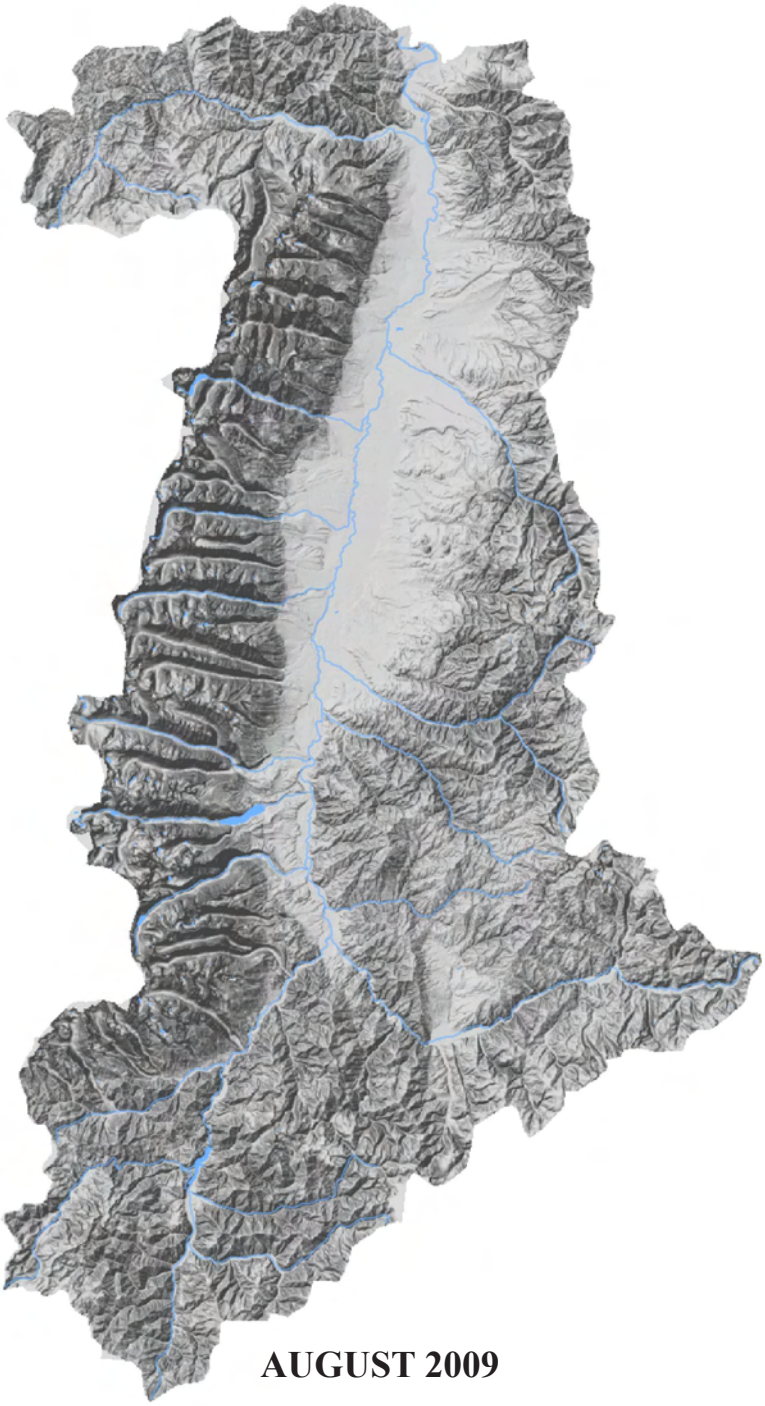
BITTERROOT RIVER SUBBASIN PLAN FOR FISH AND WILDLIFE CONSERVATION

EXECUTIVE SUMMARY



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A report prepared for the
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RESERVATION OF RIGHTS

A number of agencies, groups, and entities participated in the development of this Bitterroot River Subbasin Plan, Part I (Assessment Volume), Part II (Inventory Volume), and Part III (Management Plan Volume), its appendices, and electronically linked references and information (hereafter Plan). The primary purpose of the Plan is to help direct Northwest Power Planning Council funding of projects that respond to impacts from the development and operation of the Columbia River hydropower system.

Nothing in this Plan, or the participation in its development, is intended to, and shall not be interpreted to, compromise, influence, or preclude any government or agency from carrying out any past, present, or future duty or responsibility which it bears or may bear under any authority. Nothing in this Plan or the participation in its development constitutes a waiver or release of any rights, including the right to election of other remedies, or is intended to compromise, influence, or preclude any government or agency from developing and prosecuting any damage claim for those natural resource impacts identified in the Plan which are not directly and exclusively resulting from, or related to, the development and operation of the Columbia River hydropower system.

Nothing in this Plan or the participation in its development is intended to, and shall not be interpreted to, waive any rights of enforcement of regulatory, adjudicatory, or police powers against potentially responsible parties for compliance with applicable laws and regulations pertaining to natural resource damages throughout the Bitterroot River Subbasin whether or not specifically identified in this Plan. This Plan is the result of a group effort. Nothing in it or the participation in its development should be interpreted as constituting unqualified acceptance or endorsement of the Plan, its appendices, or any electronically linked reference or information by any party.

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Clark Fork Coalition
Lolo Watershed Group

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EXECUTIVE SUMMARY

Introduction

The Bitterroot Subbasin Plan is a framework for conserving and restoring fish and wildlife in the Bitterroot River watershed in western Montana. Subbasin plans identify priority restoration and protection strategies for fish and wildlife populations and habitat in the United States portion of the Columbia River system. These plans are tools to implement the Northwest Power and Conservation Council's (NWPCC) Columbia River Basin Fish and Wildlife Program, which directs more than $140 million per year of Bonneville Power Administration (BPA) electricity revenues to protect, mitigate, and enhance fish and wildlife affected by hydropower dams. Subbasin plans provide a context for evaluating potential projects for funding through the NWPCC's program.

The Bitterroot Subbasin Plan is organized into three sections: (1) Subbasin Assessment, (2) Subbasin Inventory, and (3) Subbasin Management Plan. The Assessment provides a description of the watershed, and its habitats and species, resulting in a list of focal species and priority habitats in the particular context of the Bitterroot River watershed. The Inventory describes existing programs and projects that address focal species and priority habitats. The Management Plan includes objectives, strategies and an adaptive management framework for managing focal species and habitats throughout the 10-to-15-year period covered by this subbasin plan. These sections are summarized in more detail below.

Subbasin Assessment

What is the Assessment?

The primary purpose of the Subbasin Assessment is to consolidate and synthesize existing technical information about the environmental conditions and fish and wildlife populations of the Bitterroot River Subbasin. The Assessment identifies conservation priority species and habitats for the subbasin which are the foundation for management objectives and strategies included in the Subbasin Management Plan. For the aquatic environment, the Assessment identifies two aquatic focal species (bull trout and westlope cutthroat trout). For the terrestrial environment, the Assessment identifies six conservation target habitats (riparian, wetland, sagebrush, grassland, dry forest, and mesic forest). The Assessment progresses from a broad characterization of the subbasin to specific analysis of target species and habitats and includes four chapters:

- Chapter 1 contains an overview of the Assessment and describes the scope and approach to its development.
- Chapter 2 contains a subbasin characterization. This chapter describes ecoregions, climate, geology, topography, channel morphology, soils, vegetation and land cover, hydrology, and water quality characteristics of the subbasin. A discussion of the subbasin demography including population growth and land uses is also included, identifying how human activities have influenced the current vegetation patterns and disturbance regimes. Chapter 2 concludes with a discussion of the subbasin in the regional context of the Columbia River Basin where its relationship to the Endangered Species Act and influence of external environmental conditions are high-lighted.

- Chapter 3 further characterizes the broad habitat units found within the subbasin, identifying critical functions and processes, historical and current conditions, and limiting factors and disturbances for each. Broad habitat units present in the Bitterroot Subbasin and described in this chapter include: (1) aquatic, (2) riparian and wetland, (3) grassland and shrub, (4) coniferous, and (5) agricultural and farmland.
- Chapter 4 describes aquatic and terrestrial species and habitats present in the subbasin and identifies those species and habitats that are a conservation priority. For the aquatic environment, two focal aquatic species were selected; bull trout and westslope cutthroat trout. For the terrestrial environment, six conservation target habitats (riparian, wetland, sagebrush, grassland, dry forest, and mesic forest) were selected based on the occurrence and distribution of conservation target species or target species habitat requirements. This chapter identifies the limiting factors for conservation priority species and concludes by summarizing the key findings and presenting the working hypotheses for both.

A brief summary of each of the major sections of the Assessment follows.

Introduction

Scope and Approach

The Assessment addresses vertebrate fish and wildlife found currently or historically within the Bitterroot Subbasin. In addition, aquatic invertebrate species with formal conservation status in the State of Montana are included; and vegetation is addressed in terms of biomes, habitat categories, and specific habitats pertinent to fish and wildlife.

Information was derived from existing sources, primarily technical literature and online databases. Local experts provided input, particularly agency biologists from Montana Fish Wildlife and Parks (MFWP) and the U.S. Forest Service (USFS). Data sources included MFWP, the Montana Natural Heritage Program (MNHP), Montana Partners in Flight Bird Conservation Program (PIF), and the Interactive Biodiversity Information System (IBIS) databases maintained by Northwest Habitat Institute.

The Assessment provides a framework for evaluating current conditions and developing future objectives and strategies to protect, mitigate, and enhance fish and wildlife populations in the subbasin. The framework includes a general characterization of the landscape and a review of biomes and habitat characteristics, an analysis of the status of key species, the status of habitats (for terrestrial species), and the status of aquatic habitat units (12-digit hydrologic unit code numbers or 6th-field HUCs) for aquatic species.

Subbasin Characterization

Subbasin Description and Location

The Bitterroot Subbasin is located entirely in Ravalli and Missoula Counties in the Rocky Mountains of western Montana and covers 2,889 square miles. The Bitterroot Mountains along the Idaho border form much of the southern boundary and the entire western boundary; the crest of the Sapphire Mountains forms the eastern boundary. The Bitterroot River, a tributary to the Clark Fork of the Columbia River, flows through the center of the subbasin. From the confluence of the East Fork and West Fork just south of Darby, Montana, the river flows northward 84 river miles to its confluence with the Clark Fork River in Missoula, Montana.

Most of the subbasin is steep, mountainous, and heavily forested and the majority of the lands are managed by the U.S. Forest Service's Bitterroot (BNF) and Lolo National Forests (LNF). A broad central valley is primarily in private ownership and is developed for housing or in agriculture. The subbasin is part of the Clark Fork-Pend Oreille River Basin.

Ecoregions and Ecological Units

The Bitterroot Subbasin includes three U.S. Environmental Protection Agency (EPA) third-level ecoregions: the Northern Rockies, the Idaho Batholith, and the Middle Rockies. This Subbasin is a transition zone between the moist Northern Rockies and the drier Middle Rockies. The majority falls within the Middle Rockies area, except the East and West Forks uplands, which are an eastern extension of the Idaho Batholith, and Lolo Creek, which is largely in the Northern Rockies ecoregion, a Pacific-climate-influenced area.

Climate

The Bitterroot Subbasin is in a transitional area between the moist, Pacific-influenced mountains to the west along the Idaho/Montana border, and the dry, mild summer-cold winter climate common to the rest of southwestern Montana. Total subbasin precipitation is dominated by snow. Annual precipitation is highly correlated to elevation, as is winter snowfall. At high elevations, an estimated 65 to 75 percent of annual precipitation occurs as accumulated snowfall between late October and April. The valley area where all the agricultural acreage is located is a semi-arid zone with only 10 to 12 inches of annual precipitation.

Annual mean maximum daily temperature ranges between 58.6 degrees and 57.3 degrees Fahrenheit (14 degrees Celsius). High elevation sites have much lower minimum temperatures than valley sites, with minimum temperatures of negative 10 degrees Fahrenheit (negative 23 degrees Celsius) to negative 15 degrees Fahrenheit (negative 26 degrees Celsius) regularly recorded in winter.

Geology

The Bitterroot Mountains and much of the West Fork and East Fork area are composed of Cretaceous granitic rocks associated with the Idaho Batholith. The Sapphire Mountains on the east side of the subbasin are composed of metasedimentary rocks of the Middle Proterozoic Belt Supergroup. Tertiary sediments overlie the bedrock throughout the area, make up most of the basin fill, and outcrop as unconsolidated tertiary sediments on the eastern benches and foothills of the Bitterroot Valley and to a lesser extent on the west side. There are two prominent Quaternary alluvial terraces within the valley; the Riverside Terrace is located 10 to 15 feet above the current floodplain, and the Hamilton Terrace is 20 to 25 feet above the floodplain. The valley bottom is interlaced with ancestral river channels that form sloughs, oxbows, and alternate overflow channels for the Bitterroot River.

Topography and Channel Morphology

The Bitterroot Subbasin is topographically complex. Elevations range from just over 10,000 feet to 3,100 feet. Three major types of topography are present: (1) the Bitterroot Valley forms a broad valley averaging 7 to 10 miles wide, made up of flat floodplains, gently sloping terraces, and rolling foothills; (2) the Sapphire Mountains are a moderately steep, moderately dissected range rising from 4,000 feet to 7,500 feet; and (3) the Bitterroot Mountains are dissected by numerous parallel drainages, forming extremely steep canyons, cliffs, and rocky peaks as they rise abruptly from 4,000 to 4,500 feet at the western valley margin to elevations averaging over 9,000 feet. More than 3,000 miles of perennial streams drain the area.

Soils

Soils in the Bitterroot Subbasin are related to geologic substrates and landforms. Soils vary greatly due to the influences of climate, vegetation, and hydrology. The NRCS describes typical Bitterroot Subbasin soils by landscape position. Lolo Creek and Bitterroot Mountain soils include mostly inceptisols and entisols. East Fork-West Fork and Bitterroot Mountain soils are part of the Idaho batholith system, which includes abundant granitic rocks as well as other igneous rocks and metamorphic rocks like quartzite. The most common soil complex in the subbasin above the East Fork-West Fork confluence is the Ovando-Elkner-Rock Outcrop type. The Sapphire Range soils include those formed from Belt metasedimentary rock as well as some granitics. Well-drained inceptisols (recently formed soils) are common, and small amounts of volcanic ash exist in some soils. Bitterroot Valley soils and many adjacent foothill soils are largely mollisols that formed organic matter in their surface horizon due to long-term grassland cover. Valley soil textures are diverse, ranging from very coarse to very fine.

Vegetation and Land Cover

Conifer forests are the dominant natural vegetation type. Other types of forest are found in riparian areas and floodplains and include broadleaf forests such as black cottonwood or quaking aspen. Shrublands include sagebrush lands located primarily on east-side benches and several distinctive shrub types found in the southeastern part of the subbasin in warm, dry locations. Native grasslands were once abundant in the central Bitterroot Valley, but have been heavily altered by grazing, agriculture, development, and invasive weeds. Riparian lands, including riparian shrublands and forests, and wetlands, lakes, ponds, and rivers are critical cover types for many fish and wildlife species. Riparian areas and wetlands cover less than two percent of the entire subbasin.

Hydrology

The Bitterroot River is the dominant surface-water feature in the subbasin. Its hydrology is dominated by snowpack accumulation in winter and spring snowmelt runoff. The size of the accumulated snowpack at high elevations (5,000 to 10,000 feet) in late winter is the major determinant of water yield and the magnitude of river flows for the remainder of the year. Tributary streams reflect the same seasonal runoff pattern as the river, with high flows in spring and early summer and often very low flows in late summer and early fall

Irrigation withdrawals are substantial and have important influences on hydrology as they significantly reduce the flow in the river and many tributary streams. Much of this water eventually returns to the river, often through groundwater. Groundwater inflow is an important component of Bitterroot River flows during the fall-to-winter low-flow seasons. Irrigation water that soaks into the ground is extremely important to the Bitterroot River system under current land and water-use patterns. Nearly all major aquifers in the subbasin discharge into the Bitterroot River, directly or indirectly. Groundwater levels increase rapidly on both the east and west sides of the valley when irrigation season begins, then gradually decline after the season ends.

Water Quality

Water quality issues in the subbasin are mostly related to non-point sources of pollutants, alteration of channels, and water withdrawals. Sediment, nutrients, and temperature are three of the most commonly cited water quality issues for the mainstem of the Bitterroot River and some tributary streams. In many cases, these water quality problems can be related to land-use issues in tributary watersheds or along the river itself.

Population and Land Uses

The population of the subbasin was approximately 51,000 at the time of the 2000 census. Ravalli County, the south side of the City of Missoula, and Lolo are very fast-growing areas of Montana. Ravalli County's population growth is considered peri-urban and non-farm rural; the largest town is Hamilton (population of 3,705 in 2000). The year 2010 populations of Missoula County and Ravalli County are projected to reach over 109,000 and 46,000, respectively.

Ravalli County held approximately 210,000 acres of agricultural land in 2004, which represented a decline of 18 percent since the early 1980s when the total was closer to 260,000 acres. The transition from agricultural acres has been primarily to residential development. Private forestland accounts for 103,160 acres in the subbasin, and federal and state forestland accounts for 1,095,000 acres.

Voters passed an Open Lands Initiative in Ravalli County in 2006, which authorized a ten million dollar bond measure to acquire conservation easements and prevent the subdivision of valuable resource lands. A similar ten million dollar measure was passed by Missoula County voters in 2006 as a follow-up to a 1995 program run by Missoula City-County governments.

Economic Overview

The subbasin has a diverse economy; professional/management, service, retail, and construction are the leading employment categories. Farming and timber is less than 3 percent of the employment total. Farming generates about $25 million in cash receipts annually, down from a high of near $50 million in the 1970s. Many people managing small farms are retired, and/or have other sources of income. Timber industry jobs are few, especially since the Darby Lumber mill closed in 1999.

Bitterroot Subbasin in the Regional Context

The Bitterroot Subbasin is part of the greater Columbia River basin and is within the Mountain Columbia province. Due to the geological and biological history of the area, the Bitterroot River was not accessible to anadromous fish, but it is immediately adjacent to three anadromous fish-bearing watersheds in Idaho: the North Fork of the Salmon River, the Selway River, and the Lochsa/Clearwater River.

The subbasin is part of the Clark Fork River Recovery Unit as described in the Draft Bull Trout Recovery Plan. The Clark Fork Recovery Unit includes the entire Clark Fork River basin, including Lake Pend Oreille. Although this recovery unit remains one of the relative strongholds of bull trout, most migratory populations of fluvial and adfluvial bull trout have been seriously depleted. Declining abundance has been due in large measure to disruption of historical connectivity, particularly within mainstem river corridors. Large hydroelectric dams, erected on the mainstem Clark Fork River fifty to one hundred years ago, were the catalyst for much of the historical disruption of the migratory corridor. Presently three hydroelectric Dams (Cabinet Gorge, Noxon Rapids and Thompson Falls) prevent upstream movement of bull trout in the Clark Fork River basin (Milltown dam, a few miles upstream of the confluence of the Bitterroot and Clark Fork Rivers, was removed in 2008 after blocking all upstream fish migration for 100 years

The subbasin still holds a unique resident westslope cutthroat trout population with a high degree of genetic purity, which is also the result of abundant surface water combined with the fact that the upper portion of tributaries are on public land.

Characterization of Habitats

Aquatic Habitats

Components of aquatic systems are interdependent and linked to a diversity of habitats, plants, and animals in and around the stream. Every stream is a dynamic system that is continually altered by the changing character of the watershed; streams naturally change course, overflow, erode their beds and banks, and deposit sediment. The many functions and processes that form and maintain aquatic systems influence the structural and biological components of the system. For example, stream habitat components support different fish behaviors; channel configuration influences fish and other aquatic species and different life stage use of the stream; riparian vegetation type and structure provides shade, cover, food chain support, and instream structure in the form of large and coarse woody debris.

Historically, the Bitterroot streams and rivers were cold and clean, and stream substrates consisted of clean, permeable gravels, cobbles, boulders, and sand. Aquatic habitats were distributed according to natural variability within watersheds created by geology, aspect, slope, and size, as well as natural disturbance such as landslides, forest fires, floods, etc. Aquatic habitats and the species of wildlife, fish, and invertebrates dependent on them varied based on the type of channel and dominant formation processes.

Currently, aquatic habitats maintain approximately the same distribution as they did during pre-settlement times; however, portions of existing habitats have been significantly altered. These impacts have resulted in degraded habitats and a reduced distribution of native aquatic species. A primary example is the large irrigation system with several large-volume reservoirs that has altered the timing and distribution of channel flow in the valley. Perhaps the most significant single impact on aquatic habitats has been the introduction of non-native species. Non-native aquatic species now threaten the diversity and abundance of native species and the ecological stability of ecosystems in many areas of the subbasin.

Riparian and Wetland Habitats

Riparian and wetland areas are considered separately from aquatic habitats but are functionally tied to aquatic habitats. Riparian and wetland functions are important to consider as part of a conservation planning framework. Primary functions include: water storage and peak flow moderation, streamflow maintenance, groundwater recharge, nutrient cycling, sediment retention, bank and shoreline stabilization, terrestrial habitat support, aquatic habitat support, biodiversity support and maintenance.

Four different data sources quantify wetland and riparian acreage in the Bitterroot Subbasin: (1) historical USFS vegetation mapping based on data collected between 1932 and 1940; (2) current USFS wetlands; (3) current GAP (USGS GAP Analysis Program 2005) data; and (4) National Wetland Inventory mapping completed by the Montana Natural Heritage Program in 2007.

Palustrine forested (PFO) wetlands occur primarily in the Bitterroot River floodplain and along tributary streams. Palustrine scrub-shrub (PSS) wetlands occur primarily in the Bitterroot River floodplain, along irrigation and road-side ditches, along tributary streams, and on some slopes on the west side of the valley. Palustrine emergent (PEM) wetlands occur primarily along oxbows and open-water areas within the Bitterroot River floodplain, as fringe wetlands adjacent to created ponds and beaver ponds, within irrigated agricultural fields, along irrigation and roadside ditches, and to a lesser extent along tributary streams.

Over the past 100 years in unprotected parts of the subbasin, humans have drastically altered riparian and wetland habitats. The most significant disturbances and limiting factors affecting the restoration and conservation of riparian and wetland systems in the subbasin include: residential development and associated infrastructure, conversion of agricultural lands to subdivided residential lands, loss of federal regulatory protection for some wetlands under the Clean Water Act, the spread of invasive species, wetland type conversion, streambank stabilization using rip-rap or other hard materials that directly impacts unconsolidated shore wetlands.

Grassland and Shrub Habitats

Grassland ecosystems in the Bitterroot Subbasin are an eastern extension of the Palouse prairie intermountain bunchgrass vegetation type abundant in southwest Canada and eastern Washington and Oregon. These grasslands are usually characterized by the dominant perennial bunchgrasses, although numerous other grass and forb species comprise this diverse ecosystem. Grasslands provide a rich nutrient base where the natural digestive recycling of consumed grasses facilitates the transfer of carbon, nitrogen, and phosphorous back into the soil where it can be reabsorbed in a mineral state.

Upland shrub ecosystems in the subbasin include dry terraces located throughout the subbasin and steeper foothill slopes on the east side of the southern Bitterroot. These shrub habitats provide a number of critical functions, including serving as important corridors between native grasslands and riparian and forested habitats.

Early explorers noted the undulating prairies that extended from the east bank of the Bitterroot River up to the foothills of the rolling Sapphire Mountains. The prairies had little timber but were covered in grasses and sagebrush. The large areas of grasslands were influenced by cultural burning practices of the local Salish peoples, who regularly burned the lower elevations to create as much savanna as possible for their horse herds and the buffalo that spilled out across the Divide.

Native grass and shrublands in the Bitterroot Subbasin are increasingly threatened. Many pasture sites have been overgrazed, and large areas have been converted to cropland or development. Soil crusts have been disturbed, which has adversely affected the rate of nitrogen fixation, soil stability, fertility, structures, and water infiltration. Native plant species have been significantly reduced, as has the value of grasslands to native wildlife. The widespread loss of native grasslands in the subbasin can be attributed to numerous causes: residential construction, conversion to cropland and grazing land, wildfire exclusion, and introduction of weeds and other invasive plant species. Climate change appears to be influencing native grass and shrublands in the western United States. Climate change impacts to these habitats include less winter snowfall, earlier snowmelt, and larger and more frequent wildfires.

Coniferous Habitats

The habitats described in this section include the Dry Forest and Mesic Forest Conservation Focus Habitat. More than 60 percent of the subbasin has coniferous or other forested communities. Critical functions and processes of coniferous forests are all interrelated and include: wildlife habitat and connectivity, fire, water storage, nutrient cycling, insects and disease, and carbon sequestration.

Many wildlife species in the subbasin use coniferous habitat for food and shelter year-round. The continuum of forested habitat types throughout the mountainous elevations provides cover for a variety of wildlife species, enabling them to move between habitats more safely. Low-elevation ponderosa pine

forests connecting with riparian habitat types on the valley floor provide habitat connectivity between the Bitterroot and Sapphire mountain ranges. Many streams originate in forested areas where conifer trees provide a number of aquatic habitat benefits including shading and cooling, bank stabilization, and the creation of pools and other in-stream habitat features from roots and fallen trees. The same forested habitat types have been present in the Bitterroot Subbasin over the last 100 years, however the relative abundance of each habitat type has changed over time with natural and human-caused changes to the landscape.

In general, coniferous forest habitat types transition with elevation zones, slope aspects, and moisture regimes. Most forested lands in the Bitterroot Subbasin are located on the Bitterroot National Forest (BNF). USFS-administered lands are managed for recreation, wildlife, fisheries, water, cultural resources, as well as timber, minerals, and grazing. Large, continuous areas of forested USFS-administered lands provide habitat for both fish and wildlife species. However, disturbances like road building, logging, mineral extraction and grazing that impact these habitats have occurred and still occur on Forest Service and private forested lands. Additional primary disturbances include fire suppression, insects and disease, drought, development, and recreation.

Since 1973, lightning caused fires have been allowed to burn in the Selway-Bitterroot Wilderness when they do not pose a threat to development in the Bitterroot Valley. The Forest Service and other land management agencies practice fire management, including fire suppression near private lands. Fire suppression can result in a surplus of fuels, resulting in more severe fires that can damage fish and wildlife habitat by destroying habitats and forage and reducing water quality.

Some forest insect and disease outbreaks result in significant mortality of coniferous tree species. Forest insects and diseases are also influenced by climate change, as evidenced by increases in mountain pine beetles, the outbreaks of which are usually limited by extreme cold temperatures. Mountain pine beetles, which often kill their host trees, generate more dead fuels in the forests that can result in more severe forest fires.

Western Montana has recently experienced a period of drought. Long-term drought can influence plant community composition and structure and also increase the risk of wildfire damage to plant communities and wildlife habitat. Climate change may worsen drought conditions in portions of the western United States. Development at the forest edge decreases the overall area of forest present and impacts wildlife habitat and wildlife movement between forested areas and adjacent grass and shrublands. Development at the forest edge also influences fire management strategies as managers seek to minimize property damage and loss when fires occur close to development. Recreation also impacts forested areas because trails and roads are constructed through forested environments, increasing human activity within wildlife habitats.

Agricultural and Farmland Habitats

The habitats described in this section are included as a portion of the Grassland Conservation Focus Habitat. Prior to European settlement, the Bitterroot Salish used fire and light domestic grazing to maintain valley bottomlands as native bunchgrass and low-shrub habitat. Between 1905 and 1918, the Big Ditch Company (later Bitter Root Irrigation District) constructed the Big Ditch, running from Lake Como on the west side, across the Bitterroot River via siphon, northward along the east side of the valley to east of Florence. While originally intended to supply water for apple orchards being marketed

to easterners as a contemporary lifestyle product, the Big Ditch set the stage for later agricultural development. By distributing abundant water across the dry east side with its pockets of deep and highly fertile soil, the Big Ditch provided the backbone for a complex irrigation infrastructure.

The total acreage of agricultural lands in the subbasin has continuously decreased. While a loss of native composition and the threat of invasive species is a concern for native grasslands, most agricultural lands can still be used to some extent by native wildlife. Agricultural land overlaps spatially with wildlife habitat. Most intact wildlife corridors connecting public land and the Bitterroot River are associated with large, contiguous areas of agricultural land, so these lands should be a high priority for conservation.

Limiting factors and considerations for the conservation of agricultural land in the subbasin include: residential development has reduced and will continue to reduce overall agricultural land and will contribute to the fragmentation of agricultural lands that are currently functioning as wildlife habitat or wildlife movement corridors; irrigation infrastructure influences wildlife movement patterns by providing water sources; a shift from agricultural to residential use will result in changes in the irrigation system; irrigation infrastructure creates barriers for fish movement and causes some fish to move out of the river and tributary streams; irrigation infrastructure drives distribution of some riparian and wetland habitats particularly on the east side of the subbasin; where agriculture is conducted using a range of Best Management Practices (BMPs), agriculture can contribute to wildlife and aquatic habitat, but where BMPs are not being applied, agriculture can degrade wildlife and aquatic habitat.

Fish and Wildlife Communities and Target Species

This chapter describes aquatic and terrestrial species and habitat present in the subbasin and identifies conservation priority species and habitats. For aquatic environments, conservation priority species are called Focal Species. For terrestrial environments, conservation priority species are linked to key habitats, called Conservation Target Habitats.

Wildlife Resources

Wildlife resources in the subbasin were analyzed at two levels. The first level assesses species of conservation concern and their actual status in the Bitterroot Subbasin. The second level identifies the particular habitats most in need of conservation.

The first level of analysis yielded a list of 78 terrestrial conservation target species within the subbasin, based on four criteria: (1) species is a Montana Species of Concern (MSOC), (2) species has been identified as a conservation priority by a Federal or Montana agency; (3) species plays a particularly important ecological or economic role in the subbasin (e.g. certain big game species), or (4) species serves as an important habitat indicator for monitoring purposes. For each conservation target species, their habitat associations and their actual status in the Bitterroot was determined from personal and telephone interviews and email communication with wildlife biologists familiar with the Bitterroot Subbasin.

The second level of analysis compared the habitat categories used by different Montana-based conservation studies, assigned conservation target species identified in the first level of analysis to their primary habitats, and ranked these “conservation target habitats” based on the number of target species that depend on them in the subbasin and the relative abundance of each habitat. This analysis yielded six conservation target habitats: riparian, wetland, sagebrush, grassland, dry forest, and mesic forest.

Limiting factors for each conservation target habitat were identified by a Terrestrial Technical Subcommittee representing various agencies and conservation organizations working in the subbasin. Limiting factors are those activities or events that reduce the amount and quality of habitat available and/or decrease the ability of wildlife to effectively use that habitat for each aspect of their lifecycle. Table 1 summarizes primary limiting factors for conservation target habitats identified in the Bitterroot Subbasin.

Table 1. Limiting factors identified for target habitats.

Limiting Factor	Riparian	Wetland	Grassland	Sagebrush	Xeric Forest	Mesic Forest
Water quality degradation (sediment, nutrient, agro-chemicals)		X				
Altered hydrology		X				
Altered channels (dikes, channelization)	X	X				
Agricultural land conversion			X	X		
Fragmented by development	X		X	X		
Fragmented by roads						X
Timber management					X	X
Fire regime					X	X
Insects and disease						X
Grazing regime	X			X		
Weeds & exotic species		X	X	X	X	
Wildlife/human conflicts (incl. pets, off-road vehicles, recreation)	X	X	X			

Fish and Aquatic Resources

Aquatic species of concern in the Bitterroot Subbasin were identified using the following criteria: (1) threatened or endangered under the ESA; (2) candidate or proposed species under ESA; (3) ranks of G1 through G3 on the NatureServe ranking system; (4) recently delisted under the ESA; or (5) Tier I in Montana's Comprehensive Fish and Wildlife Conservation Plan. Bull trout, westslope cutthroat trout, a stonefly, and western pearlshell are the four species that meet these criteria. Of these four species bull trout (Salvelinus confluentus) and westslope cutthroat trout (Oncorhynchus clarki lewisi) were selected as focal species based on their current status, distribution, and ability to indicate overall ecosystem health. Both are native species with significantly reduced ranges, and both are listed as species of concern by the State of Montana or are designated as a Federal endangered or threatened species under the Endangered Species Act (ESA).

As part of assessing the ecological relationships between the current environment and focal species populations, the Bitterroot Subbasin planners and Aquatic Technical Subcommittee evaluated all the 6th-field hydrologic units (HUCs) in the subbasin, generally using the Forest Service's Aquatic Multi-scale Assessment and Planning Framework developed by the Rocky Mountain Research Station. This

assessment tool is being used in forest plan revisions throughout U.S. Forest Service Regions 1 and 4. It includes a six step process for future management of aquatic resources: (1) documenting existing conditions; (2) determining desired conditions; (3) identifying risks and threats; (4) conducting an analysis of risks and threats; (5) developing a restoration strategy; and (6) monitoring.

A modified version of the aquatic multi-scale assessment tool was used to complete the following aquatic environment components of the subbasin assessment: summarize population status of aquatic focal species in the subbasin by 6th-field HUCs; describe existing environmental conditions in the subbasin by 6th-field HUCs; and classify 6th-field HUCs according to the degree of anthropogenic disturbances and potential for restoration.

Existing environmental conditions within the subbasin were determined using the aquatic multi-scale assessment tool through an analysis of watershed integrity. This analysis ranks 6th-field HUCs according to the relative degree of anthropogenic disturbances that can potentially affect soil productivity, hydrologic and geomorphic processes, water quality, and ultimately aquatic habitats. The intent is to use anthropogenic disturbance as a surrogate for overall watershed condition. This assessment relies on the assumption that watersheds with the least amount of human disturbance continue to function within the natural range of variability under the present climatic conditions.

At the focal species level, the multi-scale assessment tool was used to determine the primary limiting factors or threats and risks to focal species. The assessment is based on ranking a series of risks and threats to focal species populations. Risks and threats are ranked on a scale from low (1) to extreme (4) by 6th-field HUC. Risks are intrinsic population characteristics such as genetic characteristics, recruitment, isolation, and population size. Threats are land uses or conditions that can directly, indirectly, or cumulatively affect watershed conditions or aquatic habitats.

Ranking 6th-field HUCs according to anthropogenic disturbance results in a direct link to the effects of those disturbances, which can then be directly linked to restoration and conservation strategies. Assessing population viability risks at the 6th-field HUC assisted with development of biological objectives for each focal species. For each 6th-field HUC, the Aquatic Technical Subcommittee used quantitative data and professional knowledge and judgment to score each of the risks and threats. To assess the impact of these factors on focal species on a subbasin level, the subcommittee used the cumulative rankings for each category to calculate the percentage of HUCs ranked as either 'high' or 'extreme' (total number of HUCs with 'high' or 'extreme' rankings/total number of HUCs within subbasin boundary). The subcommittee then used these percentages to determine the primary factors limiting each focal species based on the relative spatial distribution of the most harmful factors in relation to other threat/risk categories. The subcommittee performed this analysis for both focal species (bull trout and westslope cutthroat trout) as well as on a subbasin-wide level. The subbasin-level analysis, which is summarized as a 'watershed integrity' assessment, was used to evaluate overall subbasin environmental conditions. The watershed integrity assessment indicates that on a subbasin scale, the primary disturbance indicators affecting focal aquatic species habitat are related to roads and dewatering.

At the focal species scale, this analysis resulted in three biological factors and three habitat-related factors most limiting to conservation and restoration of bull trout in the subbasin. Table 2 summarizes these factors.

Table 2. Summary of primary biological and habitat-related limiting factors to bull trout in the subbasin.

Bitterroot Subbasin Bull Trout Limiting Factors	
Biological	Growth and survival
	Isolation
	Non-native species
Habitat Related	Dewatering
	Temperature
	Habitat integrity (sediment)

This analysis resulted in two biological factors and three habitat-related factors most limiting conservation and restoration of westslope cutthroat trout in the subbasin. Table 3 summarizes these factors.

Table 3. Summary of primary biological and habitat-related limiting factors to westslope cutthroat trout in the subbasin.

Bitterroot Subbasin Westslope Cutthroat Trout Limiting Factors	
Biological	Isolation
	Non-native Species
Habitat Related	Dewatering
	Temperature
	Habitat Integrity

Interpretation and Synthesis

Two main components (Conservation Target Habitats and Aquatic Focal Species) define the set of factors limiting overall ecosystem health. For terrestrial habitats, Conservation Target Habitats are habitats whose integrity allows extrapolation of key terrestrial species' health and long-term viability. For aquatic habitats, two focal species have habitat requirements that are closely linked to the ability of aquatic habitats to provide healthy and sustainable conditions to support aquatic species diversity.

A Terrestrial Technical Subcommittee used the best available scientific data to identify limiting factors for terrestrial habitats. These factors indicate the priorities for conservation and restoration necessary to ensure the long-term viability of target conservation species. For aquatic habitats, an Aquatic Technical subcommittee identified limiting factors using a 6th-field HUC analysis of risks and threats to focal species' survival. These factors were prioritized to isolate the factors that should be addressed in subsequent restoration and conservation projects suggested by this plan.

This information provides a foundation for developing scientific hypotheses concerning ecological behavior and the ways that human intervention might prove beneficial. Given the range of habitats, the number of key species impacted, and the size of the subbasin, this analysis is necessarily confined to broad evaluations of habitat quality. Despite this lack of specificity, understanding the ways in which human activity in the subbasin is contributing to limiting factors allows initiation of restoration,

conservation, and educational programs on a scale that can potentially address these issues in a meaningful way.

The assessment results in a set of working hypotheses that form the basis for developing restoration and conservation objectives and strategies in the Management Plan. These hypotheses are listed below.

Aquatic Working Hypotheses

Aquatic working hypotheses were developed for each focal species and each of the two primary habitat units located with the Bitterroot Subbasin: the mainstem Bitterroot River (M) and Bitterroot River tributary streams. Due to the difference in management objectives and strategies, a separate working hypothesis was developed for the portion of tributary streams on public lands (T) and the portion of tributary streams on private lands (PT).

- **Bull Trout (BT) Hypothesis:** Persistence and abundance is limited by the loss of fluvial population components and genetic interchange.
- **Westslope Cutthroat Trout (WCT) Hypothesis:** Persistence and abundance is limited by genetic introgression with rainbow trout and the loss of fluvial population components and genetic interchange, which are a direct result of lost connectivity.
- **Public Tributary (T) Hypothesis:** Primary limiting factors are barriers and sediment (road-related).
- **Private Tributary (PT) Hypothesis:** Primary limiting factors are dewatering, elevated stream temperature, and overall habitat integrity.
- **Mainstem (M) Hypothesis:** Primary limiting factor is elevated summer water temperature.

Terrestrial Working Hypotheses

Terrestrial working hypotheses were developed for each of the target conservation habitats. For riparian habitats, one working hypothesis was developed for riparian habitat located along the mainstem Bitterroot River and a second developed for riparian habitat located along tributary streams.

- **Riparian Habitat (Mainstem):** Primary limiting factors for deciduous cottonwood forest and shrub riparian habitats are altered channels and floodplain functionality, fragmentation caused by development, grazing regimes, and wildlife/human conflicts.
- **Riparian Habitat (Tributaries):** Primary limiting factors for shrub riparian and riparian conifer forests are altered channels and floodplain functionality, fragmentation caused by development, grazing regimes, and wildlife/human conflicts. Minor limiting factors include agricultural land conversion, and roads and timber management (for conifer riparian).
- **Wetland Habitat:** Primary limiting factors are altered hydrology (drainage and diversion of water supply), altered channels, weeds and exotic species, and wildlife/human conflicts.
- **Grassland Habitat:** Primary limiting factors are agricultural land conversion, fragmentation caused by development, weeds and exotic species, and wildlife/human conflicts.
- **Sagebrush Habitat:** Primary limiting factors are agricultural land conversion, fragmentation caused by development, grazing regime, and weeds and exotic species.
- **Dry Forest (Dry Ponderosa pine):** Primary limiting factors are timber management, fire regime, and weeds and exotic species.
- **Mesic Forest (various subtypes):** Primary limiting factors are fragmentation caused by roads, timber management, fire regime, and insects and disease.

Subbasin Inventory

What is the Inventory?

The Bitterroot Subbasin Inventory (Inventory) describes existing protections and management plans in the subbasin and briefly discusses how well they are addressing the limiting factors described in the Assessment. The Inventory includes brief descriptions of recent restoration and conservation projects in the subbasin and summarizes work being done for fish and wildlife and how well that work is addressing the factors limiting fish and wildlife productivity and abundance.

Fish and Wildlife Conservation Protections, Plans, and Partners

Protections for fish and wildlife habitats in the subbasin include Federal Wilderness designations, National Wildlife Refuges, state and private wildlife management and conservation areas, natural areas, or various special fisheries or wildlife designations. This section of the Inventory describes the main protections and plans in place in the subbasin. In addition to the NWPCC Protected Area Program, the Inventory identifies and briefly outlines 6 federal plans, 16 state plans, 8 county programs, and 19 other conservation lands, organizations, and agencies working toward natural resource and open-lands protection in the Bitterroot Subbasin.

Restoration and Conservation Project Inventory

The Inventory includes descriptions of projects completed between 1998 and 2008. This section of the Inventory was completed by gathering information regarding various categories of projects by 6th-field hydrologic unit (HUC) or subwatershed. One of the most significant challenges to implementing a unified conservation strategy is coordination among all the subwatersheds. Compiling information about conservation and restoration activities by subwatershed makes it possible to place current activities in a subbasin context for participants in the next phase of subbasin planning. In addition to projects that involve either changes in land management or active restoration, several agencies and organizations have active programs to place private lands under conservation easements. Table 4 provides a summary of the restoration and conservation project types inventoried as occurring in the subbasin between 1998 and 2008.

Table 4. Summary of conservation project inventory conducted for the subbasin between 1998 and 2008.

Project Type	Water Lease	Fish Passage	Channel Work	Sediment Reduction	Land Exchange	Grazing Management	Habitat Restoration
Number of Subwatersheds (n=51)	13	23	13	27	10	13	26
Percent of all Subwatersheds	25	45	25	53	20	25	51

Subbasin Management Plan

What is the Management Plan?

The Management Plan sets forth a desired direction for fish and wildlife conservation and restoration in the subbasin taking into account the science, local conditions, concerns, and applicable law and policy. The hierarchical approach begins with a vision for the subbasin, followed by biological objectives and strategies to achieve the vision. The Management Plan also includes a monitoring and evaluation plan for the restoration and conservation strategies that may be implemented. The Management Plan has a 10-to-15-year horizon, recognizing that additional information and analysis may indicate the need for periodic refinement.

Vision and Scientific Guiding Principles

The vision for the NWPCC Fish and Wildlife Program is a Columbia River ecosystem that sustains an abundant, productive, and diverse community of fish and wildlife, mitigating across the basin for the adverse effects to fish and wildlife caused by the development and operation of the hydrosystem. This ecosystem provides abundant opportunities for tribal trust and treaty-right harvest and for non-tribal harvest and the conditions that allow for the recovery of the fish and wildlife affected by the operation of the hydrosystem and listed under the Endangered Species Act.

The vision for the Bitterroot Subbasin is a healthy, productive watershed sustaining abundant and diverse fish and wildlife communities and providing social, cultural, and economic well-being for present and future generations of people. It is a subbasin that effectively employs an inclusive, consensus-based approach to conservation and restoration in order to protect fish and wildlife and their habitats, consistent with the customs and quality of life valued by the communities within the subbasin.

Objectives and Strategies

The NWPCC developed biological objectives for the Columbia River Basin. These objectives describe the physical and biological changes needed to achieve the basin-wide vision. They are useful for determining the amount of basin-wide change needed to fulfill the vision, determining the cost-effectiveness of various basin-wide strategies and assessing overall Program effectiveness. The biological objectives have two components: (1) biological performance, which describes population responses to habitat conditions (in terms of capacity, abundance, productivity, and life-history diversity); and (2) environmental characteristics, which describe the environmental conditions necessary to achieve desired population characteristics.

Subbasin-Level Aquatic Objectives and Strategies

For the Bitterroot Subbasin, the Aquatic Technical Subcommittee developed aquatic objectives and strategies in response to the vision for the subbasin, the current biological and ecological conditions, and the economic and social realities described in the Assessment. The biological objectives for aquatic focal species describe the social and biological changes within the subbasin needed to achieve the vision.

Objectives were designed to mitigate aquatic limiting factors identified for focal species in the Assessment. The subcommittee developed objectives for each focal species and for categories of habitat, including the mainstem Bitterroot River and tributary streams. Table 5 lists aquatic objectives.

Table 5. Aquatic habitat objectives.

Objective ID	Objective
Biological	
BULL TROUT	
BT1	Maintain or increase the number of fish in resident bull trout populations and increase the number of migratory fish.
BT2	Where possible, reduce further expansion or suppress non-native species that have been determined to be a significant threat to bull trout.
BT3	Achieve an overall bull trout population trend that is accepted to be stable or increasing based on at least 10 years of monitoring data.
BT4	Evaluate needs and opportunities to increase populations of bull trout throughout the subbasin by 2015.
WESTSLOPE CUTTHROAT TROUT	
WCT1	Maintain or increase the total number of genetically pure local populations and maintain the broad distribution of local populations.
WCT2	Maintain or increase the number of fish in the migratory population.
WCT3	Where possible, reduce further expansion, suppress, or eradicate species that hybridize and directly compete with westslope cutthroat trout.
WCT4	Evaluate needs and opportunities to increase populations of westslope cutthroat trout throughout the subbasin by 2015.
Habitat	
MAINSTEM	
M1	Provide stream temperature connectivity in the form of cold water refugia from tributaries to support movement of focal species.
TRIBUTARIES	
Tributary (Public)	
T1	Reduce the delivery of human-caused fine sediments to the maximum extent possible.
T2	Maintain existing levels of prime, functioning tributary habitat.
Tributary (Private)	
TP1	Restore stream flows to levels that will support focal species survival.
TP2	Restore habitat diversity to support sustainable population levels of focal species.

A series of tables in the Management Plan identify strategies to achieve each of the aquatic management objectives. The Management Plan also describes the aquatic restoration prioritization approach and criteria used to identify subwatersheds where restoration strategies should be applied. This approach categorizes each 6th-field HUC into one of three categories; (1) Conservation, 2) Active Restoration or 3) Deferred Restoration. Active Restoration subwatersheds are those areas identified, according to criteria developed by the Aquatic Technical Subcommittee, as the locations where restoration, conservation, or management actions over the next 10 to 15 years would most benefit aquatic focal species.

The Management Plan identifies some near-term opportunities for watershed restoration and protection based on habitat quality, community composition, native species abundance, and ESA requirements. Near-term opportunities for restoration are those that are necessary for the recovery of listed species and in slightly to moderately degraded habitats important to focal and target species.

Subbasin-Level Terrestrial Habitat Objectives and Strategies

For the Bitterroot Subbasin, the Terrestrial Technical Subcommittee developed terrestrial objectives and strategies in response to the vision for the subbasin, the current biological and ecological conditions, and the economic and social realities described in the Assessment. Unlike the aquatic objectives, which were written in terms of population-related attributes of focal species, the terrestrial habitat objectives are described in terms of changes needed in priority habitats. Species-centered objectives and strategies were not appropriate for wildlife because adequate information is not available. Instead, wildlife objectives focus on habitat and wildlife strategies focus on the ecological function of habitat related to target species. Table 6 lists terrestrial habitat objectives.

Table 6. Terrestrial habitat objectives.

Objective ID	Objective
RIPARIAN AND WETLAND HABITATS	
RW1	Protect all existing riparian habitat in all sections of Game Management Unit 260 (from Missoula to Darby) to maintain healthy populations of all riparian deciduous forest and shrub riparian target species in each section of the GMU, and maintain connectivity of habitat/ wildlife corridors throughout the river floodplain.
RW2	Protect at least 50 percent of existing high-quality riparian habitat on private land in each tributary Game Management Unit, and conserve and manage all public land riparian habitat to maintain healthy populations of appropriate deciduous riparian forest species, all shrub riparian and all riparian coniferous forest target species in each GMU.
RW3	Protect and manage all existing wetlands in the Bitterroot River mainstem geologic floodplain area (GMU 260), and all high-quality tributary wetlands to maintain or improve subbasin populations of wetland target species by 2025.
GRASSLAND AND SAGEBRUSH/SHRUB HABITATS	
GSS1	Protect at least 30,000 new acres of Class 1 and Class 2 grassland and sagebrush/shrub habitat, including 20,000 acres in the lower and middle Bitterroot, and at least 10,000 acres in the upper Bitterroot (above Darby) by 2025.
GSS2	Improve, enhance and conserve the 30,000 new acres of grassland/sagebrush/shrub habitat protected under Objective #1.
DRY FOREST AND MESIC FOREST	
DFMF1	Maintain, conserve and manage all Class 1 (high-priority) dry forest and mesic forest habitats in all game management units, including securing protection for at least 5,000 additional acres of private land in the dry forest type by 2025, and maintain the populations of all target species in each game management unit.
DFMF2	**Objective 2 –** Restore and maintain Class 2 (priority) dry forest and mesic forest habitats in all units, including habitat restoration on 20,000 acres of dry forest and restoration of at least 20 percent of USFS mesic forests to appropriate fire regime condition classes, while maintaining or increasing populations of all target species.
DFMF3	**Objective 3 –** Restore examples of locally uncommon Class 2 mesic forest subhabitats including ecologically functional subalpine spruce-fir, western larch, burned forest, and white bark pine ecosystems, and achieve measurable increases of aspen/mixed broadleaf inclusions where opportunities exist on the landscape by 2025.
DFMF4	**Objective 4 –** Rehabilitate Class 3 dry and mesic forest habitats where opportunities exist.

A series of tables in the Management Plan identify strategies to achieve each of the terrestrial habitat management objectives.

Terrestrial conservation strategies are prioritized by evaluating and ranking land units for each habitat type for habitat conservation potential (habitat units). Evaluating and classifying habitat units will assist in applying the biological objectives and their strategies in the appropriate places. Ranking the conservation value of habitat units will guide future project selection. To prioritize conservation target habitats, patches or areas characterized as predominantly one of four habitat groups: grassland, sage/shrub, dry forest or mesic forest were identified for the subbasin. Since many of the target wildlife species for these habitats depend on large, relatively intact areas of their preferred habitat type, the largest habitat patches of each type were identified on the landscape and ranked according to conservation value. The criteria and size classes used in this prioritization are described in the Management Plan.

A slightly different approach was used for wetland and riparian habitat because these habitats are scarce in the Bitterroot Subbasin and appear in GIS analysis as large numbers of small, disjunct fragments (polygons). Therefore, for wetland and riparian habitats habitat polygons were consolidated into subsets of data, dividing the subbasin into 14 "regional subsets" based on MFWP Game Management Units. We then analyzed the regional subsets in each Game Management Unit. Therefore, the final rankings of riparian and wetland habitat conservation priorities appear as "regions" of the subbasin.

Many of the highest priority near-term opportunities for target conservation habitats in the subbasin occur on private land. Several private conservation organizations, including Rocky Mountain Elk Foundation, Bitter Root Land Trust, Five Valleys Land Trust, and Montana Fish, Wildlife & Parks, among others, work closely with private landowners to conserve wildlife habitat on these lands.

Research, Monitoring and Evaluation

A monitoring and evaluation program is needed to ensure that the strategies selected and implemented are addressing the limiting factors as anticipated, verify that the limiting factors identified in the assessment are the elements that are limiting the environmental expression and biological performance desired, and evaluate progress towards meeting objectives. The monitoring and evaluation program is described in terms of an adaptive management framework. The research plan included in the Management Plan is a first step that will be expanded over the course of the five-year iterative review process. Current or on-going research, monitoring and evaluation (RM&E) programs incorporate many of the RM&E needs identified in this section. Therefore, implementation of this plan will require close coordination with existing programs to prioritize needs, maximize effectiveness, and reduce redundancy.

Aquatic Research Plan

Aquatic research needs reflect limiting factors identified in the Assessment and the vision, hypotheses, objectives, and strategies sections of the Management Plan. This section of the Management Plan presents the primary data gaps that form the basis for development of a research agenda. Data gaps and research needs are linked to specific management objectives, which in turn are tied to the working hypotheses and limiting factors identified in the Assessment. The list of data gaps is not comprehensive, but is intended to serve as an outline for development of a comprehensive research agenda in the future. A number of entities conduct aquatic research and monitoring in the subbasin. These entities include state and federal agencies, universities, local schools, and non-profit organizations. An effective research

program will require a coordinated effort among these entities. Integrating research activities with regional efforts will also be important.

The data gaps identified by aquatic objective in the Management Plan are the foundation for the design of research projects. Each research project will require development of a number of elements, including: hypotheses, sampling frequencies, sampling protocols, experimental design, and statistical analysis appropriate for the species of interest, and the scope of research. These details will be included at the proper scale in project proposals. Objectives and strategies, hypotheses for testing, and the spatial and temporal scale at which research should be conducted provide a guide for research efforts.

The results of on-going and future research will provide the necessary data to assist planners in making management decisions, including prioritizing strategies and locations for implementing strategies within and between Active Restoration subwatersheds. The Aquatic Research Plan also describes how on-going and future research will fit into future decision making in more detail.

Terrestrial Research Plan

Substantial data gaps limit the value of a terrestrial wildlife conservation plan based on priority habitats. Data gaps exist at all levels, including basic target species population status and biology, description and understanding of target species relationship to habitats, and ecology of habitat management and restoration. The Terrestrial Research Plan is general and preliminary, and focuses on addressing the most significant data gaps. It was developed by Terrestrial Technical Subcommittee members as part of the Subbasin Plan's process of analyzing limiting factors and developing working hypotheses, objectives, and strategies.

Some components of the research plan involve development of better baseline data on target species and habitats through regular monitoring. These monitoring functions will eventually be integrated into the overall adaptive management feedback process so that long-term progress toward conservation objectives can be tracked. Evaluation of these monitoring data will be part of the adaptive management decision-making process.

A team of stakeholders will need to develop this preliminary plan into a full-scale research plan. The Lolo and Bitterroot National Forests, the USFS Regional biologists, the USDA-Rocky Mountain Research Station in Missoula, Montana Fish, Wildlife & Parks, and the University of Montana are key stakeholders. They have been collaborating on research in the Bitterroot for a number of years through the Bitterroot Ecosystem Management Research Program, which provides a strong basis for future conservation-oriented research work. A variety of federal and state agencies have species monitoring programs in the subbasin that monitor target wildlife species. Several tables in the Management Plan outline examples of ongoing monitoring programs for conservation target species.

Accomplishing the terrestrial wildlife conservation objectives will require substantial investment in additional research, monitoring, and evaluation. The Management Plan provides a table with guidance on data gaps and research and monitoring needs for specific objectives within the Subbasin Plan. These research and monitoring programs need to be developed and incorporated into the adaptive management strategy.

Adaptive Management, Monitoring and Evaluation

The Monitoring Plan outlines an adaptive management framework that links the Subbasin Management Plan with subsequent project planning, prioritization, and implementation. The Management Plan applies coarse-scale prioritization criteria to subwatersheds based on what is currently known about focal species and habitats in subwatersheds and throughout the subbasin, and includes objectives and strategies for focal species and habitats. Many data gaps still exist, particularly at the resolution of individual subwatersheds. Because adaptive management means that managers must be flexible and able to respond to new information as it becomes available, it is important to fill data gaps in a structured way, so information from research and project effectiveness monitoring can feed back into the overall program. This feedback system is the adaptive management framework for the Bitterroot Subbasin Plan.

When applied to conservation and restoration planning at a large scale (as with the Bitterroot Subbasin), adaptive management provides a necessary framework for implementing the Subbasin Plan and linking it to related programs managed by other stakeholders. So, rather than just being one activity, adaptive management encompasses all phases of implementation, including project prioritization within subwatersheds, project implementation, research, and monitoring and evaluation.

Implementing the Subbasin Plan within an adaptive management framework will result in an interdisciplinary process focused on increasing knowledge about the ecosystem and its habitats and focal species and how projects affect focal species and habitats. This allows for projects developed in later phases of Subbasin Plan implementation to incorporate effectiveness monitoring data from previous projects, resulting in new projects being more effective than they would be without this feedback loop. Figure 1 illustrates an example of this adaptive management feedback loop.

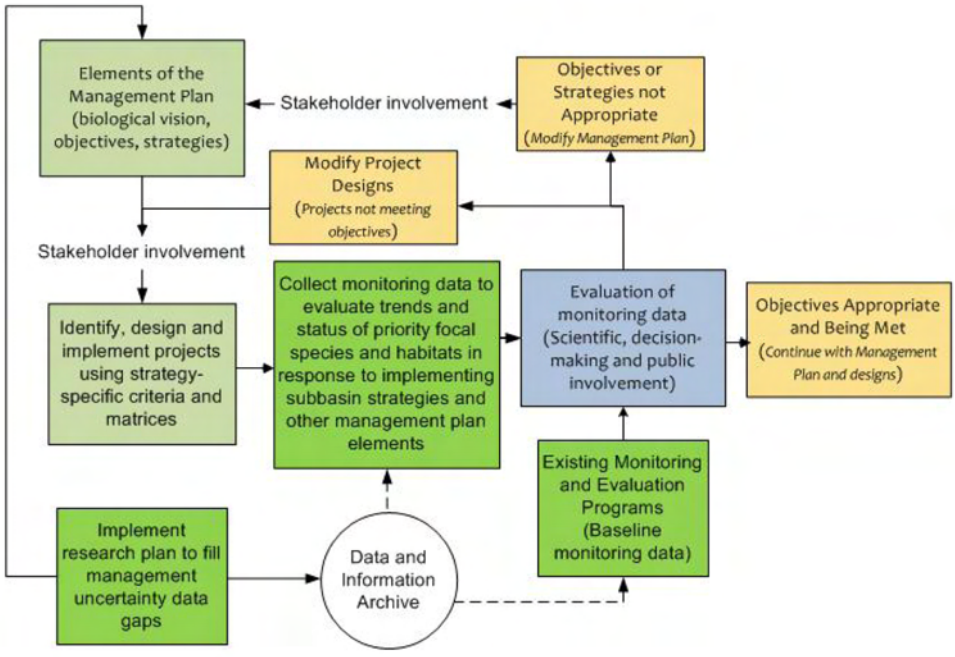

Figure 1. Bitterroot Subbasin Plan Adaptive Management Framework. Grey boxes indicate planning steps; green boxes indicate data inputs (research and monitoring), the blue box indicates the evaluation step, and brown boxes indicate decision-making steps.