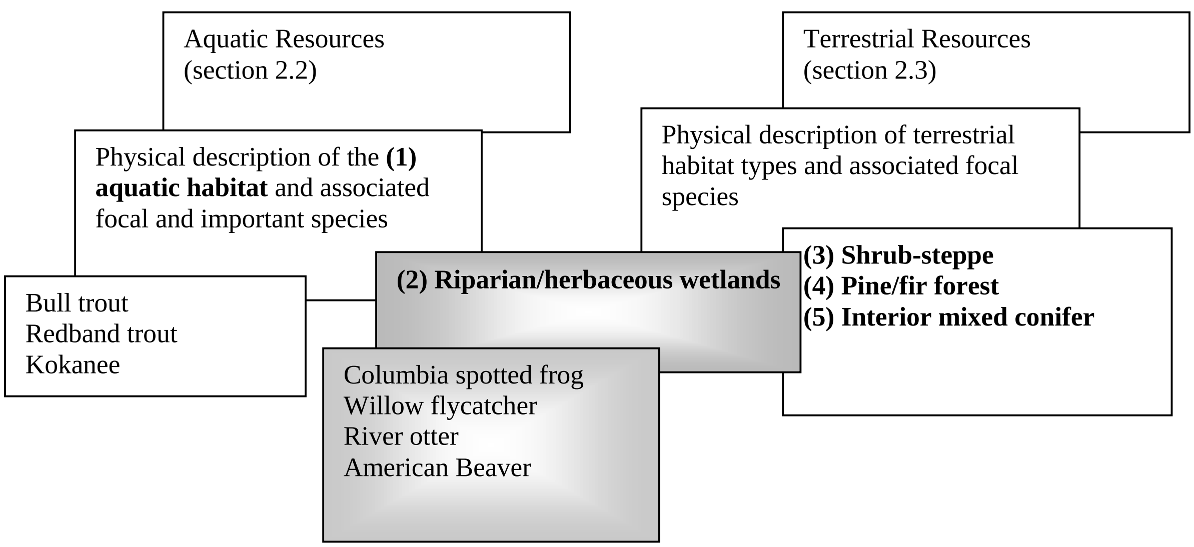



**Figure 2-1. Relationships of aquatic and terrestrial resources based on the five focal habitat types for the Boise, Payette, and Weiser subbasins assessment. The riparian/herbaceous wetlands habitat type is the link between the aquatic and terrestrial resources. The American beaver is especially important to aquatic and riparian/herbaceous wetlands since it creates and maintains waterways and affects hydrography.**

Both the aquatic and terrestrial resources sections describe the physical and biological features of a focal habitat. A focal habitat is described by a combination of unique vegetative characteristics, dominant plant species, or a successional stage with important ecological ties to fish and/or wildlife (e.g., old growth). A focal habitat may also be composed of specific environmental elements integral to the viability of fish and wildlife populations (e.g., snags and caves). One or more of the following criteria were used to identify focal habitats presented in this assessment:

- Comparatively high fish and/or wildlife density
- Comparatively high fish and/or wildlife species diversity
- Important fish and/or wildlife breeding habitat
- Important fish and/or wildlife seasonal ranges
- Important fish and/or wildlife movement corridors
- Rareness
- High vulnerability to habitat alteration
- Unique or dependent species

Five terrestrial focal habitats in the Boise, Payette, and Weiser were selected using land cover information and structure type (stand age). Because habitat description can be very specific and involve combinations of field survey data, remote sensing classifications, geography, botanical composition, and other factors, we used a simplified approach to collecting and analyzing all these data over large regional scales in these subbasins.

Data sources defining habitat distribution in this assessment include the Interior Columbia Basin Ecosystem Management Project (ICBEMP)[1] and the Geographic Approach to Planning (GAP)[2] data sets. The ICBEMP (1997) data set supplied information on the potential (i.e., historical) vegetation coverage, while the GAP II (2003) data set supplied information on current coverage. As with any remotely derived product, including the GAP II data set, there is a certain degree of uncertainty. Spatial and spectral resolutions, temporal constraints, cloud cover, and geometric correction accentuate these uncertainties. While the habitats of foremost importance are the aquatic, riparian, and herbaceous wetlands; GAP II (2003) classification accuracies commonly range between 40% and 70% in this region (Appendix 1-2), and we were unable to ascertain reliable estimates of riparian habitat classifications other than linear stream measures and wetland inventories. Therefore, obtaining reliable information on the quantity and quality of the riparian and herbaceous wetlands in the Boise, Payette, and Weiser subbasins is of high importance.

Sixteen focal species were identified as either having special ecological, cultural, or legal status, or they could be used to evaluate the health of the ecosystem and the effectiveness of management actions. These species were selected primarily because they were species at risk and could be used as indicators for related species in similar habitats. While many animals were considered, final decisions were influenced by how well studied the species were, how well they could be monitored, and technical team expertise.

[1] More than 300 different geographic information system (GIS) data layers or themes were compiled or created in support of the ICBEMP assessment and development of the resulting environmental impact statement. In addition, numerous databases were created. The U.S. Forest Service (USFS) Pacific Northwest Research Station serves as custodian of project data. These data are available for download from the ICBEMP web site. This web site is maintained by the USFS and Bureau of Land Management (BLM) Interior Columbia Basin Ecosystem Management Project.

[2] GAP analysis is a rapid conservation evaluation method for assessing the current status of biodiversity at large spatial scales. It uses GIS to identify habitat types. By identifying their habitats, GAP analysis gives land managers, planners, scientists, and policy makers the information they need to make better-informed decisions when identifying priority areas for conservation.

Overall, the following selection criteria were used for focal species selection:

- Federal/state classification
- Cultural/economic significance
- Critical ecological function
- Indicator of environmental health
- Locally significant or rare
- Guild representative
- Habitat obligate
- Managed species
- Relationship to salmon
- Data availability

**Table 2-1. Focal habitats and focal species associated with those focal habitats in the Boise, Payette, and Weiser subbasins, Idaho.**

| Focal Habitat Type | Focal Species | Species' Key Roles in Maintaining Ecological Conditions |
|---|---|---|
| Aquatic | Bull trout (*Salvelinus confluentus*) | Top aquatic predator. Spawns in very cold headwater areas. |
| | Redband trout (*Oncorhynchus mykiss*) | Native salmonid, present throughout subbasins in higher densities than bull trout. Adults, carcasses, eggs, and juveniles provide food for other fish, birds, and mammals. |
| | Kokanee (*Oncorhynchus nerka*) | Provides nutrient source from reservoir/lake area to spawning tributaries through spawning and carcass deposition. Adults, carcasses, eggs, and juveniles provide food for other fish, birds, and mammals. May replace partial function of anadromous fish in limited locations. |
| Riparian/herbaceous wetlands | Columbia spotted frog (*Rana luteiventris*) | Prey for secondary or tertiary consumer (primary or secondary predator). Insectivorous predator (controls insect populations). Aids in physical transfer of substances for nutrient cycling (carbon, nitrogen, phosphorous, etc.). |
| | Willow flycatcher (*Empidonax traillii*) | Prey for secondary or tertiary consumer (primary or secondary predator). Insectivorous predator (controls insect populations). Nutrient cycling (energy transfer). |
| | Bald eagle (*Haliaeetus leucocephalus*) | Pirates food from other species; controls terrestrial vertebrate populations (through predation or displacement). Primary creation of aerial structures (possibly used by other organisms). |
| | American beaver (*Castor canadensis*) (the only species that actively creates waterways) | Prey for secondary or tertiary consumer (primary or secondary predator). Primary burrow excavator (fossorial or underground burrows). Creates trails (possibly used by other species); aids in physical transfer of substances for nutrient cycling (carbon, nitrogen, phosphorus, etc.); physically affects (improves) soil structure, aeration (typically by digging); impounds water by creating diversions or dams; creates ponds or wetlands by building physical barriers; creates standing dead trees (snags). |
| Shrub-steppe | Greater sage-grouse (*Centrocercus urophasianus*) | Prey for secondary or tertiary consumer (primary or secondary predator). Disperses seeds. |
| | Sharp-tailed grouse (*Tympanuchus phasianellus*) | Prey for secondary or tertiary consumer (primary or secondary predator). Carrier, transmitter, or reservoir of diseases that affect other wildlife species. Disperses seeds/fruits (through ingestion or caching). |

| Focal Habitat Type | Focal Species | Species' Key Roles in Maintaining Ecological Conditions |
|---|---|---|
| | Pygmy rabbit (*Brachylagus idahoensis*) | Prey for secondary or tertiary consumer (primary or secondary predator). Primary burrow excavator (creates burrows). Uses burrows dug by other species (secondary burrow user); creates runways (possibly used by other species); physically affects (improves) soil structure, aeration (typically by digging). |
| | Mule deer (*Odocoileus hemionus*) | Herbivory on trees, shrubs, grasses, and forbs that may alter vegetation structure and composition. Major prey species for carnivores. Creates trails (possibly used by other species); uses trails created by other species. |
| | Southern Idaho ground squirrel (*Spermophilus brunneus endemicus*) | Prey for secondary or tertiary consumer (primary or secondary predator). Creates small burrows; disperses seeds/fruits (through ingestion or caching). |
| Pine/fir forest (dry, mature) | White-headed woodpecker (*Picoides albolarvatus*) | Primary cavity excavator in snags or live trees. Transportation of viable seeds, spores, plants or animals. Disperses seeds/fruits (through ingestion); physically fragments down wood. |
| | Flammulated owl (*Otus flammeolus*) | Prey for secondary or tertiary consumer (primary or secondary predator). Secondary cavity user. Primary consumer of insects (moths, beetles). |
| | Northern Idaho ground squirrel (*Spermophilus brunneus brunneus*) | Prey for secondary or tertiary consumer (primary or secondary predator). Creates small burrows; disperses seeds/fruits (through ingestion or caching). |
| Interior mixed conifer | Pileated woodpecker (*Dryocopus pileatus*) | Primary cavity excavator in snags or live trees. Primary predator of wood-boring insects. Physically fragments down wood; provides nest holes for suite of secondary cavity nesters. |

One focal aquatic species—the bull trout (*Salvelinus confluentus*)—and three focal terrestrial species—the bald eagle (*Haliaeetus leucocephalus*), Canada lynx (*Lynx canadensis*), and northern Idaho ground squirrel (*Spermophilus brunneus brunneus*)—in the Boise, Payette, and Weiser subbasins are listed as threatened under the Endangered Species Act of 1973 (ESA)[3] (Table 2-2). The gray wolf (*Canis lupus*) within this area is considered a nonessential experimental population. The Canada lynx, gray wolf, and the two listed plant species—Spalding's catchfly (*Silene spaldingii*) and MacFarlane's four o'clock (*Mirabilis macfarlanei*)—were not selected as focal species for the focal habitat types but are included in this assessment (see section 2.3.5) because of their potential to influence future management actions or projects.

[3] The designation *threatened* means any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. The term *endangered* means any species that is in danger of extinction throughout all or a significant portion of its range.

**Table 2-2. Species listed under the Endangered Species Act that occur, or historically occurred, in the Boise, Payette, and Weiser subbasins.**

| Species | Status | Date | Protective Regulations |
|---|---|---|---|
| **Fish** | | | |
| Bull trout (*Salvelinus confluentus*) | threatened | November 1, 1999 | 64 Federal Register (FR) 58910 |
| **Birds** | | | |
| Bald eagle (*Haliaeetus leucocephalus*) | endangered<br>threatened | March 11, 1967<br>July 12, 1995 | 32 FR 4001<br>60 FR 35999 |
| **Mammals** | | | |
| Canada lynx (*Lynx canadensis*) | threatened | March 24, 2000 | 65 FR 16051 |
| Gray Wolf (*Canis lupus*) | threatened (nonessential experimental population)[a] | March 11, 1967<br>November 18, 1994<br>November 22, 1994 | 32 FR 4001<br>59 FR 60252<br>59 FR 60266 |
| Northern Idaho ground squirrel (*Spermophilus brunneus brunneus*) | threatened | April 5, 2000 | 65 FR 17779 |
| **Plants** | | | |
| Spalding's catchfly (*Silene spaldingii*) | threatened | October 10, 2001 | 66 FR 51597 |
| MacFarlane's four o'clock (*Mirabilis macfarlanei*) | threatened | March 15, 1996 | 61 FR 10693 |

[a] The Endangered Species Act Amendments of 1982, P.L. 97-304, made significant changes to the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*), including the creation of section 10(j), which provides for the designation of specific animals as "experimental." Under section 10(j), a listed species reintroduced outside its current range, but within its historical range, may be designated, at the discretion of the Secretary of the Interior, as "experimental." This designation increases the U.S. Fish and Wildlife Service's flexibility and discretion in managing reintroduced endangered species because such experimental animals may be treated as threatened species. The act requires that animals used to form an experimental population be separated geographically from non-experimental populations of the same species.

## 2.1 Key Ecological Functions of Fish and Wildlife Species

### 2.1.1 Overview

#### *2.1.1.1 Key Ecological Functions and Environmental Correlates*

Understanding ecological roles of fish and wildlife in different habitat types is important in understanding the consequences of management actions on the ecosystem. As illustrated in Table 2-1, many species perform several functions in their environments, and some functions may be performed by more than one species. The number of wildlife species performing a specific ecological function is called functional redundancy, and it is one community pattern describing species complexes. We evaluated functional redundancy and ecological patterns of wildlife species listed in Appendix 1-1 in the Boise, Payette, and Weiser subbasins.

Key ecological functions (KEFs) and key environmental correlates (KECs) were used to describe and compare wildlife species and their associations with each other and their environment (Appendix 2-1). The KEFs of species define the major ecological roles that these species play in the ecosystem and the resulting influences on system diversity, productivity, and sustainability of resource use and production (Marcot and Vander Heyden 2001). KEFs are derived for each species using a standardized classification system consisting of 85 categories (Appendix 2-1). Species performing fewer ecologic functions (lower number of KEF categories) are considered functional specialists, while species performing more ecologic functions (higher number of KEF categories) are considered functional generalists. One limitation to using this classification system is that it is unable to assess the relative impacts or importance of different functions, and with few exceptions, there has been little research done to quantify the rates of KEFs (e.g., tonnage of soil worked by burrowing and digging animals per acre per year).

KECs are a measure of environmental influences on the distribution and abundance of organisms. KECs are derived for each species using a standard classification system that includes categories for vegetation habitat elements, non-vegetation terrestrial elements, aquatic bodies and substrates, and anthropogenic structures. As with KEFs, one limitation of KEC information is that it represents simple categorical relations with species rather than quantified correlations (i.e., specific amounts, levels, or rates of each KEC and corresponding population densities or trends of each species).

#### *2.1.1.2 Functional Specialists and Generalists*

In the Boise, Payette, and Weiser subbasins, the frequency of species by number of KEF categories is characterized by a normal frequency distribution (Figure 2-2 and Appendix 2-1). There are 20 species that perform only one key ecological function in the Boise, Payette, and Weiser subbasins (Figure 2-2 and Appendix 2-1). One species, the black bear (*Ursus americanus*), performs 14 key ecological functions. The majority of the species in the Boise, Payette, and Weiser subbasins perform between three and five key environmental functions (Figure 2-2).

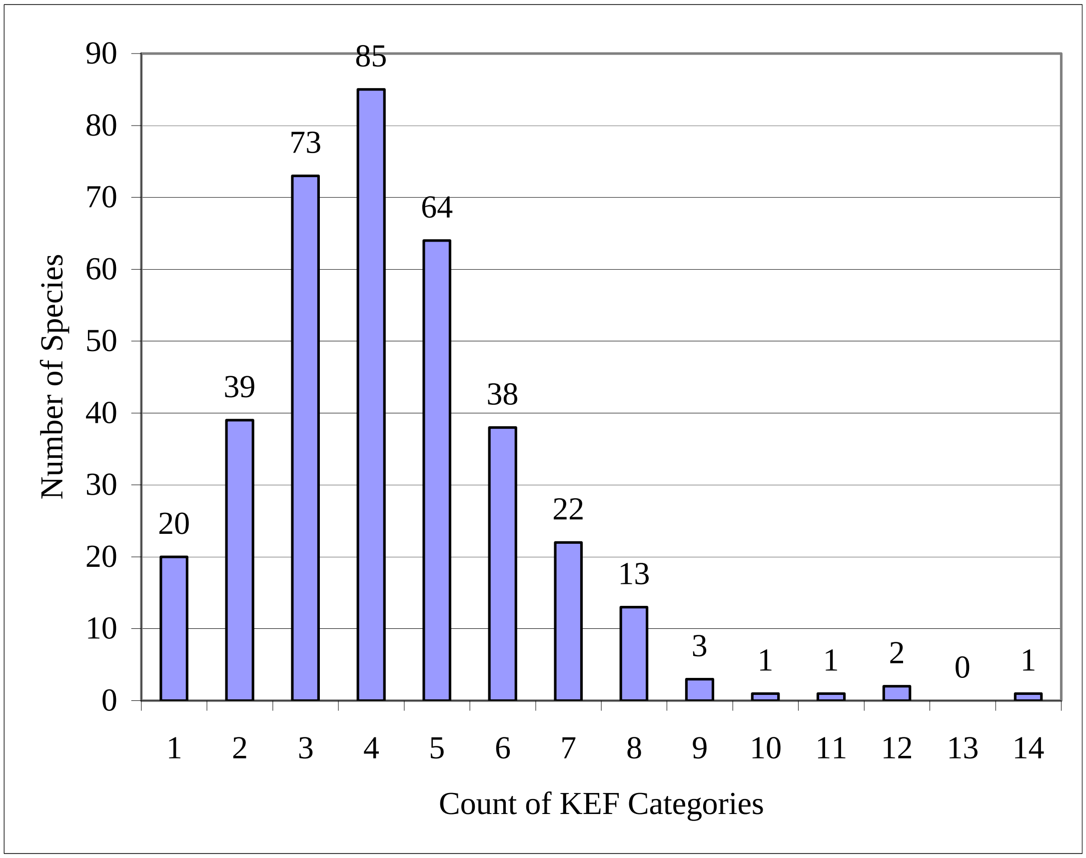



**Figure 2-2. Number of vertebrate wildlife species by number of categories of key ecological functions (KEFs) that they perform in the Boise, Payette, and Weiser subbasins (IBIS 2003).**

#### *2.1.1.3 Functional Richness*

We determined the functional richness in the Boise, Payette, and Weiser subbasins by estimating the total number of KEF categories in a community (IBIS 2003). The wildlife habitats in the Boise, Payette, and Weiser subbasins appear more or less equally functionally rich, with between 24 and 44 species per wildlife habitat (Appendix 2-1). The most functionally rich communities are the riparian and herbaceous wetland areas. Forested habitats are also slightly greater in functional richness than shrub-steppe or grassland habitats are.

#### *2.1.1.4 Trophic Levels*

We used an evaluation of key ecological functions to depict general trophic structures of communities and identify species aiding in the physical transfer of substances for nutrient cycling. In the Boise, Payette, and Weiser subbasins, 198 wildlife species (53%) are categorized as primary consumers (herbivores), 325 (88%) are secondary consumers (primary predators) and 7 (<1%) species are tertiary consumers (secondary predators) (Figure 2-3). Bird species appear to play a proportionally large role across all trophic levels. Minor trophic categories in these subbasins include carrion feeders (<1%, mostly birds and mammals), cannibalistic feeders (<1%, amphibians and mammals), and coprophagous feeders (feces eaters) (<1%, all mammals).

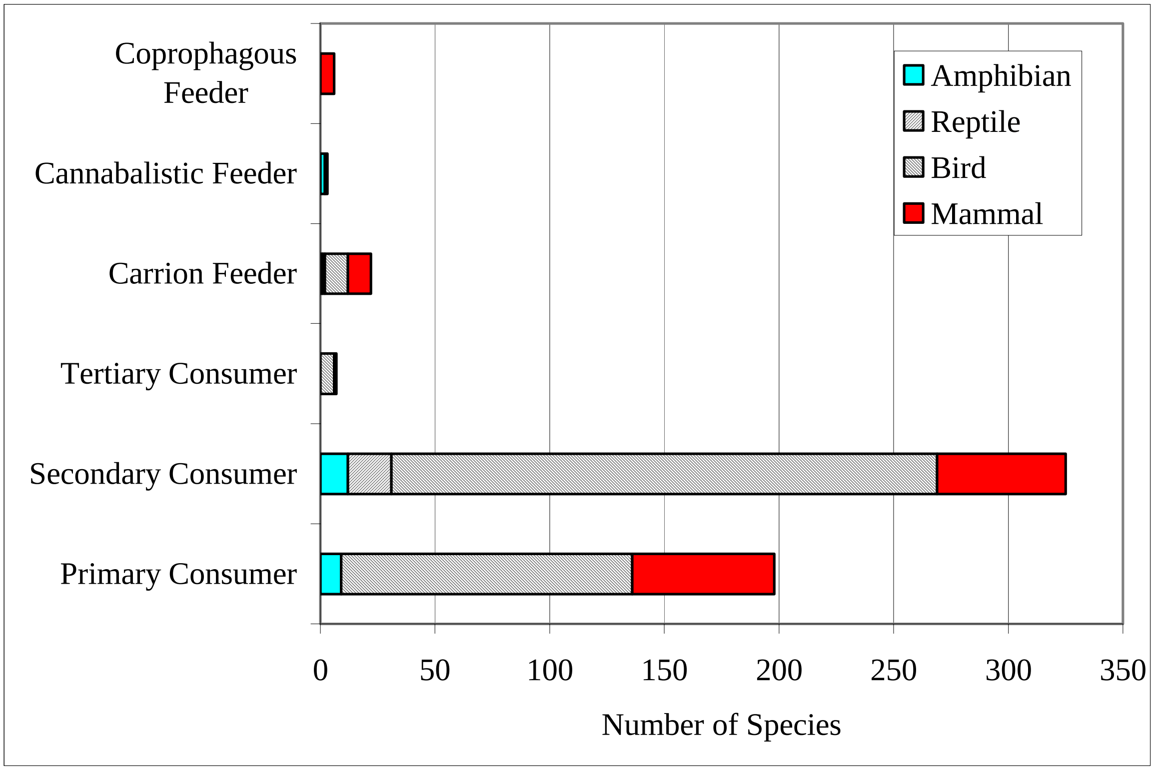



**Figure 2-3. Trophic level functions of wildlife in the Boise, Payette, and Weiser subbasins (IBIS 2003).**

We evaluated 27 categories of organismal relationships within wildlife communities (Figure 2-4 and Appendix 2-1). KEFs are commonly performed by a variety of wildlife; however, different families of wildlife occasionally serve to satisfy a specific function. For example, according to IBIS data, both birds and mammals create roosting, denning, and nesting structures that other amphibian, reptile, bird, and mammal species might use. But only birds serve as pollination vectors, and mammals are singularly responsible for the distribution of fungi and lichens (Figure 2-4).

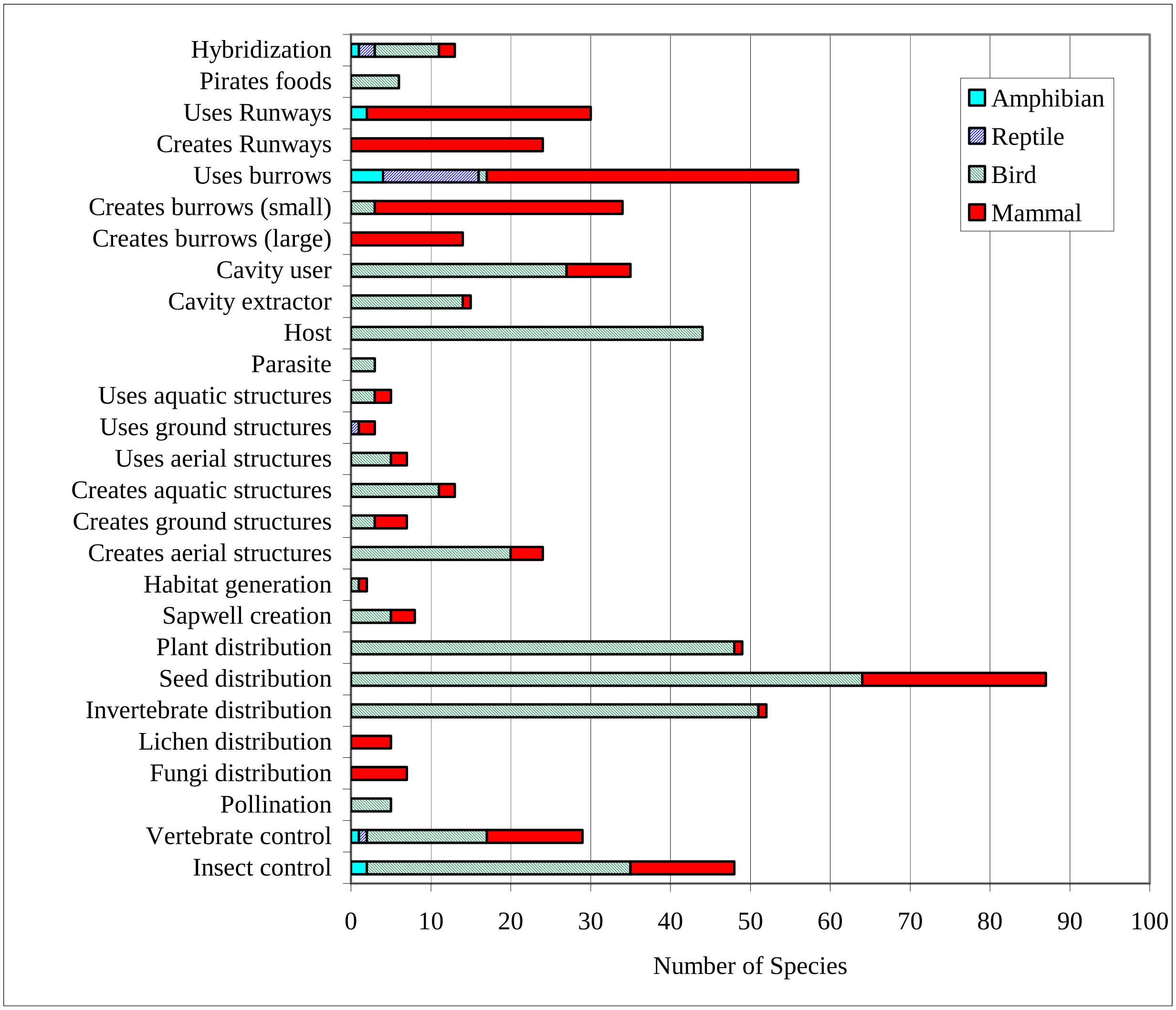



**Figure 2-4. Organismal functional relations of wildlife in the Boise, Payette, and Weiser subbasins (IBIS 2003) (see also Appendix 2-1).**

### *2.1.1.5 Total Functional Diversity*

Total functional diversity is functional richness weighted by functional redundancy (Brown 1995). From historical to current conditions (circa 1850 to 2000), the amount of change in total functional diversity has decreased significantly. This decreased diversity in the Boise, Payette, and Weiser subbasins (Figure 2-5) suggests that anthropogenic activity may be destabilizing ecosystems in the subbasins (IBIS 2003). A few areas have increased in total functional diversity (Figure 2-5). These increases might be explained in part by animals leaving or being eliminated from areas of high anthropogenic disturbance (Figure 1-15) and gaining refuge in the roadless and wilderness areas (Figure 1-14) and relatively intact watersheds (Figures 1-17 and 1-18).

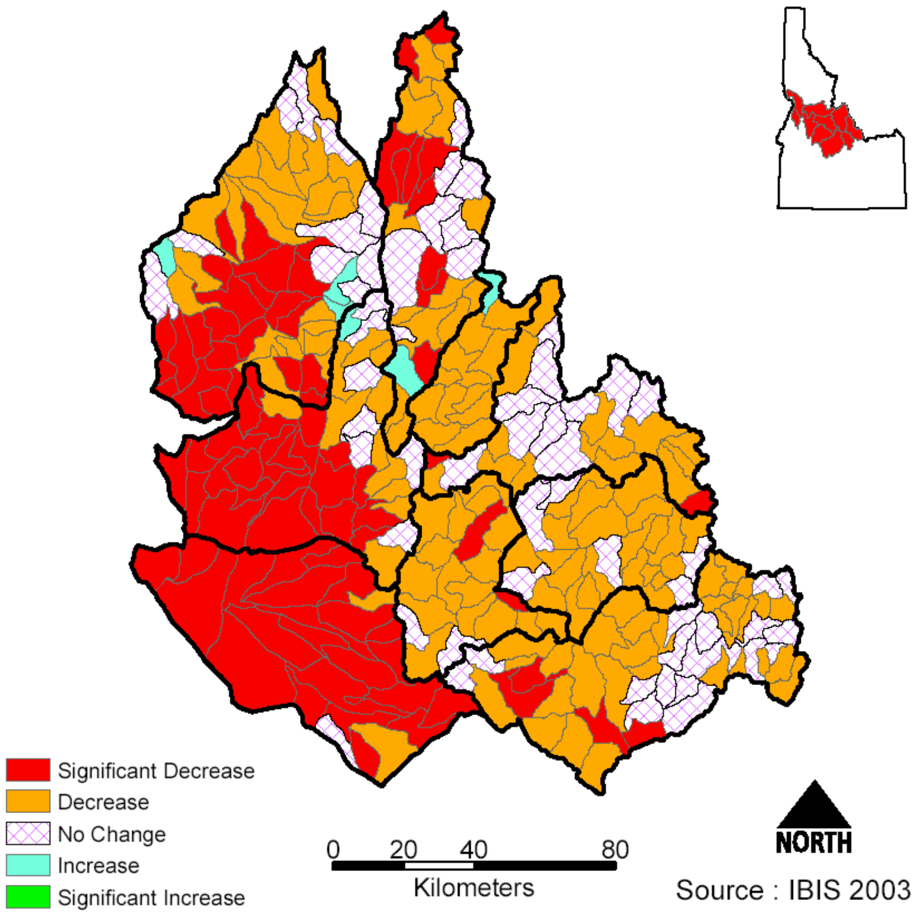



**Figure 2-5. Change in total functional diversity from historical to current conditions (circa 1850 to 2000) in the Boise, Payette, and Weiser subbasins (IBIS 2003).**

### *2.1.1.6 Functional Profiles*

Functional profiles show the degree of functional redundancy in wildlife communities across several KEF categories. Marcot and Vander Heyden (2001) hypothesize that functional redundancy imparts resilience because increases in functional redundancy are often correlated to increases in functional resilience (or resistance for that function). Communities that are functionally homologous have similar functional profiles and patterns of functional redundancy, even if the species performing the functions differ. Functionally homologous communities can also be expected to operate in similar ecological ways.

We assessed the relative functional redundancy at the trophic level for the focal habitats (Figure 2-6). While the lack of existing habitat information limits a detailed analysis of functional homologies, broad interpretations of relations can be made. Riparian/herbaceous wetlands, for example, appear to have the greatest number of species performing the greatest number of ecological functions at both the trophic and organismal relations level (Figure 2-6 and Figure 2-7).

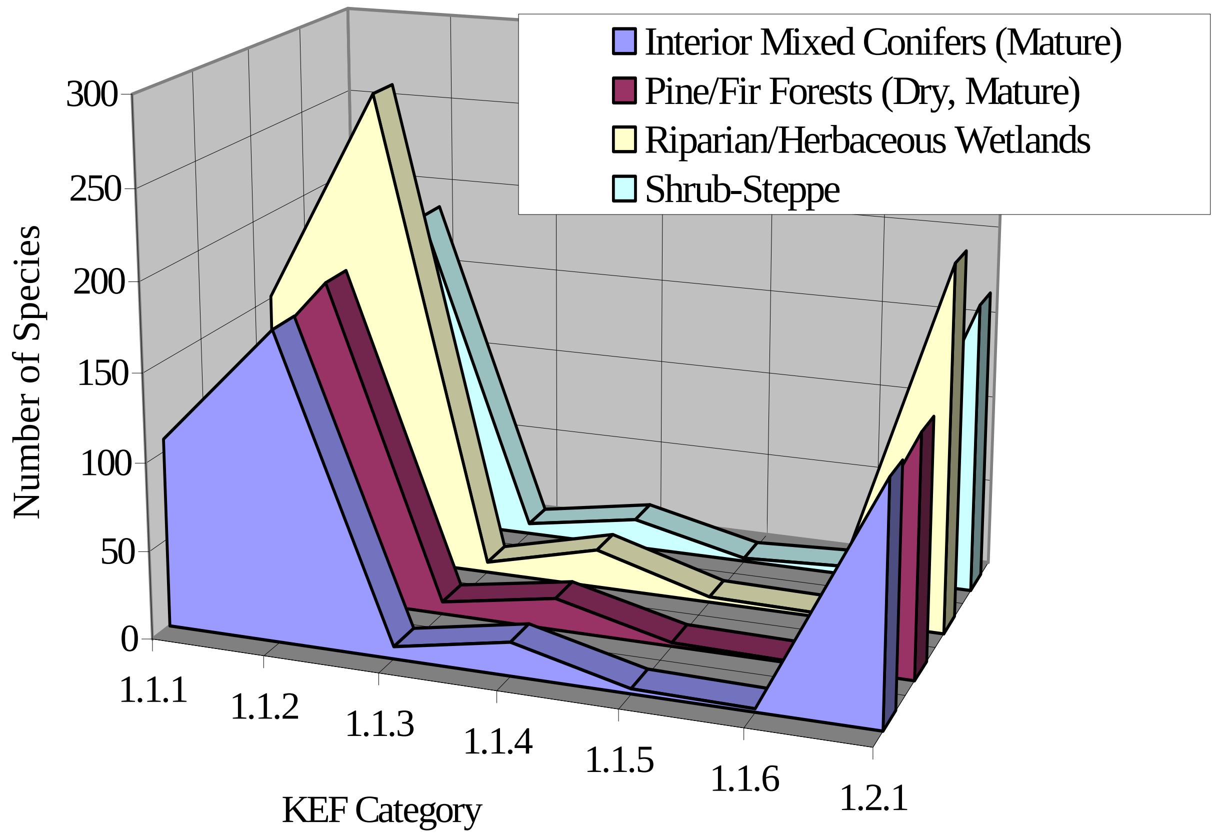



**Figure 2-6. Relative degree of functional redundancy in trophic levels compared across the focal habitat types in the Boise, Payette, and Weiser subbasins (IBIS 2003) (see Appendix 2-1 for KEF category definitions).**

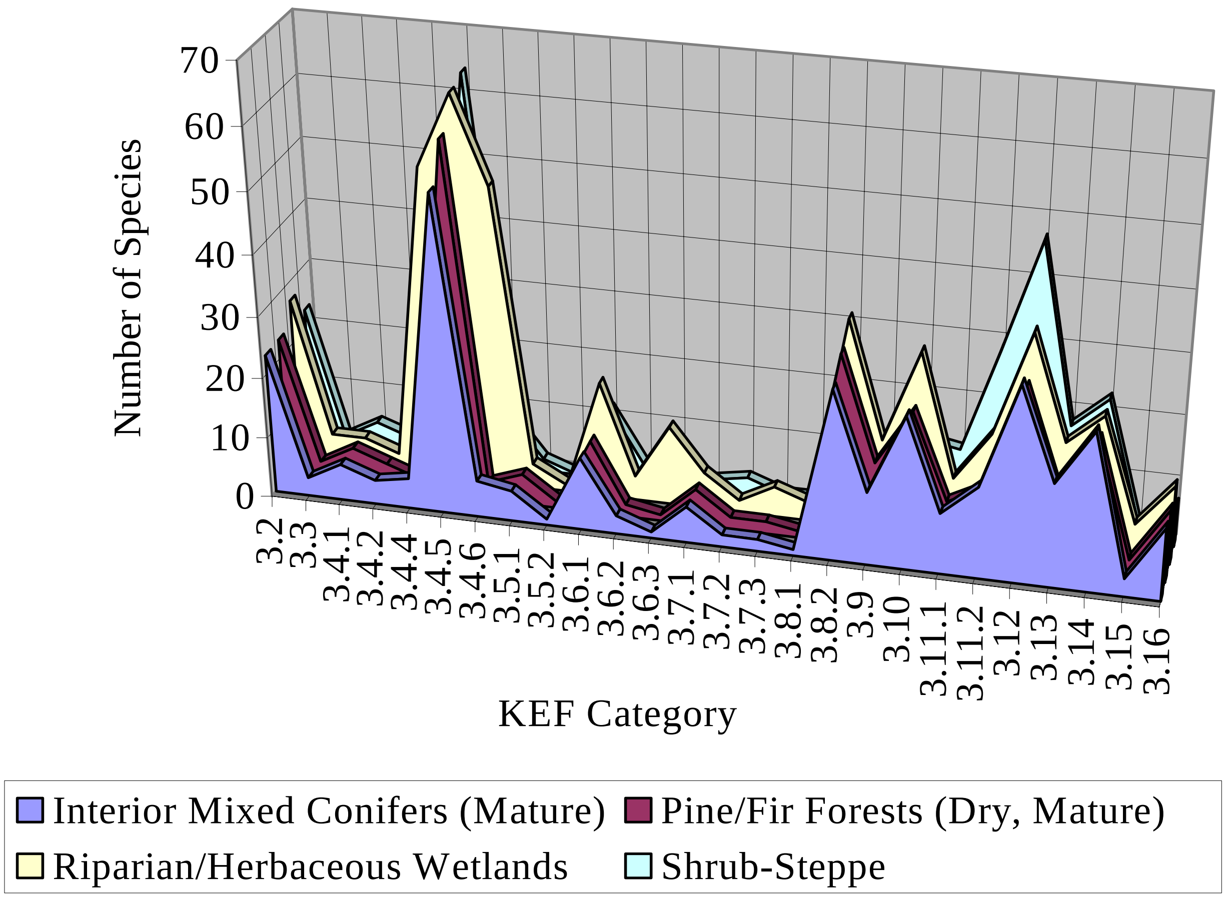



**Figure 2-7. Relative degree of functional redundancy in organismal relationships among focal habitat types in the Boise, Payette, and Weiser subbasins (IBIS 2003) (see Appendix 2-1 for KEF category definitions and numbers). Riparian/herbaceous wetlands appear as a more functional resilient habitat type than other focal habitats. There is redundancy in seed and fruit dispersal because many species are shown to disperse seeds and fruits for all focal habitat types (category 3.4.5). In contrast, some focal habitat types have very few species acting as pollinators (3.3) or dispersing lichens (3.4.2).**

Findings from a comparison of functional profiles for focal habitat types suggest that the riparian/herbaceous wetlands are a functionally resilient habitat type, while other focal habits are less functionally resilient. The functional profiles also show which ecological functions or roles are performed by many species or only a few species for each focal habitat type. For instance, many species are shown to disperse seeds and fruits for all focal habitat types (KEF category 3.4.5) (Figure 2-7), implying some redundancy for this ecological function. In contrast, for some habitat types very few species act as pollinators (KEF category 3.3) or disperse lichens (KEF category 3.4.2) (Figure 2-7).

#### *2.1.1.7 Critical Functional Link Species*

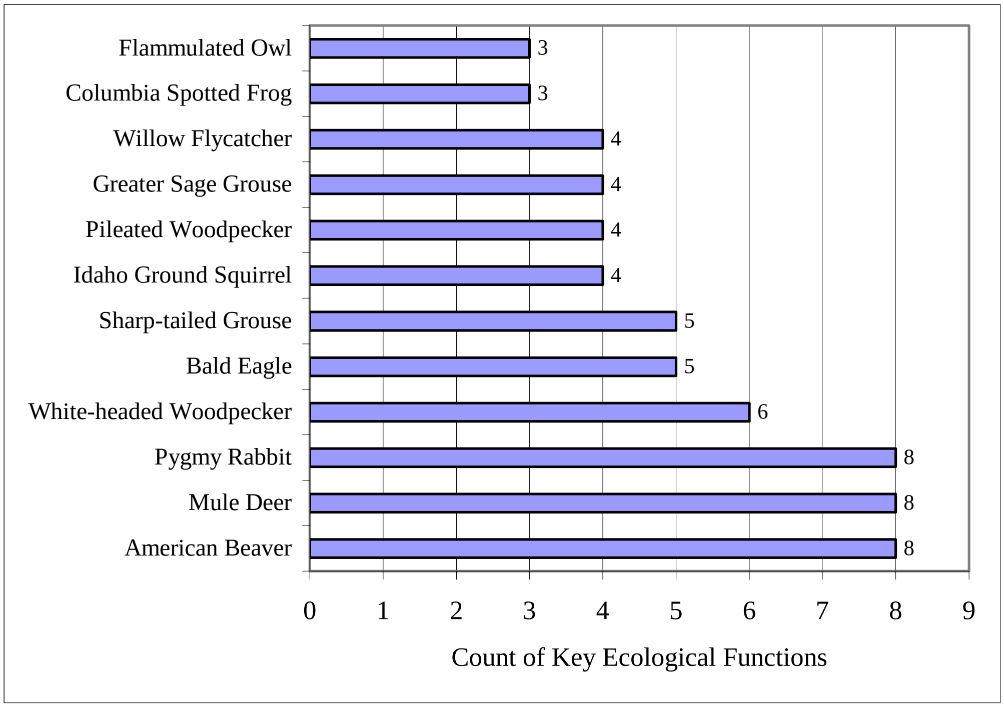
By definition, if a species is the only one that performs a particular ecological function within a community, then it is a critical functional link species. For example, the American beaver (*Castor canadensis*) is a focal species in the subbasin assessment and also a critical functional link species for several habitat types because it is the only species that impounds water by creating diversions or dams.

Loss of functions serves to degrade ecosystem integrity. Even seldom-performed functions can lead to declines in ecosystem integrity and resilience. “Imperiled functions” are those ecological functions that are fulfilled by very few species; by species that are scarce or declining; or by species that, if extirpated, would lead to the loss of the function in the ecosystem. Reductions or extirpation of species that perform critical functional links may have ripple effects in the ecosystem, causing unexpected or undue changes in biodiversity, biotic processes, and the functional web of a community.

### 2.1.2 Focal Species

We summarized KEFs and KECs for each focal wildlife species in the Boise, Payette, and Weiser subbasins (Figure 2-8). Wildlife species that have high KEF counts are considered to be generalists in the environment, while species that have low KEF counts are considered to be specialists (Figure 2-8, upper graph). Species that have high KEC counts are considered to be robust in that they can more easily adapt to changes in their environment than species with low KEC counts (Figure 2-8, lower graph). Among focal species list for the Boise, Payette, and Weiser subbasins, the bald eagle, mule deer (*Odocoileus hemionus*), and American beaver appear to be more resilient to changes in their environment because they have high KEF and KEC counts. The focal species most susceptible to changes in their environment are the flammulated owl (*Otus flammeolus*) and pileated woodpecker (*Dryocopus pileatus*).

The greater sage-grouse (*Centrocercus urophasianus*), Columbia spotted frog (*Rana luteiventris*), and Idaho ground squirrel (*Spermophilus brunneus*) are focal species with relatively low KEF counts (specialists), but they have relatively high KEC counts (Figure 2-8). This combination indicates that, while these species are specialists, they are capable of adapting to changes in their environment.



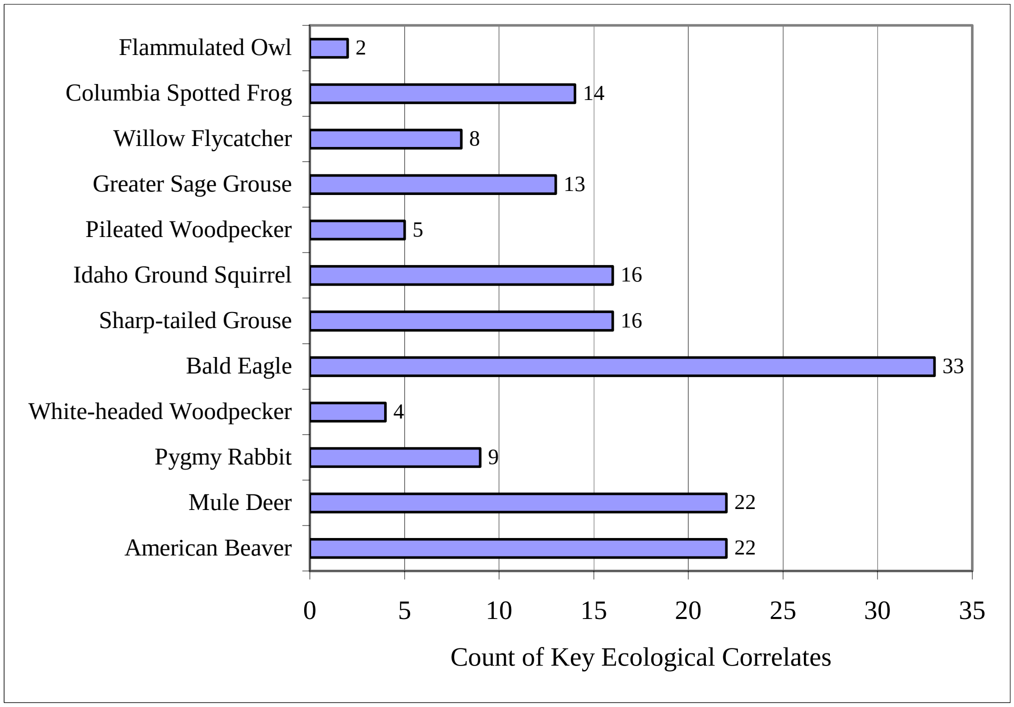




**Figure 2-8. Focal wildlife species counts of key ecological functions (KEFs) (upper graph) and key environmental correlates (KECs) (lower graph) in the Boise, Payette, and Weiser subbasins (IBIS 2003).**

To evaluate how the ecological functions and roles of wildlife and fish species might overlap, we assessed the focal species for direct associations with aquatic environments Figure 2-9). KEC counts for these species reveal that the American beaver, Columbia spotted frog, and bald eagle would be better adapted to changes in their environment because they perform diverse functions in both aquatic and terrestrial environments. Mule deer and sharp-tailed grouse (*Tympanuchus phasianellus*), on the other hand, would be more easily impacted by changes in their aquatic environments.

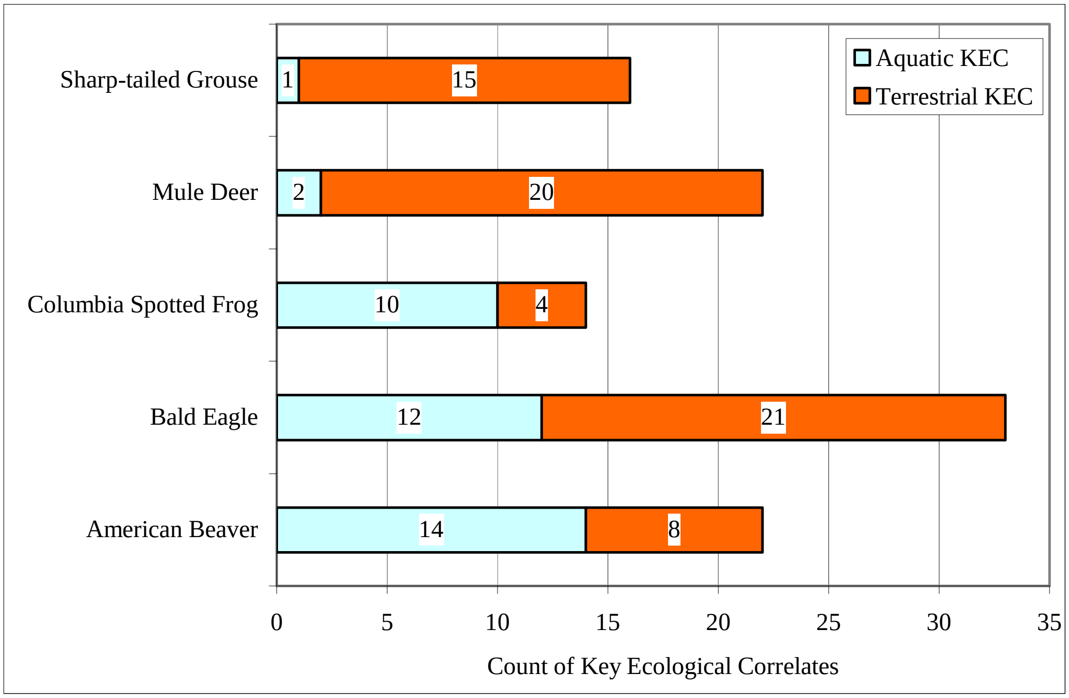



**Figure 2-9. Focal species associated with both terrestrial and aquatic environments in the Boise, Payette, and Weiser subbasins and the species' respective key environmental correlate (KEC) counts (IBIS 2003).**

Using the IBIS data set and known species distribution in the Boise, Payette, and Weiser subbasins, we determined the percentage of change in total functional diversity for each of the focal species and their associated focal habitats. Focal habitats are not spatially consistent in terms of diversity and condition, so different geographic areas manifest different changes in total functional diversity (Figure 2-5 and Appendix 2-2). For example, of the total shrub-steppe habitat available to the pygmy rabbit (*Brachylagus idahoensis*) in the Boise, Payette, and Weiser subbasins, about 45% has seen a significant decrease in total functional diversity while none of the habitat has seen a significant increase. Overall, the total functional diversity of the focal species and their associated habitats has declined in the Boise, Payette, and Weiser subbasins (Figure 2-10 and Figure 2-11).

The same approach can be applied to understanding the changes in total functional diversity for each of the focal habitats in the Boise, Payette, and Weiser subbasins (Figure 2-11). All of the focal habitat types have seen declines in total functional diversity. But riparian/herbaceous wetlands and shrub-steppe habitats demonstrate more significant impacts due to more significant decreases in total functional diversity (Figure 2-5 and Appendix 2-3). It should be noted that these relationships are general descriptions at the subbasin level and may not reflect specific conditions within any one watershed.

Analyses of KEFs and KECs add insight into the relationships between focal species and their habitats and provide an overview of the status and trends within ecological complexes. Our analyses demonstrated negative trends in ecosystem health affecting habitat quality and quantity, as well as species resilience.

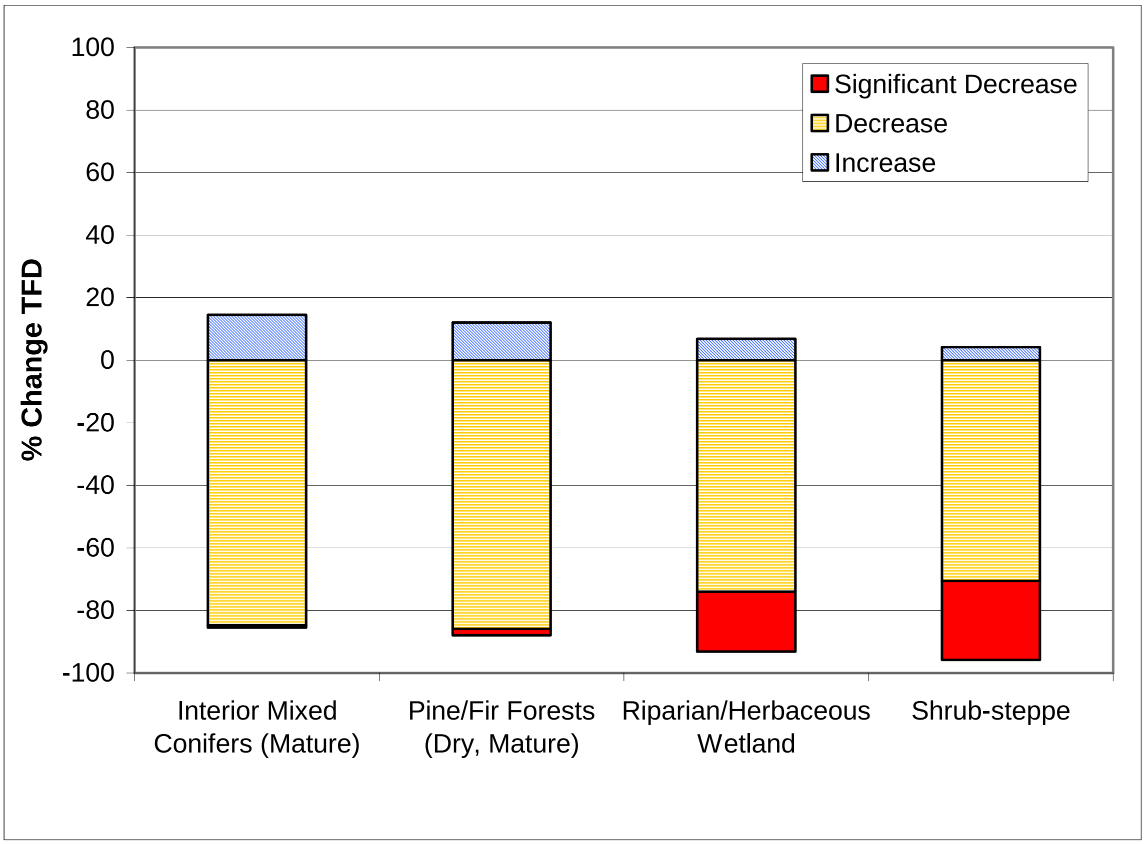



**Figure 2-10. Percentage of change in total functional diversity for each of the focal habitats in the Boise, Payette, and Weiser subbasins, Idaho (IBIS 2003).**

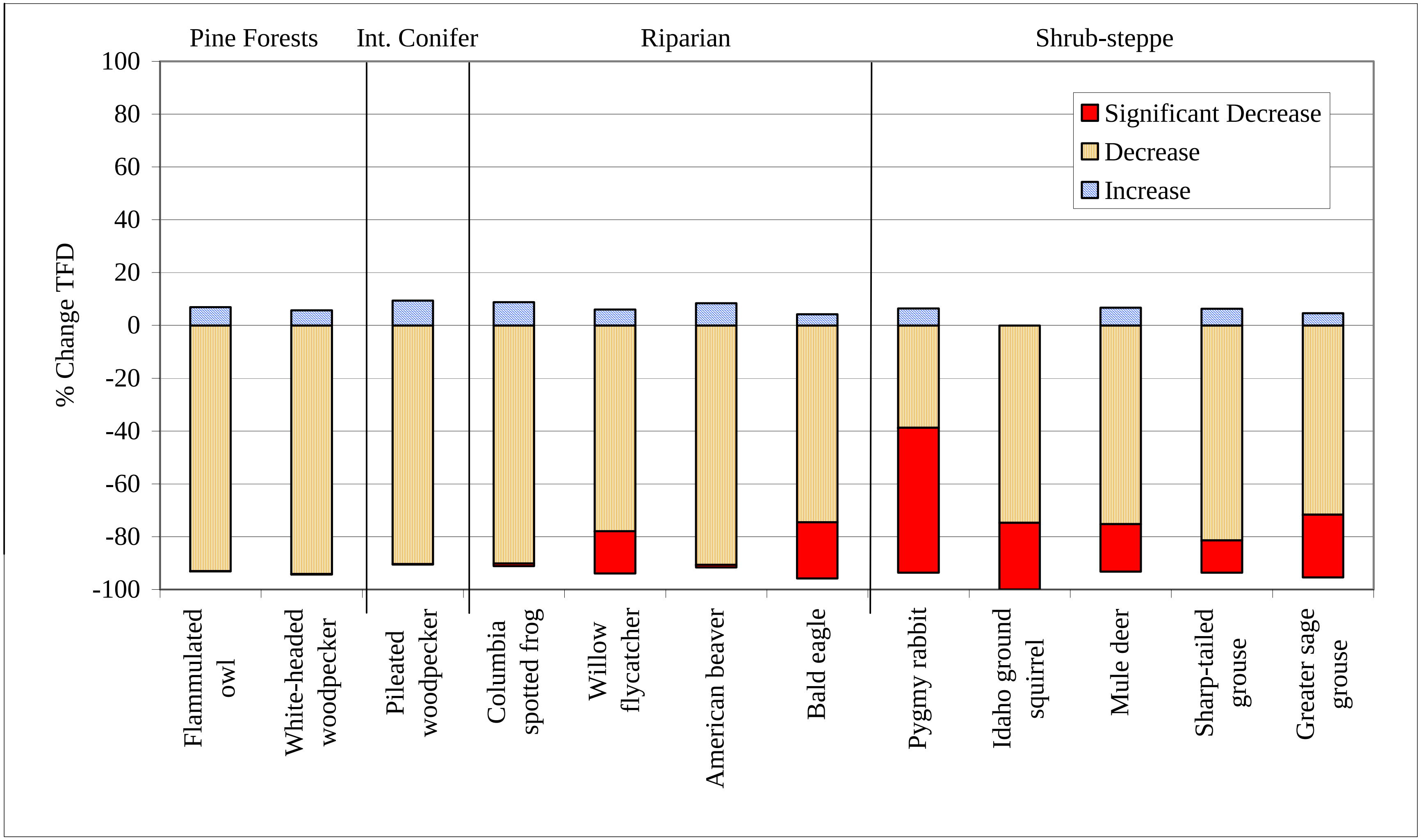



**Figure 2-11. Percentage of change in total functional diversity for each focal species in its respective habitat types in the Boise, Payette, and Weiser subbasins (IBIS 2003).**

## 2.2 Aquatic Resources

Assessments of native salmonids across watersheds throughout the Columbia River basin (ICBEMP 1997) suggest that the Boise, Payette, and Weiser subbasins contained a large portion of the formally occupied anadromous salmonid habitat and a high proportion of species strongholds relative to other subbasins in the region. Many of the subwatersheds within the subbasins support strong populations of one or more native species of non-anadromous salmonids, including populations with large fluvial (migratory) adults.

### 2.2.1 Focal Species

Focal species (Table 2-3) for the aquatic portion of this assessment were chosen according to guidelines provided by the Northwest Power and Conservation Council (NPPC 2001). These guidelines suggested inclusion of species that met the following criteria in order of importance:
1) designation as a federal endangered or threatened species, 2) ecological significance, 3) cultural significance, and 4) local significance. Further guidance from the Independent Science Review Panel was to use no more than five focal species for the assessment. Based on the above guidelines, the following focal species were chosen by the fisheries technical team: 1) bull trout because it is the only federally listed fish species in the subbasin; 2) redband trout (*Oncorhynchus mykiss*) because it widespread throughout the subbasin and of management importance; and 3) kokanee (*Oncorhynchus nerka*) because it occurs possibly as a remnant native stock in Payette Lake and represents lakes and reservoirs. The technical team listed additional species that were not chosen as focal species but were considered important in the subbasin or were recently extirpated.

The watershed was chosen as the organizational unit for focal species discussions. The watershed is considered the appropriate unit when dealing with aquatic species because the condition of an aquatic ecosystem is dependent on land and water management in the watershed (Doppelt *et al*. 1993). Bull trout population delineations were identified by the U.S. Fish and Wildlife Service (2002).

**Table 2-3. Focal, important, and recently extirpated species in the Boise, Payette, and Weiser subbasins, identified by the fisheries technical team.**

| Focal Species | Important Species | Recently Extirpated Species |
|---|---|---|
| Bull trout | Shorthead sculpin | Sockeye salmon |
| Redband trout | Paiute sculpin | Chinook salmon |
| Kokanee | Mottled sculpin | Steelhead |
| | Leopard dace | Pacific lamprey |
| | Mountain whitefish | |

#### 2.2.1.1 Bull Trout (*Salvelinus confluentus*)

##### 2.2.1.1.1 Conservation Status

Bull trout (*S. confluentus* [Suckley 1858]) were listed under the ESA as threatened on November 1, 1999 (64 FR 58910). Earlier rulemakings had listed distinct population segments of bull trout as threatened in the Columbia, Klamath, and Jarbidge river basins (63 FR 31647, 63 FR 42747, 64 FR 17100). The Bull Trout Technical Recovery Team developed a draft recovery plan that provided a framework for implementing recovery actions for the species. The bull trout draft recovery plan was also used as the principal basis for identifying critical habitat for species. The proposed designation of critical habitat was published on November 29, 2002 (67 FR 71236).

##### 2.2.1.1.2 Description

Bull trout and Dolly Varden (*Salvelinus malma*) were considered to be the same fish (from about 1882 to 1927). Then in 1978, Cavender provided evidence that the two species were distinct. In 1991, Hass and McPhail provided evidence to support these findings. Bull trout can reach ages of more than 20 years and lengths of 30 to 70 cm, depending on food availability and growing conditions in their environment. They can weigh up to 10 kg. Bull trout are olive-green to blue-gray on their backs, almost silver on their sides, and white on their bellies. Yellow, orange, or red spots are found on the sides and back. Some variations in color and appearance do occur. For example, in spawning males, the spots on the sides are brighter and the belly may be red or orange. Lake-dwelling bull trout may have a silver sheen to their sides, and young bull trout often have seven to ten pale dark bands along their sides, separated by narrow light stripes. The pelvic and anal fins have white leading edges, not followed by black. Bull trout are often misidentified, especially juveniles. The key to correctly identifying bull trout is the absence of black spots on the dorsal fin.

##### 2.2.1.1.3 Life History

Bull trout exhibit a number of life history strategies. These fish spawn more than once, and some may spawn in alternate years. Stream-resident bull trout complete their entire life cycle in the tributary streams where they spawn and rear. Migratory bull trout spawn in tributary streams where juvenile fish usually rear from one to four years before migrating to either a larger river (i.e., fluvial) or lake (i.e., adfluvial) where they spend their adult life, returning to the tributary stream to spawn (Fraley and Shepard 1989). Resident and migratory forms may be found together, and either form can produce resident or migratory offspring (Rieman and McIntyre 1993).

The size and age of bull trout is variable, depending on life history strategy. Resident bull trout tend to be small, averaging 20 cm in length and rarely exceeding 30 cm. Adults that migrate to larger downstream rivers average about 40 cm and often exceed 61 cm (Goetz 1989). Maximum sizes are reached in large lakes and reservoirs where adults can grow to over 69 cm in length and 10 kg in weight (McPhail and Baxter 1996). Under appropriate conditions, bull trout regularly live to ten years. Under exceptional circumstances, they reach ages in excess of 20 years (Fraley and Shepard 1989, McPhail and Baxter 1996). Bull trout normally reach sexual maturity in four to seven years.

The spawning habitat preferred by bull trout consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989). Bull trout typically spawn from August to November during periods of decreasing water temperatures (Swanberg 1997). However, migratory forms are known to begin spawning migrations as early as April and move upstream as much as 250 km to spawning areas (Fraley and Shepard 1989, Swanberg 1997).

Depending on water temperature, egg incubation is normally 100 to 145 days (Pratt 1992). Water temperatures of 1.2 to 5.4 °C have been reported for incubation, with an optimum (i.e., best embryo survivorship) temperature reported to be from 2 to 4 °C (Fraley and Shepard 1989, McPhail and Baxter 1996).

Juveniles remain in the substrate after hatching, and the time from egg deposition to emergence of fry can exceed 200 days. During the relatively long incubation period in the gravel, bull trout eggs are especially vulnerable to fine sediments and degraded water quality (Fraley and Shepard 1989). Increases in fine sediment appear to reduce egg survival and emergence (Pratt 1992). High juvenile densities have been reported in areas characterized by a diverse cobble substrate and a low percent of fine sediments (Shepard *et al.* 1984).

Bull trout are opportunistic feeders, with food habits that are primarily a function of size and life history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macro-zooplankton, and small fish (Donald and Alger 1993, McPhail and Baxter 1996). Adult migratory bull trout feed almost exclusively on other fish (Rieman and McIntyre 1993).

#### 2.2.1.1.4 Population Trends and Distribution

Bull trout have very specific habitat requirements. Habitat components that particularly influence their distribution and abundance include water temperature, cover, channel form and stability, spawning and rearing substrate conditions, and migratory corridors (Fraley and Shepard 1989; Goetz 1989; Pratt 1992; Rieman and McIntyre 1993, 1996; Rieman *et al*. 1997; Watson and Hillman 1997). Relatively cold water temperatures are characteristic of bull trout habitat. Water temperatures above 15 °C are believed to limit their distribution (Fraley and Shepard 1989, Rieman and McIntyre 1996). Although adults have been observed in large rivers throughout the Columbia River basin in water temperatures up to 20 °C, Gamett (1999) documented steady and substantial declines in bull trout abundance in stream reaches where water temperature ranged from 15 to 20 °C. Thus, water temperature may partially explain the generally patchy distribution of bull trout in a watershed. In large rivers, bull trout are often observed “dipping” into the lower reaches of tributary streams, and it is suspected that cooler waters in these tributary mouths may provide important thermal refugia, allowing them to forage, migrate, and overwinter in waters that would otherwise be, at least seasonally, too warm. Spawning areas are often associated with cold springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992, Rieman and McIntyre 1993, Rieman *et al.* 1997).

The Boise, Payette, and Weiser subbasins are part of the Southwest Idaho Bull Trout Recovery Unit, which is divided into three subunits and nine core areas (Table 2-4 and Figure 2-12). Boundaries of core areas generally reflect isolation by one or more dams. Historically, no barriers to fish migration existed between the subbasins and the Snake River. Currently, bull trout populations are upstream of reservoirs and unsuitable habitat (Figure 2-13). Data on bull trout abundance through time in the recovery unit are nonexistent (USFWS 2002).

**Table 2-4. Description of Southwest Idaho Bull Trout Recovery subunits and core areas (USFWS 2002).**

| Subunit | Core Area | Description |
|---|---|---|
| Boise River | Arrowrock | Boise River watershed upstream of Arrowrock Dam, including North and Middle Forks Boise River and South Fork Boise River downstream of Anderson Ranch Dam |
| | Anderson Ranch | South Fork Boise watershed upstream of Anderson Ranch Dam |
| | Lucky Peak | Lucky Peak Reservoir and its tributaries |
| Payette River | North Fork Payette | Watersheds upstream of Cascade Dam |
| | Middle Fork Payette | Watersheds upstream of the confluence with the South Fork Payette River |
| | Upper South Fork Payette | Watershed upstream of Big Falls, including Deadwood River downstream of Deadwood Dam |
| | Deadwood River | Watersheds in the Deadwood River drainage upstream of Deadwood Dam |
| | Squaw Creek | Watersheds in Squaw Creek upstream of its confluence with the Payette River |
| Weiser River | Weiser River | Watersheds upstream of and including the Little Weiser River |

Using recent (1998 and later) electrofishing survey information from multiple sources, we estimated bull trout abundance within the Boise and Payette subbasins and created individual estimates by core area. Estimates are for bull trout of all sizes for streams within designated local population areas. Methods and data are presented in Appendix 1-2. We estimated bull trout abundance in the Boise River subbasin upstream of Arrowrock Reservoir at 93,471. Abundance was estimated at 38,500 for the Anderson Ranch core area and 56, 576 for the Arrowrock core area. For the Payette River subbasin upstream of Black Canyon Dam (excluding populations in the North Fork Payette River), abundance was estimated at 72,348. Abundance was estimated at 5,003 for the Deadwood River core area, 10,035 for the Middle Fork Payette River core area, 3,414 for the Squaw Creek core area, and 57,746 for the South Fork Payette River core area.

As mentioned earlier, the Southwest Idaho Bull Trout Recovery Unit is divided into three subunits, each of which is discussed below.

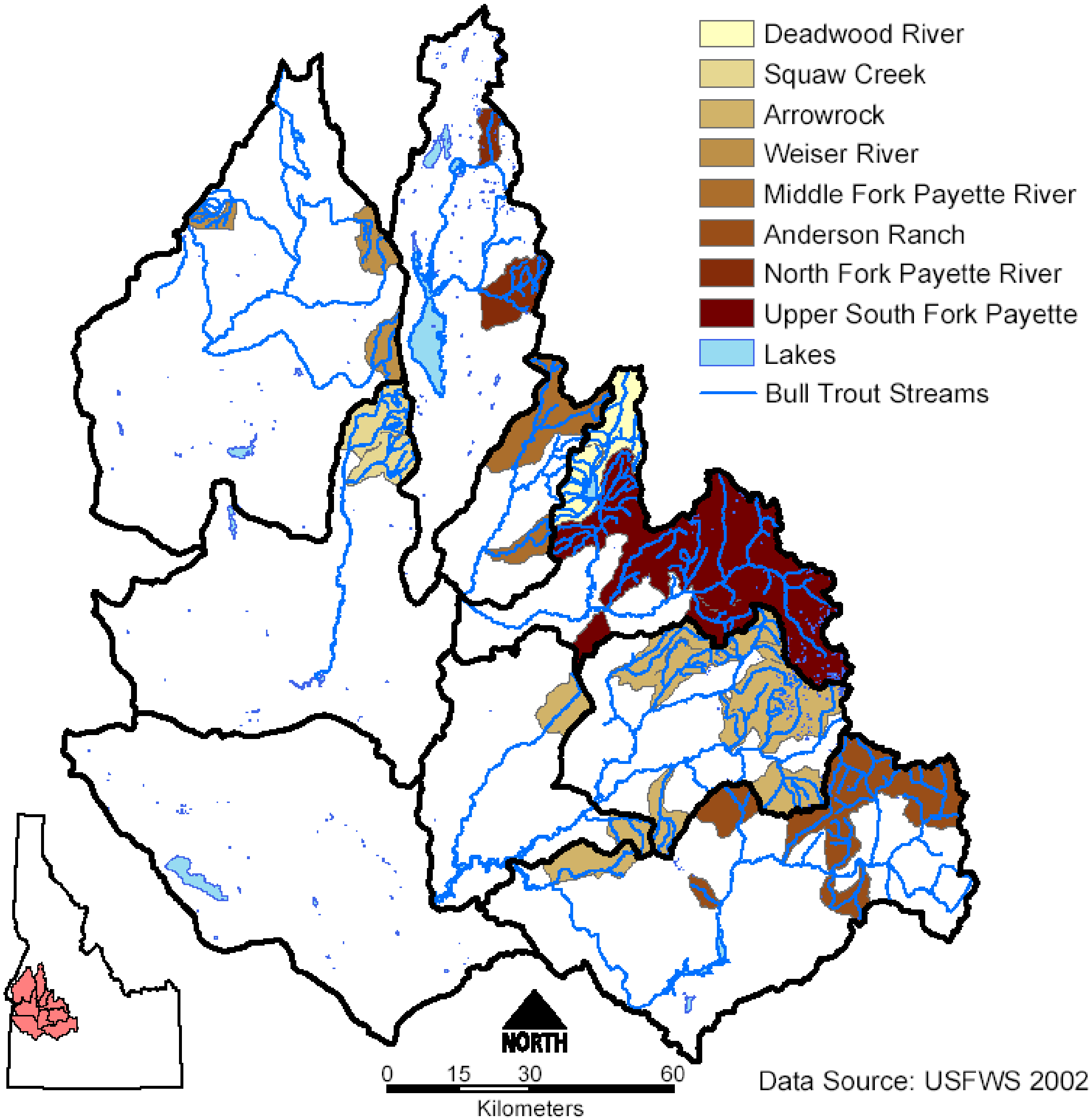



**Figure 2-12. Bull trout core populations in the Boise, Payette, and Weiser subbasins, as defined by the draft bull trout recovery plan (USFWS 2002).**

**Boise River Recovery Subunit**—All bull trout in the Boise River Recovery Subunit are located upstream of Lucky Peak Dam (an impassable barrier). Anderson Ranch and Arrowrock dams also form impassable barriers to upstream migration. Long-term trend data are nonexistent for bull trout populations in the Boise, Payette, and Weiser subbasins. The Arrowrock and Anderson Ranch core areas contain most of the large migratory adult bull trout located in the Southwest Idaho Bull Trout Recovery Unit. The migratory life history forms currently use the reservoirs (Arrowrock and Anderson Ranch) for overwintering and foraging. Adult abundance estimates for migratory adult bull trout were conducted in several locations in the Boise River Recovery Subunit. Adult abundance in Arrowrock and Anderson Ranch reservoirs was between 350 and 475 fish (Table 2-5). The estimate of post-spawning adults in the North Fork Boise River was close to 1,000 individuals (Table 2-5), but this estimate is thought to be biased high.

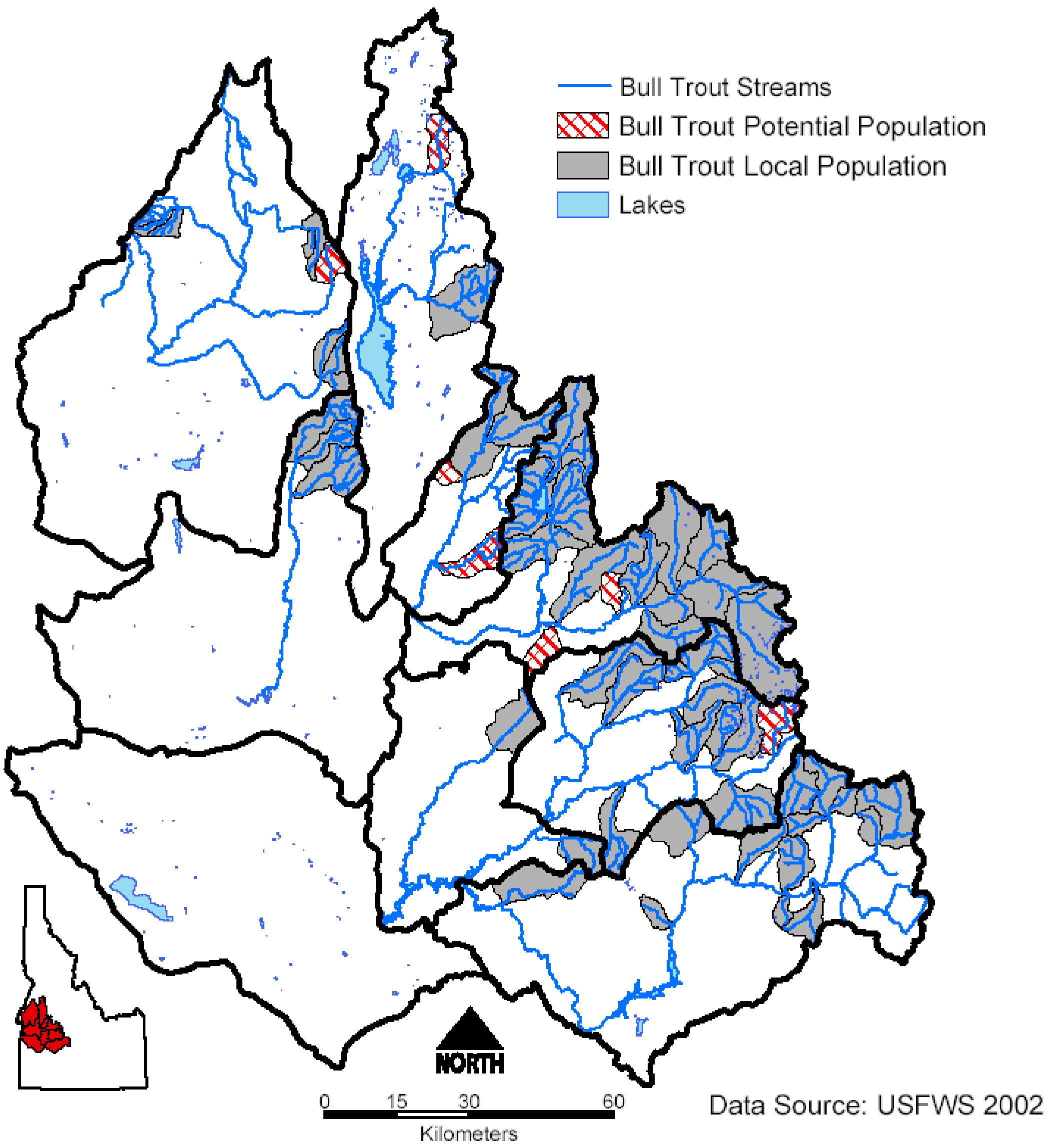



**Figure 2-13. Local and potential populations of bull trout in the Boise, Payette, and Weiser subbasins. Local populations contain known spawning and rearing populations of bull trout (USFWS 2002).**

Large fluvial adult bull trout have been documented in Big Smokey and Johnson Creek drainages an estimated 58 miles from Anderson Ranch Reservoir (Kevin Meyer, Idaho Department of Fish and Game, personnel communication). Fifty-seven adult bull trout from Anderson Ranch Reservoir were radio-tagged in 1998 and 1999. Of the individual fish locations identified during August and September, 70% were tracked to headwaters areas (thought to be spawning migration). These fish had returned to the reservoir by the end of November (Partridge *et al*. 2000).

**Table 2-5. Adult abundance estimates in the Boise River Core Subunit (USFWS – unpublished data).**

| Date | Core Area | Location | Life Stage | Abundance[a] |
|---|---|---|---|---|
| 1996–1997 | Arrowrock | Arrowrock Reservoir | Adult (> 300 mm) | 471 (95% CI 389–590) |
| 1998 | Arrowrock | Arrowrock Reservoir | Adult (> 300 mm) | 354 (95% CI 133–575) |
| 1999–2000 | Anderson Ranch | Anderson Ranch Reservoir | Adult (> 300 mm) | 368 (95% CI 282–454) |
| 1999–2000 | Arrowrock | North Fork Boise River | Post-spawn adult | 969 (SD ± 228) |

[a] CI = confidence interval; SD = standard deviation

**Payette River Recovery Subunit**—The Payette River Recovery Subunit contains two impassable dams, Black Canyon located low in the drainage and Deadwood Dam located on the Deadwood River (tributary to the South Fork Payette River). Black Canyon and Deadwood dams are both owned and managed by the U.S. Bureau of Reclamation. Deadwood Dam isolates the bull trout in the Deadwood River core area from bull trout in the Upper South Fork Payette River core area. The Deadwood River population spawns in the headwater areas of the Deadwood River and in Deer and Trail creeks. Resident and migratory life history forms occur upstream of Deadwood Reservoir. USFS fish population surveys estimated 1,160 individual bull trout, which is described as “weak” in the U.S. Fish and Wildlife Service’s draft bull trout recovery plan (2002).

Big Falls on the Payette River is the dividing point between the Middle Fork Payette core area and the Upper South Fork Payette River core area. The falls is natural and thought to be a barrier to bull trout migration. The Upper South Fork core area includes the Deadwood River downstream of the dam. Bull trout are known to spawn in watersheds of the upper and middle South Fork Payette River, including Canyon, Clear, Whitehawk, and Scott creeks. The combined populations of Whitehawk and Scott creeks were estimated at 3,315 individuals and considered “strong” by the USFS (> 2000 individuals and > 500 adults). The Canyon Creek population was estimated at 2,653 individuals. Other populations throughout the South Fork Payette River are thought to be between 224 and 1,500 individuals. Most bull trout in the South Fork Payette River core area are resident life history forms, though small numbers of migratory adults are thought to occur.

Bull trout spawning in the Middle Fork Payette River core area occurs in the upper portions of the watershed, including the Middle Fork Payette River, Bull Creek, and Sixteen-to-One Creek. Populations were estimated at 2,932 in the Upper Middle Fork Payette and 2,550 for the combined Bull Creek and Sixteen-to-One creeks. Adults are found lower in the drainage, indicating that some migratory individuals exist. Bull trout in the North Fork Payette River core area are confined to the Gold Fork drainage and North Fork Lake Creek. Spawning in the Squaw Creek population occurs in the upper Squaw Creek and Third Fork Squaw Creek. A migratory component is thought to remain in the Squaw Creek population. Unfortunately, population estimates are not available for these areas.

**Weiser River Recovery Subunit**—Bull trout located in the Weiser River Recovery Subunit are primarily resident life history forms. Bull trout have been located in headwater streams of the Little Weiser River (Anderson Creek, Sheep Creek, and the upper Little Weiser River), Middle Fork Weiser River, East Fork Weiser River, Dewey Creek, and Hornet Creek watersheds. Recent surveys have failed to detect bull trout in the Middle Fork Weiser River. In 1994, bull trout densities were estimated in Anderson and Sheep creeks at 5.7 to 5.6 fish/100 $m^2$. Dewey Creek bull trout populations were estimated at 3.2 fish/100 $m^2$ in pool habitat only. Bull trout density in the Hornet Creek watershed was estimated at 4 to 10 fish/100 $m^2$ (Figure 2-14). Unfortunately, no more population estimates are available at this time.

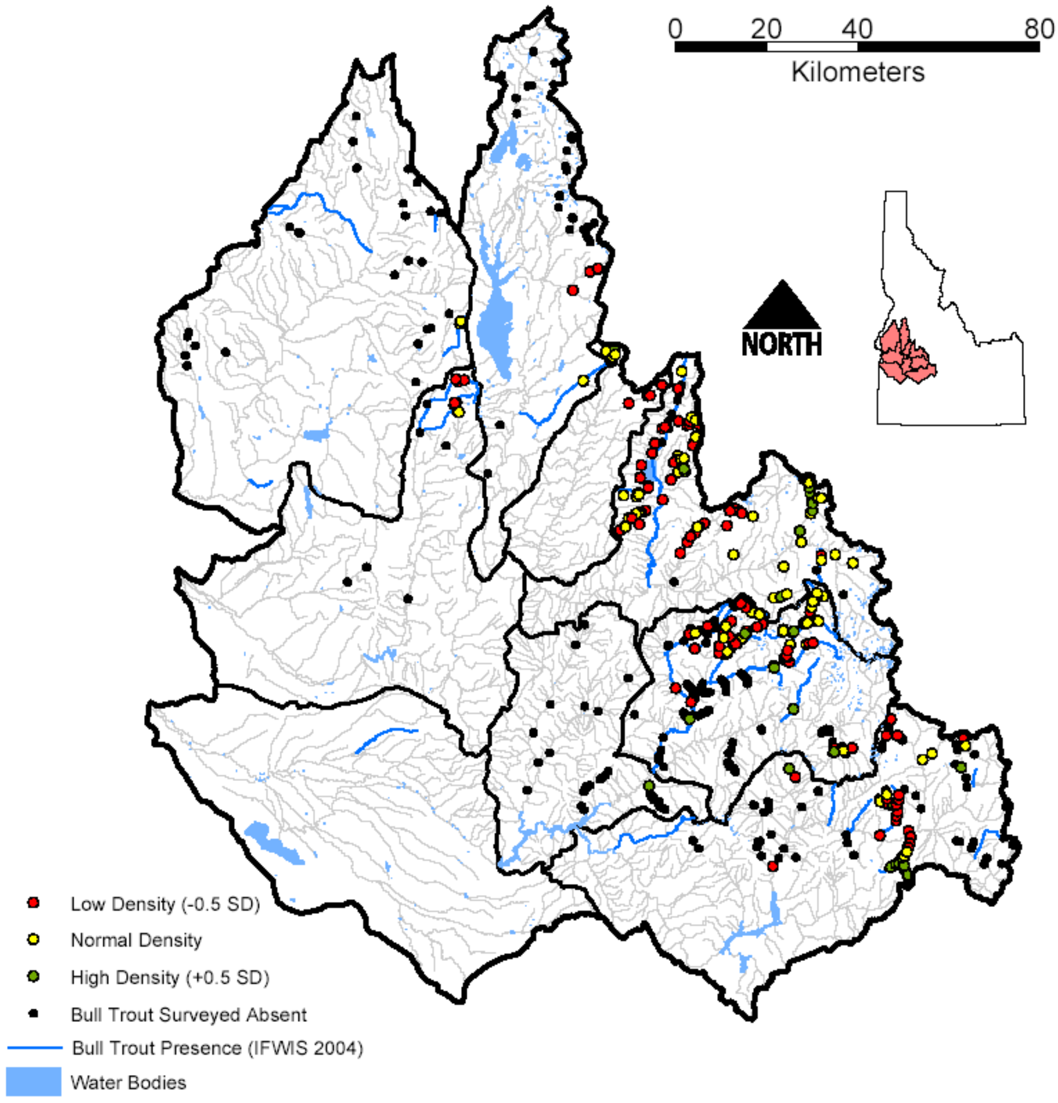



**Figure 2-14. Normalized densities of bull trout in the Boise, Payette, and Weiser subbasins. Data sources include various fish surveys conducted by the Idaho Department of Fish and Game, USFS Rocky Mountain Research Station, and U.S. Bureau of Reclamation. See Appendix 1-2 for methods and limitations of this data.**

### *2.2.1.2 Redband/rainbow trout (***Oncorhynchus mykiss***)*

#### 2.2.1.2.1 Conservation Status

Redband trout are defined as all wild native rainbow trout east of the Cascade Range in the Columbia River basin. In Idaho, all native rainbow trout (including steelhead) are considered redband trout (Behnke 1992). Redband trout are listed as a species of special concern by the State of Idaho (Idaho Code 13.01.06) and the U.S Fish and Wildlife Service.

#### 2.2.1.2.2 Life History

Redband trout typically mature at two to four years of age, with males possibly maturing one year earlier than females in the same populations. Spawning occurs in the spring in areas of flowing water that allow oxygen to circulate through redds. Spawn timing is controlled by both environmental and genetic factors. Redband trout may exist as resident or migratory populations. Growth is influenced by temperature, genetics, and food availability. Redband trout feed on insects and may become piscivorous at larger sizes. Trout are adapted to cold water and typically cease feeding when water temperatures exceed 22 to 25 °C. However, native redband trout from northwestern Nevada, southwestern Idaho, and southeastern Oregon appear to be adapted to considerably warmer temperatures (Behnke 1992, Gamperl *et al*. 2002). Anadromous redband trout (steelhead) were eliminated by dams.

#### 2.2.1.2.3 Population Trends and Distribution

Widespread stocking of hatchery rainbow trout into waters where native redband trout potentially existed and in areas inaccessible to redband trout complicates the identification of historical distribution. The current distribution reflects a combined abundance of redband and rainbow trout. Due to the scarcity of information regarding native redband and hatchery rainbow trout introgression, any references to redband trout are made with the understanding that genetic status of the population is unknown. Redband trout are widely distributed throughout the Boise, Payette, and Weiser subbasins (Figure 2-15). High-density populations of redband trout were observed in all 4th field hydrologic unit codes (HUCs) within the Boise, Payette, and Weiser subbasins, except for the Middle Fork and South Fork Payette watersheds. The Weiser subbasin contained most of the high-density populations sampled within the three subbasins.

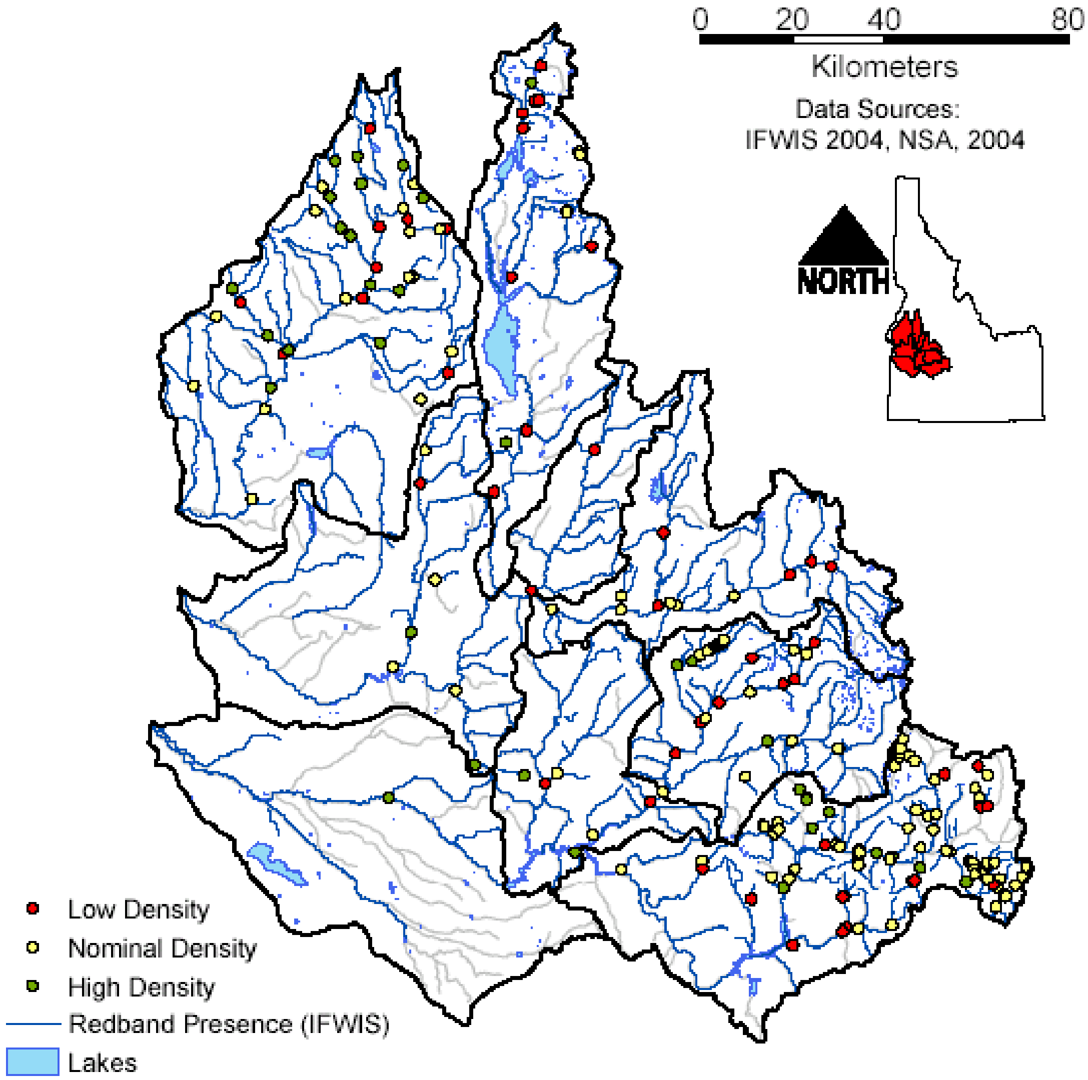



**Figure 2-15. Relative population density of redband/rainbow trout in the Boise, Payette, and Weiser subbasins at the 4th field HUC level (IDFG 2004).**

### *2.2.1.3 Kokanee (Oncorhynchus nerka)*

#### 2.2.1.3.1 Conservation Status

Kokanee are not included on any federal or state protection or species of concern list. Kokanee were native to Payette Lake, but the current population appears to be primarily the result of hatchery stocking. All kokanee in reservoirs throughout the subbasin are supplemented or supported by hatchery stocking.

#### 2.2.1.3.2 Life History

Kokanee are lake resident fish that spawn in tributaries or in gravel along the shores of lakes or reservoirs. Kokanee spawning occurs in the fall between August and November, and kokanee die after spawning. Maturation usually occurs after three to five years, and size at maturity varies widely (generally 254 to 355 mm). Kokanee fry travel to the lake to rear and mature after exiting the redd. Diet is primarily zooplankton and small invertebrates (chironomid larvae). Populations are known to fluctuate naturally.

#### 2.2.1.3.3 Population Trends and Distribution

Kokanee are found in Payette and Little Payette lakes and in Cascade, Deadwood, Andersen Ranch, Lucky Peak, and Arrowrock reservoirs. Current kokanee populations are primarily the result of hatchery introductions. Populations in Payette Lake and Deadwood Reservoir are naturally reproducing. Populations in Anderson Ranch Lucky Peak and Arrowrock are supplemented with hatchery kokanee.

## 2.2.2 Recently Extirpated Species

Anadromous fish runs have been extirpated from the Middle Snake Province (including the Boise, Payette, and Weiser subbasins) above Hells Canyon Dam. Fall Chinook (*Oncorhynchus tshawytscha*) salmon used the main Snake River, while steelhead and spring/summer Chinook salmon used the main river for access to and from tributaries including the Boise, Payette, Weiser, Powder, Burnt, Malheur, and Owyhee rivers. Corless (1990) mentioned that the Weiser Indians and Northern Paiute Tribe of eastern Oregon took salmon from the Boise, Payette, Weiser, and Snake rivers, and these were “all major runs.” Steelhead were taken in spring, and Chinook came in September. Sockeye salmon (*Oncorhynchus nerka*) “ran in vast numbers” between August and late October and spawned in Big Payette Lake near McCall, Idaho.

The Boise River once supported runs of Chinook salmon and steelhead. Fort Boise was a great fishing ground for the Bannocks and other bands of the Shoshone Tribe. Suckley (1860) reported spawning fish “seemed to almost fill the water in places suitable for that purpose.” Streams that were noted to historically support spawning salmon or steelhead in the Boise system included: Mores Creek and the Middle Fork Boise River. The Boise River was blocked to anadromous fish runs beginning first with Barber Dam in 1904 (with a functioning fish ladder), the New York Diversion Dam in 1906, and Arrowrock Dam in 1911–1912.

The Payette River also historically supported anadromous fish including Chinook salmon, steelhead, and sockeye salmon. The outlet of Payette Lake was a favored camp of the Shoshone and Nez Perce tribes. In decreasing importance to historic Indian fisheries, Payette watersheds included Deadwood River, Deer Creek, South Fork Payette River, Little Squaw Creek, Warm Springs Creek, Clear Creek, Canyon Creek, Silver Creek, Middle Fork Payette River, and the mainstem Payette River. Construction of Black Canyon Dam on the Payette River in 1924 resulted in the complete blockage of the drainage to Chinook salmon, sockeye salmon, and steelhead.

Payette Lake on the North Fork Payette River supported the largest sockeye salmon run in Idaho and the only sockeye salmon run upstream of Hells Canyon. Commercial fishing for sockeye salmon in Payette Lake between 1870 and 1880 took up to 75,000 fish a year (Evermann 1896). Creeks that supported spawning salmon and steelhead in the Payette subbasin included Squaw Creek, Gold Fork, Lake Fork, South Fork Payette River, Harris Creek (Fry 1980), North Fork Payette River, Shafer Creek, Harris Creek, Jackass Creek, and Porter Creek (Lyle 1975).

The Weiser River supported Chinook salmon and steelhead. Spawning was thought to occur in the upper mainstem Weiser River, Little Weiser River, West Fork Weiser River, Middle Fork Weiser, Mann Creek, and

Wildhorse River. Evermann (1896) mentioned the presence of live Chinook salmon in the Weiser River above Council, Idaho, about mid-September. He saw no fish on the Weiser River in a mile of examination upstream of the Council Valley.

Pacific lamprey (*Lampetra tridentata*) were also thought to be present in the Boise, Payette, and Weiser subbasins prior to construction of the Hells Canyon Complex (historical presence was confirmed at Swan Falls Dam on the Snake River upstream of the mouth of the Boise River). Construction of the Hells Canyon Complex (Brownlee, Oxbow, and Hells Canyon dams) from the late 1950s through the late 1960s on the Snake River blocked Chinook salmon and steelhead access to the Weiser River.

Chapman and Chandler (2001) estimated the amount of lost usable anadromous habitat in each of the subbasins upstream of the Hells Canyon Complex. The estimates for usable habitat in streams greater than third order with less than a 10% gradient were 1,806 km for the Boise subbasin, 1,322 km for the Payette subbasin, and 1,182 km for the Weiser subbasin.

#### 2.2.2.1 Steelhead (Oncorhynchus mykiss)

Steelhead have the greatest diversity of life history patterns of any Pacific salmonid species. Steelhead can spend up to four years in fresh water prior to smoltification and then live up to three years in salt water prior to first spawning. Steelhead also have the ability to spawn more than once (iteroparity), whereas all other species of *Oncorhynchus*, (except cutthroat trout [*O. clarki*]) spawn once and then die (semelparity). The frequency of multiple spawnings in steelhead populations is variable both within and among populations (Childerhouse and Trim 1979). Scale analysis conducted in the Clearwater River, Idaho, indicated a repeat spawning rate of approximately 2% in 1952 (Whitt 1954), when only two dams impeded their migration. Repeat spawning rates averaging 1.6% have been documented for wild summer steelhead populations in the Yakima River subbasin (above four mainstem dams) (Hockersmith *et al*. 1995).

The presence of resident and anadromous forms of *O. mykiss* makes steelhead life history very complex. The degree of gene flow between life history forms of different fish is known to be highly variable (Ehlinger and Wilson 1988, Foote *et al*. 1989, Verspoor and Cole 1989, Zimmerman and Reeves 2000). Life history appears to be plastic in many salmonids, as indicated by the production of anadromous returns from resident populations and vice versa (Osinova 1984, Foote *et al*. 1989). Additionally, the presence of resident forms of *O. mykiss* complicates juvenile sampling efforts since there is no way to differentiate the two life history forms until migration actually occurs.

Steelhead typically spawn between March and June. Depending on water temperature, steelhead eggs may incubate in redds for 1.5 to 4 months before hatching as alevins. Following yolk-sac absorption, alevins emerge from the gravel as fry and begin actively feeding. Young juvenile steelhead rear in fresh water from one to four years and then migrate to the ocean as smolts (Withler 1966).

#### 2.2.2.2 Sockeye Salmon (Oncorhynchus nerka)

The life history of sockeye salmon is the most variable of all the Pacific salmon, with a wide variety of adaptations for specialized conditions. Sockeye salmon life history differs from that for other Pacific salmon in that sockeye salmon use lakes for early freshwater rearing. In addition to the anadromous form, a landlocked form (referred to as kokanee) commonly exists in landlocked and anadromous-accessible waters. Kokanee are the residual nonmigratory form associated with anadromous populations (Burgner 1991).

Juvenile sockeye salmon rear one to two years in the lake prior to smoltification. Outmigration of sockeye salmon smolts begins in early April, is completed by mid-June, and peaks in mid-May. Smolts are either age 1 or age 2, and the percentage of each varies between 2 and 98%. No pattern in the timing of migration is apparent between age 1 and age 2 smolts. Fork lengths of smolts varies from 45 to over 120 mm. Adult sockeye salmon arrive at the trap on Redfish Lake Creek between mid-July and early September. Spawning takes place on the lake shoreline from late September through November, peaking in mid-October. Aging with otoliths indicates that returning adults are primarily 2-ocean, with only an occasional 1- or 3-ocean adult returning. Sex ratios of returning adults are nearly equal.

Sockeye salmon are opportunistic feeders, preying on insects, copepods, euphausiids, fish larvae, amphipods, and decapod larvae and on crustaceans, squid, and small fishes offshore.

Snake River sockeye salmon have declined dramatically in recent years. By the 1980s, only Redfish Lake supported a remnant anadromous run (Kline 1994, Kline and Younk 1995, Kline and Lamansky 1997, Hebdon *et al.* 2000). Historical reconstructions of sockeye salmon in Payette Lake have not been explored. However, Bruce Finney at the University of Alaska, Fairbanks (personnel communication to Stanley Basin Sockeye Technical Oversight Committee, January 17, 2001), using sediment records of nitrogen stable isotopes and biological indicators at Redfish Lake, reconstructed sockeye salmon abundance dating back 3,000 years. His results suggested that, prior to 1910, up to 20,000 to 40,000 sockeye salmon once returned to the Stanley Basin. Finney's studies estimated that 10 to 30% of the total, annual nutrification of Redfish Lake was provided by anadromous sockeye salmon.

#### *2.2.2.3 Pacific Lamprey (Lampetra tridentate)*

Lamprey historical distribution within the subbasin and elsewhere in Idaho is similar to that of salmon and steelhead (Simpson and Wallace 1982). The earliest documented occurrences of lamprey in Idaho were in the Snake River near Lower Salmon Falls and downstream near Lewiston (Gilbert and Evermann 1894).

Culturally important to native tribes, Pacific lamprey were also popular because of their oily flesh and their use as sturgeon bait (Gilbert and Evermann 1894). Ecologically, they are an important food for white sturgeon, and the carcasses of spawned adults provide nutrients to tributaries that also rear salmon and steelhead (Kan 1975).

General life history and habitat descriptions for this species can be found in several sources, which are summarized in Close (2000). In Idaho, Hammond (1979) described biology of lamprey larvae in selected streams. Hammond (1979) theorized that something other than size triggers transformation and migration to the ocean.

Throughout their range in the Columbia River basin, Pacific lamprey have declined to only a remnant of their pre-1940s populations. Lower Snake Dam counts numbered over 30,000 in the late 1960s but have declined to fewer than 500 fish in recent years (FPC, 2004). Currently, an estimated 3% of the lamprey that pass Bonneville Dam are counted at Lower Granite Dam (Close 2000). Based on these declines, the State of Idaho considers the Pacific lamprey to be endangered and imperiled, and they are listed by the BLM as a sensitive species.

#### 2.2.2.4 Spring/Summer Chinook (Oncorhynchus tshawytscha)

Chinook salmon are anadromous and semelparous. Fall Chinook return as adults in the late summer or fall and spawn almost immediately after reaching the natal stream (Healy 1991). Juvenile fall Chinook migrate as subyearlings, usually several months after emerging as fry, although timing of emigration is variable (Reimers and Loeffel 1967).

However, spring/summer Chinook adults enter fresh water in the spring and summer and delay spawning for several months, using holding cover in areas near the spawning grounds. Juvenile spring/summer Chinook migrate as yearlings after overwintering in the river environment. Although spring/summer types of Chinook may occupy the same streams, they can be genetically distinct and show heritable behavioral differences (Taylor and Larkin 1986, Taylor 1988). Spring and summer Chinook salmon spend one to four years in the ocean prior to returning, with the 2- and 3-ocean fish making up the majority of the returns. Kiefer *et al*. (2002) used dorsal fin cross sections to determine the ocean age of adult spring/summer Chinook salmon in the Snake River basin. They reported that the proportion of 2-ocean adult returns varied from 10% in 1998 to 93% in 2001, and the proportion of 3-ocean adult returns varied from 3% in 2001 to 80% in 1998.

Female Chinook salmon tend to dig redds in deep, fast running water and protect their eggs by covering them with river rock. Generally the size of gravel chosen depends on the size of the female parent. (Larger females may use larger substrate.) Eggs have the maximum survival in water with a temperature less than 14 °C (range: 10–15 °C) (Moyle 1976). The embryos incubate and hatch as alevins (i.e., a larval life stage dependent on food stored in a yolk sac) within the redd and remain in the gravel until they have used up all of their yolk supply. At this point, the young juveniles are called fry. Water temperature is the primary determinant in embryo development rate and timing of fry emergence from the gravel (Beacham and Murray 1989). Chinook salmon emerge from the gravel in the spring, and juveniles of the fall Chinook race migrate as subyearlings whereas the juveniles from summer and spring races generally migrate as yearlings.

### 2.2.3 Important Species

As mentioned above, most fish investigations focused on salmonids due to their value as sport fish. As a result, most native fish species in the Boise, Payette, and Weiser subbasins have very little basic life history information known about them. The mountain whitefish (*Prosopium williamsoni*) is probably the most well known, with scattered population estimates available. Other species including shorthead sculpin (*Cottus confuses*), mottled sculpin (*C. bairdi*), and leopard dace (*Rhinichthys falcatus*) are thought to be important not only for their values as forage fish for endangered bull trout in the subbasin, but they might also prove to be better indicator species for habitat quality, if more information were known about their basic life history characteristics.

#### 2.2.3.1 Shorthead Sculpin (Cottus confuses)

The shorthead sculpin is found in several areas of the Pacific Northwest (Wydoski and Whitney 1979, Page and Burr 1991). Distribution of shorthead sculpin is uncertain, mostly because of the difficulty in distinguishing this species from the mottled sculpin.

Shorthead sculpins inhabit cold, fast riffles in streams with gravel and rubble (Brown 1971, Wydoski and Whitney 1979), but they are sometimes found in slower water (Peden and Hughes 1984). In some locations, this species is more abundant in headwaters of drainages than other sculpin species are (Maughan and Saul 1979, Wydoski and Whitney 1979); elsewhere the pattern is opposite (Hughes and Peden 1984). Water temperatures in summer are somewhat cooler than for other sculpin species (7.5–16 ºC) (Wydoski and Whitney 1979, Roberts 1988). Mean summer temperature for occupied streams in northwestern Montana was 7 ºC (Gangemi 1992).

Home range size, dispersal, and mating are undocumented, although Gasser *et al*. (1981) provided some evidence that adults in Idaho are relatively sedentary. Sexual maturity is reached at two to three years of age (Lee *et al*. 1980, Gasser *et al.* 1981, Roberts 1988), by which time both sexes are about 5.2 to 6.0 cm in standard length. Some variation exists between populations: Hughes and Peden (1984) found a two-year-old female of 7.1 cm standard length. Hughes and Peden (1984) also noted that males might grow more rapidly than females. Adults live at least four or more years (Wydoski and Whitney 1979, Gasser *et al*. 1981).

Spawning occurs in April in Idaho (Gasser *et al*. 1981). Eggs are laid in burrows on the undersides of rocks (Lee *et al.* 1980, Roberts 1988). Fecundity is related to female body size (Wydoski and Whitney 1979, Gasser *et al*. 1981, Peden and Hughes 1984); 184 eggs were in a 5.3-cm-long female, and 511 eggs were in a 7.1-cm-long female in Idaho. Data on sizes of clutches (individual egg masses) are lacking. Males guard nests once eggs are laid, and hatching probably occurs in two or three weeks (Roberts 1988).

Shorthead sculpins eat the same variety of prey that most other sculpins species do. Aquatic insects of at least six orders are consumed (Gasser *et al*. 1981). Fish remains and eggs were found in the diet at each location (< 1% of total items) but only in the largest size class (7.5–9.7 cm in length). Shorthead sculpins are probably eaten by salmonids, birds, and mammals (Wydoski and Whitney 1979, Roberts 1988). There are no reports of parasites in this species (Hoffman 1967).

#### 2.2.3.2 Mottled Sculpin (Cottus bairdi)

Mottled sculpins (*Cottus bairdi*) are a common fish species that has no special conservation status. The average total length is around 7.6 cm (3 inches). Overall coloration is a light to dark brown mottling on the back and sides, becoming light or even white on the underside. Two to three dark saddle marks may be under the second dorsal fin.

Mottled sculpins are found in greatest abundance in riffle areas of fast-flowing streams with clear water and rocky (gravel or rubble) substrate (Bailey 1952, Brown 1971, Wydoski and Whitney 1979); they are found less often along rocky shorelines of lakes (Holton and Johnson 1996). It is a bottom-dwelling species, often found under or between rocks. Water depth is usually less than 1 m. Summer water temperatures are usually 13 to 19 ºC, with a maximum of 21 ºC (Bailey 1952, McCleave 1964, Wydoski and Whitney 1979).

Since this fish is commonly a benthic species, it is a bottom feeder. These fish tend to eat a variety of foods, including immature aquatic insects of at least six orders, crustaceans, small sculpins, fish eggs, annelids, and plants

(Bailey 1952, Brown 1971, Wydoski and Whitney 1979). In turn, mottled sculpins are prey for a number of salmonid species (Brown 1971, Wydoski and Whitney 1979), and are used as bait fish. At least 25 species of parasites have been reported for mottled sculpins (Hoffman 1967, Kritsky *et al*. 1977, Muzzall *et al*. 1986, Heckmann *et al*. 1987).

Sexual maturity is reached at two or three years of age, by which time individuals of both sexes are about 6.4 to 7.9 cm standard length (Bailey 1952). Adults four years old may be 8.4 to 12.0 cm standard length. Older fish are rare in Montana collections (Brown 1971). Males tend to be larger than females, and many males are polygamous (Brown and Downhower 1982). The mean number of spawnings per male was 1.5 to 4.0, depending on the population, with a maximum of 12 for an individual male.

Spawning begins in April and continues through June (Bailey 1952, Downhower and Brown 1979) in Montana; spawning may occur earlier in other regions (Wydoski and Whitney 1979). Eggs are laid in burrows on the undersides of rocks 13 to 38 cm in diameter (Bailey 1952). Clutch size is related to female length and averages 744 eggs (range = 54–1587, $n$ = 12). Males tend the nests after eggs are laid (Bailey 1952). eggs hatch in 20 to 30 days at 10 to 16 ºC (Brown 1971).

#### 2.2.3.3 Paiute Sculpin (Cottus beldingi)

The Paiute sculpin is a native resident in the Snake River above Shoshone Falls (Lee *et al*. 1980). Fish commonly reach 2.5 to 4 inches in length but rarely exceed 5 inches. They are mottled brown and black with a depressed head and a laterally compressed body. The first dorsal has seven or eight flexible spines, and the second dorsal fin has 17 soft rays (Baxter and Stone 1995).

Paiute sculpin occupy select habitats over a large area of the West, from California to Idaho (Baxter and Stone 1995). They inhabit streams with moderate currents and are commonly found in riffle areas, where they feed on benthic organisms and insect larvae residing in gravels (Moyle 1976). This species is preyed on by brook, lake, brown, and rainbow trout (Lee *et al*. 1980).

Spawning commonly occurs in the late spring (May–June), with the male of the species guarding the nest (Moyle 1976). Little has been described regarding the feeding and breeding habits of the Paiute sculpin; however, it is considered that activities are similar to those of the mottled sculpin.

#### 2.2.3.4 Leopard Dace (Rhinichthys falcatus)

The leopard dace averages 7 to 10 cm (about 3 inches) in size and is creamy in color, somewhat darker on the back, and has many large irregularly shaped spots.

The species prefers rivers with a cobble or stone bottom and relatively warm, productive waters. When leopard dace occur in the same river systems as the longnose dace (*Rhinichthys cataractae*), the two species have quite different current-flow preferences: the leopard dace prefers slow-moving currents, probably less than 0.5 m/sec, and the longnose dace prefers more rapid water (Scott and Crossman 1973).

Yearling leopard dace are commonly found in shallow cobble habitat near the current. The dace use very different habitat as a nursery area than they use as adult habitat. The sun warms the shallow nursery zone in the summer. This warming likely adds to the productivity and metabolic activity of young dace in these habitats.

Little information is known about female reproduction. Beyond observations of dace seeking refuge under rocks, no information is available on their behavior since they have not been observed in open water. Stomach contents saved from collected specimens appear to contain mostly insect larvae remains. They have not been identified completely, but algae are not seen as a major factor in the food habits of the species. Predation by and competition with sympatric prickly sculpin (*Cottus asper*), torrent sculpin (*C. rhotheus*), or rainbow trout may affect dace abundance, although hiding under rocks could provide the species with protection from predation.

#### *2.2.3.5 Mountain Whitefish (Prosopium williamsoni)*

The mountain whitefish, which is widely distributed throughout the western United States, is considered abundant throughout all major river drainages in Idaho (Simpson and Wallace 1982).

The preferred habitat of mountain whitefish is cold mountain streams (Simpson and Wallace 1982) where they are found predominantly in riffle areas during summer and deep pools during winter (Wydoski and Whitney 1979). Mountain whitefish mature at about three years of age. They are fall spawners, typically spawning in riffle areas during late October or early November when water temperatures range between 40 and 45 °F. In some instances, spawning is known to occur along gravel shores in lakes or reservoirs. Spawners produce 1,500 to 7,000 eggs, which are adhesive and stick to stream substrate. Hatching occurs in March (Simpson and Wallace 1982).

Mountain whitefish spend much of their time near the bottom of streams and feed mainly on aquatic insect larvae (AFS 2000). Mountain whitefish also feed on terrestrial insects on the surface and on fish eggs (Simpson and Wallace 1982). Although growth is variable, most mountain whitefish in Idaho are typically 3 to 4 inches long at the end of the first year and 6 to 7 inches long after two years (Simpson and Wallace 1982).

Mountain whitefish, as a native fish species of the Snake River system, are probably the most widely distributed native fish species of the *Salmonidae* family found in Idaho. They have persisted without population augmentation or special management. In many areas, mountain whitefish provide an important winter fishery because they feed more actively than most salmonids during this period.

### 2.2.4 Nonnative Descriptions

Brook trout (*Salvelinus fontinalis*) are native to eastern North America. They were introduced into Idaho in the 1800s and have been introduced throughout the Boise, Payette, and Weiser subbasins. Brook trout can be locally abundant, but abundance varies significantly throughout the subbasins (Levin *et al*. 2002). Brook trout may displace native salmonids, prey on juveniles, and hybridize with bull trout.

Smallmouth bass are native to east-central North America. They were introduced into Idaho to increase sport fishing opportunities. In the Boise, Payette, and Weiser subbasins, smallmouth bass are restricted to the lower mainstem rivers. Smallmouth bass are largely piscivorous as adults. No information exists on population numbers of smallmouth bass in the subbasins.

## 2.3 Terrestrial Resources

Distribution and abundance of fish and wildlife are dependent on the distribution and types of vegetation cover, as well as on other parameters such as geomorphology and climate. Many wildlife species demonstrate close relationships and, at times, dependence on certain vegetation complexes. Ecological relationships between vegetation cover and wildlife species within habitat types are complex and difficult to quantify or qualify, but they are important to consider when attempting to protect or restore species and habitat types.

The terrestrial assessment team identified four focal habitats for the Boise, Payette and Weiser subbasins. Using the criteria from Section 2.0, as a starting point the technical team initial discussions were based primarily upon a list of 24 habitat classifications derived from the IBIS database. Focal habitat discussions evolved over the course of four meetings as both upper and lower technical teams settled upon habitat classification questions that incorporated multiple species benefits as well as addressing high conservation priorities.

We used two different data sets (ICBEMP 1997and GAP II 2003) to estimate the percentage of change in the focal habitat types between historical and current (Table 2-7) conditions. Historical records of habitat types in the Boise, Payette, and Weiser subbasins suggest that a large amount of the Lower Boise, Payette, and Weiser watersheds was composed of shrub-steppe habitat types (Figure 2-16). Project data suggest that the areas for all focal habitat types, with the exception of shrub-steppe, have declined (Table 2-6 and Table 2-7). It is notable that there are certain restrictions on the confidence of the vegetation source data (Appendix 1-2); therefore, the exact changes in and relationships between focal habitat types may include some error.

Data limitations aside, comparisons of habitat types in Figure 2-16 and Figure 2-17 clearly illustrate the expansion of the shrub-steppe vegetative community, a redistribution of pine/fir forests, and the loss and redistribution of interior mixed conifers since historical times. While the difference in distribution of riparian habitats seems initially problematic, data limitations account for a large portion of this discrepancy. Classification resolution and the relatively small dimensions of riparian systems prohibit it from being shown in historical condition maps in many areas. See Appendix 1-2 for more information on the limitations of these data sets.

**Table 2-6. Absolute values in area ($km^2$) and percentage change between historical and current conditions for the distribution of terrestrial focal habitats in the Boise, Payette, and Weiser subbasins, using ICBEMP (1997[a]) historical and GAP II (2003) current vegetation distributions.**

| Focal Habitat Type | ICBMP Historic Data Set by Major hydrologic unit (watershed) | | | | | | | | | Total Area ($km^2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| | NMB | BMO | SFB | LBO | SFP | MFP | PAY | NFP | WEI | |
| Riparian/Herbaceous Wetlands | 0 | 0 | 0 | 854 | 0 | 0 | 387 | 0 | 102 | 1,343 |
| Shrub-steppe | 16 | 183 | 372 | 2,487 | 33 | 2 | 1,692 | 134 | 1,858 | 6,778 |
| Pine/Fir Forest | 412 | 624 | 796 | 40 | 384 | 253 | 583 | 178 | 807 | 4,078 |
| Interior Mixed Conifer | 1,318 | 636 | 1,279 | 13 | 1,586 | 626 | 464 | 1,977 | 1,326 | 9,224 |
| Other | 217 | 159 | 934 | 117 | 117 | 0 | 91 | 115 | 267 | 2,016 |
| Focal Habitat Type | GAP II Data Set by Major hydrologic unit (watershed) | | | | | | | | | Total Area ($km^2$ |
| | NMB | BMO | SFB | LBO | SFP | MFP | PAY | NFP | WEI | |
| Riparian/Herbaceous Wetlands | 39 | 47 | 101 | 50 | 56 | 21 | 64 | 113 | 111 | 602 |
| Shrub-steppe | 874 | 619 | 1,612 | 1,107 | 705 | 181 | 1,208 | 160 | 1,928 | 8,395 |
| Pine/Fir Forest | 38 | 439 | 81 | 23 | 151 | 291 | 434 | 640 | 828 | 2,925 |
| Interior Mixed Conifer | 536 | 240 | 693 | 6 | 761 | 263 | 153 | 421 | 245 | 3,318 |
| Other | 476 | 257 | 893 | 2,324 | 447 | 126 | 1,358 | 1,069 | 1247 | 8,196 |
| Focal Habitat Type | Percent Change from Historic to Current Conditions by Major hydrologic unit (watershed) | | | | | | | | | Total Area ($km^2$) |
| | NMB | BMO | SFB | LBO | SFP | MFP | PAY | NFP | WEI | |
| Riparian/Herbaceous Wetlands | 100 | 100 | 100 | -1,621 | 100 | 100 | -503 | 100 | 8 | -741 |
| Shrub-steppe | 98 | 70 | 77 | -125 | 95 | 99 | -40 | 16 | 4 | 1,617 |
| Pine/Fir Forest | -976 | -42 | -879 | -70 | -155 | 13 | -34 | 72 | 3 | -1,153 |
| Interior Mixed Conifer | -146 | -165 | -85 | -117 | -108 | -138 | -204 | -369 | -442 | -5,906 |
| Other | 100 | 100 | 100 | -1,621 | 100 | 100 | -503 | 100 | 8 | -741 |

**Table 2-7. Percentage representation of current distribution of the terrestrial focal habitat types, by major watershed, for the Boise, Payette, and Weiser subbasins (GAP II 2003).**

| Focal Habitat Type | Current Percentage (%) Representation Major Hydrologic Unit (Watershed) | | | | | | | | | Total Area ($km^2$) |
|---|---|---|---|---|---|---|---|---|---|---|
| | NMB | BMO | SFB | LBO | SFP | MFP | PAY | NFP | WEI | |
| Riparian/Herbaceous wetlands | 2 | 3 | 3 | 1 | 3 | 2 | 2 | 5 | 3 | 602 |
| Shrub-steppe | 45 | 39 | 48 | 32 | 33 | 21 | 38 | 7 | 44 | 8,395 |
| Pine/fir forest | 2 | 27 | 2 | 1 | 7 | 33 | 13 | 27 | 19 | 2,925 |
| Interior mixed conifer | 27 | 15 | 21 | 0 | 36 | 30 | 5 | 18 | 6 | 3,318 |
| Other | 24 | 16 | 26 | 66 | 21 | 14 | 42 | 44 | 29 | 8,196 |

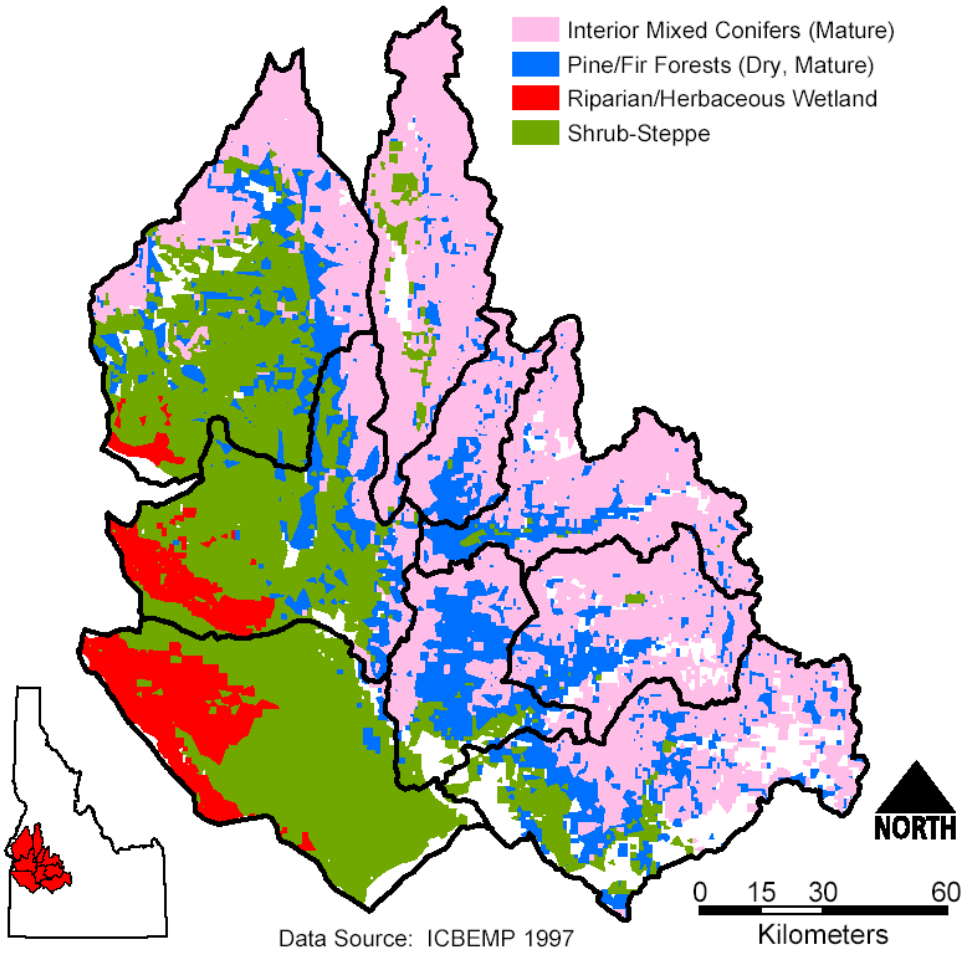



**Figure 2-16. Historical occurrences of the four identified terrestrial focal habitat types in the Boise, Payette, and Weiser subbasins (ICBEMP 1997).**

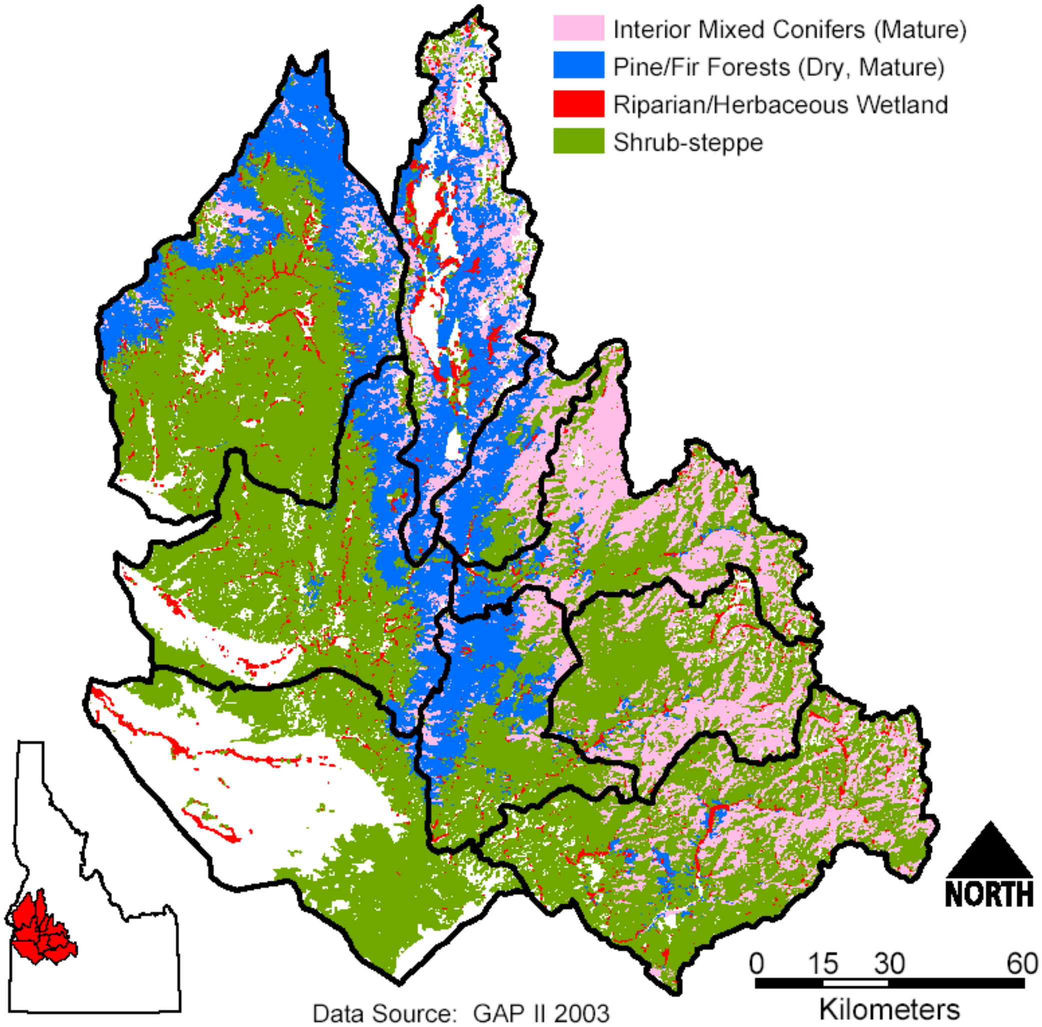



**Figure 2-17. Current occurrences of the four identified terrestrial focal habitat types in the Boise, Payette, and Weiser subbasins (Scott 2002, GAP II 2003).**

## 2.3.1 Riparian/Herbaceous Wetlands

### *2.3.1.1 Description*

By virtue of its high productivity, diversity, continuity, and critical contributions to both aquatic and terrestrial ecosystems, riparian and herbaceous wetland habitat in the subbasins (see (Figure 2-18 for estimated distribution) is a rich and vital resource to both fish and wildlife resources (Appendix 2-3). Riparian areas contain elements of both aquatic and terrestrial ecosystems that mutually influence each other and occur as transitions between aquatic and upland habitats (WDFW 2003). One hundred and fourteen bird species are documented using riparian habitat, 61 of which use it as primary habitat (IDPIF 2000). Thirteen bird species are classified as high-priority species (IDPIF 2000). Nearly one-quarter of the terrestrial vertebrate species use this habitat for essential life activities (IBIS 2003).

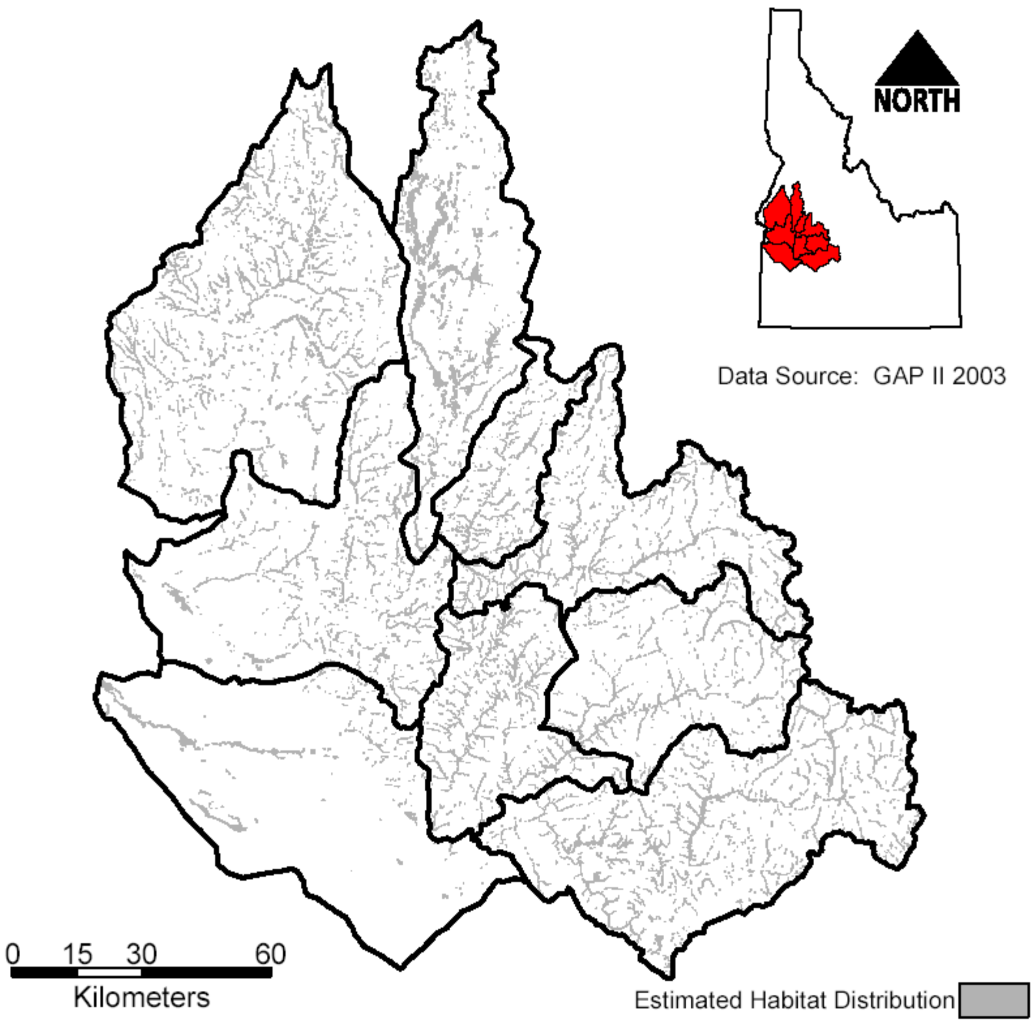



**Figure 2-18. Estimated distribution of the riparian/herbaceous wetland habitat type in the Boise, Payette, and Weiser subbasins (GAP II, Scott *et al.* 2002).**

Riparian habitat forms natural corridors that are important travel routes between foraging areas, breeding areas, and seasonal ranges (WDFW 2003). Habitat distribution is limited by geography and vulnerable to loss and degradation through human activities and land uses. Since the arrival of settlers in the early 1800s, 50 to 90% of riparian habitat in Idaho has been lost or extensively modified (Saab and Groves 1992). Remaining and intact riparian habitat has well-developed vegetation, with each of multiple canopy layers providing unique habitat niches that support a diversity of bird and mammal species (WDFW 2003).

Forested riparian habitat has an abundance of snags that are critical to cavity-nesting birds, mammals, and many insectivorous birds. Downed logs are common and provide cover and resting habitat for amphibians, reptiles, and small mammals. Wetland habitats support a large number of species and individuals, including many high-priority species (IDPIF 2000). Wetland habitats integral to riparian function have seen a 56% decrease in the last

200 years (Dahl 1990). Due to the sensitivity of these habitats and their duplicative beneficial effects on terrestrial and aquatic habitats, protection of these areas may yield the greatest gains for fish and wildlife across the landscape while involving the least amount of area (WDFW 2003).

#### *2.3.1.2 Focal Species*

The Columbia spotted frog, willow flycatcher (*Empidonax traillii*), bald eagle, and American beaver were selected as focal species associated with riparian/herbaceous wetlands in the Boise, Payette, and Weiser subbasins (Table 2-8 and Appendix 2-2). Each of these species exists in all watersheds of the subbasin. The American beaver is of particular importance in riparian/herbaceous wetlands because it creates wetlands and waterways in the mostly xeric environments of these subbasins. These wetlands and waterways are used by many other species.

**Table 2-8. Status and life history information for vertebrate focal species selected for riparian/herbaceous wetland habitat in the Boise, Payette, and Weiser subbasins. See Appendix 2-2 for detailed life history and biological information for each of the focal species.**

| Status or Life History Information | Focal Species | | | |
|---|---|---|---|---|
| | **Columbia Spotted Frog** | **Willow Flycatcher** | **Bald Eagle** | **American Beaver** |
| Conservation Status | Anticipated ESA candidate species | State protected nongame species | Federally listed under the ESA as threatened species | State game species |
| Population Status | The main population appears to be widespread and abundant. | Not rare and apparently secure, but with cause for long-term concern | In recovery, doubles breeding population every 6–7 years | Demonstrably widespread, abundant, and secure |
| Age at First Reproduction | Within 2 years at lower elevations and 4–6 years at higher elevations | At 1 year and annually thereafter | Possibly at 5 years; most breed for the first time at 6–7 years | At 2–3 years |
| Frequency of Reproduction | Iteroparous; breeding is explosive (as opposed to season-long), occurring only in the first few weeks following emergence. | Iteroparous; one brood per season except in cases of predation or nest lost. | 1–3 eggs per season | Iteroparous; only the colony's dominant female breeds, producing one litter a year. |
| Number of Offspring/ Fecundity | Tadpoles emerge from egg masses; 600–1,500 eggs per egg mass; females lay up to 50 egg masses per season | Lay 3–4 eggs per clutch; seasonal fecundity mean of 4.26 ± 0.05 SE eggs laid/season/female | 1–3 eggs per season | Average litter size varies from 2–3 kits. |
| Lifespan/ Longevity | 9–13 years | 5–7 years | 28 years | Up to 11 years in the wild and 15–21 years in captivity |

| Status or Life History Information | Focal Species | | | |
|---|---|---|---|---|
| | **Columbia Spotted Frog** | **Willow Flycatcher** | **Bald Eagle** | **American Beaver** |
| Predators | Waterbirds, sandhill cranes, and herons. Nonindigenous bullfrogs and fish. | Cooper's hawk, great horned owl, red squirrels, fox, and striped skunks. Most nest predation is believed to be mammalian, including long-tailed weasels, minks, and voles. Mule deer may trample some nests, or cattle may trample them in areas where grazing occurs. | Eggs, nestlings, and fledglings are most vulnerable to predators. Eggs in tree nests reported predated by black-billed magpies, gulls, ravens and crows, black bears, bobcats, wolverines, and raccoons. Few nonhuman species are capable or likely to prey on immature or adult bald eagle. | Has few natural predators; however, in certain areas, beavers may face predation pressure from wolves, coyotes, lynx, fishers, wolverines, and occasionally bears. Minks, otters, hawks, and owls periodically prey on kits. Humans kill beavers for fur. |
| Diet | Opportunistic forager that eats wide variety of insects as well as different mollusks, crustaceans, and arachnids. Larvae eat algae, organic debris, plant tissue, and minute water-borne organisms. | Insectivore and frugivore (i.e., fruit eater); eats mostly Hymenoptera (bees, wasps, and ants), some Coleoptera (beetles), Diptera (flies), Lepidoptera (butterflies, moths), and Hemiptera (true bugs) | Various mammalian, avian, and reptilian prey. Prefers fish. Scavenges and pirates food when available. | Appears to prefer herbaceous vegetation to woody vegetation during all seasons if it is available. |
| Trophic Relationships | Heterotrophic consumer, primary (aquatic herbivore) and secondary consumer (aquatic and terrestrial invertebrates); feeds in water on decomposing benthic substrate | Heterotrophic consumer, primary and secondary consumer | Heterotrophic consumer, secondary consumer (aquatic and terrestrial vertebrates), carrion feeder | Heterotrophic consumer, primary consumer (aquatic herbivore and foliovore [leaf eater]), bark/cambium/bole feeder, browser (leaf, stem eater) |

## 2.3.2 Shrub-Steppe

### *2.3.2.1 Description*

Shrub-steppe habitat (see Figure 2-19 for estimated distribution) was given the highest conservation priority based on trends in bird populations (Saab and Rich 1997) since shrubland birds show the most consistent population declines over the last 30 years of any group of bird species (Paige and Ritter 1999). Comparatively high fish and wildlife density and species diversity characterize shrub-steppe habitat. Approximately 100 bird species and 70 mammal species can be found in sagebrush habitats. Some of these are sagebrush obligates or near obligates. Sagebrush and the native perennial grasses and forbs of the shrub-steppe are important sources of food and cover for wildlife. Native perennial bunchgrass species serve a keystone role in the maintenance of watershed stability and resilience to disturbance events and environmental change. Loss of the abundance and vigor of bunchgrass triggers the decay of watershed integrity and the capability of these sites to produce wildlife habitat and commercial resource values (Rust *et al*. 2000). This habitat type provides important fish and wildlife breeding habitat and seasonal ranges.

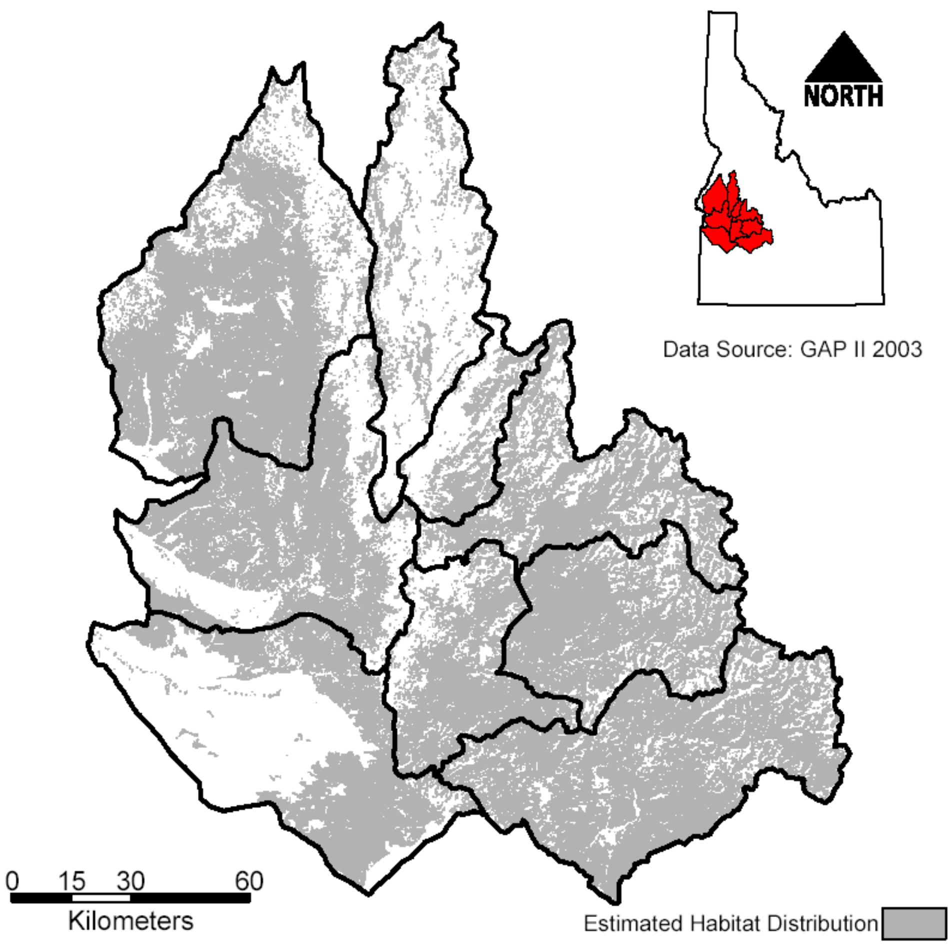



**Figure 2-19. Estimated distribution of the shrub-steppe habitat type in the Boise, Payette, and Weiser subbasins (GAP II, Scott *et al*. 2002).**

### *2.3.2.2 Focal Species*

Five vertebrate species—the greater sage grouse, sharp-tailed grouse, pygmy rabbit, mule deer, and southern Idaho ground squirrel (*Spermophilus brunneus endemicus*)—were selected as focal species for shrub-steppe habitats (Table 2-9) and Appendix 2-2). Different species of sagebrush provide food, cover, and nesting substrate, especially for sage-steppe obligates, such as the greater sage grouse and pygmy rabbit, during the winter months. The sagebrush sometimes protects other native forbs and grasses from overgrazing and acts to stabilize soil. Sagebrush species also tend to tolerate drought and cycle nitrogen. Mule deer are widely distributed in the subbasins, and migrate seasonally (Figure 2-20).

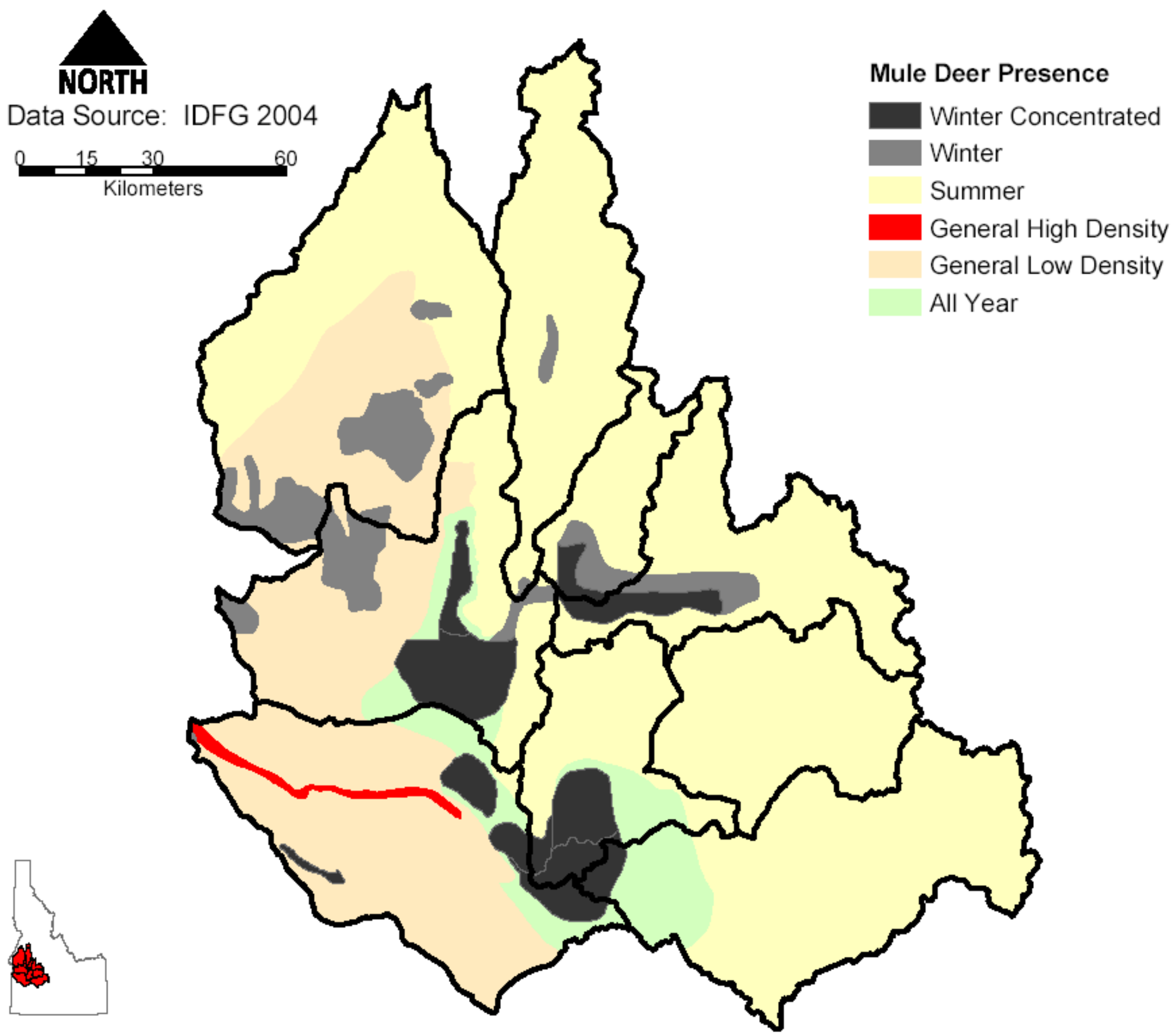



**Figure 2-20. Mule deer range distribution in the Boise, Payette, and Weiser subbasins (IDFG 2004).**

Table 2-9. Status and life history information for vertebrate focal species selected for shrub-steppe habitat in the Boise, Payette, and Weiser subbasins. See Appendix 2-2 for detailed life history and biological information for each of the focal species.

| **Status or Life History Information** | **Focal Species** | | | | |
|---|---|---|---|---|---|
| | **Greater Sage-Grouse** | **Sharp-tailed Grouse** | **Pygmy Rabbit** | **Mule Deer** | **Southern Idaho Ground Squirrel** |
| Conservation Status | State game species | BLM and USFS sensitive species | State protected nongame species | State game species | State protected nongame species |
| Population Status | Not rare and apparently secure, but with cause for long-term concern | Imperiled because of rarity or because other factors demonstrably make it very vulnerable to extinction | Imperiled because of rarity and other factors that demonstrably make it very vulnerable to extinction | Demonstrably widespread, abundant, and secure. | Imperiled because of rarity or because other factors demonstrably make it very vulnerable to extinction |
| Age at First Reproduction | Females are sexually mature their first fall and nest the following spring (Patterson 1952); males are sexually mature the spring following their first winter. | Males probably begin establishing peripheral territories their first fall, and these territories are held again the following spring. Females breed for the first time as yearlings. | Capable of breeding when they are about 1 year old (Green and Flinders 1980a, Wilde and Keller 1978) | Females usually breed at 2 years, while males may not mate until they are at least 3 or 4 years old due to competition with older males. | Most likely as yearlings |
| Frequency of Reproduction | Iteroparous; hens attempt to raise one brood in a season | Iteroparous; breed annually | Iteroparous; a maximum of 3 litters are produced per year. | Iteroparous; breed annually | Iteroparous; breed annually |
| Number of Offspring/ Fecundity | Hens incubate 7–15 eggs for about 25–27 days. After hatching, chicks wait until they are dry before leaving the nest. | Females incubate up to 12 eggs for 23–24 days. | An average of 6 young are born per litter. | Mature females commonly have twins, while yearlings have only single fawns. | Females produce 2–10 young. |
| Lifespan/ Longevity | Thought to live up to 10 years in the wild, but in one study, the average life span in both hunted and protected populations was 1–1.5 years; in another study, birds 3–4 years old were considered old. | Maximum known is 7.5 years. | Unknown, but the mortality of adults is highest in late winter and early spring. | For females, can be as long as 22 years, while males may live as long as 16 years. | Female *northern* Idaho ground squirrels are known to live for up to 8 years, while males die at a younger age due to behavior associated with reproductive activity. |

| Status or Life History Information | Focal Species | | | | |
|---|---|---|---|---|---|
| | **Greater Sage-Grouse** | **Sharp-tailed Grouse** | **Pygmy Rabbit** | **Mule Deer** | **Southern Idaho Ground Squirrel** |
| Predators | Raptors and crows are the primary predators, while coyotes, bobcats, minks, badgers, and ground squirrels are the most important ground predators. | Primary predators include the red fox, coyote, and red-horned owl. | Weasels are the principal predators. The coyote, red fox, badger, bobcat, great horned owl, and northern harrier also prey on the rabbits. | Include humans, domestic dogs, coyotes, wolves, black bears, grizzly bears, mountain lions, lynx, bobcats, and golden eagles | The prairie falcon, goshawk, red-tailed hawk, Swainson's hawk, ferruginous hawk, northern harriers, Cooper's hawk, golden eagle, raven, badger, coyote, long-tailed weasel, gopher snake, and western rattlesnake |
| Diet | Sagebrush, grasses, forbs, and insects comprise the annual diet. | Primarily herbivorous and utilize a variety of leafy plant material including buds, fruits, and catkins of woody species | The primary food is big sagebrush, which may comprise up to 99% of the food eaten in winter. Grasses and forbs are also eaten from mid- to late summer. | Primarily browsers, feeding on several thousand different plant species across their range (Snyder 1991a) | Mixed grass seeds, roots, bulbs, and flower heads |
| Trophic Relationships | Heterotrophic consumer, primary consumer (aquatic herbivore and foliovore), flower/bud/catkin feeder, frugivore (fruit eater), secondary consumer (primary predator or primary carnivore of terrestrial invertebrates) | Heterotrophic consumer, primary consumer (herbivore and foliovore), browser (leaf, stem eater), grazer (grass, forb eater) | Heterotrophic consumer, primary consumer (herbivore and foliovore), browser (leaf, stem eater), grazer (grass, forb eater), coprophagous feeder (feces eater). | Heterotrophic consumer, primary consumer (herbivore and foliovore), browser (leaf, stem eater), grazer (grass, forb eater), fungivore (fungus eater) | Heterotrophic consumer, primary consumer (herbivore), granivorous feeder, grazer |

### 2.3.1 Pine/Fir Forest (Dry, Mature)

#### *2.3.3.1 Description*

The xeric, old forest habitat type (see

Figure 2- for distribution) is significantly less in extent than it was before 1900 (Quigley and Arbelbide 1997). Quigley and Arbelbide (1997) included much of this habitat in their dry forest potential vegetation group, which they concluded has departed from natural succession and disturbance conditions. The greatest structural change in this habitat is the reduced extent of the late seral, single-layer condition (4–24% canopy cover and greater than 53 cm diameter at breast height). These types primarily occur at low elevations on south and west aspects. Some slopes in the drier habitats are steep. Important components of this habitat type are large downed material, snags, and decadence.

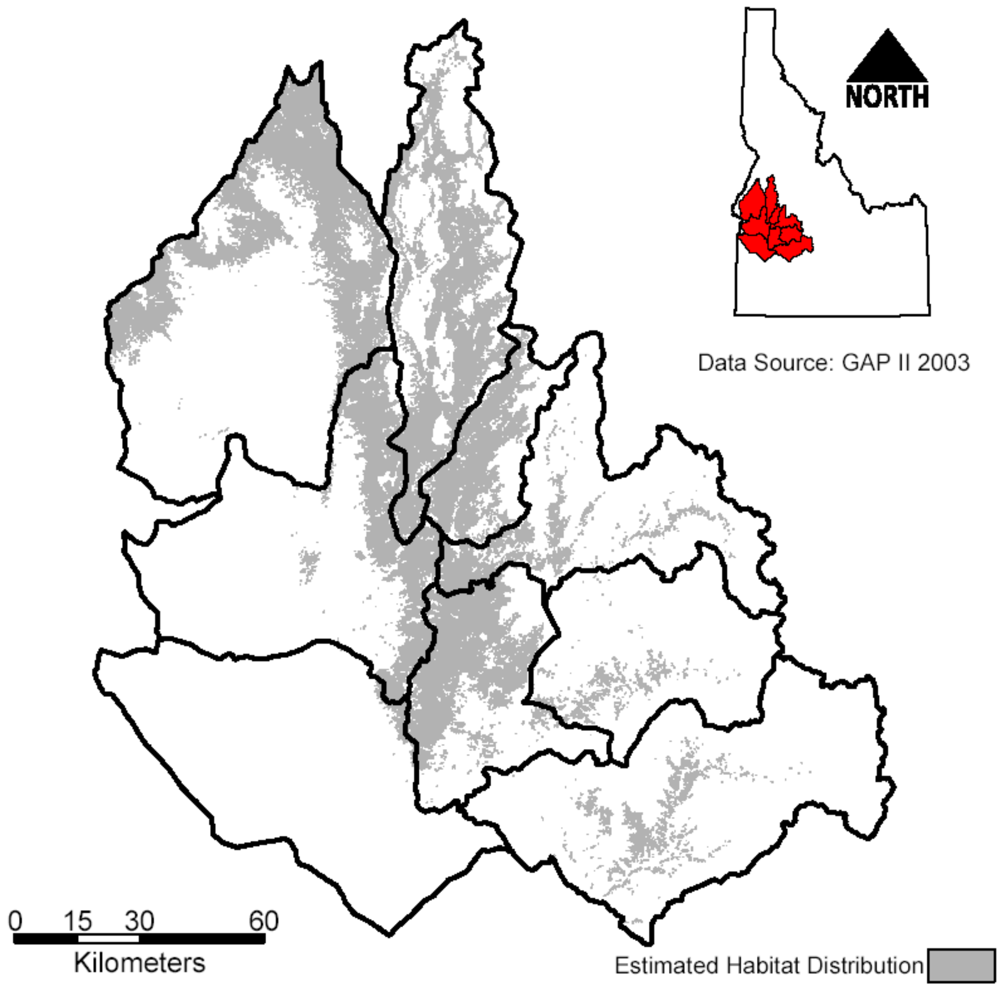



**Figure 2-21. Distribution of the pine/fir forest (dry, mature) habitat type in the Boise, Payette, and Weiser subbasins (GAP II, Scott *et al.* 2002).**

This forest type provides important breeding and nesting habitat for rare white-headed woodpeckers (*Picoides albolarvatus*) and flammulated owls. This xeric, open canopy forest type also provides winter range for ungulates and serves as movement corridors in winter. Carnivores benefit from concentrated ungulate prey populations on winter range in this type. This forest type is maintained by fire and vulnerable to fire exclusion. The low-elevation, warm aspect, and low snowfall characteristics of this forest type make it vulnerable to land conversion and residential development. Intensive wood gathering can reduce the number of snags in this type considerably.

This habitat is generally degraded because of increased exotic plants and decreased native bunchgrasses (IBIS 2003). One-third of ponderosa pine (*Pinus ponderosa*) and dry Douglas-fir (*Pseudotsuga menziesii*) or grand fir (*Abies grandis*) community types listed in the National Vegetation Classification are considered imperiled or critically imperiled (Anderson *et al*. 1998).

#### 2.3.3.2 Focal Species

Three vertebrate species—the white-headed woodpecker, flammulated owl, and northern Idaho ground squirrel—were selected as focal species in the Boise, Payette, and Weiser subbasins, Idaho (

Table 2-10 and Appendix 2-2). The white-headed woodpecker appears to subsist largely on vegetable matter, with ponderosa pine seeds comprising about 50 to 90% of its diet; the remainder is made up of ants, beetles, other insects, and spiders (Beal 1911, Ligon 1973). This species is an important transporter of viable seeds and

indicates whether large-diameter ponderosa pine is present. The flammulated owl is an insectivore, and its favored areas are open aspen or ponderosa pine forests where the summers are dry and warm, the insect abundance or diversity is high, and nesting cavities are available (McCallum *et al*. 1994). Changes in forest structure may also change insect abundance, thereby impacting flammulated owl populations.

**Table 2-10. Status and life history information for focal species selected for the pine-fir forest (dry, mature) habitat type in the Boise, Payette, and Weiser subbasins. See Appendix 2-2 for detailed life history and biological information for each of the focal species.**

| Status or Life History Information | Focal Species | | |
|---|---|---|---|
| | **White Headed Woodpecker** | **Flammulated Owl** | **Northern Idaho Ground Squirrel** |
| Conservation Status | State protected nongame species | State species of special concern | Federally listed as threatened species |
| Population Status | Rare or uncommon but not imperiled | Rare or uncommon but not imperiled | 200–250 individuals total |
| Age at First Reproduction | No data | Unknown; females probably breed in first year | Unknown, but most likely as yearlings |
| Frequency of Reproduction | Iteroparous; annual breeder | Iteroparous; breeds annually; one brood per year; replacement clutches are rare | Annual breeder |
| Number of Offspring/ Fecundity | About 3–5 young per pair fledge each year. | Generally 2–4 eggs are laid. | Generally 2–10 young per year |

| Status or Life History Information | Focal Species | | |
|---|---|---|---|
| | White Headed Woodpecker | Flammulated Owl | Northern Idaho Ground Squirrel |
| Lifespan/ Longevity | There is no data on life span or survivorship. | Although the maximum-recorded age for a wild owl is only about 8 years, the life span is probably longer | About 8 years for females; typically, fewer years for males |
| Predators | Chipmunks are known to prey on the eggs and nestlings. Also, great horned owls prey on adults. | Predators such as red squirrels, cats, and bears raid the nests. Adults are also subject to predation by the Cooper's hawk and great horned owls. | The prairie falcon, goshawk, red-tailed hawk, Swainson's hawk, ferruginous hawk, northern harrier, Cooper's hawk, golden eagle, raven, badger, coyote, long-tailed weasel, gopher snake, and western rattlesnake |
| Diet | Appears to subsist largely on vegetable matter, with about 50–90% of the diet comprised of ponderosa pine seeds; the remainder is made of ants, beetles, other insects, and spiders. | Nocturnal arthropods like owlet moths, beetles, crickets, grasshoppers, caterpillars, centipedes, millipedes, spiders, and scorpions | Small seeds and grain, bluegrass, roots, bulbs, leaf stems, flower heads |
| Trophic Relationships | Heterotrophic consumer, primary consumer (herbivore), spermivore (seed eater), secondary consumer (primary predator or primary carnivore of terrestrial invertebrates) | Heterotrophic consumer, secondary consumer (primary predator or primary carnivore of terrestrial invertebrates) | Heterotrophic consumer, primary consumer (herbivore), granivorous feeder, grazer |

## 2.3.4 Interior Mixed Conifer

### *2.3.4.1 Description*

The interior mixed conifer habitat (see Figure 2- for distribution) makes up most of the continuous montane forests of the inland Pacific Northwest. It is located between the subalpine portions of the montane mixed conifer forest habitat and lower treeline ponderosa pine forests. This habitat is more extensive than it was prior to 1900, probably as a result of fire suppression and timber harvest (IBIS 2003).

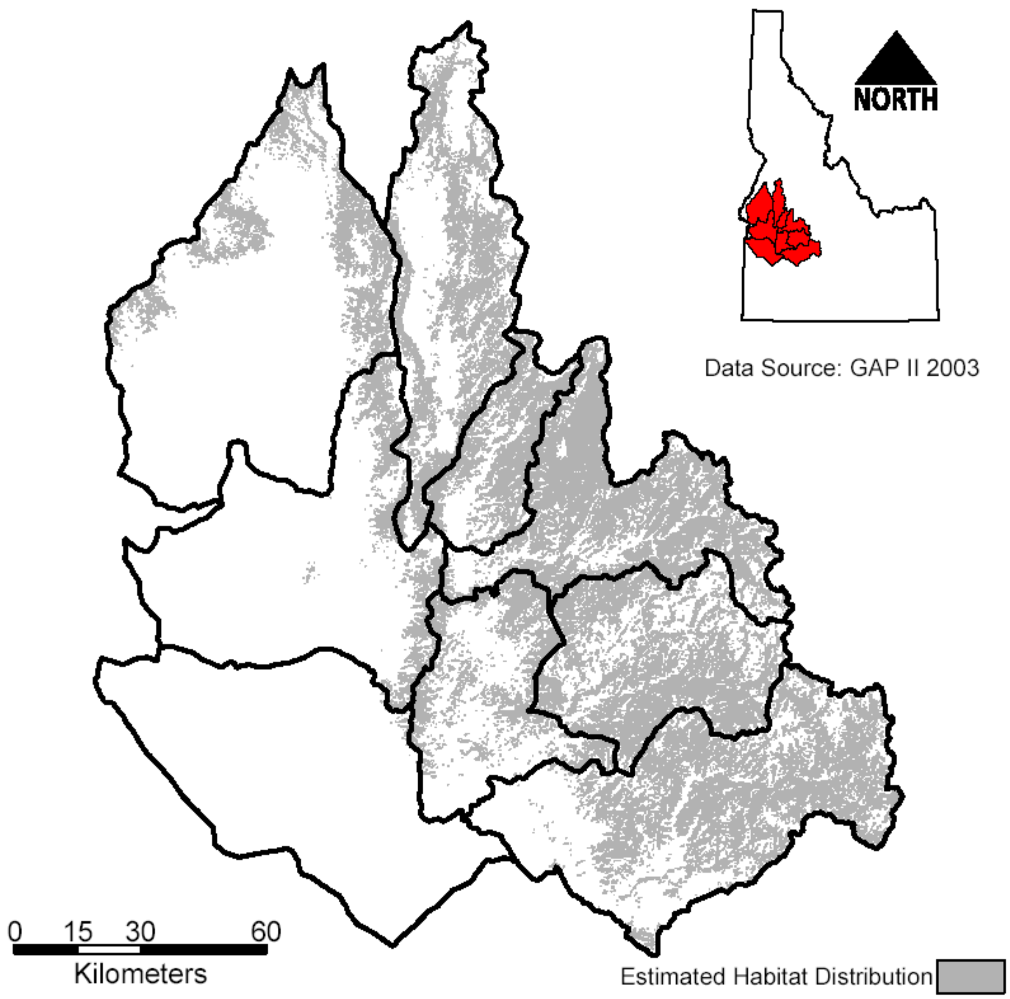



**Figure 2-22. Distribution of the interior mixed conifer habitat type in the Boise, Payette, and Weiser subbasins (GAP II, Scott *et al*. 2002).**

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Twenty percent of Pacific Northwest Douglas-fir, grand fir, western red cedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), and western white pine (*Pinus monticola*) associations listed in the National Vegetation Classification are considered imperiled or critically imperiled. Currently, mixed conifer stands lack snags, have high tree density, and be composed of smaller and more shade-tolerant trees (Quigley and Arbelbide 1997). Late seral forests of shade-intolerant species are now essentially absent. Although this habitat type is not limited in terms of landscape composition, it is the most susceptible to uncharacteristic stand-replacement fires due to fire suppressive policies.

This forest type provides year-round habitat for pileated woodpeckers. The pileated woodpecker requires mature forest containing snags. It is snags where the pileated excavates cavities for nesting and roosting. Because woodpeckers such as the pileated one abandon many of their excavated nest holes, they create high-quality nesting habitat for many other species of birds, mammals, and reptiles (Bull 1987). Pileated woodpeckers also consume large numbers of wood-boring insects that damage commercially important trees. The pileated woodpecker may serve as a key species in the Boise, Payette, and Weiser subbasins by sustaining a diversity of other wildlife species.

#### *2.3.4.2 Focal Species*

One vertebrate species, the pileated woodpecker, was chosen as a focal species for the interior mixed conifer habitat in the Boise, Payette, and Weiser subbasins (

Table 2-11 and Appendix 2-2). As a large, nonmigratory insectivore, the pileated woodpecker may provide an important role in controlling insect outbreaks, particularly those of tree beetles.

**Table 2-11. Status and life history information for the focal species selected for the interior mixed conifer habitat type in the Boise, Payette, and Weiser subbasins. See Appendix 2-2 for detailed life history and biological information for the pileated woodpecker.**

| Status or Life History Information | Focal Species |
|---|---|
| | Pileated Woodpecker |
| Conservation Status | Protected nongame species |
| Population Status | Not rare and apparently secure but with cause for long-term concern |
| Age at First Reproduction | Breed after first year (Bull and Meslow 1988) |
| Frequency of Reproduction | Iteroparous; annual breeder; one brood per season |
| Number of Offspring/ Fecundity | Clutch size ranges from 1–6; 4 young is the most common number |
| Lifespan/ Longevity | At least 9 years in the wild (Hoyt and Hoyt 1951, Hoyt 1952), but thought to be greater than 9 years (Bull and Jackson 1995) |
| Predators | The northern goshawk, Cooper’s hawk, red-tailed hawk, great horned owl, American marten, and the gray fox |
| Diet | Feeds on insects, primarily carpenter ants and wood-boring beetle larvae; also eats wild fruits and nuts |
| Trophic Relationships | Heterotrophic consumer, secondary consumer (primary predator or primary carnivore of terrestrial invertebrates) |

### 2.3.5 Threatened and Endangered Species

The Endangered Species Act (ESA) and other federal regulations have significant implications for landscape management on public and private lands in the Columbia River Basin. While these laws are intended to protect and recover individual species near extinction, the quantity and quality of many habitats across the U.S. are in decline and new species continue to be listed under ESA.

Practices of managing wildlife and their habitat on a species-by-species basis sometimes fail to recognize the importance of biological diversity, or "biodiversity," to the health of the ecosystem (Wheeler 1996). The protection of a threatened or endangered species often results in the protection of small parcels of habitats. Sometimes other non-listed species benefit from the protection of a listed species. But this type of wildlife and fish management may lead to fragmented populations, and is reactive to problems rather than proactive.

Therefore, for terrestrial assessment purposes, the technical teams opted to base the assessment and management plan upon an ecosystem-based approach with an emphasis upon focal habitats and a select number of focal species within these habitats. This habitat-based assessment places greater emphasis upon key habitats and their functional components, and less emphasis upon selected focal species. An artifact of this approach is the perception that threatened, endangered, candidate or sensitive (TECS) species are being overlooked or ignored. The technical teams recognized the significant role TECS species have in the ecosystem structure and function; however, the technical teams also felt that some TECS species were inappropriate choices as focal species for the following reasons:

- Some TECS species are not necessarily the best indicators of habitat type.
- TECS species are not always the best indicators of habitat quality.
- TECS species are not necessarily the best indicators of the effectiveness of management actions.
- TECS species habitat evaluation protocols at the watershed scale are non-existent.
- Sometimes very little information is available for TECS species.
- TECS species-specific recovery analysis was not the goal of the assessment.
- Many non-TECS species were more effective at meeting the focal species selection criteria (Section 2.0).

Federal management direction predicates that TECS species are addressed through the Endangered Species Act and other laws or regulation, thus, TECS species must be considered in the planning process regardless of the assessment approach. Further, the management and recovery responsibility for species listed under the Endangered Species Act fall under federal authority. The assessment addresses the significance of TECS species separately from other focal species by tabulating them and mapping known locations of pertinent species within the planning area, but does not attempt to assess their management or recovery.

#### 2.3.5.1 *Bald Eagle (*Haliaeetus leucocephalus)

The bald eagle is a large bird of prey associated with aquatic ecosystems. The bird historically ranged throughout North America. The bald eagle was first listed as endangered under the ESA on March 11, 1967 (32 FR 4001). Since its first listing, the bald eagle population has increased in number and expanded in range. It is estimated that the species has doubled its breeding population every six or seven years since the late 1970s. The improvement is a direct result of the banning of dichloro-diphenyl-trichloroethane (DDT) and other organochlorines, habitat protection, and other recovery efforts. Recently, the bald eagle was down listed to threatened status on July 12, 1995 (60 FR 35999). In the Pacific region, development-related habitat loss was identified to be a major factor limiting the abundance and distribution of bald eagles.

The bald eagle is an opportunistic forager that eats a variety of mammals, birds, and reptiles. But it prefers fish to other food types. It often scavenges prey items when available, pirates food from other species when it can, and captures its own prey only as a last resort. Bald eagles are capable of breeding in their fifth year of life, but they may not start to breed until they are six or seven years old. Typically, a female lays one to three eggs per season. Bald eagles can live up to 28 years in the wild.

- **Trophic Relationships—**heterotrophic consumer, secondary consumer (primary predator or primary carnivore of vertebrates), piscivorous (fish eater), ovivorous (egg eater), carrion feeder

- **Key Ecological Role—**pirates food from other species, controls terrestrial vertebrate populations (through predation or displacement), provides primary creation of aerial structures (possibly used by other organisms)

#### *2.3.5.2 Northern Idaho Ground Squirrel (*Spermophilus brunneus brunneus*)*

The northern Idaho ground squirrel was listed as a threatened species on April 5, 2000 (66 FR 17779). One of the rarest of North American ground squirrels, this species inhabits areas in the North Fork Payette and Weiser watersheds. The current population of northern Idaho ground squirrels is estimated at about 200 to 250 individuals. The squirrel is at risk of extinction primarily because of habitat loss and fragmentation. Other factors impacting the squirrel's survival are competition with Columbian ground squirrels (*Spermophilus columbianus*) and recreational shooting.

The northern Idaho ground squirrel emerges from hibernation in late March or early April and within two weeks begins searching for a mate. Female squirrels produce between 2 and 10 young. Female northern Idaho ground squirrels are known to live for up to eight years, while males die at a younger age due to behavior associated with reproductive activity.

- **Trophic Relationships—**heterotrophic consumer; primary consumer (herbivore); granivorous (eats small seeds and grain); grazer (bluegrass); consumer of roots, bulbs, leaf stems, flower heads

- **Key Ecological Role—**is prey for secondary or tertiary consumer (primary or secondary predator), is a primary burrow excavator (fossorial or underground burrows), creates and uses trails (possibly used by other species), disperses seeds/fruits (through ingestion or caching), disperses vascular plants, physically affects (improves) soil structure and aeration (typically by digging)

#### *2.3.5.3 Canada Lynx (Lynx canadensis)*

On March 24, 2000, the Canada lynx was federally listed as threatened (65 FR 16051) under the ESA. Lynx populations experience volatile swings, becoming very low about every ten years (Burt and Grossenheider 1976, Fox 1978, Mech 1980, USFWS 1994). Therefore, they can be rare in any given area at these times.

Some female lynx can breed as yearlings (Snyder 1991b). Prey scarcity may suppress breeding (Lippincott 1997). The breeding season extends between January and February and sometimes into April (Nellis *et al*. 1972, Brainerd 1985). The gestation period lasts between 62 and 74 days (Snyder 1991b). Females generally give birth in March or April, but sometimes in May or June, producing one litter of three to four kittens (Snyder 1991b). The maximum lifespan for a lynx is between 15 and 18 years in captivity (Snyder 1991b).

Lynx occur in both dense climax forests and second-growth stands. In Alaska and Canada, they prefer boreal forests, and in the Intermountain West, they prefer spruce (*Picea* spp.)–subalpine fir (*Abies lasiocarpa*) and lodgepole pine (*Pinus contorta*) forests. Lynx are associated with dense climax forests at elevations above 1,200 m (Koehler and Brittell 1990), and they also use early seral stage communities bordering dense forests. Because their populations are closely tied to snowshoe hare (*Lepus americanus*) numbers, lynx can also be found in second-growth forests when hare are numerous (DeVos and Matel 1952, Heinselman 1973).

Lynx require a mix of early and late seral habitats to meet their food and cover needs. Early seral habitats provide the lynx with a prey base, while mature forests provide denning space and hiding cover (Snyder 1991b). Pockets of dense forest must be interspersed with prey habitat. Lynx den in rotten logs, beneath tree roots, and in rock crevices. Koehler (1990) reported that lynx use forests with a high density of downfall logs (more than 40 logs per 46 $m^2$ lying 0.3–1.3 m above the ground).

Lynx prey primarily on snowshoe hare. Their diet also includes ducks (*Anas* spp.); upland game birds (especially grouse [*Dendragapus* spp.]); and various forest rodents, including squirrels (scuirids, spermophilids). Lynx also feed on deer (*Odocoileus* spp.), moose (*Alces alces*), and caribou (*Rangifer tarandus*) carcasses. Saunders (1963) reported that lynx are able to kill these large mammals.

Predators of lynx include humans, mountain lions (*Felis concolor*), bears (*Ursus* spp.), and other lynx. Because of the cyclic nature of the population, one management strategy to ensure kitten recruitment is to put a moratorium on trapping for the three years following the declining phase of lynx (USFWS 1994).

Lynx can also be managed by managing for snowshoe hare, their primary prey. Hare populations increase dramatically following disturbance, particularly fire (Snyder 1991b). For instance, fires that create snowshoe hare cover and food generally benefit lynx (Heinselman 1973, Koehler and Brittell 1990). Fire may have negative short-term effects by eliminating cover for snowshoe hare and lynx. However, as succession progresses and snowshoe hares become abundant, lynx benefit. Lynx usually do not cross openings greater than 90 m, and they use travel corridors with tree densities of 450 per hectare. Therefore, fires or logging operations that create large openings without leaving travel corridors between pockets of dense forest may be detrimental to lynx (DeVos and Matel 1952, Saunders 1963, Grange 1965, Deems and Pursley 1978).

- **Trophic Relationships—**heterotrophic consumer, secondary consumer (primary predator or primary carnivore of herbivorous vertebrates).
- **Key Ecological Role—**is an apex predator, indicates specific habitat elements, uses runways created by other species.

#### 2.3.5.4 Gray Wolf (Canis lupus)

The gray wolf was listed as endangered under the ESA on March 9, 1978 (43 FR 9607). On November 22, 1994, areas in Idaho, Montana, and Wyoming were designated as nonessential experimental populations in order to initiate gray wolf reintroduction projects in central Idaho and the Greater Yellowstone Area (59 FR 60252, 59 FR 60266). Special regulations for the experimental populations allow flexible management of wolves, including authorization for private citizens to take wolves in the act of attacking livestock on private land.

The gray wolf is a social species, normally living in packs of 2 to 12 wolves. Packs tend to occupy a territory of 500 to 1,000 square kilometers and defend this area from other packs and individual wolves. Packs are primarily family groups consisting of a breeding pair, their pups from the current year, offspring from the previous year, and occasionally an unrelated wolf. Normally, only the top-ranking (alpha) male and female in each pack breed and produce pups. A pack has a single litter annually of four to six pups (range 1–11 pups). Yearling wolves often disperse from their natal packs and become nomadic, covering large areas while searching for unoccupied habitat and an individual of the opposite sex to begin their own territorial pack.

- **Trophic Relationships**—heterotrophic consumer, primary consumer (herbivore), frugivore (fruit eater), secondary consumer (primary predator or primary carnivore of vertebrates), tertiary consumer (secondary predator or secondary carnivore)

- **Key Ecological Role**—is a primary burrow excavator (fossorial or underground burrows), creates and uses trails (possibly used by other species), controls terrestrial vertebrate populations (through predation or displacement), creates feeding opportunities for other organisms

#### 2.3.5.5 Spalding's Catchfly (Silene spaldingii)

Spalding's catchfly is a member of the pink carnation family (Caryophyllaceae). A long-lived perennial herb, it ranges in height from 20 to 61 cm. Reproduction is by seed only. The plant was listed as a threatened species on October 10, 2001 (66 FR 51597). The listing did not include a designation of critical habitat. Seven populations occur in Idaho, but these occurrences are in the Salmon subbasin rather than in the Boise, Payette, or Weiser subbasins.

The plant is typically associated with grasslands dominated by native perennial grasses such as Idaho fescue (*Festuca idahoensis*) or rough fescue (*F. scabrella*). Other associated species include bluebunch wheatgrass (*Pseudoroegneria spicata*), snowberry (*Symphoricarpos albus*), Nootka rose (*Rosa nutkana*), yarrow (*Achillea millefolium*), prairie smoke avens (*Geum triflorum*), sticky purple geranium (*Geranium viscosissimum*), and arrowleaf balsamroot (*Balsamorhiza sagittata*). Scattered individuals of ponderosa pine may also be found in or adjacent to Spalding's catchfly.

Many Spalding's catchfly populations are isolated from other populations by large distances, and the majority of the populations occur at scattered localities separated by habitat that is not suitable for this species. Most of the remaining sites that support Spalding's catchfly are small and fragmented, and existing sites are vulnerable to impacts from grazing, trampling, herbicide use, competition with nonnative vegetation, and urban and agricultural development.

#### 2.3.5.6 MacFarlane's Four O'clock (*Mirabilis macfarlanei*)

MacFarlane's four-o'clock was first listed as an endangered species on October 26, 1979 (44 FR 61912). Only three populations were known at that time, with a total of 20 to 25 individual plants. The species was threatened by several factors, including trampling, collecting, livestock grazing, disease, and insect damage. After the species was listed, additional populations were discovered, and populations on public lands were actively managed and monitored. Consequently, the plant was down listed to a threatened status on March 15, 1996 (61 FR 10693).

MacFarlane's four-o'clock is a long-lived herbaceous perennial with a deep-seated, thickened root. Individual plants have been observed to live over 20 years. In addition to reproducing by seed, plants reproduce clonally from a thick, woody tuber that sends out many shoots (collectively called a genet).

MacFarlane's four-o'clock occurs in river canyon grassland habitats that are characterized by regionally warm and dry conditions. Habitat for MacFarlane's four-o'clock generally consists of bunchgrass communities dominated by bluebunch wheatgrass (*Pseudoroegneria spicata*). Associated grass species include sand dropseed (*Sporobolus cryptandrus*), red three-awn (or Fendler threeawn, *Aristida longiseta*), and Sandberg bluegrass (*Poa secunda*). Additional species that may be found in MacFarlane's four-o'clock habitat include yarrow (*Achillea millefolium*), pale alyssum (*Alyssum alyssoides*), soft brome (*Bromus moths*), cheatgrass (*B. tectorum*), netleaf hackberry (*Celtis reticulata*), rabbitbrush (*Ericameria nauseosa*), and smooth sumac (*Rhus glabra*).

All currently known populations of MacFarlane's four-o'clock in Idaho occur in Idaho County. As part of the 1985 recovery plan objectives, one new population was established at Lucile Caves along the Salmon River canyon. This colony appears to be stable. In the Hells Canyon National Recreation Area, three MacFarlane's four-o'clock sites monitored from 1990 to 1995 appear to be stable (Kaye 1995). Improved livestock management by the U.S. Forest Service and Bureau of Land Management has reduced impacts to MacFarlane's four-o'clock from livestock grazing on federal lands (Johnson 1995).

### 2.3.6 Environmental Conditions

Natural ecosystems are enormously intricate. The complex mosaic of habitats within the Interior Columbia Basin results from the interaction of physical and biological variables including soil and vegetative characteristics, climate, wind, fire, and species interactions. All of these variables contribute to the "proper" functioning of these systems.

Over the past century, however, humans have become an increasingly significant factor in how these systems function by disturbing and accentuating many of these ecological processes and interactions. As anthropomorphic processes modify the pathways and patterns of ecosystem development and succession, the structure of the system has become simplified (Carey *et al*. 1996). Simplification and loss of diversity has, in turn, led to the loss or potential loss of plant, animal, and fish species and reduced the ability of the land and waters to provide continued, predictable flows of resources that contribute to both traditional and current human values and demands (USDA 1995).

We describe the current environmental conditions in relation to focal species, habitats, and anthropogenic change. We characterized the subbasins according to the habitats summarized in Table 2-1. Taking into account data and information limitations (Appendix 1-2), our discussion of environmental conditions focuses at the subbasin scale in terms of aquatic, riparian/herbaceous wetland, shrub-steppe, pine/fir forest, and mixed conifer forest habitats (Figure 2-17).

### *2.3.6.1 Boise Subbasin*

#### 2.3.6.1.1 North/Middle Fork Boise

**Aquatic Habitat—**This watershed includes waters upstream of Arrowrock Dam. Unlike many other river systems in Idaho, the stream and river habitats and hydrography in the North and Middle Fork Boise rivers upstream of Arrowrock Reservoir have normal timing, temperatures, and magnitudes because they have not been heavily impacted by water diversion or impoundment. The South Fork Boise River below Anderson Ranch Dam has an altered hydrograph, temperature regime, and sediment transport typical of tailwater river systems in the western United States. In areas with low road densities, high-quality aquatic habitats exist in the headwater areas of this watershed. The watershed has been influenced by both road development that has impacted riparian areas and increased fine sediment, as well as legacy effects from dredge mining, fires, and timber-harvest activities. Arrowrock Reservoir has an active storage capacity of 280,526 acre-feet and is the first in the system to be drafted to meet irrigation needs in the Boise River system. Arrowrock Reservoir is normally drafted to a pool of 28,000 acre-feet (below 10,000 acre-feet in drought years) before Lucky Peak Reservoir is drafted. The development of Arrowrock Reservoir inundated an estimated 33 river km of mainstem river habitat while the development of Lucky Peak Reservoir inundated an estimated 18.5 river km of mainstem Boise River habitat and 7 river km of Mores Creek. A completed total maximum daily load (TMDL) for the upper Boise River watersheds provides site-specific information on watershed conditions (IDEQ 2000).

**Riparian/Herbaceous Wetlands—**The most quantifiable impact to wetland habitats in the North/Middle Fork Boise watershed results from development and/or conversion within the floodplain. Sixteen points of water diversion have been constructed in the North/Middle Fork Boise watershed for irrigation purposes (IDWR 2003). The diversions have significant ramifications to hydrologic processes and wetland structure and function in the watershed. Other forms of development and/or land conversion within the 50- and 100-year floodplains impact wetland habitat quantity and quality. This watershed is mostly undeveloped and has relatively low road densities, so anthropogenic influences are less pronounced. Data limitations prevent an accurate or precise quantification of the direct and indirect losses of riparian/herbaceous wetland habitats in the North/Middle Fork Boise watershed.

**Shrub-Steppe—**Shrub-steppe habitat types currently comprise 45% of the landscape in the North/Middle Fork Boise watershed. Based on predictive models, this is an increase of nearly 98% from historical conditions. Considering data and model limitations of the information, shrub-steppe habitat increases may be attributed either to stand-replacement fires having recently burned approximately 50% of the North/Middle Fork Boise watershed or 50 years of fire suppression having allowed the shrub component of grassland habitats to expand at the expense of native grassland habitat. Regardless, the quality of remaining shrub-steppe habitat is severely reduced from its historical condition (Dobler *et al*. 1996, West 1999).

**Pine/Fir Forests—**Pine/fir forests are not a significant component of the landscape in the North/Middle Fork Boise watershed. Currently, pine/fir forest accounts for just 2% of the habitat. According to the best estimates available, this is a decline of nearly 1,000% from historical conditions. Data limitations pertaining to historical acreages of forested habitats inhibit our ability to more precisely quantify losses in pine/fir forest habitat (Appendix 1-2). The quality of the pine/fir forest habitat has shifted from a mix of seral stages to a young seral-dominated habitat with higher stem density and lower diversity and cover of understory species. Fire suppression has led to a buildup of fuels that in turn increase the likelihood of stand-replacing fires.

The xeric, mature ponderosa pine habitat was assessed as a separate component of the pine/fir forest. Historically, this habitat was open and parklike, with relatively little understory vegetation except for perennial forbs and grasses. However, historical timber harvest and grazing activities in the watershed removed the mature ponderosa pine and eliminated vegetation that carries ground fire, respectively. Currently, fire suppression inhibits normal forest successional processes, resulting in younger tree cohorts of more shade-tolerant species that give the habitat a more closed, multi-layered canopy.

**Interior Mixed Conifer Forest—**Interior mixed conifer forest habitats comprise an estimated 27% of the landscape in the North/Middle Fork Boise watershed. According to predicted estimates, this is a decrease of nearly 146% from historical conditions. The mature forest component of the interior mixed conifer forest has been most affected by timber harvest and fire suppression. Timber harvest has focused on large shade-intolerant species in mid- and late seral forests, leaving shade-tolerant species. Fire suppression has reinforced timber harvest effects by promoting less fire-resistant, shade-intolerant trees. The resultant stands at all seral stages tend to lack snags, have high tree density, and be composed of smaller and more shade-tolerant trees. Mid-seral forest structure is currently 70% more abundant than historical conditions (IBIS 2003). Late seral forests of shade-intolerant species are now essentially absent. Early seral forest abundance is similar to that found historically but lacks snags and other legacy features. In the North/Middle Fork Boise watershed, the mesic, mature forest component has also been nearly lost due to timber harvest and fire regime alteration.

#### 2.3.6.1.2 Boise–Mores Creek

**Aquatic Habitat—**The Boise–Mores Creek watershed includes tributaries and waters upstream of Lucky Peak Reservoir below Arrowrock Reservoir. The Mores Creek watershed has a small population of bull trout in the headwaters. Lucky Peak Reservoir has an active storage capacity of about 264,400 acre-feet. The dam is operated primarily for flood-control purposes and irrigation storage. In 1988, a three-unit power plant was constructed. Lucky Peak Reservoir is generally filled by Memorial Day to provide recreational opportunities and maintained nearly full until Labor Day. Irrigation water is drawn in September through October, and the reservoir is typically maintained at a low level during the winter for flood-control purposes. In drought years, Lucky Peak Reservoir is drafted when Arrowrock nears minimum pool level and releases from Arrowrock are insufficient to meet irrigation demand. The Bureau of Reclamation and Idaho Department of Fish and Game jointly administer a combined 152,300 acre-feet of storage water in Lucky Peak Reservoir to provide a minimum streamflow for fish and wildlife during the winter in the Boise River. These storage water rights are junior to most existing irrigation storage rights in the Boise River system. Lucky Peak Reservoir inundated an estimated 18.5 river km of mainstem Boise River habitat and 7 river km of Mores Creek.

**Riparian/Herbaceous Wetlands**—The most quantifiable impact to wetland habitats in the Boise–Mores watershed results from various forms of development and/or conversion within the floodplain. Four hundred eighty-three points of water diversion have been constructed in the Boise–Mores Creek watershed for irrigation purposes (IDWR 2003). The diversions have significant ramifications to hydrologic processes and wetland structure and function in the watershed. Other forms of development and/or land conversion within the 50- and 100-year floodplains impact wetland habitat quantity and quality. Anthropogenic influences on the habitat become more pronounced in the downstream sections of the watershed. Data limitations prevent accurate or precise quantification of the direct and indirect losses of riparian/herbaceous wetland habitat in the Boise–Mores Creek watershed.

**Shrub-Steppe**—Shrub-steppe habitat types currently comprise 39% of the landscape in the Boise–Mores Creek watershed. Based on the best estimates, this is an increase of nearly 70% from historical conditions. Shrub-steppe habitat increases may be attributed to two components of an altered fire regime. Stand-replacement fires have recently burned approximately 25% of the Boise–Mores Creek watershed, and when fires are suppressed, the shrub component of grassland habitat expands at the expense of native grassland habitat. Regardless, the quality of remaining shrub-steppe habitat is severely reduced from the historical condition (Dobler *et al*. 1996, West 1999).

**Pine/Fir Forests**—Currently, pine/fir forest habitat amounts to 27% of the landscape in the Boise–Mores Creek watershed. Based on the best data available, this is a decline of 42% from historical conditions.

However, data limitations pertaining to historical acreages of forested habitats inhibit our ability to precisely quantify habitat losses (Appendix 1-2). The quality of the pine/fir forest habitat has shifted from a mix of seral stages to a young seral-dominated habitat with higher stem density and lower diversity and cover of understory species. Fire suppression has led to a buildup of fuels that in turn increase the likelihood of stand-replacing fires.

The xeric, mature forest component of the pine/fir forest habitat was assessed in terms of ponderosa pine habitat. Historically, this habitat was mostly open and parklike, with relatively little undergrowth trees. It was the predominant landscape feature. Timber-harvest activities in the watershed during the last century selectively harvested the mature stands, while other factors limited reestablishment of normal forest successional processes. Currently, much of this habitat has a younger tree cohort of more shade-tolerant species that give the habitat a more closed, multilayered canopy.

**Interior Mixed Conifer Forest**—Currently, interior mixed conifer forest habitat amounts to 15% of the landscape in the Boise–Mores Creek watershed. Based on the best data available, this is a decline of 165% from historical conditions. The mature forest component of the interior mixed conifer forest has been most affected by timber harvest and fire suppression. Timber harvest has focused on large shade-intolerant species in mid- and late seral forests, leaving shade-tolerant species. Fire suppression enforces those logging priorities by promoting less fire-resistant, shade-intolerant trees. The resultant stands at all seral stages tend to lack snags, have high tree density, and be composed of smaller and more shade-tolerant trees. Mid-seral forest structure in the Columbia River basin is currently 70% more abundant than it was historically (IBIS 2003). Late seral forests of shade-intolerant species are now essentially absent. Early seral forest abundance is similar to that found historically but lacks snags and other legacy features. In the Boise–Mores Creek watershed, the mesic, mature forest component has also been nearly lost due to timber harvest and fire regime alteration.

#### 2.3.6.1.3 South Fork Boise

**Aquatic Habitat—**The South Fork Boise watershed includes waters upstream of Anderson Ranch Dam. This watershed supports one of the three known adfluvial bull trout populations in the Southwest Idaho Bull Trout Recovery Unit. The South Fork Boise watershed upstream of Anderson Ranch Dam has areas of high-quality habitat associated with areas of low road density. Impacts are similar to those in the North/Middle Fork Boise watershed including road development (impacted riparian areas, increased fine sediment, fish passage barriers), legacy effects from dredge mining, fires, timber-harvest activities, and grazing. Considerable information on this watershed is available in the subbasin assessment for upper Boise River watersheds (IDEQ 2000), completed for the TMDL process. Anderson Ranch Reservoir has an active storage capacity of 423,200 acre-feet and two hydropower units. A minimum release of 300 cubic feet per second (cfs) is maintained below the dam from September 15 through the following March 31. The minimum flow from April 1 through September 15 is 600 cfs; however, releases are normally above 1,000 cfs. Releases are managed conservatively to retain as much carryover as possible to meet the minimum streamflow requirements and not exceed the power plant capacity of about 1,600 cfs.

**Riparian/Herbaceous Wetlands—**The most quantifiable impact to wetland habitats in the South Fork Boise watershed results from various forms of development and/or conversion within the floodplain. Two hundred sixty-nine points of water diversion have been constructed in the South Fork Boise watershed, primarily for irrigation purposes. The diversions have significant ramifications to hydrologic processes and wetland structure and function in the watershed. Other forms of development and/or land conversion within the 50- and 100-year floodplains impact wetland habitat quantity and quality. Anthropogenic influences on the habitat become more pronounced in the downstream sections of the watershed. Data limitations prevent accurate or precise quantification of the direct and indirect losses of riparian/herbaceous wetland habitat in the South Fork Boise watershed.

**Shrub-Steppe—**Shrub-steppe habitat types currently comprise nearly half of the landscape in the South Fork Boise watershed. Based on the best estimates, this is an increase of 77% from historical conditions. Shrub-steppe habitat increases may be attributed to two components of an altered fire regime. Stand-replacement fires have recently burned approximately 30% of the South Fork Boise watershed, and when fires are suppressed, the shrub component of grassland habitat expands at the expense of native grassland habitat. Regardless, the quality of remaining shrub-steppe habitat is severely reduced from the historical condition (Dobler *et al*. 1996, West 1999).

**Pine/Fir Forests—**Pine/fir forest habitat is not a significant component of the landscape in the South Fork Boise watershed. Currently, pine/fir forest accounts for just 2% of the habitat. According to the best estimates available, this is a decline of nearly 900% from historical conditions. Data limitations pertaining to historical acreages of forested habitats inhibit our ability to precisely quantify pine/fir forest habitat losses in the South Fork Boise watershed (Appendix 1-2). The quality of the pine/fir forest habitat has shifted from a mix of seral stages to a young seral-dominated habitat with higher stem density and lower diversity and cover of understory species. Fire suppression has led to a buildup of fuels that in turn increase the likelihood of stand-replacing fires.

The xeric, mature forest component of the pine/fir forest habitat was assessed in terms of ponderosa pine habitat. Historically, this habitat was mostly open and parklike, with relatively little undergrowth trees. It was the predominant landscape feature. Timber-harvest activities in the watershed during the last century selectively harvested the mature stands, while other factors limited reestablishment of normal forest successional processes. Currently, much of this habitat has a younger tree cohort of more shade-tolerant species that give the habitat a more closed, multilayered canopy.

**Interior Mixed Conifer Forest—**Currently, interior mixed conifer forest habitat amounts to 21% of the landscape in the South Fork Boise watershed. Based on the best data available, this is a decline of 85% from historical conditions. The mature forest component of the interior mixed conifer forest has been most affected by timber harvest and fire suppression. Timber harvest has focused on large shade-intolerant species in mid- and late seral forests, leaving shade-tolerant species. Fire suppression enforces those logging priorities by promoting less fire-resistant, shade-intolerant trees. The resultant stands at all seral stages tend to lack snags, have high tree density, and be composed of smaller and more shade-tolerant trees. Mid-seral forest structure in the Columbia River basin is currently 70% more abundant than it was historically (IBIS 2003). Late seral forests of shade-intolerant species are now essentially absent. Early seral forest abundance is similar to that found historically but lacks snags and other legacy features. In the South Fork Boise watershed, the mesic, mature forest component has also been nearly lost due to timber harvest and fire regime alteration.

#### 2.3.6.1.4 Lower Boise

**Aquatic Habitat—**The Lower Boise watershed is heavily influenced by development in the watershed. It is unlikely that any tributary in this watershed is currently in an unimpacted state from one or more of the following: water diversion, wastewater/stormwater return, altered riparian, lack of floodplain access, and channelization. The mainstem Boise River is subject to altered hydrograph, temperature regime, and sediment transport typical of tailwater systems in the western United States. Considerable information on this watershed is available in the subbasin assessment for lower Boise River watersheds (IDEQ 2001), completed for the TMDL process.

**Riparian/Herbaceous Wetlands—**The most quantifiable impact to wetland habitats in the Lower Boise watershed results from various forms of development and/or conversion within the floodplain. Two thousand twenty-three points of water diversion have been constructed in the Lower Boise watershed, primarily for irrigation purposes (IDWR 2003). The diversions have significant ramifications to hydrologic processes and wetland structure and function in the watershed. Other forms of development and/or land conversion within the 50- and 100-year floodplains impact wetland habitat quantity and quality. Anthropogenic influences on the habitat in this watershed are the greatest as the river corridor passes through the urban/suburban areas of the Treasure Valley. Although habitat losses are known to be significant in this watershed, data limitations prevent accurate or precise quantification of the direct and indirect losses of riparian/herbaceous wetland habitat in the Lower Boise watershed.

**Shrub-Steppe—**Nearly one-third of the habitat in the Lower Boise watershed is shrub-steppe habitat types. Currently, shrub-steppe habitats comprise 32% of the landscape in the Lower Boise watershed. Based on the best estimates, this is a decrease of 125% from historical conditions. Much of the shrub-steppe habitat losses in the Lower Boise watershed have resulted from conversion to agricultural uses and then subsequent conversion to developed landscapes. The quality of remaining shrub-steppe habitat remnants in the watershed is severely reduced from the historical condition (Dobler *et al*. 1996, West 1999).

**Pine/Fir Forests—**Pine/fir forest habitat is not a significant component of the landscape in the Lower Boise watershed. Currently, pine/fir forest accounts for just 1% of the habitat. According to the best estimates available, this is a decline of nearly 70% from historical conditions. Data limitations pertaining to historical acreages of forested habitats inhibit our ability to precisely quantify pine/fir forest habitat losses in the Lower Boise watershed (Appendix 1-2). The quality of the pine/fir forest habitat has shifted from a mix of seral stages to a young seral-dominated habitat with higher stem density and lower diversity and cover of understory species. Fire suppression has led to a buildup of fuels that in turn increase the likelihood of stand-replacing fires.

The xeric, mature forest component of the pine/fir forest habitat was assessed in terms of ponderosa pine habitat. Historically, this habitat was mostly open and parklike, with relatively little undergrowth trees. It was the predominant landscape feature. Timber-harvest activities in the watershed during the last century selectively harvested the mature stands, while other factors limited reestablishment of normal forest successional processes. Currently, much of this habitat has a younger tree cohort of more shade-tolerant species that give the habitat a more closed, multilayered canopy.

**Interior Mixed Conifer Forest—**Currently, interior mixed conifer habitat does not occur in any significant amount in the Lower Boise watershed. Historically, the habitat type occurred in the watershed, but development and fires undoubtedly took their toll on the remnant stands of timber near the sprawling communities within the Treasure Valley.

### *2.3.6.2 Payette Subbasin*

#### 2.3.6.2.1 South Fork Payette

**Aquatic Habitat—**This watershed includes waters upstream of the confluence of the Middle Fork and South Fork Payette rivers. The hydrologic regime of the South Fork Payette River is slightly modified by the dam on the Deadwood River. Deadwood Dam has an active storage capacity of about 162,000 acre-feet to provide water for hydropower generation at Black Canyon Dam. In the Payette system, releases for irrigation demand are met first from Deadwood Reservoir, usually in July and August, to minimize the draft of Cascade Reservoir. After Labor Day, the draft of Deadwood Reservoir is reduced and late season irrigation demand is met by releases from Cascade Reservoir. A minimum of 50 cfs is released from Deadwood Dam in the winter for fish and wildlife. A minimum pool of 50,000 acre-feet is a target established by administrative decision. Deadwood and Cascade reservoirs are informally managed for flood control with a goal of limiting flows at Horseshoe Bend, Idaho, to 12,000 cfs. Flows from the Deadwood River contribute an average of 28% (20% minimum to 40% maximum) of the total flow to the South Fork Payette River, as recorded at the gage at Lowman, Idaho (USGS streamflow data 1942 to 2001). Other than the Deadwood River, the hydrologic regimes of the South Fork Payette watershed show very little impact from water diversions. In areas with low road densities, high-quality aquatic habitats exist in the headwater areas in this watershed. Deadwood Reservoir contains one of three known adfluvial bull trout populations in the Southwest Idaho Bull Trout Recovery Unit.

**Riparian/Herbaceous Wetlands—**The most quantifiable impact to wetland habitats in the South Fork Payette watershed results from various forms of development and/or conversion within the floodplain. Two hundred eighteen points of water diversion have been constructed in the South Fork Payette watershed for a variety of purposes. The diversions have significant ramifications to hydrologic processes and wetland structure and function in the watershed. Other forms of development and/or land conversion within the 50- and 100-year floodplains impact wetland habitat quantity and quality. This watershed is one of the most remote areas of the Boise, Payette, and Weiser subbasins, so anthropogenic influences are less pronounced. Nevertheless, data limitations prevent accurate or precise quantification of the direct and indirect losses of riparian/herbaceous wetland habitat in the South Fork Payette watershed.

**Shrub-Steppe—**Shrub-steppe habitat types currently comprise 33% of the landscape in the South Fork Payette watershed. Based on the best estimates, this is an increase of nearly 95% from historical conditions. Shrub-steppe habitat increases may be attributed to two components of an altered fire regime. Stand-replacement fires have recently burned approximately 20% of the South Fork Payette watershed, and when fires are suppressed, the shrub component of grassland habitat expands at the expense of native grassland habitat. Regardless, the quality of remaining shrub-steppe habitat is severely reduced from the historical condition (Dobler *et al*. 1996, West 1999).

**Pine/Fir Forests—**Currently, pine/fir forest habitat amounts to 7% of the landscape in the South Fork Payette watershed. Based on the best data available, this is a decline of 155% from historical conditions. However, data limitations pertaining to historical acreages of forested habitats inhibit our ability to precisely quantify habitat losses (Appendix 1-2). The quality of the pine/fir forest habitat has shifted from a mix of seral stages to a young seral-dominated habitat with higher stem density and lower diversity and cover of understory species. Fire suppression has led to a buildup of fuels that in turn increase the likelihood of stand-replacing fires.

The xeric, mature forest component of the pine/fir forest habitat was assessed in terms of ponderosa pine habitat. Historically, this habitat was mostly open and parklike, with relatively little undergrowth trees. It was the predominant landscape feature. Timber-harvest activities in the watershed during the last century selectively harvested the mature stands, while other factors limited reestablishment of normal forest successional processes. Currently, much of this habitat has a younger tree cohort of more shade-tolerant species that give the habitat a more closed, multilayered canopy.

**Interior Mixed Conifer Forest—**Currently, interior mixed conifer forest habitat amounts to 36% of the landscape in the South Fork Payette watershed. Based on the best data available, this is a decline of 108% from historical conditions. The mature forest component of the interior mixed conifer forest has been most affected by timber harvest and fire suppression. Timber harvest has focused on large shade-intolerant species in mid- and late seral forests, leaving shade-tolerant species. Fire suppression enforces those logging priorities by promoting less fire-resistant, shade-intolerant trees. The resultant stands at all seral stages tend to lack snags, have high tree density, and be composed of smaller and more shade-tolerant trees. Mid-seral forest structure in the Columbia River basin is currently 70% more abundant than it was historically (IBIS 2003). Late seral forests of shade-intolerant species are now essentially absent. Early seral forest abundance is similar to that found historically but lacks snags and other legacy features. In the South Fork Payette watershed, the mesic, mature forest component has also been nearly lost due to timber harvest and fire regime alteration.

#### 2.3.6.2.2 Middle Fork Payette

**Aquatic Habitat—**The Middle Fork Payette watershed includes the Middle Fork Payette River and tributaries upstream of the confluence with the South Fork Payette River. Channel types (Rosgen 1996) in the watershed range from A/B in headwater areas to C in the lower elevations. Substrate in the lower section is dominated by large amounts of sand and has a high width:depth ratio. Numerous stream segments in the Middle Fork Payette watershed were listed as water quality impaired due to sediment. The Middle Fork Payette has a naturally high background sediment levels from the geology of the area, and the TMDL implementation plan indicates a goal of 76% in reductions of sediment from anthropogenic activities, primarily from nonpoint source inputs (IDEQ 2003a).

**Riparian/Herbaceous Wetlands—**The most quantifiable impact to wetland habitats in the Middle Fork Payette watershed results from various forms of development and/or conversion within the floodplain. Three hundred nineteen points of water diversion have been constructed in the Middle Fork Payette watershed, primarily for dryland irrigation purposes in the central valleys. The diversions have significant ramifications to hydrologic processes and wetland structure and function in the watershed. Other forms of development and/or land conversion within the 50- and 100-year floodplains impact wetland habitat quantity and quality. Data limitations prevent accurate or precise quantification of the direct and indirect losses of riparian/herbaceous wetland habitat in this watershed.

**Shrub-Steppe—**Shrub-steppe habitat types currently comprise 21% of the landscape in the Middle Fork Payette watershed. Based on the best estimates, this is an increase of 99% from historical conditions. Shrub-steppe habitat increases in the Middle Fork Payette watershed may largely be attributed to the altered fire regime that allows the shrub component of grassland habitats to expand at the expense of native grasslands. The quality of the existing shrub-steppe habitat is severely reduced from the historical condition (Dobler *et al*. 1996, West 1999).

**Pine/Fir Forests—**Currently, pine/fir forest habitat amounts to 33% of the landscape in the Middle Fork Payette watershed. Based on the best data available, this is increase of 13% from historical conditions. However, data limitations pertaining to historical acreages of forested habitats inhibit our ability to precisely quantify habitat losses (Appendix 1-2). The quality of the pine/fir forest habitat has shifted from a mix of seral stages to a young seral-dominated habitat with higher stem density and lower diversity and cover of understory species. Fire suppression has led to a buildup of fuels that in turn increase the likelihood of stand-replacing fires.

The xeric, mature forest component of the pine/fir forest habitat was assessed in terms of ponderosa pine habitat. Historically, this habitat was mostly open and parklike, with relatively little undergrowth trees. It was the predominant landscape feature. Timber-harvest activities in the watershed during the last century selectively harvested the mature stands, while other factors limited reestablishment of normal forest successional processes. Currently, much of this habitat has a younger tree cohort of more shade-tolerant species that give the habitat a more closed, multilayered canopy.

**Interior Mixed Conifer Forest—**Currently, interior mixed conifer forest habitat amounts to 30% of the landscape in the Middle Fork Payette watershed. Based on the best data available, this is a decline of 138% from historical conditions. The mature forest component of the interior mixed conifer forest has been most affected by timber harvest and fire suppression. Timber harvest has focused on large shade-intolerant species in mid- and late seral forests, leaving shade-tolerant species. Fire suppression enforces those logging priorities by promoting less fire-resistant, shade-intolerant trees. The resultant stands at all seral stages tend to lack snags, have high tree density, and be composed of smaller and more shade-tolerant trees. Mid-seral forest structure in the Columbia River basin is currently 70% more abundant than it was historically (IBIS 2003). Late seral forests of shade-intolerant species are now essentially absent. Early seral forest abundance is similar to that found historically but lacks snags and other legacy features. In the Middle Fork Payette watershed, the mesic, mature forest component has also been nearly lost due to timber harvest and fire regime alteration.

#### 2.3.6.2.3 Payette

**Aquatic Habitat—**The Payette watershed includes all tributaries to the mainstem Payette River downstream of the North Fork Payette River. The Payette River downstream of Black Canyon dam is significantly altered from historical conditions. Black Canyon Dam, with a capacity of around 45,000 acre-feet, has two hydropower units. Black Canyon Reservoir is maintained at a steady level during the irrigation season by adjusting releases from Deadwood, Cascade, and Black Canyon dams. The river has been impacted by channelization, riparian vegetation loss, altered temperature regime (from irrigation return water and Black Canyon Dam), and numerous irrigation diversions that reduce flow. Coldwater fish tend to become increasingly scarce downstream of Black Canyon Dam. Water passing Black Canyon Dam exceeds Idaho's coldwater biota temperature standard of mean daily water temperature not exceeding 19 °C. Upstream of Black Canyon Dam, discharge has been altered by Cascade Dam on the North Fork Payette River and Deadwood River on the South Fork Payette River. Considerable information on the lower Payette watershed is available in the lower Payette TMDL implementation plan (IDEQ 2003b).

**Riparian/Herbaceous Wetlands—**The most quantifiable impact to wetland habitats in the Payette watershed results from various forms of development and/or conversion within the floodplain. One thousand five hundred fifty-seven points of water diversion have been constructed in the Payette watershed, primarily for dryland irrigation purposes in the central valleys. The diversions have significant ramifications to hydrologic processes and wetland structure and function in the watershed. Other forms of development and/or land conversion within the 50- and 100-year floodplains impact wetland habitat quantity and quality. Data limitations prevent accurate or precise quantification of the direct and indirect losses of riparian/herbaceous wetland habitat in this watershed.

**Shrub-Steppe—**Shrub-steppe habitat types currently comprise 38% of the landscape in the Payette watershed. Based on the best estimates, this is a decrease of 40% from historical conditions. Shrub-steppe habitat decreases may largely be attributed to recent large-scale rangeland fires and conversion of shrub-steppe habitat to agricultural land use. The quality of remaining shrub-steppe habitat is severely reduced from the historical condition (Dobler *et al*. 1996, West 1999).

**Pine/Fir Forests—**Currently, pine/fir forest habitat amounts to 13% of the landscape in the Payette watershed. Based on the best data available, this is a decrease of 34% from historical conditions. However, data limitations pertaining to historical acreages of forested habitats inhibit our ability to precisely quantify habitat losses (Appendix 1-2). The quality of the pine/fir forest habitat has shifted from a mix of seral stages to a young seral-dominated habitat with higher stem density and lower diversity and cover of understory species. Fire suppression has led to a buildup of fuels that in turn increase the likelihood of stand-replacing fires.

The xeric, mature forest component of the pine/fir forest habitat was assessed in terms of ponderosa pine habitat. Historically, this habitat was mostly open and parklike, with relatively little undergrowth trees. It was the predominant landscape feature. Timber-harvest activities in the watershed during the last century selectively harvested the mature stands, while other factors limited reestablishment of normal forest successional processes. Currently, much of this habitat has a younger tree cohort of more shade-tolerant species that give the habitat a more closed, multilayered canopy.

**Interior Mixed Conifer Forest—**Currently, interior mixed conifer forest habitat amounts to 30% of the landscape in the Payette watershed. Based on the best data available, this is a decline of 138% from historical conditions. The mature forest component of the interior mixed conifer forest has been most affected by timber harvest and fire suppression. Timber harvest has focused on large shade-intolerant species in mid- and late seral forests, leaving shade-tolerant species. Fire suppression enforces those logging priorities by promoting less fire-resistant, shade-intolerant trees. The resultant stands at all seral stages tend to lack snags, have high tree density, and be composed of smaller and more shade-tolerant trees. Mid-seral forest structure in the Columbia River basin is currently 70% more abundant than it was historically (IBIS 2003). Late seral forests of shade-intolerant species are now essentially absent. Early seral forest abundance is similar to that found historically but lacks snags and other legacy features. In the Payette watershed, the mesic, mature forest component has also been nearly lost due to timber harvest and fire regime alteration.

#### 2.3.6.2.4 North Fork Payette

**Aquatic Habitat—**The North Fork Payette watershed includes the main North Fork Payette River and all tributaries upstream of the confluence of the mainstem Payette River. Cascade Dam forms the major storage reservoir in the system, but Payette Lake and Little Payette Lake both have dams on their outlets for water storage. Cascade Dam has an active storage capacity of 653,200 acre-feet . Hydropower operations at the dam are owned by Idaho Power Company. Reservoir level on behind Cascade Dam is held as high as possible for recreation and water quality. Most late-season irrigation releases in the Payette system are made from Cascade Reservoir. Winter flows are targeted at a minimum of 200 cfs, and a minimum pool of

300,000 acre-feet (250,000 acre-feet of active storage) has been established by administrative decision. The dam on Payette Lake provides 35,000 acre-feet of irrigation water. Aquatic habitat in the North Fork Payette River is substantially altered by the presence of dams, which fragment the system. In addition, Cascade Reservoir alters the temperature regimes downstream of the reservoir. No fish passage is provided at any of the dams in the watershed.

**Riparian/Herbaceous Wetlands**—The most quantifiable impact to wetland habitats in the North Fork Payette watershed results from various forms of development and/or conversion within the floodplain. One thousand one hundred twenty-three points of water diversion have been constructed in the North Fork Payette watershed, primarily for dryland irrigation purposes in the central valleys. The diversions have significant ramifications to hydrologic processes and wetland structure and function in the watershed. Other forms of development and/or land conversion within the 50- and 100-year floodplains impact wetland habitat quantity and quality. Data limitations prevent accurate or precise quantification of the direct and indirect losses of riparian/herbaceous wetland habitat in this watershed.

**Shrub-Steppe**—Shrub-steppe habitat types currently comprise 7% of the landscape in the North Fork Payette watershed. Based on the best estimates, this is an increase of 16% from historical conditions. Shrub-steppe habitat increases in the North Fork Payette watershed may largely be attributed to the altered fire regime that allows the shrub component of grassland habitats to expand at the expense of native grasslands. The quality of remaining shrub-steppe habitat is severely reduced from the historical condition (Dobler *et al*. 1996, West 1999).

**Pine/Fir Forests**—Currently, pine/fir forest habitat amounts to 27% of the landscape in the North Fork Payette watershed. Based on the best data available, this is an increase of 3% from historical conditions. However, data limitations pertaining to historical acreages of forested habitats inhibit our ability to precisely quantify habitat losses (Appendix 1-2). The quality of the pine/fir forest habitat has shifted from a mix of seral stages to a young seral-dominated habitat with higher stem density and lower diversity and cover of understory species. Fire suppression has led to a buildup of fuels that in turn increase the likelihood of stand-replacing fires.

The xeric, mature forest component of the pine/fir forest habitat was assessed in terms of ponderosa pine habitat. Historically, this habitat was mostly open and parklike, with relatively little undergrowth trees. It was the predominant landscape feature. Timber-harvest activities in the watershed during the last century selectively harvested the mature stands, while other factors limited reestablishment of normal forest successional processes. Currently, much of this habitat has a younger tree cohort of more shade-tolerant species that give the habitat a more closed, multilayered canopy.

**Interior Mixed Conifer Forest**—Currently, interior mixed conifer forest habitat amounts to 18% of the landscape in the North Fork Payette watershed. Based on the best data available, this is a decline of 369% from historical conditions. The mature forest component of the interior mixed conifer forest has been most affected by timber harvest and fire suppression. Timber harvest has focused on large shade-intolerant species in mid- and late seral forests, leaving shade-tolerant species. Fire suppression enforces those logging priorities by promoting less fire-resistant, shade-intolerant trees. The resultant stands at all seral stages tend to lack snags, have high tree density, and be composed of smaller and more shade-tolerant trees. Mid-seral forest structure in the Columbia River basin is currently 70% more abundant than it was historically (IBIS 2003). Late seral forests of shade-intolerant species are now essentially absent. Early seral forest abundance is similar to that found historically but lacks snags and other legacy features. In the North Fork Payette watershed, the mesic, mature forest component has also been nearly lost due to timber harvest and fire regime alteration.

#### 2.3.6.3 Weiser

**Aquatic Habitat—**The Weiser watershed has no mainstem storage reservoirs. Irrigation storage reservoirs have been constructed on tributary streams for a total storage capacity of about 83,000 acre-feet of water. The lower Weiser River from the mouth to Galloway Dam is subjected to low summer flows and increased water temperatures. Upstream of Galloway Dam, water quantity and quality improves enough to support a limited redband trout population. Some areas in the headwaters of the Weiser River have good habitat with strong populations of redband trout. Three watersheds in the Weiser subbasin have been identified as supporting bull trout spawning and rearing.

**Riparian/Herbaceous Wetlands—**The most quantifiable impact to wetland habitats in the Weiser watershed results from various forms of development and/or conversion within the floodplain. Three thousand eight hundred seventy-three points of water diversion have been constructed in the Weiser watershed, primarily for dryland irrigation purposes in the central valleys. The Weiser watershed is one of the most heavily impacted watersheds in Idaho due to the density of water diversions. The diversions have significant ramifications to hydrologic processes and wetland structure and function in the watershed. Other forms of development and/or land conversion within the 50- and 100-year floodplains impact wetland habitat quantity and quality. Data limitations prevent accurate or precise quantification of the direct and indirect losses of riparian/herbaceous wetland habitat in this watershed.

**Shrub-Steppe—**Shrub-steppe habitat types currently comprise nearly half of the landscape in the Weiser watershed. Based on the best estimates, shrub-steppe habitat has increased an estimated 4% from historical conditions. Shrub-steppe habitat increases have occurred in the Weiser watershed despite a significant amount of land conversion to agricultural purposes. These shrub-steppe habitat increases may largely be attributed to the altered fire regime that allows the shrub component of grassland habitats to expand at the expense of native grasslands. The quality of remaining shrub-steppe habitat is severely reduced from the historical condition (Dobler *et al*. 1996, West 1999).

**Pine/Fir Forests—**Currently, pine/fir forest habitat amounts to 19% of the landscape in the Weiser watershed. Based on the best data available, this is an increase of 3% from historical conditions. However, data limitations pertaining to historical acreages of forested habitats inhibit our ability to precisely quantify habitat losses (Appendix 1-2). The quality of the pine/fir forest habitat has shifted from a mix of seral stages to a young seral-dominated habitat with higher stem density and lower diversity and cover of understory species. Fire suppression has led to a buildup of fuels that in turn increase the likelihood of stand-replacing fires.

The xeric, mature forest component of the pine/fir forest habitat was assessed in terms of ponderosa pine habitat. Historically, this habitat was mostly open and parklike with relatively little undergrowth trees and was the predominant landscape feature. Timber-harvest activities in the watershed during the last century selectively harvested the mature stands, while other factors limited reestablishment of normal forest successional processes. Currently, much of this habitat has a younger tree cohort of more shade-tolerant species that give the habitat a more closed, multilayered canopy.

**Interior Mixed Conifer Forest—**Currently, interior mixed conifer forest habitat amounts to just 6% of the landscape in the Weiser watershed. Based on the best data available, this is a decline of 442% from historical conditions. The mature forest component of the interior mixed conifer forest has been most affected by timber harvest and fire suppression. Timber harvest has focused on large shade-intolerant species in mid- and late seral forests, leaving shade-tolerant species. Fire suppression enforces those logging priorities by promoting less fire-resistant, shade-intolerant trees. The resultant stands at all seral stages tend to lack snags, have high tree density, and be composed of smaller and more shade-tolerant trees. Mid-seral forest structure in the Columbia River basin is currently 70% more abundant than it was historically (IBIS 2003). Late seral forests of shade-intolerant species are now essentially absent. Early seral forest abundance is similar to that found historically but lacks snags and other legacy features. In the Weiser watershed, the mesic, mature forest component has also been nearly lost due to timber harvest and fire regime alteration.

# 3 Biological Resources Limiting Factors

Abundance, productivity, and diversity of organisms are integrally linked to the characteristics of their ecosystem. We assume that a naturally functioning ecosystem provides the basis for sustainable populations of organisms that are native to that system. Ecosystems, their habitats, and fish and wildlife populations are expected to fluctuate; while more dynamic than stable, these variations demonstrate and rely on the resilience of ecosystems and their components. This resilience is generally greater in systems retaining all or the majority of their components.

Human activities may affect ecosystems in ways similar to natural occurrences, but human impacts tend to be chronic, directional, and long term rather than episodic. Therefore, human effects on ecosystem function tend to alter the system beyond the range of natural variation to which native organisms are adapted, resulting in decreased habitat quality or quantity for these native species.

The Interior Columbia Basin Ecosystem Management Project (ICBEMP) assessment concluded that development of the interior Columbia Basin over the last 150 years has greatly altered ecological processes, to the detriment of many native species of fish and wildlife (ICBEMP 1997). Information collected for the ICBEMP assessment was considered in the preparation of the terrestrial portion of this assessment. ICBEMP data presented here were intended for use at a broad scale, generally at a watershed level (Appendix 1-2). Land- and water-use practices contributing to these changes included unrestricted or little-restricted livestock grazing, road construction, timber harvest and fire management, certain intensive agricultural practices, placer and dredge mining, dam construction, and stream channelization. The ICBEMP assessment also concluded that these anthropogenic disturbances cause risks to ecological integrity by reducing biodiversity and threatening riparian-associated species across broad geographic areas.

We suggest that reduction of habitat quality and quantity and fragmentation of habitat are impacting fish and wildlife species chosen as focal species in the Boise, Payette, and Weiser subbasins. The causes and effects of the fragmentation and reductions in habitat quantity and quality are presented in Table 3-1. In section 3.1, we discuss watershed-specific impacts to aquatic habitats in terms of the degree to which an altered ecosystem component impacts the habitat quality or quantity for focal fish species in the subbasins, based on information and professional judgment. Watershed impacts to terrestrial habitat types are presented in terms of how the quality or quantity of a habitat is impacted by identified causes.

**Table 3-1. Expression of limiting factors and their causes for each focal habitat type in the Boise, Payette, and Weiser subbasins of Idaho. The classification of exogenous material refers to nonnatural physical barriers to migration, chemical impacts, and nonnative plants or animals (aquatic habitat information modified from Gregory and Bisson 1997; sediment information from Waters 1995).**

| Focal Habitat | Limiting Factor | Cause of Limiting Factor | Expression of Limiting Factor |
|---|---|---|---|
| Aquatic | | | |
| | Habitat quality | | |
| | | Alteration of channel structure | |
| | | | Loss of floodplain access alters hydrology by preventing energy dissipation of high flows, reduces organic matter input from riparian interaction<br>Change in pool to riffle ratio reduces rearing/overwinter habitat<br>Loss or reduction in large woody debris reduces cover for fish, alters sediment storage and pool formation, reduces production of macroinvertebrates, changes salmon carcass transport rates<br>Changed substrate reduces salmonid egg survival and loss of interstitial space for rearing, reduces macroinvertebrate production<br>Changes in interaction with groundwater/hyporheic zone reduces nutrient exchange, reduces potential for recolonizing disturbed substrates |
| | | Alteration of hydrology | |
| | | | Changes timing of discharge-related lifecycle, changes food availability, alters sediment and organic matter transport, may reduce biodiversity, leads to juvenile crowding, reduces primary/secondary productivity, increases predation, changes sediment transport by reducing stream power, may result in stranding, increases water temperature |
| | | Increased sedimentation | |
| | | | Affects macroinvertebrate production, reduces rearing area, reduces pool volumes |
| | | Change in water temperature | |
| | | | Alters migration patterns, changes emergence timing, may result in behavioral avoidance, increases susceptibility to disease/parasites, changes mortality in macroinvertebrate community |
| | | Altered riparian areas | |

| Focal Habitat | Limiting Factor | Cause of Limiting Factor | Expression of Limiting Factor |
|---|---|---|---|
| | | | (Effects to salmonids) Reduce cover, reduce large woody debris recruitment thereby changing channel structure, reduce production of macroinvertebrates, reduce access to terrestrial invertebrates for food, reduce growth, decrease shading increases water temperature (see ecosystem effects to Riparian/Herbaceous Wetlands below) |
| | | Exogenous materials | |
| | | | Chemical pollution reduces invertebrate production, possible mortality of fish<br>Exotics increase competition, displacement, introgression of population, predation, disease risk, altered nutrient cycles |
| Aquatic | | | |
| | Habitat quantity | | |
| | | Exogenous materials | |
| | | | Barriers reduce access to suitable habitat either completely or seasonally, affect behavior by preventing migration and colonization, lead to loss of thermal refuge, results in population fragmentation for resident fish species<br>Chemical pollution makes habitat uninhabitable |
| Riparian/herbaceous wetlands | | | |
| | Habitat quality | | |
| | | Altered fire regime | |
| | | | Stand-replacement fire reduces watershed integrity |
| | | Grazing/browsing | |
| | | | Changes soil condition, results in introduction of nonnative vegetation and loss of native vegetation, reduces species diversity and vegetative density, increases water temperature, results in excessive sedimentation due to bank and upland instability, results in high coliform bacterium counts, alters channels, reduces water table, alters aquatic nutrient cycling |
| | | Altered hydrology | |
| | | | Increases water temperature, degrades water quality, alters sediment movement, results in direct blockage of material and organisms and streambank erosion, reduces habitat complexity, results in stream channelization, results in wetland drainage or filling, leads to inundation, reduces amount of mature riparian vegetation, reduces number of beaver, increases overland flow, reduces filtration capability, increases effects due to pollution |
| | | Timber harvest | |

| Focal Habitat | Limiting Factor | Cause of Limiting Factor | Expression of Limiting Factor |
|---|---|---|---|
| | | | Results in bed scour and streambank erosion; alters sediment movement and aggregation; destabilizes streambanks; reduces instream woody debris; alters snow depth and timing and rate of runoff; leads to wetter soils resulting in later summer runoff; accelerated runoff on roads, trails, and landings; degrades water quality |
| | | Land-use /conversion/development | |
| | | | Seasonal recreation and tourism increases disturbance from road and trail networks |
| | | Exotic invasives | |
| | | | Reduces biodiversity and foragability, while physically fragmenting habitats. |
| Riparian/herbaceous wetlands | | | |
| | Habitat quantity | | |
| | | Altered hydrology | |
| | | | Reduces amount of habitat due to channel alteration and lowered water table |
| | | Land-use /conversion/development | |
| | | | Results in localized conversion of habitat to agriculture or “urban” infrastructure, increases disturbance from road and trail networks |
| Riparian/herbaceous wetlands | | | |
| | Fragmentation/ connectivity | | |
| | | Altered hydrology | |
| | | | Reduces amount of habitat due to channel alteration and lowered water table |
| | | Land-use /conversion/development | |
| | | | Results in localized conversion of habitat to agriculture or “urban” infrastructure |
| Shrub-steppe | | | |
| | Habitat quality | | |
| | | Altered fire regime | |
| | | | Results in vegetative uniformity and loss of perennial herbaceous understory, increases susceptibility to noxious weed spread, leads to unmanageable fuel loading, results in conversion to annual grassland habitat |
| | | Grazing/browsing | |

| Focal Habitat | Limiting Factor | Cause of Limiting Factor | Expression of Limiting Factor |
|---|---|---|---|
| | | | Alters vegetative community, ecosystem structure and function, and species composition; leads to trampling of vegetation and soil; alters fire regime; decreases soil organic matter aggregates, decreases infiltration capacity; increases overland flow; results in localized habitat fragmentation due to “trailing” |
| | | Altered hydrology | Decreases infiltration capacity, increases overland flow, increases potential for nonpoint source pollution |
| | | Land-use /conversion/development | Results in habitat fragmentation from conversion and road networks, increases disturbance from road and trail networks |
| | | Exotic invasives | Displace native species, alter predator/prey relationships, decrease ecosystem resiliency, reduce biodiversity, reduce soil productivity, reduce aesthetic quality, reduce forage, destroy crops |
| Shrub-steppe | Habitat quantity | Altered fire regime | Results in large-scale habitat loss due to stand-replacing fire |
| | | Land-use /conversion/development | Results in conversion of habitat to dryland or irrigated agriculture or to “urban” infrastructure, leads to exclusion due to increased human/wildlife conflict at the wildland interface |
| Shrub-steppe | Fragmentation/ connectivity | Altered fire regime | Fragments habitat due to landscape-scale stand-replacing fire |
| | | Land-use /conversion/development | Results in localized conversion of habitat to agriculture or “urban” infrastructure, increases disturbance from road and trail networks |
| Pine/fir forest | Habitat quality | | |

| Focal Habitat | Limiting Factor | Cause of Limiting Factor | Expression of Limiting Factor |
|---|---|---|---|
| | | Altered fire regime | |
| | | | Reduces landscape complexity and habitat diversity, alters ecosystem processes, alters successional stages and associated plants and animals, elevates insect and disease risk |
| | | Grazing/browsing | |
| | | | Alters fire regime and forest structure, reduces herbaceous understory, alters understory cover and composition, results in introduction of noxious weeds, reduces plant litter, alters nutrient cycling, compacts soils, reduces infiltration, increases soil erosion, results in dietary conflicts between wildlife and domestic ungulates |
| | | Timber harvest | |
| | | | Reduces productivity, results in loss of nutrients, compacts soil, increases soil erosion, disrupts microorganism processes, results in fragmentation |
| | | Land-use /conversion/development | |
| | | | Increases disturbance from road and trail networks |
| | | Exotic invasives | |
| | | | Outcompete native plants species, reduce native plant and animal biodiversity, decrease forage production, increase soil erosion, increase sedimentation |
| Pine/fir forest | | | |
| | Habitat quantity | | |
| | | Timber harvest | |
| | | | Historical harvest regimes led to loss of habitat and structural components |
| Pine/fir forest | | | |
| | Fragmentation/ connectivity | | |
| | | Altered fire regime | |
| | | | Fragments habitat due to large-scale stand-replacing fire |
| | | Land-use /conversion/development | |
| | | | Results in localized fragmentation due to housing development and timber-harvest infrastructure, increases disturbance from road and trail networks |
| Native grasslands | | | |
| | Habitat quality | | |
| | | Altered fire regime | |

| Focal Habitat | Limiting Factor | Cause of Limiting Factor | Expression of Limiting Factor |
|---|---|---|---|
| | | | Results in shrub/conifer encroachment, alters nutrient cycling, leads to vegetative uniformity, increases susceptibility to noxious weed invasion, results in conversion to annual grassland habitat |
| | | Grazing/browsing | Alters vegetative community, ecosystem structure and function, and species composition; leads to trampling of vegetation and soil; alters fire regime; decreases soil organic matter and soil aggregates, decreases infiltration capacity; increases overland flow; results in localized habitat fragmentation due to "trailing" |
| | | Land-use /conversion/development | Results in habitat fragmentation from conversion and road networks |
| | | Exotic invasives | Displace native species, alter predator/prey relationships, decrease ecosystem resiliency, reduce biodiversity, reduce soil productivity, reduce aesthetic quality, reduce forage, destroy crops |
| Native grasslands | Habitat quantity | Altered fire regime | Results in habitat losses due to conversion to shrub/conifer types |
| | | Land-use /conversion/development | Results in localized conversion of habitat to dryland or irrigated agriculture or "urban" infrastructure, increases disturbance from road and trail networks |
| Native grasslands | Fragmentation/ connectivity | Land-use /conversion/development | Results in localized conversion of habitat to dryland or irrigated agriculture or "urban" infrastructure, increases disturbance from road and trail networks |
| Aspen | Habitat quality | Altered fire regime | Reduces post-fire regeneration, reduces fine fuels to carry fire, results in conifer encroachment/change in successional processes |

| Focal Habitat | Limiting Factor | Cause of Limiting Factor | Expression of Limiting Factor |
|---|---|---|---|
| | | Grazing/browsing | |
| | | | Reduces aspen habitat due to excessive grazing of regenerative stands |
| | | Altered hydrology | |
| | | | Results in localized habitat degradation due to water table reduction |
| | | Timber harvest | |
| | | | Ignorance of aspen stand ecological significance during timber harvest reduces integrity of aspen stands |
| Aspen | | | |
| | Habitat quantity | | |
| | | Altered fire regime | |
| | | | Reduces aspen habitat due to successional processes |
| | | Grazing/browsing | |
| | | | Reduces aspen habitat by inhibiting stand regeneration |
| | | Altered hydrology | |
| | | | Reduce aspen habitat due to dysfunctional hydrology |
| Juniper/mountain mahogany | | | |
| | Habitat quality | | |
| | | Altered fire regime | |
| | | | Results in conifer encroachment/change in successional processes, leads to landscape dominated by overly mature, decadent stands and high fuel loading resulting in "hot" fires with slow regenerative ability |
| | | Grazing/browsing | |
| | | | Results in high palatability and nutrition resulting in overbrowsing, increases water runoff and erosion, reduces regeneration |
| | | Exotic invasives | |
| | | | Displace native species, decrease ecosystem resiliency, reduce biodiversity, reduce soil productivity, reduce forage |
| Juniper/mountain mahogany | | | |
| | Habitat quantity | | |

| Focal Habitat | Limiting Factor | Cause of Limiting Factor | Expression of Limiting Factor |
|---|---|---|---|
| | | Altered fire regime | |
| | | | Results in conifer encroachment |
| | | Grazing/browsing | |
| | | | Inhibits regeneration |
| Whitebark pine | | | |
| | Habitat quality | | |
| | | Altered fire regime | |
| | | | Results in interspecific site competition/successional processes; leads to landscape dominated by overly mature, decadent stands |
| | | Exotic invasives | |
| | | | Results in direct mortality due to blister rust |
| Whitebark pine | | | |
| | Habitat quantity | | |
| | | Altered fire regime | |
| | | | Reduces habitat due to lack of regeneration |
| | | Exotic invasives | |
| | | | Results in landscape habitat losses due to blister rust |

## 3.1 Causes of Limiting Factors By Watershed

Aquatic habitats are created and maintained by natural processes (watershed size, vegetation, slope, geology, and climate) within the watersheds that encompass them (Doppelt *et al*. 1993). In addition to reflecting the nature of their watersheds, flowing waters shape the watersheds over time by cutting channels, terracing floodplain, depositing sediment, and transporting materials from highlands to lowlands (Stanford 1996). Ward (1989) further describes the nature of stream networks, indicating that any point along a stream has four dimensions (longitudinal, lateral, vertical, and temporal) that combine to form that particular location. The longitudinal dimension is related to the location of the point in the profile of the stream (from headwaters to mouth). The lateral dimension encompasses the transition of the stream into the terrestrial environment. The movement of water as subsurface or interstitial flows within the river and its floodplain is the vertical link, and the naturally associated changes in the system over time of all these components is the fourth dimension (temporal).

The distribution and abundance of aquatic animals and invertebrates are determined by their distinct preferences and tolerances for specific habitat conditions. As discussed above, the conditions at any point along a stream are determined by conditions upstream of that point. Therefore, the distribution and abundance of aquatic species must be examined in the context of the stream and its associated watershed.

The functional components of aquatic ecosystems are made up of several ecosystem "features" that are interrelated and interdependent. These features can generally be classified into the following categories; channel structure, hydrology, sediment, riparian vegetation, and water quality. In addition to the natural variation present in the processes that form ecosystems, human actions have altered the ecosystem components. The degree of alteration can range from minor (little detectable effect) to severe (total disruption), with varying lengths of effects.

The complexity of natural systems requires that, in order to fully understand any ecosystem, all of its components must be evaluated. Thus, in addition to an analysis of the aquatic effects and limiting factors within the Columbia River drainage, an analysis of the terrestrial effects and limiting factors is also necessary. For this analysis, six identified factors of primary importance (identified by the technical team for terrestrial resources) were intersected spatially and cross-tabulated against the area of each watershed to produce relative rankings of the effect (or strength of expression) for each watershed (Table 3-2).

The purpose of this section is to identify ecosystem features that have been altered and are believed to keep fish and wildlife populations in the basin from reaching their full potential. Generally, very few quantitative studies have been performed in the subbasins to identify the mechanisms or degree of the effects of these alterations. So the information presented here for the subbasins is based on a variety of sources (direct observation, local knowledge, and professional judgment) that were informed by the substantial literature available documenting the effects of changes to aquatic ecosystem features on the life histories and survival of salmonids and terrestrial species. Altered ecosystem components were ranked from 1 (least influence on ecosystem or populations) to 3 (greatest influence on ecosystem or population). Highlighting only one altered component of an ecosystem feature does not imply that all other components of that feature are functioning. It is likely that the higher the ranking, the more likely that multiple components of the ecosystem are not functioning. This information conveys a prioritization of the predominant causes of limiting factors by watershed, each of which is discussed below.

**Table 3-2. Rankings of the impacts of limiting factor causes for terrestrial resources in each watershed in the Boise, Payette, and Weiser subbasins (rankings by the technical team: 0 = none to insignificant, 1 = low, 2 = moderate, and 3 = high).**

| Watershed[a] | Altered Fire Regime | Grazing/ Browsing | Altered Hydrologic Regime | Timber Harvest | Land-Use Conversion | Invasive/ Exotics |
|---|---|---|---|---|---|---|
| NMB | 3 | 1 | 3 | 1 | 1 | 2[b] |
| BMO | 3 | 2 | 3 | 2[b] | 3 | 3 |
| SFB | 3 | 3 | 3 | 2[b] | 1 | 3 |
| LBO | 3 | 3 | 3 | 1 | 3 | 3 |
| SFP | 3 | 1 | 1 | 1 | 0 | 3 |
| MFP | 3 | 1[b] | 1 | 2 | 1 | 2 |
| PAY | 3 | 3 | 3 | 2 | 3[b] | 3 |
| NFP | 3 | 1 | 3 | 1[b] | 3 | 3 |
| WEI | 3 | 3 | 3 | 2 | 3 | 3 |

[a] See Table 1-1 for watershed acronyms.
[b] More information is necessary to confirm this rating.

### 3.1.1 North and Middle Fork Boise

The North and Middle Fork Boise watershed is defined along the boundaries of the Arrowrock Bull Trout Core Area, which includes all waters upstream of Arrowrock Dam. The North and Middle Fork Boise watershed has some drainages that are impacted by areas of high road density, contributing to sediment issues, reducing riparian habitat quality, and causing fish passage problems from related culverts (see barriers in Table 3-3). A culvert on Roaring River blocks approximately 20 miles of habitat, and a recent survey identified 9 barriers to adult and juvenile salmonid migration in the North and Middle Fork Boise watershed (BNF, 2003; SNF, 2003). Additionally, the fish ladder at Kirby Dam is thought to be only moderately effective due to timing and management of operations.

Altered sediment and increased temperatures are believed to impact aquatic ecosystems in the Pikes Fork and Bear River (Table 3-3). Increased fine sediment limits water quality in the Bear River area. Brook trout, which are locally abundant in areas in the subbasin, are a hybridization and competition threat to bull trout populations. Arrowrock Reservoir forms the lower end of this watershed; consequently, reservoir operations have a large impact on bull trout and kokanee populations. Fluctuating water levels hamper the survival of kokanee in the reservoir and may impact migrating bull trout. Some areas of channel modifications exist where there were past dredge-mining activities.

The most significant cause of terrestrial limiting factors in the North and Middle Fork Boise watershed is the altered fire regime, with at least 28% of the total watershed area having an impact rating of high (Table 3-4). The watershed has approximately 151 km (8%) of sediment-impaired streams (EPA 1998), and large areas are at high risk for major ecologic damage from wildfire. The least significant causes of limiting factors are timber harvest and habitat fragmentation, with predominantly moderate and low effects.

There is extensive grazing in this watershed, with 88% of the area being allotted to horse grazing, and only 11% of the area being ungrazed (Figure 3-1 and Appendix 1-3). Although grazing was eliminated as an ecosystem feature from Table 3-3, the fisheries technical assessment team had initially rated effects of grazing as a 3 for bull trout in this watershed.

**Table 3-3. Ranked impacts of altered ecosystem features affecting population characteristics, habitat quality, and quantity for focal fish species in tributaries to the North and Middle Fork Boise watershed. Degree of impact is ranked as P (component is functioning properly and recommended for protection), 1 (least influence), 2 (moderate influence), 3 (greatest influence and highest priority).**

| Ecosystem Feature | Altered Component | Subbasin and Watershed[a,b] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Boise | | | Payette | | | | | Weiser |
| | | NMB | SFB | BMO | LBO | SFP | MFP | NFP | PAY | WEI |
| Channel structure | Floodplain reduction | P | P | 1 | 1 (RB) | P | P | P | 3 (RB) | P |
| | Pool to riffle ratio | P | P | 1 | 1 (RB) | P | 3 (BT) | P | 3 (RB) | P |
| | Large woody debris | P | P | 2 (BT) | 1 (RB) | P | P | P | P | P |
| Hydrology | Reservoir operations | 2 (BT), 3(KOK) | 3 (BT, KOK) 1 (RB, BT) | P | 1 (RB) | P | P | P | 3 (RB) | P |
| | Discharge | P | P | P | P | P | P | P | P | P |
| | Low flow | P | P | P | 1 (RB) | P | P | 3 (RB) | 3 (RB) | 3 (RB) |
| | Peak | P | P | P | 1 (RB) | P | P | P | 3 (RB) | P |
| Riparian vegetation | Shade | P | P | P | P | P | 3 (BT, RB) | P | P | P |
| | Streambank stability | P | P | P | P | P | 3 (BT, RB) | P | P | P |
| Sediment | Increased fines | 3 (BT) | P | P | P | 3 (BT, RB) | 2 (upper) 3 (lower) | 3 (RB) | 3 (RB) | 3 (BT, RB) |
| Water quantity | Water diversions | P | 1 (RB, BT) | P | P | P | P | P | P | P |
| | Temperature | P | P | P | P | P | P | 3 (RB) | 3 (RB) | 3 (BT, RB) |
| Exogenous material | Exotic invasives | 3 (BT)[c] | P | 3 (BT)[c] | P | 3 (BT)[c] | P | 3 (BT)[c] 3 (RB)[d] | P | 3 (BT)[c] |
| | Barriers | 3 (RB), 2 (BT) | 3 (BT, RB) | 1 (BT) | P | 3 (BT) | 2 (BT, RB) | 3 (BT, RB) | 3 (BT) | 3 (BT) |

[a] See Table 1-1 for watershed acronyms.
[b] BT = bull trout, KOK = kokanee, RB = redband trout
[c] impacted by brook trout
[d] impacted by hatchery rainbow trout

**Table 3-4. Comparison of relative percentages of area impacted by causes of limiting factors in the North and Middle Fork Boise watershed for terrestrial resources (ICBEMP 1997[a]).**

| Causes of Limiting Factors | Very Low | Low | Medium | High | Very High |
|---|---|---|---|---|---|
| Human population density | (*x*<1) | (1<*x*>10) 75 | (10<*x*>60) 25 | (60<*x*<100) | (*x*>100) |
| Habitat fragmentation | | 45 | 55 | | |
| Altered fire regime (1% of the area is not at risk) | | 30 | 41 | 28 | |
| Timber harvest (45% of the area has no harvest) | | 23 | 23 | 9 | |
| Grazing/browsing (11% of the area has no grazing) | | 1 | 79 | 9 | |

[a] For information about ICBEMP data limitations, see Appendix 1-2.

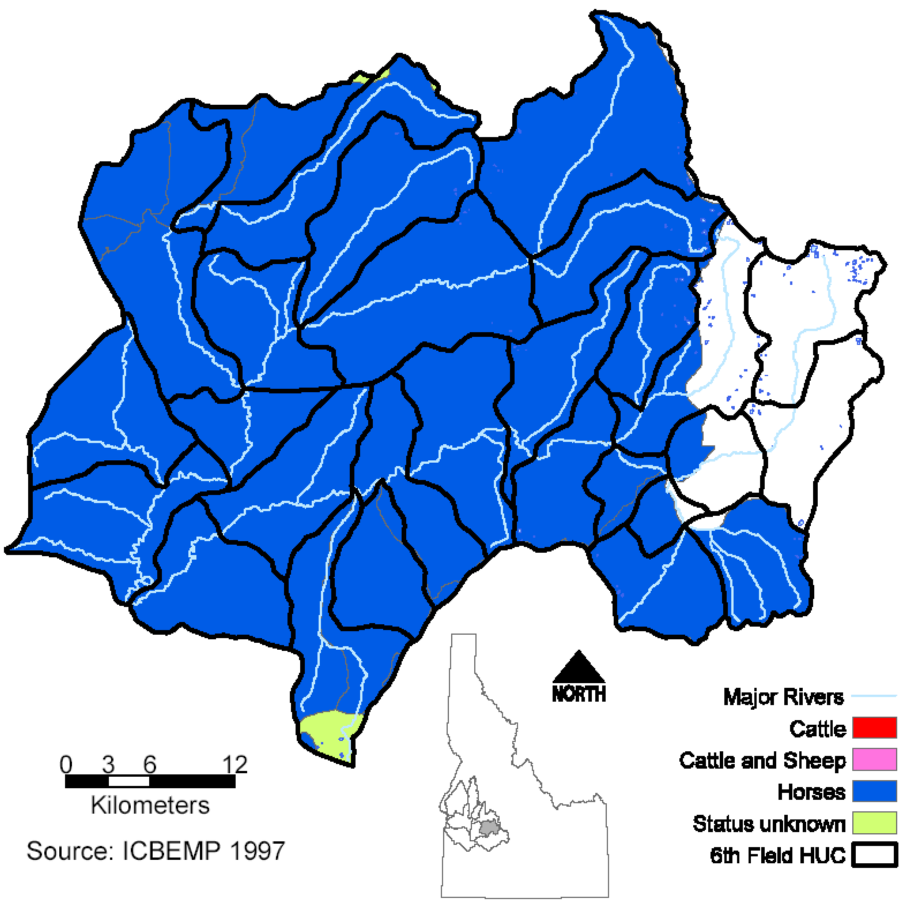


**Figure 3-1. Status of allotted grazing the North/Middle Fork Boise watershed (ICBEMP 1997). See Appendix 1-2 for information on limitations of this data set.**

### 3.1.2 South Fork Boise

The South Fork Boise watershed is defined as the waters upstream of Andersen Ranch Dam. A recent survey identified 31 barriers to adult salmonid migration and 40 barriers to juvenile salmonid migration (BNF, 2003; SNF, 2003). Because brook trout are locally abundant in areas in the subbasin, they are a hybridization and competition threat to bull trout populations. Reservoir operations and stream barriers inhibit local and regional bull trout populations in this watershed (Table 3-3).

The mainstem South Fork Boise River was identified as having altered riparian areas caused by extensive dredge mining, which altered the substrate and channel form in several areas of the watershed. Reservoir operations of Andersen Ranch Dam can impact kokanee populations and bull trout that migrate from the reservoir and overwinter in the reservoir.

The most significant cause of terrestrial limiting factors in the South Fork Boise watershed is human population density and development (Table 3-5). The watershed has approximately 306 km (16%) of sediment-impaired streams (EPA 1998), and several large urban areas exist within the watershed. While habitat fragmentation and altered fire regime are significant causes of limiting factors, their effect is not considered to be as dominant as population density. Although grazing allotments cover the entire watershed, most areas are for cattle and sheep, which are of lower concern from the perspective of limiting factor causes (Figure 3-2 and Appendix 1-3). Timber harvest is active in the watershed; however, large areas are not highly impacted, and almost a third of the watershed has no timber activity (Table 3-5). Additionally, the South Fork Boise watershed has road construction and density concerns similar to those in the North and Middle Fork Boise watershed.

**Table 3-5. Comparison of relative percentages of area impacted by causes of limiting factors in the South Fork Boise watershed for terrestrial resources (ICBEMP 1997[a]).**

| Causes of Limiting Factors | Very Low | Low | Medium | High | Very High |
|---|---|---|---|---|---|
| Human population density | $(x<1)$ | $(1<x>10)$ 52 | $(10<x>60)$ 46 | $(60<x<100)$ 3 | $(x>100)$ |
| Habitat fragmentation | | 33 | 60 | 7 | |
| Altered fire regime (2% of the area is not at risk) | | 5 | 57 | 19 | |
| Timber harvest (29% of the area has no harvest) | | 20 | 34 | 18 | |
| Grazing/browsing (1% of the area has no grazing) | | 30 | 62 | 7 | |

[a] For information about ICBEMP data limitations, see Appendix 1-2.

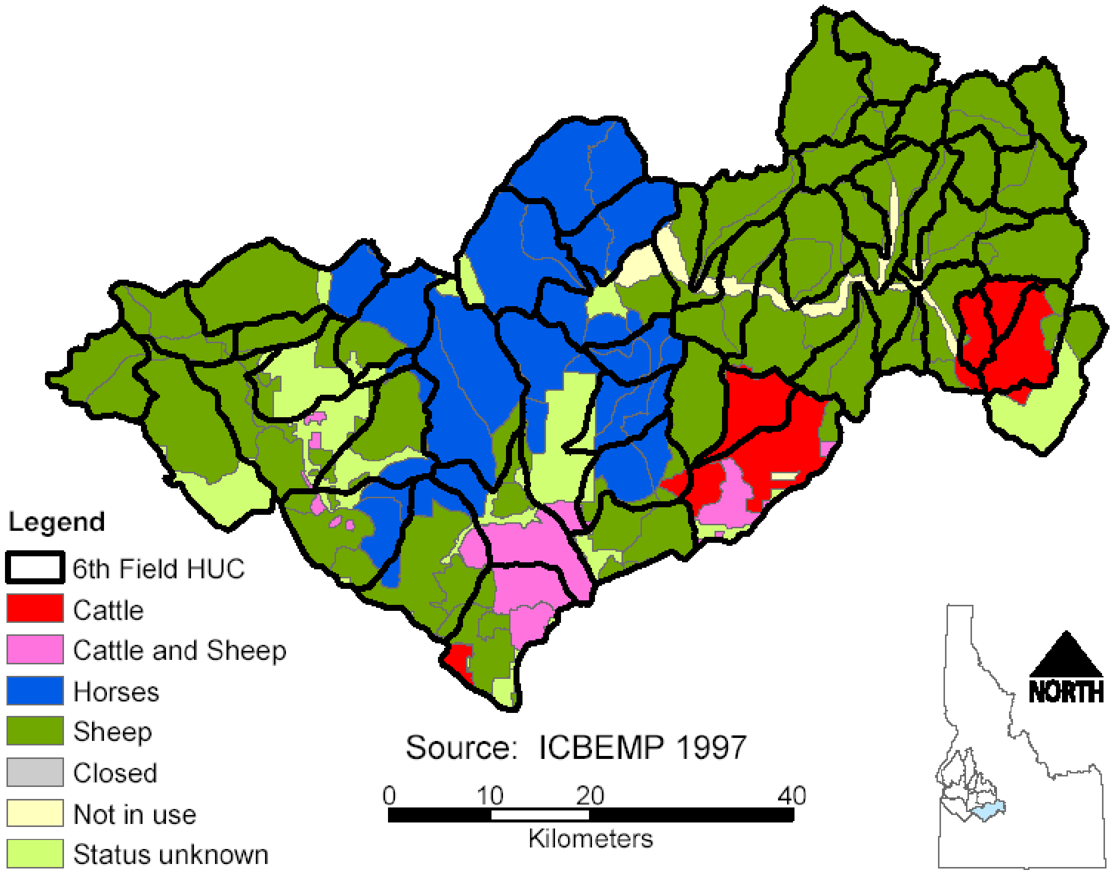


**Figure 3-2. Status of allotted grazing in the South Fork Boise watershed (ICBEMP 1997). See Appendix 1-2 for information on limitations of this data set.**

### 3.1.3 Boise–Mores

The Boise–Mores watershed is defined as waters upstream of Lucky Peak Dam to Arrowrock Dam. The Mores Creek subwatershed is heavily impacted by channel alterations from historic dredging, construction of State Highway 21 and its effects on riparian habitat, and loss of connectivity to the floodplain. Headwaters suffer from reduced amounts of instream large woody debris, which in turn reduce pool/riffle ratios and habitat complexity. Brook trout are present but appear to be limited to areas downstream of bull trout populations. Lack of connectivity to other bull trout populations and small patch size are a significant concern for the single bull trout population in this watershed (Table 3-3). A Bureau of Land Management report recommended the replacement of the Hay Fork culvert with a bridge or open bottom arch to increase spawning and rearing habitat for bull trout (BLM 2003).

The most significant cause of terrestrial limiting factors in the Boise–Mores watershed is timber harvest, with 64% of the watershed having an impact rating of high (Table 3-6). The watershed has approximately 178 km (17%) of sediment-impaired streams (EPA 1998), and timber harvest and associated road construction is dramatically changing habitat distributions and integrity.

**Table 3-6. Comparison of the relative percentages of area impacted by the causes of limiting factors in the Boise–Mores watershed for terrestrial resources (ICBEMP 1997[a]).**

| Causes of Limiting Factors | Very Low | Low | Medium | High | Very High |
|---|---|---|---|---|---|
| Human population density | (*x*<1) | (1<*x*>10)<br>7 | (10<*x*>60)<br>80 | (60<*x*<100)<br>12 | (*x*>100)<br>2 |
| Habitat fragmentation | | 13 | 80 | 7 | |
| Altered fire regime<br>(1% of the area is not at risk) | | 28 | 42 | 28 | |
| Timber harvest<br>(10% of the area has no harvest) | | 21 | 4 | 64 | |
| Grazing/browsing<br>(20% of the area has no grazing) | | 12 | 63 | 5 | |

[a] For information about ICBEMP data limitations, see Appendix 1-2.

There are many water diversions [1] in the watershed (Figure 3-3), but they are not believed to impose an exceptional effect on any fish populations (Table 3-3). While population density and altered fire regime are significant causes of limiting factors, they are not considered to contribute as much as timber harvest to effects in the watershed. Habitat fragmentation and grazing are the least significant limiting factors in the Boise–Mores watershed, with 20% of the area ungrazed, 17% of the remaining not in use, and over 50% grazed by horses (Appendix 1-3).

[1] The points of water diversion (PODs) summed are actually water rights with surface water irrigation PODs associated with them. The total consists of the Snake River Basin Adjudication recommended rights, the claims they are or will be processing, and any other licensed and permitted rights currently recognized. There can be more than one POD associated with a water right and vice versa, so the count is an estimate. Also, because the amount of water that can be diverted at any one time depends on available water and many other factors, no diversion rates or volumes have been given. Models are being developed to estimate diversion rates or volumes, but the findings can only be verified and used in areas where there is a substantial effort at gauging the flow.

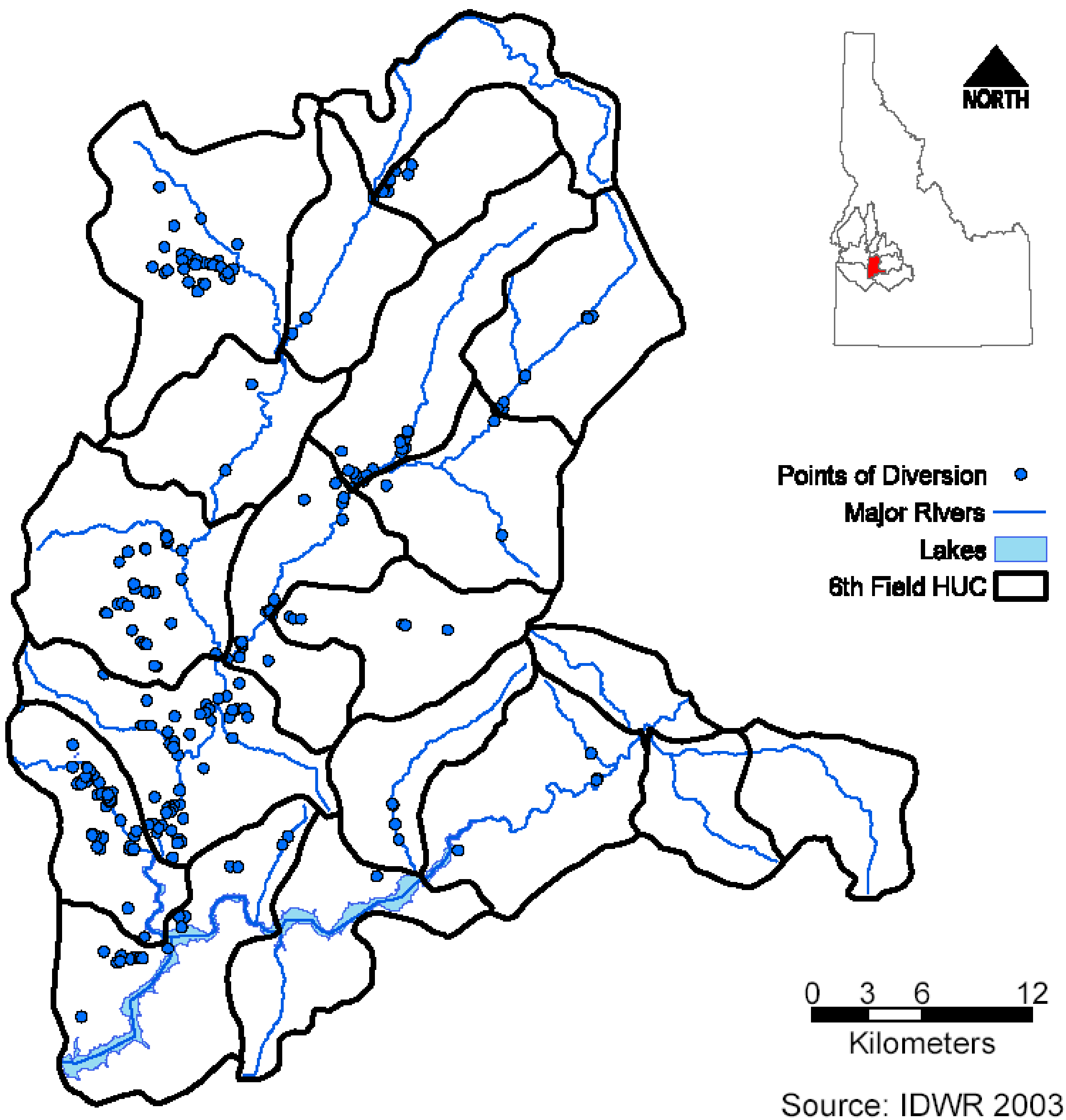


**Figure 3-3. Distribution of points of diversion in the Boise–Mores watershed (IDWR 2003). See Appendix 1-2 for information on limitations of this data set.**

### 3.1.4 Lower Boise

The Lower Boise watershed is in the center of the largest metropolitan area in Idaho, containing the urban areas of Boise, Meridian, Nampa, and Caldwell (Figure 3-4). Lucky Peak Dam controls flows in this section of the river. Riparian habitat has been significantly altered, and access to floodplains is limited. The reservoir has altered the timing and magnitude of water flows. These alterations are thought to negatively impact redband trout spawning (high flows following redd construction lead to scouring loss) (Table 3-3). Tributaries to the lower Boise River are severely altered. Additional water quality limitations may be imposed by stormwater inputs and nutrient loading from adjacent land uses.

The most significant causes of terrestrial limiting factors in the Lower Boise watershed are population density and habitat fragmentation (Table 3-7). Because of the urban areas of Boise, Meridian, Nampa, and Caldwell (Figure 3-4), this watershed is a major recreation area. The watershed has approximately 392 km (33%) of sediment-impaired streams (EPA 1998), and habitat fragmentation in this watershed is presumably a function of population density and land conversion. The effects of timber harvest and grazing, however, are relatively low. Over half of the Lower Boise watershed is not grazed (Appendix 1-3).

**Table 3-7. Comparison of relative percentages of area impacted by causes of limiting factors in the Lower Boise watershed for terrestrial resources (ICBEMP 1997[a]).**

| Causes of Limiting Factors | Very Low | Low | Medium | High | Very High |
|---|---|---|---|---|---|
| Human population density | ($x<1$) | ($1<x>10$) | ($10<x>60$)<br>3 | ($60<x<100$)<br>7 | ($x>100$)<br>90 |
| Habitat fragmentation | | | 16 | 51 | 33 |
| Altered fire regime<br>(50% of the area is not at risk) | | 3 | 46 | | |
| Timber harvest<br>(33% of the area has no harvest) | | 23 | 35 | 9 | |
| Grazing/browsing<br>(56% of the area has no grazing) | | 42 | 2 | | |

[a] For information about ICBEMP data limitations, see Appendix 1-2.

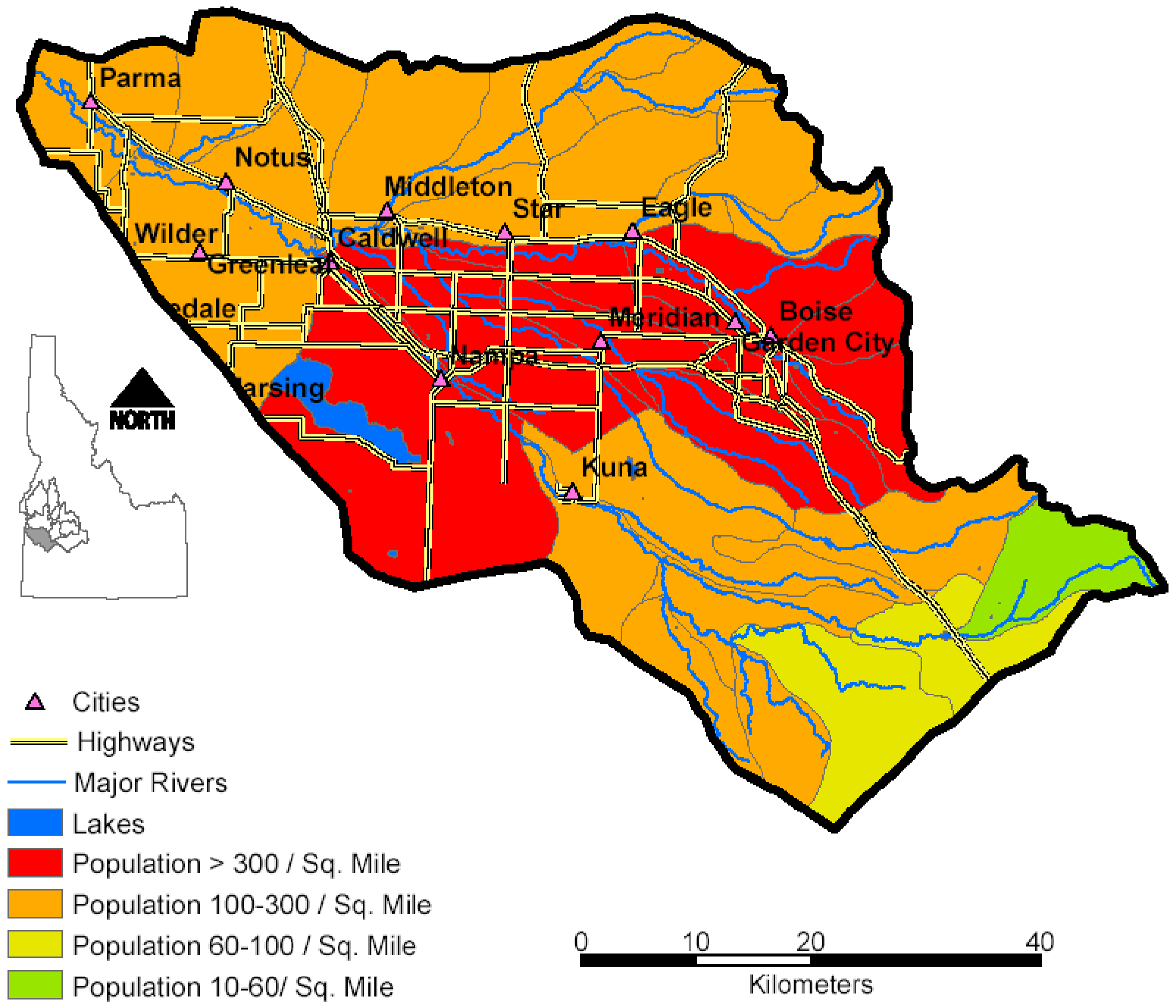


**Figure 3-4. Degree of urbanization in the Lower Boise watershed. See Appendix 1-2 for information on data limitations.**

### 3.1.5 South Fork Payette

Much of the South Fork Payette watershed is in relatively good condition. Deadwood Dam alters the hydrology and temperature of the Deadwood River and constitutes a major barrier to fish passage (Table 3-3 and Figure 3-5). Kokanee are present in Deadwood Reservoir. The kokanee population has been subject to numerous impacts from multiple management actions, including egg and fish removal. Stabilizing the kokanee population would likely benefit bull trout populations in the area. The Clear Creek drainage was noted as having relatively high road densities, fish passage issues from culverts, increased sedimentation and riparian alterations, and brook trout that threaten bull trout populations. Strong brook trout populations are present in some lakes in the headwater areas, and they provide a constant source population for the upper South Fork Payette River system. Impacts to native redband trout from hatchery-strain rainbow trout are suspected but unknown. The geology of the area makes the water extremely sterile, resulting in low densities of resident trout.

The most significant causes of terrestrial limiting factors in the South Fork Payette watershed are population density and timber harvest, with at least 25% of the watershed having an impact rating of high from these causes (Table 3-8). Sixty-one percent of the watershed is timbered to at least a moderate degree, and about one-third of the watershed has a density of between 10 and 60 residential homes per acre. While the altered fire regime does have a moderate influence in the watershed, its effects are not as great as those resulting from timber harvest and population density. Approximately 221 km (18%) of the streams in this watershed are sediment impaired. The least significant causes of limiting factors are grazing and habitat fragmentation. More than 75% of this watershed is allotted for grazing, most of which is for horses (Appendix 1-3).

**Table 3-8. Comparison of relative percentages of area impacted by causes of limiting factors in the South Fork Payette watershed for terrestrial resources (ICBEMP 1997[a]).**

| Causes of Limiting Factors | Very Low | Low | Medium | High | Very High |
|---|---|---|---|---|---|
| Human population density | $(x<1)$ | $(1<x>10)$<br>65 | $(10<x>60)$<br>34 | $(60<x<100)$<br>1 | $(x>100)$ |
| Habitat fragmentation | | 57 | 43 | | |
| Altered fire regime<br>(2% of the area is not at risk) | | 42 | 37 | 19 | |
| Timber harvest<br>(15% of the area has no harvest) | | 29 | 32 | 24 | |
| Grazing/browsing<br>(23% of the area has no grazing) | | | 50 | 27 | |

[a] For information about ICBEMP data limitations, see Appendix 1-2.

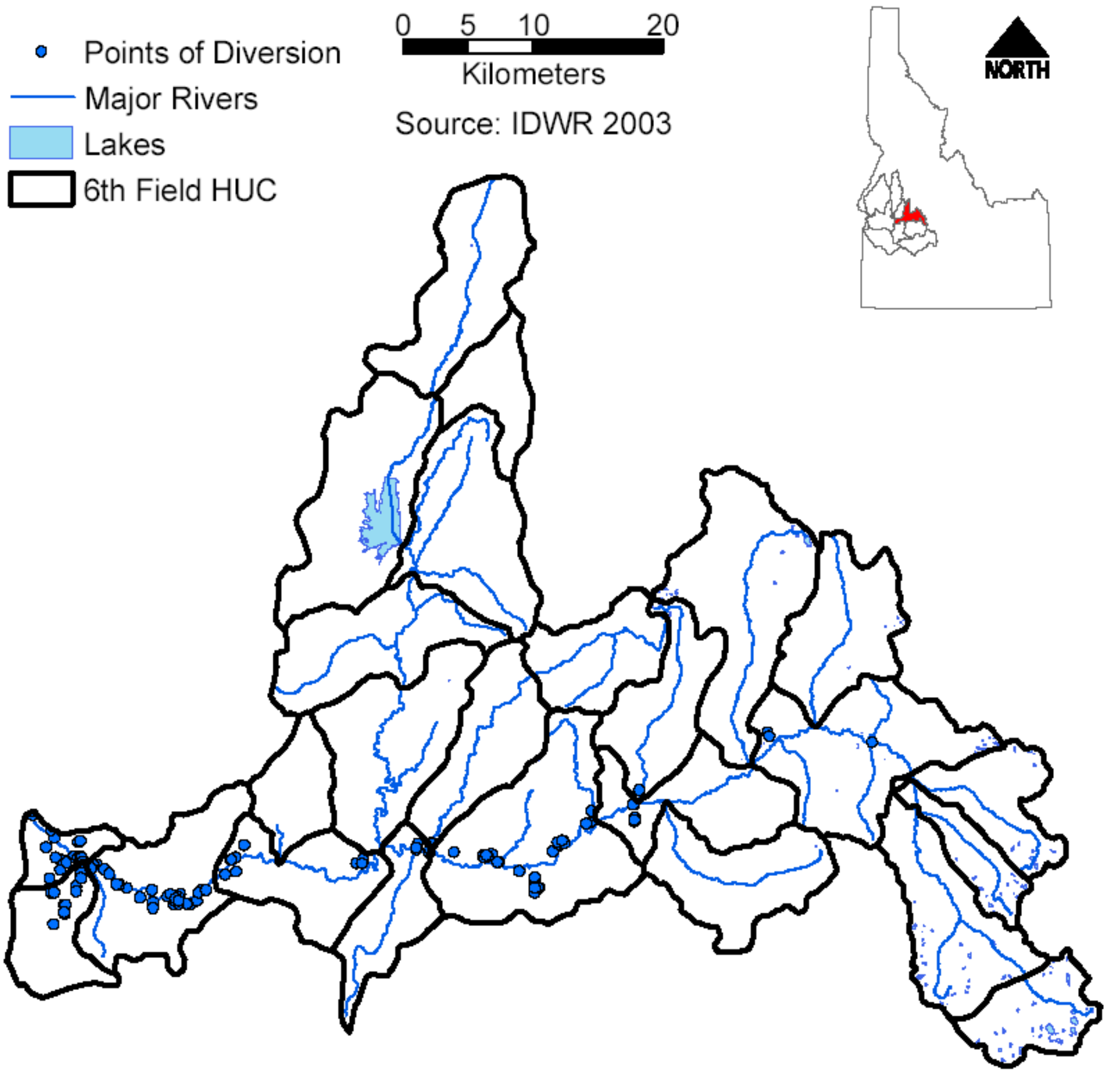


**Figure 3-5. Distribution of points of diversion in the South Fork Payette watershed (IDWR 2003). See Appendix 1-2 for information on limitations of this data set.**

### 3.1.6 Middle Fork Payette

The upper Middle Fork Payette watershed is heavily roaded, and a large number of barriers to waterways exist in the lower section of the watershed (Figure 3-6). The lower section of the mainstem river is on the 303(d) list as a sediment-impaired stream (Table 3-3). Lack of habitat complexity in the lower sections is noticeable. Connectivity to other bull trout populations in this watershed is a concern but unknown. The system lacks deep pools for overwintering salmonids, and significant riparian alterations have occurred in the drainage. Within this watershed, sterile hatchery rainbow trout are still stocked in Silver Creek, which is one of the few remaining waters to receive annual releases of rainbow trout.

The most significant cause of terrestrial limiting factors in the Middle Fork Payette watershed is timber harvest, with 66% of the watershed having an impact rating of high

(Table 3-9). The watershed contains 154 km (33%) of sediment-impaired streams. The altered fire regime and population density also have moderate influences in the watershed, but their effects are not considered to be as great as those from timber harvest. The least significant causes of limiting factors are habitat fragmentation and grazing, with 71% of the area grazed by horses and 21% not allotted for grazing (Appendix 1-3).

**Table 3-9. Comparison of relative percentages of area impacted by causes of limiting factors in the Middle Fork Payette watershed for terrestrial resources (ICBEMP 1997[a]).**

| Causes of Limiting Factors | Very Low | Low | Medium | High | Very High |
|---|---|---|---|---|---|
| Human population density | $(x<1)$ | $(1<x>10)$ 54 | $(10<x>60)$ 46 | $(60<x<100)$ | $(x>100)$ |
| Habitat fragmentation | | 11 | 89 | | |
| Altered fire regime | | 24 | 40 | 35 | |
| Timber harvest (5% of the area has no harvest) | | 26 | 4 | 66 | |
| Grazing/browsing (21% of the area has no grazing) | | | 24 | 55 | |

[a] For information about ICBEMP data limitations, see Appendix 1-2.

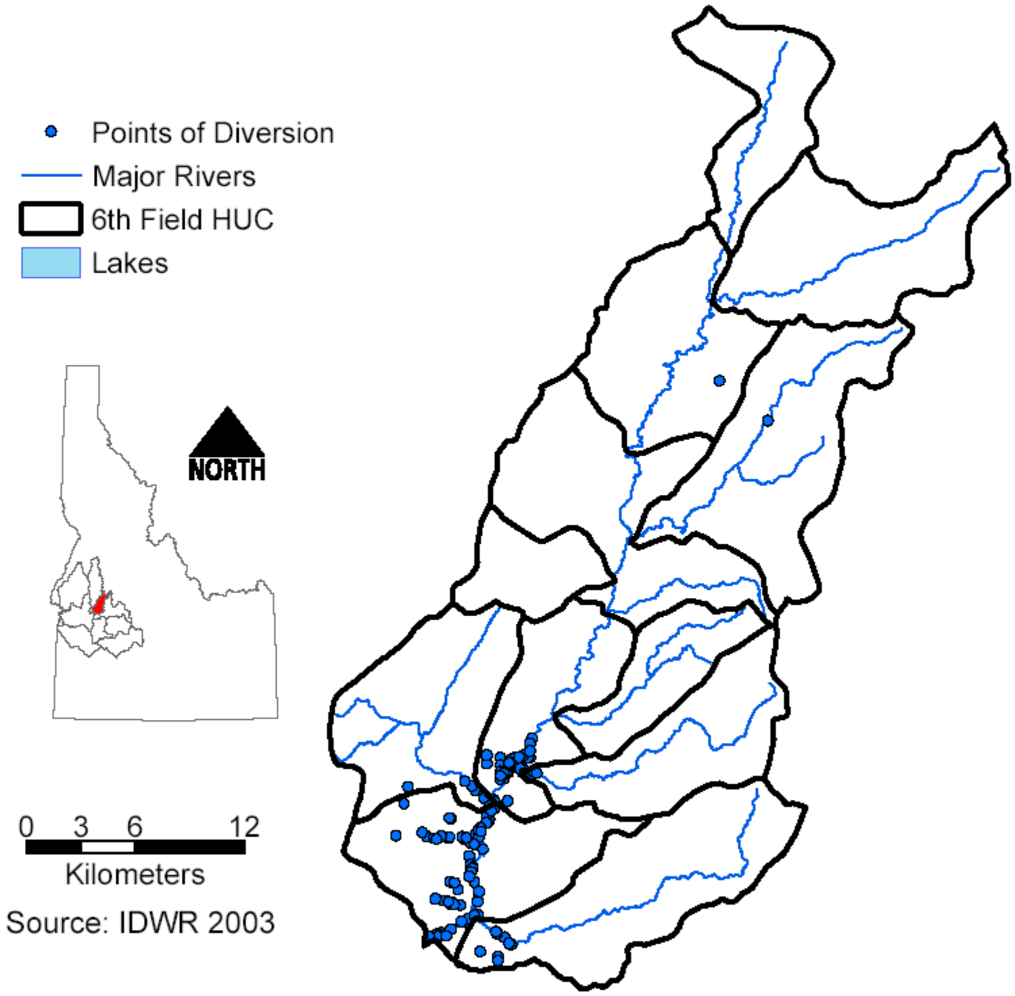


**Figure 3-6. Distribution of points of diversion in the Middle Fork Payette watershed (IDWR 2003). See Appendix 1-2 for information on limitations of this data set.**

### 3.1.7 North Fork Payette

Cascade Reservoir is located on the North Fork Payette River. Cascade Dam constitutes a complete blockage for upstream fish migration, and the reservoir increases water temperatures in the summer. Sediment is a concern for the lower sections of streams in this watershed. Only two bull trout populations occur in the watershed, and the persistence of these populations is threatened by three factors: 1) lack of connectivity to other populations in other bull trout core areas in the Payette River subbasin, 2) habitat fragmentation from fish-passage barriers (dams and culverts, see Figure 3-7), and 3) presence of brook trout (Table 3-3). The Gold Fork diversion was mentioned as a priority for fish passage, as were screening diversions on Lake Fork. The kokanee population in Payette Lake is self-sustaining, and the major concern is keeping the spawning habitat in good condition.

The most significant cause of terrestrial limiting factors in the North Fork Payette watershed is timber harvest, with at least 67% of the total area having an impact rating of high (Table 3-10). The watershed contains 181 km (16%) of sediment-impaired streams, and over 77% of the region is at least moderately effected by timber harvest. The altered fire regime and population density also have moderate influences in the watershed, but these effects are not as great as those resulting from timber harvest. The least significant causes of limiting factors are habitat fragmentation and grazing, with 53% of the area not grazed and 29% of the remaining area allotted for grazing but not currently used (Appendix 1-3).

**Table 3-10. Comparison of relative percentages of area impacted by causes of limiting factors in the North Fork Payette watershed for terrestrial resources (ICBEMP 1997[a]).**

| Causes of Limiting Factors | Very Low | Low | Medium | High | Very High |
|---|---|---|---|---|---|
| Human population density | ($x$<1)<br>2 | (1<$x$>10)<br>6 | (10<$x$>60)<br>74 | (60<$x$<100)<br>17 | ($x$>100)<br>1 |
| Habitat fragmentation | | 8 | 79 | 12 | 1 |
| Altered fire regime<br>(10% of the area is not at risk) | | 29 | 41 | 20 | |
| Timber harvest<br>(5% of the area has no harvest) | | 19 | 10 | 67 | |
| Grazing/browsing<br>(53% of the area has no grazing) | | | 21 | 26 | |

[a] For information about ICBEMP data limitations, see Appendix 1-2.

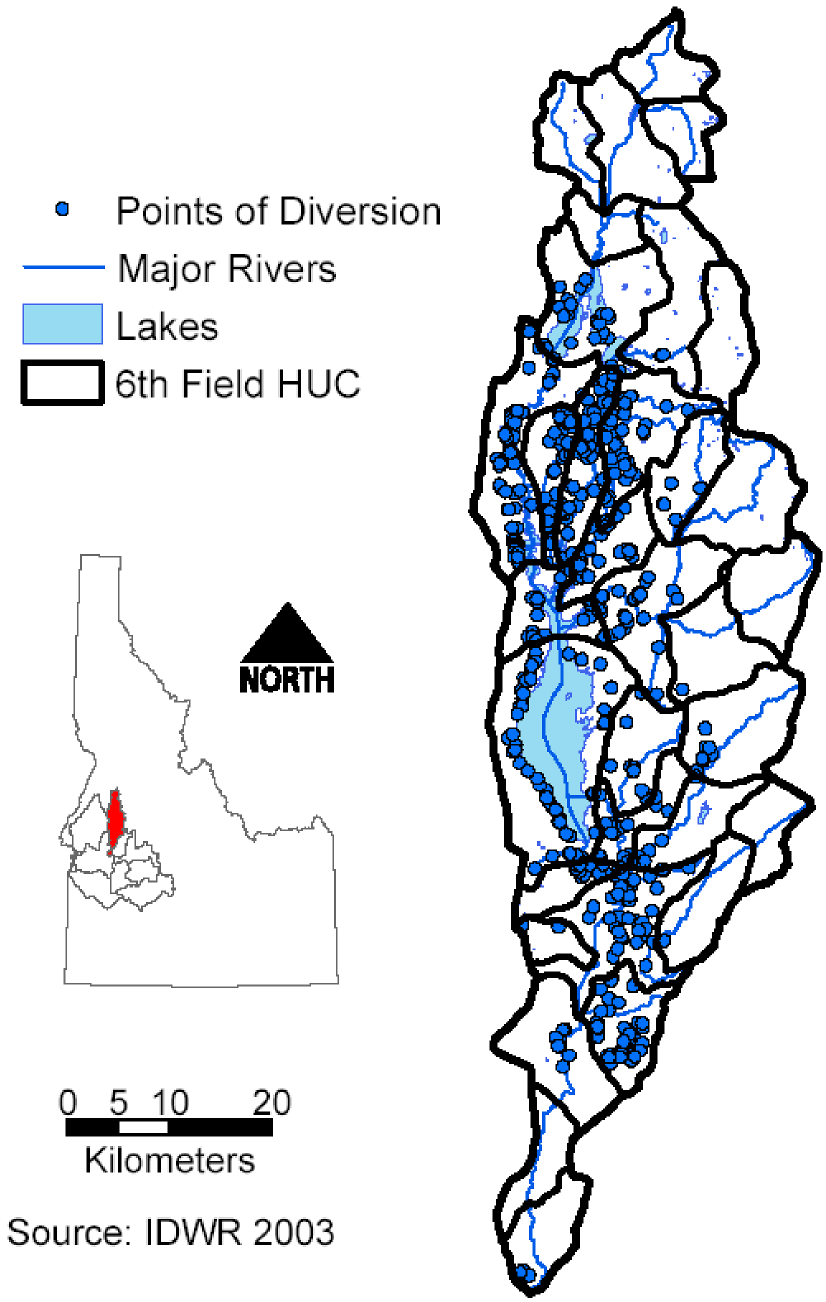


**Figure 3-7. Distribution of points of diversion in the North Fork Payette watershed (IDWR 2003). See Appendix 1-2 for information on limitations of this data set.**

### 3.1.8 Mainstem Payette

Black Canyon Dam is located on the Payette River in the mainstem Payette watershed. The reservoir is a complete blockage to upstream fish migration, has a high turnover rate, is very shallow, and provides little fish habitat. The river below the reservoir has high temperatures, and coldwater fish abundances decline downstream of the reservoir (Table 3-11). The lower Payette River is dominated by introduced warmwater fish. Bull trout are present in the Squaw Creek drainage, and fish passage barriers (culverts) are a threat to population persistence (Figure 3-8). The lower section of Squaw Creek has unscreened diversions, and the channel may dewater at certain times of the year. The lower section of Squaw Creek is on the 303(d) list for sediment impairment. Brook trout are present in the Squaw Creek drainage, but they are not in high abundance.

The most significant cause of terrestrial limiting factors in the Payette watershed is habitat fragmentation, with 60% of the total area having an impact rating of high (Table 3-3). The watershed contains 110 km (8%) of sediment-impaired streams. Timber harvest and population density also have moderate influences in the watershed, but their effects are not as great as those resulting from habitat fragmentation. The least significant causes of limiting factors are altered fire regime and grazing, with 19% of the area not grazed and 17% of the remaining area allotted for grazing but not currently used. The remainder of grazed area is designated as status unknown in the source data (Appendix 1-3).

**Table 3-11. Comparison of relative percentages of area impacted by causes of limiting factors in the Payette watershed for terrestrial resources (ICBEMP 1997[a]).**

| Causes of Limiting Factors | Very Low | Low | Medium | High | Very High |
|---|---|---|---|---|---|
| Human population density | (*x*<1) | (1<*x*>10) | (10<*x*>60)<br>57 | (60<*x*<100)<br>27 | (*x*>100)<br>16 |
| Habitat fragmentation | | | 40 | 60 | |
| Altered fire regime<br>(10% of the area is not at risk) | | 13 | 69 | 8 | |
| Timber harvest<br>(37% of the area has no harvest) | | 29 | 13 | 21 | |
| Grazing/browsing<br>(19% of the area has no grazing) | | 55 | 24 | 2 | |

[a] For information about ICBEMP data limitations, see Appendix 1-2.

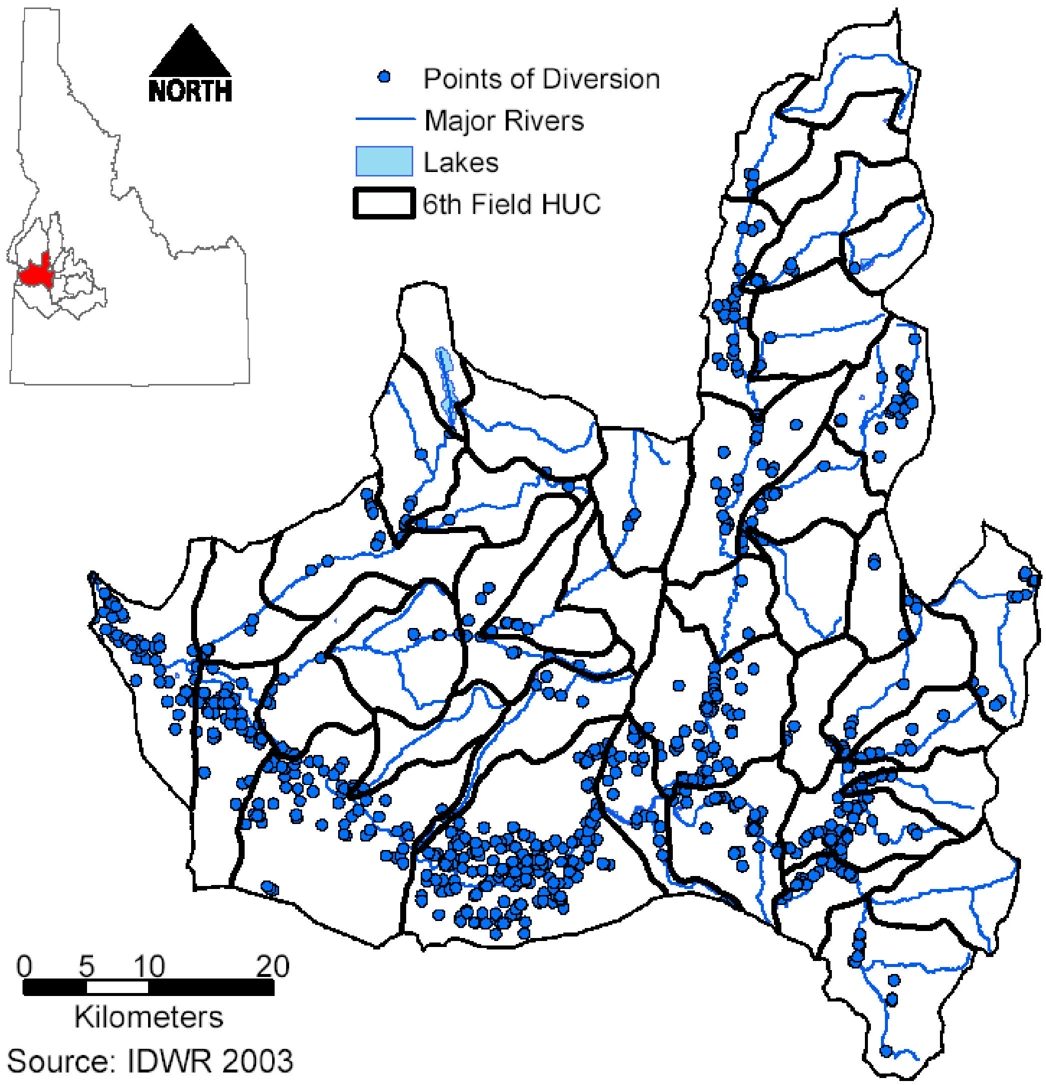


**Figure 3-8. Distribution of points of diversion in the mainstem Payette watershed (IDWR 2003). See Appendix 1-2 for information on limitations of this data set.**

### 3.1.9 Weiser

The Weiser watershed is impacted by high road densities and increased sedimentation from land use (Table 3-3). Some sections of the river and some tributaries are dewatered at certain times of the year. There are very few bull trout populations in this watershed. Fragmentation of existing populations from culverts is a major issue (Figure 3-9), as is the isolation of bull trout populations from each other regarding the long-term persistence of these populations. Brook trout are a concern where they are sympatric with bull trout.

The most significant cause of terrestrial limiting factors in the Weiser watershed is habitat fragmentation, with 100% of the total area having an impact rating of medium or greater (Table 3-12). The watershed contains 325 km (17%) of sediment-impaired streams. The altered fire regime, habitat fragmentation, and timber harvest also have moderate influences in the watershed, but their effects are not as great as that resulting from habitat fragmentation. Grazing is a notable cause of limiting factors in the Weiser subbasin, with 37% of the total area grazed by cattle or cattle and sheep combined, and 53% of the area classified as status unknown (Appendix 1-3).

**Table 3-12. Comparison of relative percentages of area impacted by the causes of limiting factors in the Weiser watershed for terrestrial resources (ICBEMP 1997[a]).**

| Causes of Limiting Factors | Very Low | Low | Medium | High | Very High |
|---|---|---|---|---|---|
| Human population density | ($x<1$) | ($1<x>10$) | ($10<x>60$)<br>82 | ($60<x<100$)<br>13 | ($x>100$)<br>5 |
| Habitat fragmentation | | | 35 | 62 | 3 |
| Altered fire regime<br>(10% of the area is not at risk) | | 29 | 41 | 20 | |
| Timber harvest<br>(29% of the area has no harvest) | | 33 | 15 | 24 | |
| Grazing/browsing<br>(7% of the area has no grazing) | | 31 | 55 | 7 | |

[a] For information about ICBEMP data limitations, see Appendix 1-2.

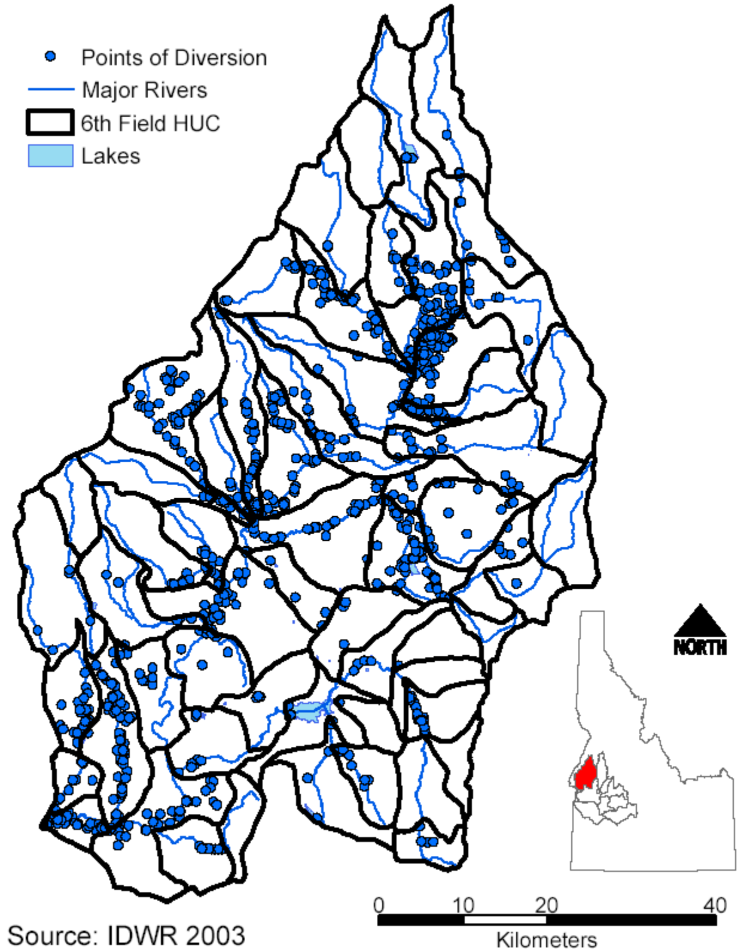


**Figure 3-9. Distribution of points of diversion in the Weiser watershed (IDWR 2003). See Appendix 1-2 for information on limitations of this data set.**

## 3.2 Out-of-Subbasin Effects

While this assessment is focused on in-basin systems and effects, it must also be acknowledged that, within a subbasin, significant impacts may be realized from causes outside that subbasin. Because the Columbia River drainage is very large and diverse, a complete assessment of any singular subbasin also requires a holistic overview of the effects of the drainage system as a whole and the implication of these large-scale out-of-basin effects on that subbasin. For this discussion, out-of-subbasin effects are organized into two parts: aquatic and terrestrial.

### 3.2.1 Out-of-Subbasin Effects to Aquatic Resources

Dams within the Boise and Payette subbasins are operated to meet irrigation needs and generate electricity. Most of the points of use for irrigation water are within the subbasin, but the hydropower generated within the two subbasins is part of the larger generating networks of the Federal Columbia River Power System (FCRPS) and Idaho Power Company. Due to the interconnected nature of the power systems, reservoir operations for power production are influenced by power needs and generating capacities within and outside the subbasins. In addition to power generation, water from the upper Snake River basin (i.e., upstream of Lower Granite Dam) is used for flow augmentation for salmon migration in the lower Snake and Columbia rivers. Approximately 427,000 acre-feet of water is provided annually by the U.S. Bureau of Reclamation (BOR) to meet flow-augmentation requirement of the 2000 biological opinion (NMFS 2000). The BOR is obligated to ensure a high likelihood of providing this amount of water each year. To attain the requirement of 427,000 acre-feet, the BOR has initiated a program to acquire reservoir storage space and natural flow rights throughout the drainage above Lower Granite Dam. This water can come from anywhere in the Snake River basin, including reservoirs in the Boise or Payette subbasins.

The Hells Canyon Complex (Brownlee, Oxbow, and Hells Canyon dams), which is located on the Snake River downstream of the Boise, Payette, and Weiser subbasins, represents a complete barrier to fish migration. The lack of suitable fish-collection and -passage technology available when the Hells Canyon Complex was constructed resulted in the elimination of Chinook salmon and steelhead from the Weiser subbasin. Any future attempts to reintroduce salmon and steelhead to the Boise, Payette or Weiser subbasin will require development of suitable fish-collection and -passage technology to overcome passage issues at the Hells Canyon Complex.

### 3.2.2 Out-of-Subbasin Effects to Terrestrial Resources

Out-of-basin effects are most frequently discussed in terms of the impacts to aquatic resources, primarily anadromous fish species. Furthermore, discussions of the out-of-basin effects have largely ignored the role of salmon in ecosystems where they hatch, rear, spawn, and die. Relatively little information has been collected pertaining to the role that anadromous fish populations have in the function of terrestrial landscape components.

For terrestrial assessment purposes, out-of-basin effects in the Boise, Payette, and Weiser subbasins are discussed in terms of the following categories:

- Nutrient loss
- Noxious weeds
- Insect and disease outbreaks—natural and unnatural
- Invasive exotic wildlife
- Habitat linkages
- Genetic linkages
- Development
- Habitat loss
- Climate cycles—short term and long term

#### *3.2.2.1 Nutrient Loss*

Salmon declines are traditionally viewed in terms of species extinction and diminishing supply for sport and commercial fishing. Therefore, salmon recovery has focused on production hatcheries, mainstem migration, and harvest constraints. When salmon return from the ocean to spawn, they bring vital nutrients with them to the watershed. Through decomposing carcasses, the salmon spawning process offers a vital source of food not just for other fish species, but also for a whole host of organisms in the watershed. Salmon are vital to ecosystem health. This reduction in nutrients is one indication of ecosystem instability resulting in the degradation of aquatic and terrestrial species and habitats (Gresh *et al*. 2000).

Many wildlife species feed on anadromous fishes of several life-history stages (Willson and Halupka 1995). There is evidence that the availability of anadromous fish is critically important for the survival or reproduction of some wildlife species. In some regions, anadromous fishes in fresh water appear to be keystone food resources for vertebrate predators and scavengers, forging an ecologically significant link between aquatic and terrestrial ecosystems (Willson and Halupka 1995). The spatial distribution of anadromous fish in fresh water, including the occurrence of runs in very small streams, has important consequences for wildlife biology (social interactions, distributions, activity patterns, and survivorship) and conservation biodiversity (Willson and Halupka 1995).

In Idaho, anadromous fish were once found in more than 60% of the state (IDFG 1992a). Prior to development, Idaho produced an estimated 39% of the total spring Chinook salmon, 45% of the total summer Chinook salmon, 5% of the total fall Chinook salmon, and 55% of the total summer steelhead in the Columbia River basin (Mallet 1974). These unique species, as well as sockeye salmon and Pacific lamprey, hatch and rear in freshwater streams and migrate to and from the ocean, a distance of up to 900 miles (1,448 km).

This reduction in nutrients is one indication of ecosystem failure that has contributed to the downward spiral of salmonid abundance and diversity and the terrestrial species and habitats dependent on those nutrient resources (Gresh *et al*. 2000).

In the Boise, Payette, and Weiser subbasins, alterations and dams within the subbasins initially impacted anadromous fish runs. The completion of Brownlee Dam in 1958 eliminated salmon and steelhead from the Boise, Payette and Weiser subbasins.

#### 3.2.2.2 Noxious Weeds

The issues of noxious weeds and the effects they are having on the Boise, Payette, and Weiser subbasin habitats have been discussed in detail in other sections (affected watersheds in section 3.1 and section 1.7.5). Regarding noxious weeds in the Boise, Payette, and Weiser subbasins, out-of-basin effects result from the influx of people, livestock, and equipment into the subbasin for various work or recreational activities (Karl *et al*. 1996). The Boise, Payette, and Weiser subbasins provide numerous recreational opportunities for fishing, hunting, and water-sports enthusiasts. The rapid spread of many noxious weeds in the Boise, Payette, and Weiser subbasins can be primarily attributed to human activities that bring “contaminated” equipment, gear, livestock, and livestock supplies into the subbasin from areas outside (Karl *et al*. 1996, NISC 2003). State, federal, and nongovernmental organizations are collaborating to document and track the spread of noxious weeds (USNAL 2004). The science of invasive species management seeks to develop management tools, technologies, and strategies for effective control of noxious weeds at the appropriate landscape scales (TNC 2003).

#### 3.2.2.3 Insect and Disease Outbreaks

Insect and disease outbreaks are both natural and common events in the Boise, Payette, and Weiser subbasins. Generally, most insect infestations are localized occurrences with little impact or ramifications at larger scales (Amman and Cole 1983). However, given the altered functionality of some aspects of the environment, each additional disruption of ecological function becomes cumulative and leads to further decline of environmental integrity (section 2.3.6).

The effects of deleterious disease outbreaks in the form of whitebark pine blister rust are illustrated in Table 3-1. Regarding insect and disease outbreaks in the Boise, Payette, and Weiser subbasins, out-of-basin effects may be discussed in terms of vectors and pathways (NISC 2003). Pathways are the means by which species are transported from one location to another. Natural pathways include wind, currents, and other forms of dispersal that specific species have developed morphologically and behaviorally (NISC 2003). Man-made pathways are those that are enhanced or created by human activity. These are characteristically of two types (NISC 2003).

The first type is intentional or the result of a deliberate action to translocate an organism. Examples of intentional introductions include the intended movement of living seeds, whole plants, or pets. A specific intentional pathway can only be judged by the positive or negative impact of the organisms being moved (NISC 2003).

The second type is the result of unintentional movement of organisms. Examples of unintentional pathways are ballast water discharge (e.g., red-tide organisms), soil associated with the trade of nursery stock (e.g., fire ants), fruit and vegetable importation (e.g., plant pests), and the international movement of people (e.g., pathogens). In these and countless other unintentional pathways, the movement of species is an indirect byproduct of our activities (NISC 2003).

For the purposes of the National Invasive Species Council (NISC), the term “vector” is viewed as a biological pathway for a disease or parasite (i.e., an organism that transmits pathogens to various hosts) and is not completely synonymous with the much broader definition of a pathway (NISC 2003).

#### *3.2.2.4 Invasive Exotic Wildlife*

Invasive exotic wildlife may have significant impacts on Boise, Payette, and Weiser subbasin aquatic and terrestrial habitats and species. Although neither species is currently documented in the Boise, Payette, and Weiser subbasins, two species of exotic wildlife with potential negative impacts to Salmon subbasin watersheds include the New Zealand mudsnail and the bullfrog.

Around 1986, the New Zealand mudsnail was most likely introduced to Idaho from imported products at a fish hatchery near Hagerman, Idaho, from which it was widely disseminated through trout stocking (Bowler 1991). This western American strain is clonal and apparently did not bring the normally associated trematode parasites with it. Without its natural enemies, the mudsnail has spread uncontrolled through some of the most productive waters in North America (Bowler 1991). The mudsnail has a tremendous propensity to populate its environment rapidly, and upward of 700,000 mudsnails per square meter have been found in some waters. The mudsnail does not appear to be self-limiting from density-dependent effects. Their sheer numbers dominate the base of the food web, and they can consume over 80% of a river’s productivity (Bowler 1991). Though quantitative analysis is not yet published, it appears quite likely that the presence of large numbers of New Zealand mudsnail can have a profoundly negative impact on a trout or salmon fishery with subsequent negative impacts to terrestrial resources.

Introduced predators such as the bullfrog can have devastating effects on faunas that evolved without equivalent predatory types (Schwalbe and Rosen 1988). The bullfrog, as an exotic in the absence of key original enemies (the basses, pikes, snapping turtles, and water snakes of the eastern United States), attains tremendous population densities. Such nonnative predators, in core population areas of native species, can lead to regional extinctions and may account for some unexplained amphibian declines (Schwalbe and Rosen 1988).

#### 3.2.2.5 Habitat Linkages

Maintaining wild habitats that support the long-term survival of native wildlife populations throughout the Columbia River basin and providing for the continued course of the region's large-scale evolutionary and ecological processes require scientific and conservation action at the continental scale (Noss and Soule 1998, Robinson *et al*. 2004).

Habitat fragmentation has been recognized as a major threat to the survival of natural populations and the functioning of ecosystems. The reduction of large, more or less continuous habitats to small and isolated patches may affect the abundance and species composition of those living in the area (Martin *et al*. 2000). Some factors that may contribute to this decline include changes in predation or food availability, microclimatic effects, loss of genetic variation, and lack of recolonization following local extinctions (Noss and Soule 1998, Robinson *et al*. 2004).

Unfortunately, the effects of this widespread habitat fragmentation on populations remain unknown. Further, some of the species affected may be dominant carnivores and act as "keystone predators." These are species whose removal dramatically alters the composition of ecological communities by resulting in the decline and extinction of some species and marked increase in others (Noss and Soule 1998, Carroll *et al.* 2001, Robinson *et al*. 2004).

Although certain species have much more influence than others on an ecosystem's structure, not all ecosystems include a single species that exerts such a pervasive influence. In fact, most ecosystems are somewhat sensitive to the loss of any one of many species, though some losses have greater impact on the system than others (Noss and Soule 1998, Woodroffe and Ginsberg 1998, Gittleman *et al*. 2001, Mattson and Merrill 2002, Robinson *et al*. 2004).

One of the approaches that conservation biology implements to mitigate the effects of habitat fragmentation is the development of habitat reserves and wildlife corridors. All species require a minimum amount of habitat for survival. Wildlife habitat reserves are established to meet these requirements for as many species as possible. Some national parks, wilderness areas, and other protected habitats are suitable for the survival of a wide range of species (Noss and Soule 1998, Haila 1999, Robinson *et al*. 2004). Maintaining connectivity or "linkage" between wildlife populations across the landscape will make for healthier populations and could prevent many of the detrimental consequences of habitat fragmentation. Maintaining opportunities for wildlife movement across the landscape preserves the natural processes that animals have used for centuries (Servheen and Sandstrom 1993, Ruediger *et al*. 1999, Ruediger *et al*. 2000).

The physical representation of a subbasin or watershed is defined primarily by the geomorphology of the landscape and secondarily by humans seeking to understand complex ecosystem structure and function in a context that is comprehensible. The functional components of the landscape do not necessarily "recognize" the anthropogenic or natural boundaries that are used to describe the environment. Habitat fragmentation, either natural or anthropogenic, may become an out-of-basin effect, if a specific functional components becomes limited outside of the subbasin, thereby increasing the importance or significance of that component inside the subbasin.

#### 3.2.2.6 Genetic Linkages

Other effects of habitat fragmentation can be changes in population structure resulting from changes in dispersal patterns. As fragmentation proceeds, dispersal from one habitat fragment to another becomes more difficult. Many studies have addressed the threats to the small populations resulting from the fragmentation of formerly large populations (Noss 1991). The basic idea is that local populations become separated so widely that their demography and genetic dynamics become independent of one another, which may eventually lead to local extinctions and/or loss of genetic variation (Noss and Soule 1998, Robinson *et al*. 2004).

Regional groups of interconnected populations are called metapopulations. These metapopulations are, in turn, connected to one another over broader geographic ranges. As local populations within a metapopulation fluctuate in size, they become vulnerable to extinction during periods when their numbers are low. Extinction of local populations is common in some species, and the regional persistence of such species is dependent on the existence of a metapopulation (Flather *et al*. 1998). As a result, the elimination of a portion of the metapopulation structure of some species can increase the chance of regional extinction of the species (Noss and Soule 1998, Robinson *et al*. 2004).

Out-of-basin losses of metapopulation structure may have important ramifications to aquatic and terrestrial components of the landscape within the Boise, Payette, and Weiser subbasins. It is relatively easy to comprehend the significance of the loss of prominent species such as Chinook salmon or the grizzly bear. It is much more difficult to comprehend the role less conspicuous species have in metapopulation structure and ecosystem function. Conserving genetic diversity at landscape scales is essential because genetic variation allows species to adapt and survive environmental changes (Noss and Soule 1998, Robinson *et al*. 2004).

Ecosystem diversity is thought of as the broadest means for protecting species diversity and genetic diversity (Noss 1983). To protect an ecosystem, all the species within that ecosystem must be protected (Groves *et al.* 2002). Populations of many species are not completely isolated but are connected by the movement of individuals (immigration and emigration). Consequently, the dynamics and evolution of many local populations are determined by both the populations’ life histories and patterns of movement of individuals between populations (Noss and Soule 1998, Robinson *et al*. 2004).

#### *3.2.2.7 Development*

Human impacts on wildlife and habitats have been accelerated in the Boise, Payette, and Weiser subbasins as a result of development of federal hydropower projects in the Columbia River basin. Having a reliable and affordable power source, irrigation water supply, and employment opportunities provided impetus for development of agriculture and other industry (NPCC 2003).

This development has led to increased human disturbance of wildlife populations, increased human use of wildlife, and accelerated habitat losses across the Boise, Payette, and Weiser subbasins. Factors limiting terrestrial resources in the Boise, Payette, and Weiser subbasins are dominated by modification of forested stands through timber management and combined effects of mining, grazing, agriculture, and residential development, including roads (NPCC 2003).

While difficult to quantify, the indirect effects of hydropower development can be far-reaching. Mitigation for these effects will address a broader array of habitats and species than the construction loss assessments. Protection of existing high-value habitats and restoration of habitats are viewed as primary goals (NPCC 2003).

Habitat losses due directly to the construction of the four lower Snake River dams have been identified in the *Lower Snake River Compensation Plan* (LSRCP) process (USFWS 2001). Mitigation for those fish and wildlife habitat losses has been primarily focused on aquatic resources, with an emphasis on hatchery production to replace salmon and steelhead lost when the dams were completed (USFWS 2001). Habitat loss assessments and mitigation efforts have occurred in downstream sections of the lower Snake River, but the LSRCP was not established to deal with habitat losses in Boise, Payette, and Weiser subbasin watersheds due to the secondary effects of hydropower generation (BPA 1997, NPCC 2003). The NPCC has a funding process whereby terrestrial and aquatic habitats can potentially receive funding for restorative work. However, the terrestrial components of the landscape have received comparatively little funding (NPCC 2004).

#### *3.2.2.9 Climate Cycles*

Climatic variation is identified as an out-of-basin effect since research is beginning to show that land-use practices can influence regional climate and vegetation in adjacent natural areas in predictable ways (Pielke *et al*. 1994, Stohlgren *et al*. 1998). Northern ecosystems are expected to be particularly sensitive to climatic changes. In addition, climatic changes are predicted to be most pronounced in the North, with implications for biodiversity, annual growth pattern, forage quality, and carrying capacity for terrestrial species (UNEPWCMC 2004). Climate change is likely to have considerable impacts on most or all ecosystems. The distribution patterns of many species and communities are determined, to a large degree, by climatic parameters, but the responses to changes in these parameters are rarely simple (UNEPWCMC 2004).

At the simplest level, changing patterns of climate will change the natural distribution limits for species or communities. In the absence of barriers, it may be possible for species or communities to migrate in response to changing conditions. Vegetation zones may move toward higher latitudes or higher altitudes following shifts in average temperatures. In most cases, natural or man-made barriers will impact the natural movement of species or communities (UNEPWCMC 2004).

Rainfall and drought will also be of critical importance. Extreme flooding will have implications for large areas, especially riverine and valley ecosystems. Rates of change will also be important, and these rates will vary at regional and even local levels. The maximum rates of spread for some sedentary species, including large tree species, may be slower than the predicted rates of change in climatic conditions (UNEPWCMC 2004). In many cases, further complications will arise from the complexity of species interactions and differential sensitivities to changing conditions among species. Certain species may rapidly adapt to new conditions and act in competition with others (UNEPWCMC 2004). Negative impacts may include increased ranges of insect pests and diseases, as well as failure of crops in some regions from drought or flooding (UNEPWCMC 2004).

Mesoscale atmospheric/land-surface modeling, short-term trends in regional temperatures, forest distribution changes, and hydrology data indicate that the effects of land-use practices on regional climate may overshadow larger-scale temperature changes commonly associated with observed increases in carbon dioxide and other greenhouse gases (Pielke *et al.* 1994, Stohlgren *et al*. 1998).

# 4 Inventory/Synthesis

## 4.1 Inventory

A component of the assessment process is the examination of previous and current management actions (projects) that seek to address limiting factors for focal species and habitats in the Boise, Payette, and Weiser subbasins. The inventory (Appendix 4-1) provides a list of fish and wildlife restoration activities being conducted in each watershed in the Boise, Payette, and Weiser subbasins, including information on project funding. 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 subbasins 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 Boise, Payette, and Weiser subbasins contain roadless and other protected areas, including land under wilderness and roadless designations as described in section 1 of this assessment.

### 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 watersheds within the Boise, Payette, and Weiser subbasins were reviewed in the subbasin summaries (NPPC 2002, p. 109–124).

Important and ongoing management plans and programs include mitigation for the Anderson Ranch and Black Canyon facilities (i.e., dams, power plants, and reservoir areas associated with these federal hydropower projects), under the direction of the Pacific Northwest Electric Power Planning and Conservation Act of 1983 and the subsequent Northwest Power and Conservation Council's Columbia River Basin Fish and Wildlife Program.

The Anderson Ranch facility covered about 4,812 acres of wildlife habitat, while the Black Canyon facility covered about 1,115 acres. These acreages include dam and power plant staging areas. A separate mitigation plan has been developed for each facility. A modified Habitat Evaluation Procedure (HEP) was used to assess the benefits of mitigation plans to wildlife. The interagency work group used target species habitat units (HUs) lost at each facility as a guideline during the mitigation planning process while considering the needs of wildlife in the areas. Totals of 9,619 and 2,238 target species HUs were estimated to be lost in the Anderson Ranch and Black Canyon/Deadwood facility areas, respectively. Through a series of projects, the mitigation plans provide benefits of 9,620 target species HUs to mitigate for wildlife impacts resulting from the Anderson Ranch facility and benefits of 2,195 target species HUs to mitigate for wildlife impacts from the Black Canyon facility. Target species to be benefited by the Anderson Ranch and/or Black Canyon mitigation plans include the mallard, Canada goose, mink, yellow warbler, black-capped chickadee, ruffed grouse, mule deer, blue grouse, sharp-tailed grouse, ring-necked pheasant, and peregrine falcon (IDFG 1986).

The goal of the mitigation plan for the Anderson Ranch facility is to at least replace the target species HUs lost due to the development and operation of the facility through a combination of the protection and enhancement projects. Per agreement between the Idaho Department of Fish and Game and Bonneville Power Administration (Project No. 86-73), the interagency work group has made a strong effort to develop mitigation actions (projects) that address the needs of wildlife and benefit the greatest number of target species. However, as large multiple-species projects are developed, it becomes apparent that some target species will gain more HUs than were originally lost, while other targets species will gain fewer HUs than were lost. With this knowledge, the interagency work group agreed that some tradeoffs between species would have to occur to meet contractual agreements and provide for the needs of wildlife in the area. Furthermore, this methodology provides for the most cost-effective and reasonable means of mitigation (IDFG 1987).

From 1997 to 2000, 14,038 HUs were protected or enhanced on approximately 23,000 acres. Easements are expected to continue in the future, and funding has been secured for at least partial continuance (average ~$380,000/year for 2002–2005). It is projected that, by 2010, 40,719 HUs will be mitigated for wildlife habitat, which will address 75% of the construction losses (NPPC 2002). No fisheries loss assessment has been conducted for federal hydropower projects in the Boise or Payette subbasins.

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

1. *State of Idaho Strategic Plan for Idaho* (www.agri.state.id.us/PDF/Animal/Strategic%20Plan.pdf)

2. Bureau of Land Management's *Abandoned Mine Lands Plan* (AML; www.id.blm.gov/aml/program.htm)

3. Great Basin Restoration Initiative (www.fire.blm.gov/gbri/)

4. *Standards for Rangeland Health and Guidelines for Livestock Grazing Management" for Idaho* (www.id.blm.gov/publications/data/SGFinal.pdf)

5. Idaho Department of Fish and Game's *Wolf Management Plan* (www.accessidaho.org/species/id_wolf_cons_plan.pdf)

6. Elk–bison environmental impact statement (EIS; bisonandelkplan.fws.gov/)

7. *Fire Management Plan* (FMP) and environmental assessment (www2.state.id.us/lands/Bureau/firemgt.htm)

8. Transportation plan EIS (www.itd.idaho.gov/planning/reports/plan20yr/plantoc.html)

9. *Idaho Drought Plan* with federal water-related drought response programs (www.fsa.usda.gov/drought/finalreport/filec/IDAHO%20State%20Drought%20Programs.htm)

10. Idaho Water Resources Board water resources planning (www.idwr.state.id.us/waterboard/Planning/comprehensive%20planning.htm)

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 Boise, Payette, and Weiser subbasins 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 175 projects with objectives targeting a variety of species and/or habitat management issues. We classified the projects into 12 activity categories based on project descriptions provided. The categories and 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 only represent numerical tallies of project categories. Funding summaries are based on project counts only, not on funding levels. Projects identifying multiple funding groups were classified for all organizations involved. Project-specific information is located in Appendix 4-1.

Funding for habitat restoration projects in the Boise subbasin was primarily local, federal, or Resource Advisory Committees (RAC II) (Figure 4-1). Funding for projects in the Payette subbasin was primarily federal, RAC II, or local (Figure 4-2). Funding for projects in the Weiser subbasin was primarily federal, with 78% of projects reporting some type of federal funding (Figure 4-3).

**Table 4-1. Project activity categories and criteria for habitat restoration projects identified in the Boise, Payette, and Weiser subbasins.**

| 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 |
| 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 |

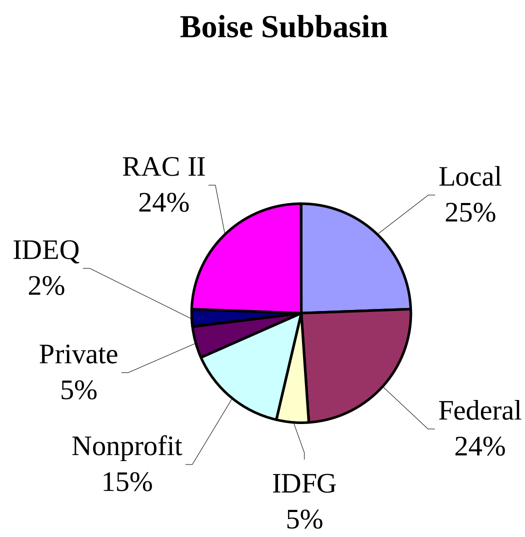


**Figure 4-1. Funding breakdown for habitat restoration projects in the Boise subbasin identified during the assessment process. Local = City or County; Federal = U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service, and Bureau of Reclamation; IDFG = Idaho Department of Fish and Game.**

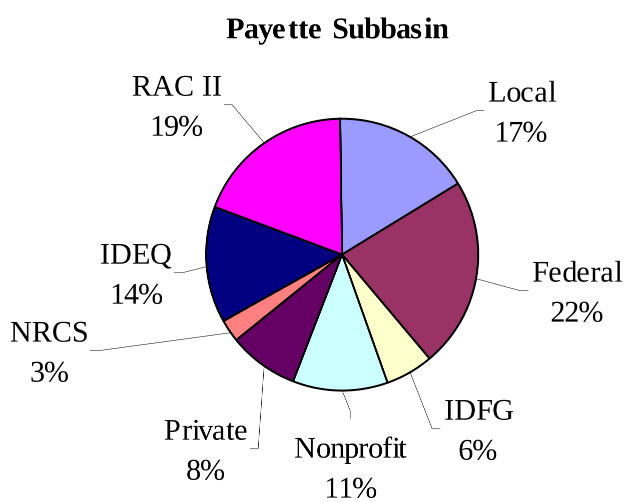


**Figure 4-2. Funding breakdown for habitat restoration projects in the Payette subbasin identified during the assessment process. Local = City or County; Federal = U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service, and Bureau of Reclamation; IDFG = Idaho Department of Fish and Game; Private = Business or landowner; NRCS = Natural Resources Conservation Service; IDEQ = Idaho Department of Environmental Quality; RAC II = Resource Advisory Committees.**

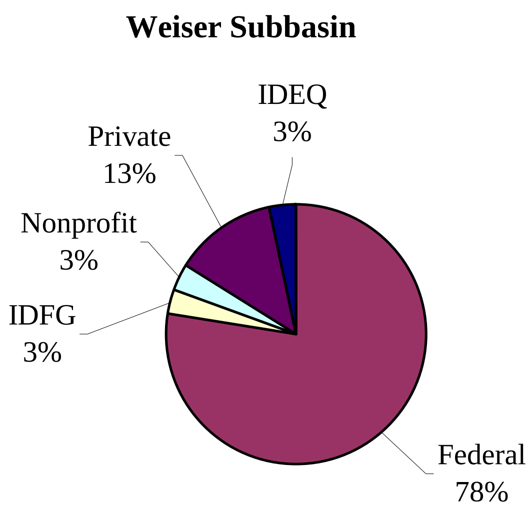


**Figure 4-3. Funding breakdown for habitat restoration projects in the Weiser subbasin identified during the assessment process. IDEQ = Idaho Department of Environmental Quality; Federal = U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service, and Bureau of Reclamation; IDFG = Idaho Department of Fish and Game; Private = Business or Landowner.**

#### *4.1.3.1 Boise Subbasin*

**Habitat Restoration Activities**—We identified 68 projects designed to restore fish and wildlife habitat in the Boise subbasin (Figure 4-4). Channel restoration, wetland restoration, and upland habitat protection were the most common restoration activities reported in the Boise watershed. Habitat restoration projects categorized by watershed are presented in Table 4-2.

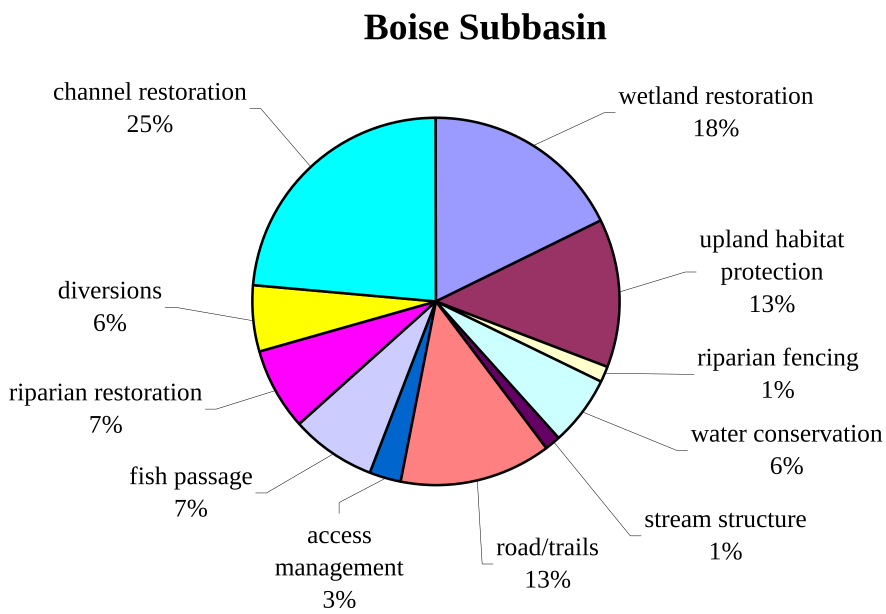


**Figure 4-4. Summary of 68 habitat restoration activities in the Boise subbasin identified during the assessment process.**

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

| **Project Activity Category** | **Watershed** | | | |
|---|---|---|---|---|
| | **North/Middle Fork Boise** | **Boise–Mores** | **South Fork Boise** | **Lower Boise** |
| Wetland restoration | 1 | 2 | 1 | 8 |
| Upland habitat protection | 1 | 5 | 1 | 2 |
| Riparian fences | 0 | 1 | 0 | 0 |
| Water conservation | 1 | 1 | 1 | 1 |
| Stream structure | 0 | 0 | 1 | 0 |
| Road/trails | 1 | 1 | 6 | 1 |
| Access management | 0 | 1 | 0 | 1 |
| Fish passage | 1 | 2 | 1 | 1 |
| Grazing management | 0 | 0 | 0 | 0 |
| Riparian restoration | 1 | 1 | 1 | 2 |
| Diversions | 1 | 1 | 1 | 1 |
| Channel restoration | 0 | 0 | 2 | 14 |
| **Totals** | **7** | **15** | **15** | **31** |

#### 4.1.3.2 Payette Subbasin

**Habitat Restoration Activities**—We identified 59 projects designed to restore fish and wildlife habitat in the Payette subbasin (Figure 4-5). Upland habitat protection and riparian fencing were the most common habitat restoration activities reported in the Payette subbasin (Table 4-3). We identified 21 projects in the North Fork Payette watershed, with road and trail maintenance being the most commonly reported activity (Table 4-3).

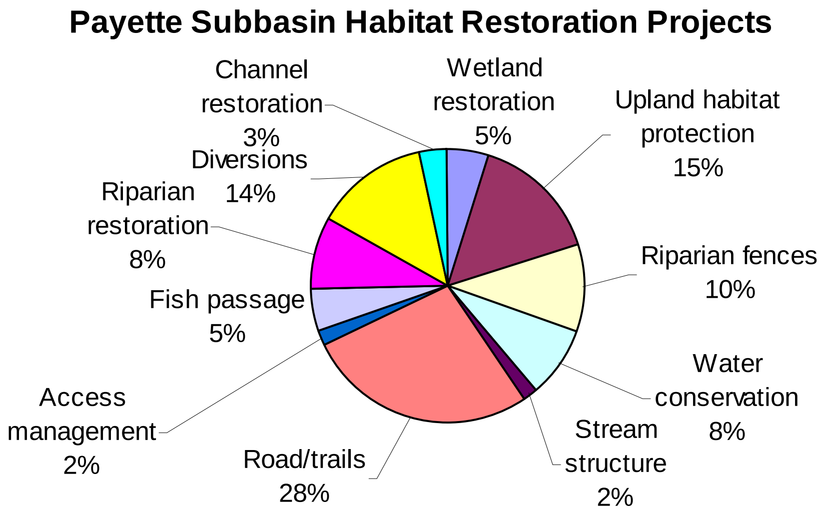


**Figure 4-5. Summary of 59 habitat restoration activities in the Payette subbasin identified during the assessment process.**

**Table 4-3. Number of habitat restoration projects by watershed in the Payette subbasin by project activity categories.**

| Project Activity Category | Watershed | | | |
|---|---|---|---|---|
| | South Fork Payette | Middle Fork Payette | Payette | North Fork Payette |
| Wetland restoration | 1 | 1 | 0 | 1 |
| Upland habitat protection | 3 | 1 | 3 | 2 |
| Riparian fences | 0 | 1 | 3 | 2 |
| Water conservation | 1 | 2 | 0 | 2 |
| Stream structure | 0 | 1 | 0 | 0 |
| Road/trails | 11 | 1 | 0 | 4 |
| Access management | 0 | 1 | 0 | 0 |
| Fish passage | 0 | 0 | 1 | 2 |
| Grazing management | 0 | 0 | 0 | 0 |
| Riparian restoration | 1 | 1 | 0 | 3 |
| Diversions | 4 | 1 | 0 | 3 |
| Channel restoration | 0 | 0 | 0 | 2 |

| Project Activity Category | Watershed | | | |
|---|---|---|---|---|
| | South Fork Payette | Middle Fork Payette | Payette | North Fork Payette |
| **Totals** | **21** | **10** | **7** | **21** |

### *4.1.3.3 Weiser Subbasin*

**Habitat Restoration Activities—**We identified 48 projects designed to restore fish and wildlife habitat in the Weiser subbasin (Figure 4-6). Diversion work, channel restoration and riparian fencing were the most common habitat restoration activities reported.

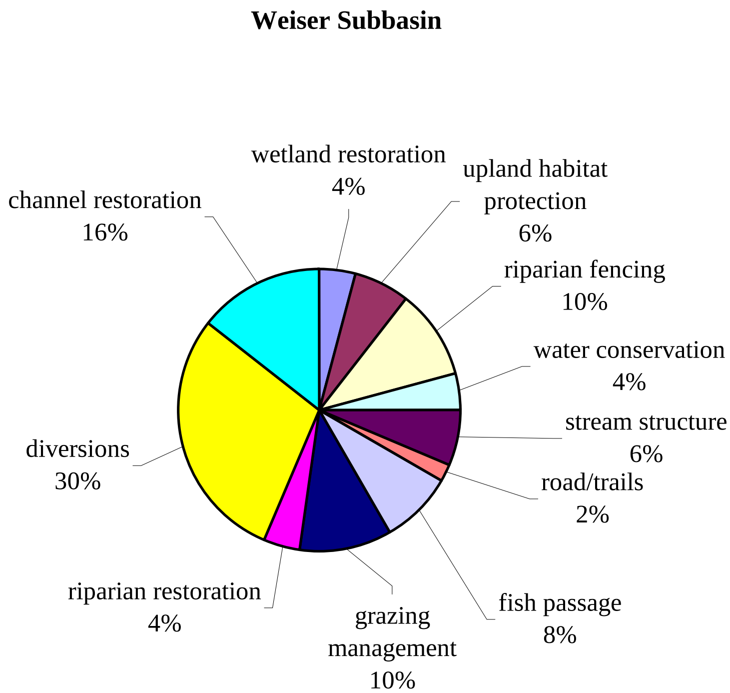


**Figure 4-6. Summary of 48 habitat restoration activities in the Weiser subbasin identified during the assessment process.**

## 4.1.4 Monitoring and Evaluation Activities

### *4.1.4.1 Aquatics*

Within the Boise, Payette, and Weiser subbasins, state and federal agencies, tribes, and occasionally private parties collect data on focal fish species. However, because new data are constantly being collected, it is impossible to provide an assessment of all available data. The lack of an easily accessible and centralized location that archives data or habitat restoration project information makes it difficult to put together a clear picture of the monitoring and evaluation activities that occur in a given year. Project descriptions, and accomplishments are presented in Appendix 4-1.

#### 4.1.4.2 Terrestrial

Terrestrial research, monitoring, and evaluation activities in the Boise, Payette, and Weiser subbasins are limited in number and scope (Appendix 4-1). Most research, monitoring, and evaluation effort is spent on threatened, endangered, candidate, or recently delisted species. Focal habitats have received negligible 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 these habitats.

### 4.1.5 Project Gap Assessment

#### 4.1.5.1 Aquatics

Within the Boise subbasin, we were able to identify restoration projects that had dealt with most major limiting factors identified in section 3 of this assessment. Although most of the major issues are being addressed, significant opportunities remain in the Boise subbasin to improve habitat for bull and redband trout through channel restoration and elimination of fish passage barriers. Reservoir operations and brook trout were identified as limiting focal fish species populations in the subbasin. Efforts have been made to address these issues, but reservoir operations are a particularly difficult issue to address from social and legal perspectives, and continued research is necessary to identify whether actions addressing brook trout population threats are effective.

In the Payette subbasin, most of the habitat for naturally reproducing bull trout and redband trout occurs above Black Canyon Dam. Most of the habitat restoration projects identified also occur in these areas. The major issues identified in section 3 are being addressed, but there are still opportunities to improve aquatic habitat by improving riparian habitat and decreasing sediment in the Middle Fork Payette River, eliminating barriers to fish passage in the North Fork Payette River, and reducing brook trout population threats where they pose a risk to bull trout throughout the subbasin.

Habitat restoration activities in the Weiser subbasin largely address the limiting factors identified in section 3. However, there is still considerable opportunity to improve habitat in the subbasin.

Compared with other subbasins and provinces in the Columbia River basin, the Boise, Payette, and Weiser subbasins have received significantly less attention in terms of aquatic and terrestrial habitat restoration. Aquatic and terrestrial activities have been underrepresented based on Columbia Basin Fish and Wildlife Program goals. Expanded coordination of project implementation with revised goals and objectives will ensure that aquatic and terrestrial landscape components in the subbasins receive adequate funding allocations. Subbasinwide coordination is discussed in detail in later sections.

#### 4.1.5.2 Monitoring and Evaluation

Prescribed fire activities were not submitted during the data-collection process for the inventory. Ecosystem structure and function in the Boise, Payette, and Weiser subbasins are intricately tied to natural fire regimes across all focal habitats. In addition to restoring fire to these fire-adapted ecosystems, additional research, monitoring, and evaluation activity pertaining to anthropogenic interference of natural fire regimes is needed to ensure that adaptive fire management strategies can be effectively implemented.

Perhaps the greatest need for natural resource conservation in the Boise, Payette, and Weiser subbasins is baseline information for each of the focal habitats. Recent 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 are unobtainable with the current information available. Undoubtedly, a tremendous amount of information has been collected at scales finer than the watershed. The current planning process did not allow adequate time to compile all the pieces into a cohesive summary. Additional research, monitoring, and evaluation efforts should be spent collecting and compiling existing data regarding focal habitat structure, function, quantity, and quality.

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 Boise, Payette, and Weiser subbasins. Based on the inventory, relatively little effort has been expended to address this issue. Expanded coordination and collaborative efforts across multiple jurisdictions is required to begin addressing altered hydrology at greater scales within the Boise, Payette, and Weiser subbasins.

## 4.2 Synthesis of Findings

### 4.2.1 Key Findings

Current and historic land-use activities have degraded freshwater habitat for focal fish species in the Boise, Payette, and Weiser subbasins. Impacts are generally most severe in the lower part of the subbasins where housing development, agriculture, and dam construction have altered the systems. They are less severe in headwater areas of the North Fork and Middle Fork Boise rivers and South Fork Payette River where flow regimes have not been altered and substantial areas are within protected wilderness or roadless drainages.

The terrestrial environment of the Boise, Payette, and Weiser subbasins is assessed in terms of four focal habitats at the watershed-scale relative to six primarily anthropogenic activities limiting habitat quantity and quality across the subbasins. For the purposes of this assessment, the definitions of the four focal habitats are simplifications of extremely complex interactions of natural processes, geomorphology, climate and land uses across the landscape. During the last 140 years, humans have had an increasingly significant impact on structure and function of the environment in the Boise, Payette, and Weiser subbasins. 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 subbasin and what the causes are.

Following is a list of key findings that apply across all three subbasins followed by lists of key findings that are specific to each individual subbasin:

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

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

3. Since 1938, 348 $km^2$ of irrigated agricultural lands in the Lower Boise, Payette, and Weiser watersheds have been converted to urban and rural development.

4. Since 1938, 866 $km^2$ of rangeland in the Lower Boise, Payette, and Weiser watersheds have been converted to irrigated agriculture.

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

6. The quantity and quality of pine/fir forest habitat have been impacted by the effects of an altered fire regime.

7. The quantity and quality of shrub-steppe habitat have been impacted by the effects of grazing and altered fire regimes.

8. Invasive exotics with negative impacts to biodiversity, forage, habitat and aesthetic quality, soil productivity, and biodiversity have impacted all habitats and watersheds in the subbasins.

9. Grazing/browsing activities by sheep and cattle have impacted plant species composition, diversity, and density, they have disrupted ecosystem functioning and altered forest dynamics.

10. Twenty-seven percent of the Boise, Payette, and Weiser subbasins are classified as grazing status undetermined.

11. Development, conversion, and other land-use practices have fragmented habitats in all but the remotest portions of watersheds in the subbasins.

12. The quantity and quality of shrub-steppe habitat have been impacted by the conversion of land to agricultural uses and subsequent conversion to urban/rural infrastructure.

13. Big game winter range in the subbasin is highly vulnerable to the expansion of urban/rural development.

Analysis of key ecological functions and environmental correlates for focal habitats and species in the Boise, Payette, and Weiser subbasins showed that there are areas within watersheds that have 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. But riparian/ herbaceous wetlands and shrub-steppe habitats have been most significantly impacted due to greater decreases in total functional diversity (section 2.1.2).

We are unable to explain why there are increases in total functional diversity for some of the focal habitats and species in the Boise, Payette, and Weiser subbasins. 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.

The analysis of key ecological functions and environmental correlates also showed how some species are linked to other species and to their habitats. For instance, a critical link species, such as the beaver, is shown to link riparian, herbaceous wetlands, and aquatic habitats because it impounds water by creating diversions or dams. Most importantly, species do not perform their ecological roles in isolation. Because of species interconnections within communities, the loss of one species could result in irreversible losses to a community and lower functional resilience.

#### 4.2.1.1 Boise Subbasin

Following is a list of key findings specific to the Boise subbasin:

1. Most bull trout and naturally reproducing redband trout populations in the Boise watershed are upstream of Arrowrock Dam.

2. Hydrologic regimes in the Middle Fork Boise watershed upstream of Arrowrock Dam and in the South Fork Boise watershed upstream of Anderson Ranch Dam are not highly altered.

3. Large migratory adult bull trout still exist in the Middle Fork Boise and South Fork Boise watersheds. These populations are unique in the Southwest Idaho Bull Trout Recovery Unit.

4. Migratory bull trout populations in the Boise subbasin are depressed.

5. Resident bull trout populations exist in good numbers in the Boise subbasin.

6. Naturally reproducing redband trout populations exist throughout the subbasin upstream of Arrowrock Dam.

7. Dams, diversions, and human development have substantially altered the Boise River and tributaries downstream of Lucky Peak Dam, depressing or eliminating populations of native salmonids.

8. Resident trout populations in the Middle Fork and South Fork Boise watersheds are fragmented or isolated due to the large numbers of impassable culverts.

9. Approximately 72% of the subbasin is classified as either moderately or highly susceptible to stand-replacement fire.

10. Approximately 72% of the subbasin has been impacted by legacy timber-harvest activities.

11. Ninety-two percent of the Lower Boise watershed is classified as having moderately to very highly altered hydrology.

12. Approximately 99.9% of the Lower Boise watershed has been either moderately or highly impacted by habitat fragmentation.

13. Since 1938, 74,627 acres (302 $km^{2)}$ of irrigated agricultural lands have been converted to urban and rural development in the Lower Boise watershed.

14. Since 1938, 195,711 acres (792 $km^2$)of rangeland have been converted to irrigated agriculture.

15. Seventy percent of the North/Middle Fork Boise watershed is classified as having low to very low impairment in terms of hydrology.

16. Interior mixed conifer forests have declined approximately 132%.

17. Approximately 76% of the subbasin is classified as moderately impacted by habitat fragmentation.

#### 4.2.1.2 Payette Subbasin

Following is a list of key findings specific to the Payette subbasin:

1. Large migratory bull trout are thought to exist in the South Fork Payette, Middle Fork Payette, and Deadwood rivers in small numbers, but no effort has been made to estimate their numbers or understand their movement patterns.

2. Good populations of resident life history bull trout exist in the South Fork Payette, Deadwood and Middle Fork Payette rivers.

3. Naturally reproducing redband trout populations are present throughout the Middle Fork and South Fork Payette watersheds.

4. Numerous barriers to fish movement exist in the North Fork Payette watershed.

5. Eighty-seven percent of the North Fork Payette watershed is classified as being moderately impacted by altered hydrology.

6. The South Fork Payette watershed is the least impacted watershed in terms of altered hydrology.

7. Pine/fir forests have declined approximately 95% in the subbasin.

8. Interior mixed conifer forests have declined approximately 188% in the subbasin.

9. Approximately 85% of the subbasin has been impacted by legacy timber-harvest activities.

10. Approximately 83% of the subbasin is classified as moderately impacted by habitat fragmentation.

11. Approximately 74% of the subbasin is classified as either moderately or highly susceptible to stand-replacement fire.

12. Since 1938, nearly 9,884 acres (40 $km^2$) of irrigated agricultural lands have been converted to rural development.

13. Since 1938, nearly 11,614 acres (47 $km^2$) of rangeland have been converted to irrigated agriculture.

#### *4.2.1.3 Weiser Subbasin*

Following is a list of key findings specific to the Weiser subbasin:

1. Good populations of naturally reproducing redband trout exist in headwater areas within the Weiser subbasin.

2. Bull trout populations in the Weiser subbasin are isolated resident populations.

3. The best stream and riparian habitats in the Weiser subbasin are confined to headwater areas.

4. Impassable culverts are fragmenting bull trout populations in the Weiser subbasin.

5. Irrigation diversions and increased temperatures limit habitat quality in the mainstem Weiser River.

6. This watershed is the most severely impacted in terms of altered hydrology, with approximately 96% of the watershed being moderately to highly impacted.

7. Interior mixed conifer forests have declined an estimated 442%.

8. Nearly 72% of the watershed has been impacted by legacy timber-harvest activities.

9. Approximately 84% of the watershed is classified as either moderately or highly susceptible to stand-replacement fire.

10. Approximately 39% of the watershed has been impacted by domestic animal grazing and browsing activities.

11. Since 1938, nearly 1,729 acres (7 $km^2$) of irrigated agricultural lands have been converted to rural development.

12. Since 1938, nearly 6,919 acres (28 $km^2$) of rangeland have been converted to irrigated agriculture.

### 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 Boise, Payette, and Weiser subbasins 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 Boise, Payette, and Weiser subbasins, terrestrial and aquatic habitat quality and quantity is optimal in the most protected, least impacted watersheds. These watersheds include the Middle Fork Payette, South Fork Payette, and North Middle Boise 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*

Within the Boise, Payette, and Weiser subbasins, the absence of anadromous fish has unknown consequences for the aquatic ecosystems, particularly with respect to impacts to fish community abundance and productivity. Consequently, true reference conditions likely do not exist within the Boise, Payette, or Weiser subbasins. In the subbasins, there are areas of good-quality habitat that is functioning within reference condition. The North Fork Boise, Middle

Fork Boise, South Fork Boise, and South Fork Payette rivers have substantial areas of roadless habitat that could be considered reference areas for aquatic habitat condition.

#### *4.2.2.2 Riparian/Herbaceous Wetlands*

Riparian/herbaceous wetland habitats occur throughout the Boise, Payette, and Weiser subbasins. However, these habitats are assumed to be in “proper functioning condition” only within the upper portions of the Middle Fork Payette, South Fork Payette, and the North Middle Boise 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 Boise, Payette, and Weiser subbasins.

#### *4.2.2.3 Shrub-Steppe*

Despite apparent gains in shrub-steppe habitat in the subbasins, it is likely that reference condition habitat does not exist except at very small scales or localized areas. Shrub-steppe habitat quality is significantly reduced across the subbasins due to altered fire regime and invasive exotics.

#### *4.2.2.4 Pine/Fir Forest*

Pine/fir forest habitats are a significant landscape feature in Boise–Mores, Middle Fork Payette, and North Fork Payette watersheds. The wilderness and roadless managed areas of these watersheds are subject to less anthropogenic impacts than other areas of the subbasins are. These portions of the subbasin are classified as having the least amount of departure from the historic fire regime. It is assumed that, at appropriate scales, most ecosystem processes are functioning at nearly optimal condition.

### 4.2.3 Near-Term Opportunities

The Boise, Payette, and Weiser subbasins assessment has identified, with the best available data and information, the most significant anthropogenic causes that limit the full functionality of ecosystem processes. Some limiting factors can be addressed with passive management actions (e.g., building a riparian protection fence). But many of the issues driving ecosystem functionality require active management approaches.

Significant opportunities for improving the health of the ecosystem exist within the subbasin over both the short- and long-term planning horizon.

#### *4.2.3.1 Aquatic*

Substantial opportunities exist to remove or modify culverts within the Boise, Payette, and Weiser subbasins to allow fish passage. Removal of barriers allowing access to unoccupied habitat is one of the most positive, certain, and rapid habitat restoration activities providing long-term benefits to fish (Roni *et al.* 2002).

#### *4.2.3.2 Riparian/Herbaceous Wetlands*

Riparian/herbaceous wetland habitats are probably the most resilient habitats on the landscape. Even minimal improvements to anthropogenic influences often result in dramatic improvement to habitat quantity, quality, structure, and function. The critical linkage between terrestrial and aquatic ecosystem components occurs in riparian/herbaceous wetland habitats. No other habitat has greater potential for collectively enhancing aquatic and terrestrial resources in the Boise, Payette, and Weiser subbasins.

Recruitment of willow needs to be measured after completion of restoration projects in the riparian habitats. The Columbian spotted frog and willow flycatcher are indicators for riparian responses to management actions, and research to measure their responses would be beneficial. Reintroduction of beaver and reduction of riparian grazing are also two strategies that could benefit riparian habitats.

#### 4.2.3.3 Shrub-Steppe

With the exception of the North Fork Payette watershed, shrub-steppe is a significant terrestrial habitat component of all Boise, Payette, and Weiser watersheds. Despite apparent gains in habitat quantity, over a century of grazing and landscape conversion has resulted in dramatic reductions in habitat quality, while an altered fire regime has disrupted the natural processes in shrub-steppe habitats. The ecological ramifications of exotic invasive species have further compromised the integrity of shrub-steppe habitat. The potential for shrub-steppe habitat restoration in the subbasins is great if a coordinated adaptive management scheme is developed that incorporates new information and technology, as it becomes available, to address altered fire regime issues and invasive exotic species.

Different species of sagebrush provide food, cover, and nesting substrate for sage-steppe obligates, such as the greater sage-grouse and pygmy rabbit. They are also important winter forage for big game species. Baseline information is needed on the distribution of pygmy rabbits and southern Idaho ground squirrels in the shrub-steppe habitat. Continuing or expanding research to determine how an altered fire regime affects the shrub-steppe community is also necessary.

#### 4.2.3.4 Pine/Fir and Interior Mixed Conifer Forests

Significant amounts of pine/fir and interior mixed conifer forest habitat occur in the Boise–Mores, Middle Fork Payette, and North Fork Payette watersheds. Apart from legacy timber-harvest activities, the fire regime is the driving force behind current forest habitat structure and function. The upper reaches of those watersheds are classified as having the least departure from historic fire regimes. However, much of the remaining forested habitat bears little resemblance to historic condition. Recent intense, large-scale burns in the subbasins have disrupted ecological processes. Significant restorative work has been initiated in the watersheds following those fires, but recovery of forest habitat quality and quantity is a long-term process. Great potential exists for restoring forested habitat structure and function at large scales through changing how fire is managed on the landscape.

Focal species for the xeric, old forest habitat in the Boise, Payette, and Weiser subbasins include the white-headed woodpecker, flammulated owl, and northern Idaho ground squirrel. The pileated woodpecker is the focal species for the interior mixed conifer habitats in the subbasins. Studies are needed to further our understanding of the relationship between snag availability and population dynamics of the flammulated owl. In addition, research should continue into determining the role of habitat fragmentation and the distribution of northern Idaho ground squirrels.

### 4.2.4 Summary of Priorities

Based on this assessment, several issues have been determined to be a priority for directing future fish and wildlife management, restoration, and protection activities in the Boise, Payette, and Weiser subbasins. Discussing priorities in this portion of the assessment is not intended to supercede the management plan prioritization process. Rather, it brings attention to the limitations of our current state of knowledge regarding ecosystem processes, structure, and function within the Boise, Payette, and Weiser subbasins. 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 Watershed Ecosystems

Restoration of the lost anadromous fish-supported nutrient cycle has implications for aquatic and terrestrial focal habitats and species. Watersheds identified as having supported historical runs of anadromous fish have lost the nutrient influx associated with spawning adults of steelhead, Chinook salmon, and sockeye salmon. Resident fish, listed bull trout, and terrestrial habitats and species would benefit from the artificial or natural return of this nutrient input.

#### 4.2.4.2 Mitigation for Federal Hydropower Development

Federal hydropower development impacted identified terrestrial species within the Boise and Payette subbasins. These projects—Black Canyon, Deadwood, and Anderson Ranch—have developed loss assessments and an existing program to implement wildlife mitigation through land acquisition. This mitigation program should be completed to increase habitat for focal terrestrial wildlife in these subbasins.

Loss assessments for resident fish due to the three federal hydropower projects need to be developed. Further assessment for losses to resident fish and wildlife from indirect losses, such as powerline construction, and direct losses from operation and maintenance of these projects is also necessary.

#### 4.2.4.3 Aquatic Habitat Data

Appendix 1-2 of the assessment identifies the constraints inherent with existing data used in this assessment. From a scientific assessment perspective, the most important information that is currently unavailable at the scale required for reasonable quantification is accurate and precise data regarding aquatic, riparian, and herbaceous wetlands 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 data be collected on which to base justifiable management decisions.

#### 4.2.4.4 Noxious and Exotic Invasive Weeds

From a terrestrial ecosystem perspective, the most important anthropogenic cause of habitat quality and quantity limitation that can be addressed by management actions is noxious and exotic invasive weeds. Collaborative weed management efforts have been established in the Boise, Payette, and Weiser subbasins. However, effective control of noxious and invasive weeds requires even greater coordination and cooperation across multiple jurisdictions and political boundaries.

#### 4.2.4.5 Altered Fire Regime

Based on this assessment and others, anthropogenic influences to the natural fire regimes are likely the most significant impact to ecosystem processes in the Boise, Payette, and Weiser subbasins. However, it is extremely difficult to reverse a century of cumulative impacts to habitat structure and function resulting from altered fire regimes. A century of fire suppressive policies has entrenched the perception in people’s minds that all wildfires harm the environment. These public perceptions have been and will continue to be difficult to overcome. Some progress into educating the public has been made in recent years. But even in the land management agencies, the prevailing "instinct" is to put out a fire. One thing is certain: regardless of fire management policies, large and catastrophic fires will continue to occur as nature attempts to reestablish a balance to the system. These fires will undoubtedly occur at great expense in terms of finances, personal property, and the natural resources themselves.

#### 4.2.4.6 Subbasinwide Coordination of Management Plans

One issue that became apparent as a result of the assessment process is that numerous state, federal, tribal, and nongovernmental entities conduct active management activities across the Boise, Payette, and Weiser subbasins, often with minimal coordination and overlooking the terrestrial components. As operating budgets become increasingly constrained, management actions must be conducted under the auspices of a collaborative "working group" across the subbasins. In addition, collaborative efforts must incorporate aquatic and terrestrial components of ecosystem processes. The coordinated implementation of management plan goals and objectives will minimize duplicated effort, enhance logistical efficiency, ensure that biological objectives are being achieved, and ultimately increase cost effectiveness.

### 4.2.5 Identification of Strategic Actions to Address the Highest Priorities

#### 4.2.5.1 Riparian Habitat Inventory

Watershed-scale assessments of riparian wetland habitat quantity and quality are necessary first steps for current and future iterations of management planning in the Boise, Payette, and Weiser subbasins. These habitat assessments would incorporate concerted research effort into replicable 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 three subbasins.

#### 4.2.5.3 Public Education Campaign

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

#### 4.2.5.4 Subbasin Coordination

We believe that an approach similar to the Upper Salmon Basin Model Watershed Project should be initiated in the Boise, Payette, and Weiser subbasins. The structure of such an organization could be based on the three subbasins together or composed of three separate subbasin working groups with an overarching coordinator. The charter of the group(s) would incorporate aquatic and terrestrial components and build on identified goals, objectives, and strategies. Such an approach would maximize the benefits derived from Bonneville Power Administration Fish and Wildlife Program funding allocations.

### 4.2.6 Working Hypotheses

The following is the overall working hypothesis $H_A$ for the Boise, Payette, and Weiser subbasins: Anthropogenic influences in the Boise, Payette, and Weiser subbasins and factors outside the subbasins 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. After a list of hypotheses that apply to all three subbasins, additional hypotheses are organized by subbasin.

#### *4.2.6.1 Subbasins Working Hypotheses*

$H_A$: Completion of habitat mitigation for Anderson Ranch, Black Canyon, and Deadwood hydropower projects will replace habitat losses and increase terrestrial habitat potential.

$H_A$: Loss of nutrient inputs from historical anadromous fish runs has reduced terrestrial and aquatic focal habitats and populations potential.

$H_A$: Operations of Anderson Ranch, Black Canyon, and Deadwood hydropower projects reduce resident focal fish habitat and population potential.

$H_A$: Construction of and inundation by Anderson Ranch, Black Canyon, and Deadwood hydropower projects reduced aquatic focal habitats and affected focal species.

$H_A$: Anthropogenic 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 the 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 reduces, degrades, or eliminates 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 effectiveness of restoration and conservation activities designed to benefit focal habitats and their focal species.

$H_A$: The status and trend of terrestrial 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.

$H_A$: Habitat conversion to rural and urban development significantly impacts the big game winter range components of shrub-steppe habitats at the urban/wildlife interface.

#### 4.2.6.2 Boise Subbasin

$H_A$: Flow regulation and impacts from development limit aquatic habitat in the Boise River and tributaries downstream of Lucky Peak Dam.

$H_A$: Barriers within the subbasin are limiting the movement and interaction of individuals between populations of focal fish species within the subbasin.

$H_A$: Populations of fish focal species that are isolated by barriers are at an increased risk of extirpation from catastrophic events.

$H_A$: In localized areas within the Boise subbasin, increased levels of fine sediment are reducing habitat quality for focal fish species.

$H_A$: Reservoir operations impact focal fish species within the Boise subbasin.

$H_A$: Nonnative salmonids are reducing the distribution and abundance of native salmonids within the Boise subbasin.

#### 4.2.6.3 Payette River Working Hypotheses

$H_A$: Increased water temperatures downstream of Black Canyon Dam on the Payette River limit the habitat quality for redband trout.

$H_A$: Increased fine sediment limits habitat quality for fish focal species in localized areas within the Payette subbasin.

$H_A$: Barriers and water diversions are limiting distribution and abundance of fish focal species within the Payette subbasin.

$H_A$: Nonnative salmonids limit the distribution and abundance of native salmonids in localized areas within the Payette subbasin.

#### 4.2.6.4 Weiser River Working Hypotheses

$H_A$: Increased water temperatures and reduced water flow limit the habitat quality for native salmonids in the mainstem Weiser River during summer months.

$H_A$: Nonnative salmonids (primarily brook trout) are limiting abundance and distribution of bull trout within the Weiser subbasin and represent a threat to the long-term persistence of these populations.

$H_A$: Bull trout abundance within the Weiser subbasin is limited by habitat quality and quantity.

$H_A$: Barriers to fish passage (primarily culverts) are limiting the long-term persistence of bull trout populations within the Weiser subbasin.

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