# 3.0 Subbasin Assessment

## 3.1 What is the Subbasin Assessment?

The primary purpose of the Subbasin Assessment is to synthesize and evaluate the biological, physical and socioeconomic characteristics of the Blackfoot Subbasin, forming a scientific and technical foundation for prioritization of restoration and protection strategies for habitat and fish and wildlife populations in the subbasin. The Assessment begins in Section 3.2 with a broad characterization of the subbasin environment and examination of the subbasin in a regional context. This overview provides the geographical, ecological, and cultural context for the remainder of the subbasin plan.

Section 3.3 and 3.4 focus on eight key conservation targets considered to be representative of the natural and cultural resources of the Blackfoot Subbasin. In these sections, we describe the conservation targets and provide an assessment of the viability, or ecological health, of each. We then focus on the stresses and threats (i.e., human impacts) that jeopardize the viability of conservation targets. This assessment of critical threats sets the stage for the development of conservation objectives and strategic actions presented in the Subbasin Management Plan (Section 5.0).

## 3.2 Blackfoot Subbasin Overview

### 3.2.1 Geography and Regional Context

The Blackfoot Subbasin encompasses 1.5 million acres (2,345 square miles) of biologically rich and diverse lands in portions of four northwest Montana counties: Lewis and Clark, Powell, Missoula and Granite. The Blackfoot Subbasin is bordered to the east by the Continental Divide, to the south by the Garnet Mountains, to the north by the Bob Marshall and Lincoln-Scapegoat Wilderness areas and to the west by the Rattlesnake Wilderness area. Elevations in the subbasin range from 9,202 feet on Scapegoat Peak to 3,280 feet near Bonner, Montana where the Blackfoot enters the Clark Fork River.

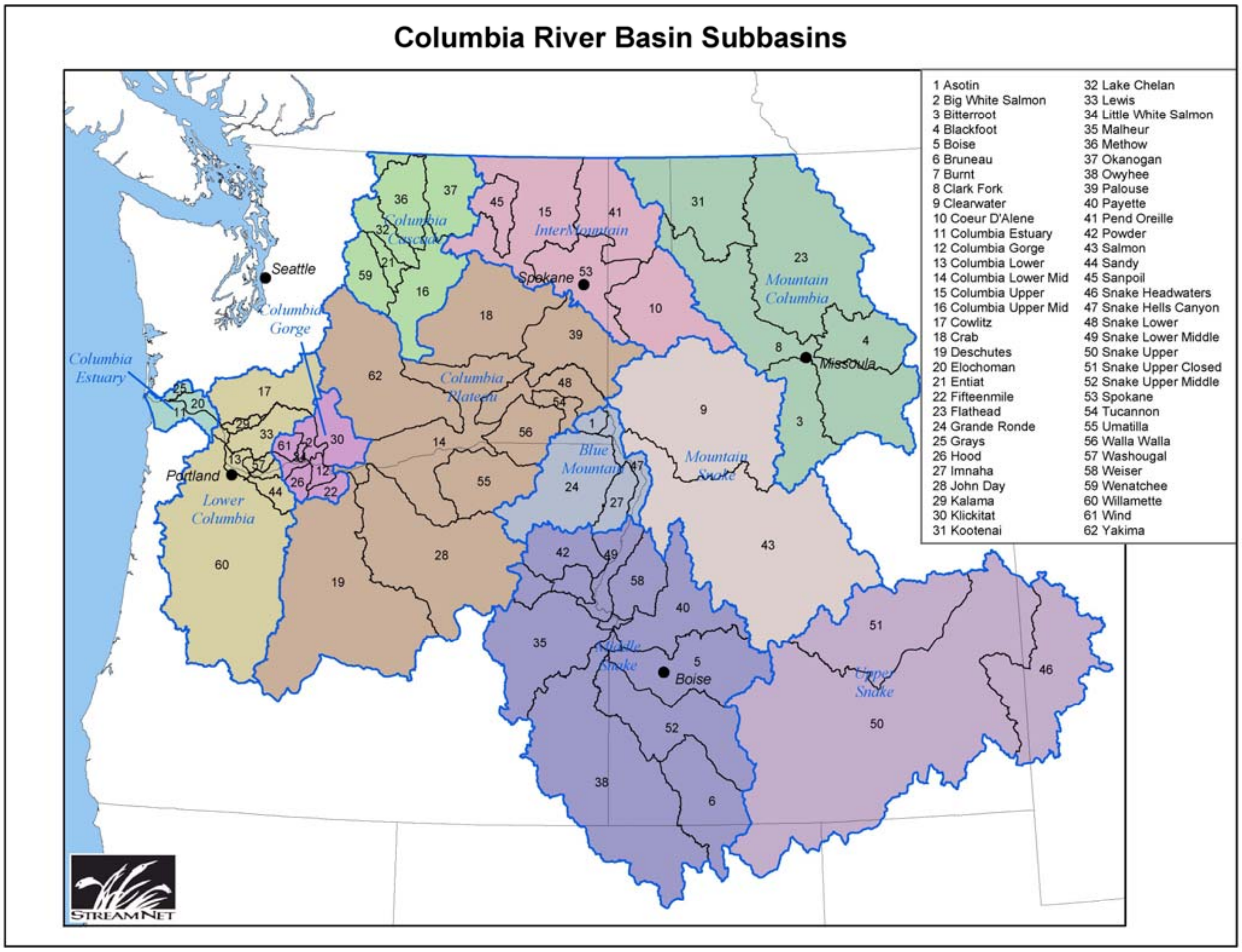
A tributary of the Columbia River, the free-flowing Blackfoot River flows 132 miles from its headwaters near Rogers Pass on the Continental Divide to its confluence with the Clark Fork River at Bonner. The subbasin is characterized by narrow headwater canyons opening to generally rolling terrain at the heart of the subbasin and ending in a narrow, incised, stream-cut canyon. The Blackfoot River is ranked as a Tier I Aquatic Conservation Focus Area in Montana's Comprehensive Fish and Wildlife Conservation Strategy. Tier I species, communities, and focus areas are considered by MFWP to be of the greatest conservation need in Montana (MFWP 2005).

The Blackfoot Subbasin is part of the Clark Fork-Pend Oreille River Basin and is identified by the U.S. Geological Survey (USGS) 8-digit HUC number 17010205.[1] The Blackfoot is one of

[1] **HUC** is the acronym for Hydrologic Unit Code (HUC). Every hydrologic unit is identified by a unique HUC consisting of two to eight digits based on the levels of classification in the hydrologic unit system. A hydrologic unit describes the area of land upstream from a specific point on the stream (generally the mouth or outlet) that

the easternmost subbasins within the Columbia River Basin (Figure 3.1). The Columbia River Basin Fish and Wildlife Program organizes the subbasins of the Columbia River Basin into 11 ecological provinces, or groups of adjoining subbasins with similar hydrology, climate, and geology. The Blackfoot Subbasin is part of the Mountain Columbia Ecological Province along with the Bitterroot, Clark Fork, Flathead, and Kootenai Subbasins (NPPC 2000). Although anadromous fisheries do not extend into the Blackfoot, the subbasin is significant as a headwaters drainage of the Columbia River system.

**Figure 3.1 Location of the Blackfoot Subbasin within the Columbia River Basin.**




The Blackfoot Subbasin is located at the southern edge of the Crown of the Continent Ecosystem (COCE), a ten million-acre area of the Northern Rocky Mountains that extends north into

contributes surface water runoff directly to this outlet point. Another term for this concept is drainage area. It is delineated by starting at a designated outlet point (usually the river mouth) and proceeding to follow the highest elevation of land that divides the direction of surface water flow (usually referred to as the ridge line). This boundary will follow the basin ridges until connected back at the outlet point. This federal interagency system conveys the hierarchical nature of the sizes and assemblages of typical natural hydrology.

Canada and includes Waterton-Glacier International Peace Park, Canada's Castle Wilderness, the Bob Marshall-Great Bear-Scapegoat Wilderness Complex, parts of the Flathead and Blackfeet Indian Reservations, Bureau of Land Management (BLM) lands and significant acreage of state and private lands. The COCE is one of the most intact ecosystems in North America. The Blackfoot Subbasin provides critical connections between the COCE and the Selway/Bitterroot Ecosystem to the south.

### 3.2.2 Geology

The Blackfoot Subbasin has a complex geologic history. The mountains near the Blackfoot River between Missoula and Rogers Pass consist mostly of Precambrian-age (1.5 billion-year-old) sedimentary rocks, including shale, siltstone, sandstone, and carbonate. These rocks, known collectively as the Belt Formation, formed as a result of almost 500 million years of deposition of sediments into a large inland sea referred to as the Belt Basin. These sedimentary deposits are remarkably consistent over large distances and have been measured locally to be over 40,000 feet thick. During the formation of the Rocky Mountains from 75 to 60 million years ago, Precambrian Belt rocks in the vicinity of the Blackfoot Subbasin were uplifted, folded, and thrust eastward over younger Paleozoic and Mesozoic Era (~543-65 million-year-old) sedimentary rocks. Between Lincoln and Rogers Pass, the Blackfoot is a narrow valley cut through this overthrust belt (Alt and Hyndman 1986).

Granitic intrusions were emplaced within the Belt rocks both before and after thrusting and resulted in the formation of mineral deposits (Alt and Hyndman 1986). Large portions of the subbasin were subsequently covered with volcanic deposits during the middle Tertiary Period (~40 million years ago). Remnants of these volcanic rocks are found primarily in the southern portion of the subbasin (Mudge et al. 1982, Lewis 1998). The Potomac Valley and the broad valley around Clearwater Junction are structural basins filled with deep sediment that deposited during the Tertiary Period, when the region had a dry climate. The two valleys were once one continuous basin until a fault raised Greenough Ridge to separate them (Alt and Hyndman 1986).

Glaciation strongly influenced the current subbasin landscape as evidenced by numerous moraines and associated hummocky topography, glacial pothole lakes and broad expanses of flat glacial outwash (Whipple et al. 1987, Cox et al. 1998). The Blackfoot Subbasin was subjected to two major periods of glaciation, the Bull Lake glaciation (~70,000 years ago) and the Pinedale glaciation (~15,000 years ago). During these periods, large continuous ice sheets extended from the mountains southward into the Blackfoot and Clearwater River valleys (Witkind and Weber 1982). During the latter part of the Pleistocene Era, the Blackfoot Valley was further shaped by the repeated filling and catastrophic draining of Glacial Lake Missoula, a massive lake formed by a series of ice dams that impounded the Clark Fork River downstream of Missoula. In the Blackfoot Valley, Glacial Lake Missoula extended upstream as far as Clearwater Junction (Alt and Hyndman 1986).

When the glaciers receded, large deposits of glacial till, glacial outwash, and glacial lakebed sediments were left behind. These deposits cover much of the Blackfoot Valley floor, shaping the topography of the valley and the geomorphology of the Blackfoot River and the lower reaches of most tributaries. Glacial features evident on the landscape today include moraines, outwash plains, kame terraces and glacial potholes. The landscape between Clearwater Junction and Lincoln, for example, is characterized by alternating areas of glacial moraines and their associated outwash plains. In this area, ice pouring down from the mountains to the north spread out to form large ponds of nearly stagnant ice several miles across known as piedmont glaciers. Muddy meltwater draining from these piedmont glaciers spread sand and gravel across the ice-free parts of the valley floor to create large outwash plains. The town of Ovando sits on one of these smooth outwash plains (Alt and Hyndman 1986). Due to the highly permeable nature of coarse outwash sediments, streams generally lose water through infiltration and often go dry where they cross outwash plains. Such is the case with the Blackfoot River between the Landers Fork and the town of Lincoln. Since glaciation, the geomorphology of the lower elevation portions of the subbasin has been modified by alluvium originating from reworked glacial deposits. Alluvial deposits cover most drainage bottoms and reach depths of several hundred feet in portions of the Blackfoot Subbasin (MDEQ 2008a, 2008b, Tetra-tech 2004).

### 3.2.3 Soils

Soils in the Blackfoot Subbasin are extremely variable due to the diverse influences of climate, topography, and geology (Figures 3.2 and 3.3). In general, the soils are strongly related to the geologic substrates and landforms of the subbasin. The State Soil Geographic (STATSGO) database provides a consistent method of assessing generalized soil characteristics on a subbasin scale. Although generalized, the STATSGO database also provides information on the physical and chemical properties of soils. The majority of soil types present in the subbasin have similar surface textures, are moderately well to well drained, and have a depth to water table between three and six feet. These dominant soils are neither prime farmland nor hydric soils supporting wetlands. For the following soils characterization, the subbasin is divided into four sections: 1) Blackfoot Headwaters planning area, 2) Nevada Creek planning area, 3) Middle Blackfoot planning area and 4) Lower Blackfoot planning area. These sections correspond with the planning areas used for TMDL development in the subbasin (Section 3.2.5.2). The soils characterizations are taken from the four Blackfoot TMDL plans (MDEQ 2003, 2004, 2008a, 2008b).

*Blackfoot Headwaters planning area*

In the Blackfoot Headwaters Planning Area, Quaternary alluvium and glacial deposits cover much of the Blackfoot River and Landers Fork valley bottoms as well as much of the Beaver Creek, Stonewall Creek and Willow Creek sub-watersheds. The headwaters of the Landers Fork deeply down cut through this Quaternary glacial till, providing a significant natural source of fine sediment and coarse cobbles to the Landers Fork and ultimately, the Blackfoot River.

*Nevada Creek planning area*

Eight soil units are present in the Nevada Creek planning area. Of these, four collectively comprise 83% of the planning area (Table 3.1). Textures of the soil units closely reflect the geology of the area. Gravelly soils are typically found in areas covered by a veneer of glacial deposits. The textural term “channery” refers to flat rock fragments, most likely derived from sedimentary Precambrian Belt rocks. The majority of soil types present have similar surface textures, are moderately well to well drained, and have a depth to water table between three and six feet.

**Table 3.1 Major Soil Units in the Nevada Creek Planning Area, Blackfoot Subbasin.**

| Soil Map Unit Name | Percent Area | Surface Texture |
|---|---|---|
| STEMPLE-MOCMONT-HELMVILLE (MT546) | 30.4% | Very channery loam |
| BIGNELL-YOURAME-ROY (MT045) | 22.0% | Gravelly clay loam |
| FERGUS-ROY-TETONVIEW (MT199) | 18.7% | Loam |
| REPP-WHITORE-WINKLER (MT473) | 12.1% | Very gravelly loam |
| WOROCK-GARLET-DANAHER (MT662) | 9.2% | Gravelly loam |
| WINKLER-PERMA-BIGNELL (MT650) | 3.0% | Gravelly loam |
| WARSING-VASTINE FAMILY-FLUVAQUENTIC HAPLAQUOLLS (MT665) | 2.0% | Loam |
| LOBERG-DANAHER-WOROCK (MT342) | 1.6% | Clay loam |
| OVANDO-ELKNER-SHADOW (MT436) | 0.9% | Gravelly silty loam |

*Middle Blackfoot planning area*
Thirty soil units are present in the Middle Blackfoot planning area, of which seven cover 75% of the planning area (Table 3.2). The majority of these seven soil units are gravelly loams and silty loams that correlate with the location of Quaternary alluvium and glacial deposits. The exception is the Worock-Garlet-Danaher Association, which appears to correlate with the location of coarser grained sedimentary Precambrian Belt rocks. The 23 minor soil units as a group correlate well with exposures of intrusive and extrusive igneous rocks as well as various Belt lithologies. The majority of soil types present have similar surface textures, are moderately well to well drained, and have a depth to water table between three and six feet.

**Table 3.2 Major Soil Units in the Middle Blackfoot Planning Area, Blackfoot Subbasin.**

| Soil Map Unit Name | Percent Area | Surface Texture |
|---|---|---|
| WALDBILLIG-HOLLOWAY-BATA (MT610) | 19.6% | Gravelly silty loam |
| WOROCK-GARLET-DANAHER (MT662) | 11.6% | Gravelly loam |
| PERMA-QUIGLEY-WILDGEN (MT445) | 9.0% | Gravelly loam |
| ROCK OUTCROP-COEROCK-PHILLCHER (MT483) | 8.5% | Unweathered bedrock |
| STEMPLE-GARLET-COWOOD (MT139) | 8.3% | Very channery loam |
| WILDGEN-WINFALL-RUMBLECREEK (MT634) | 7.5% | Gravelly loam |
| TOTELAKE-WINFALL-YOURAME (MT579) | 6.8% | Gravelly loam |

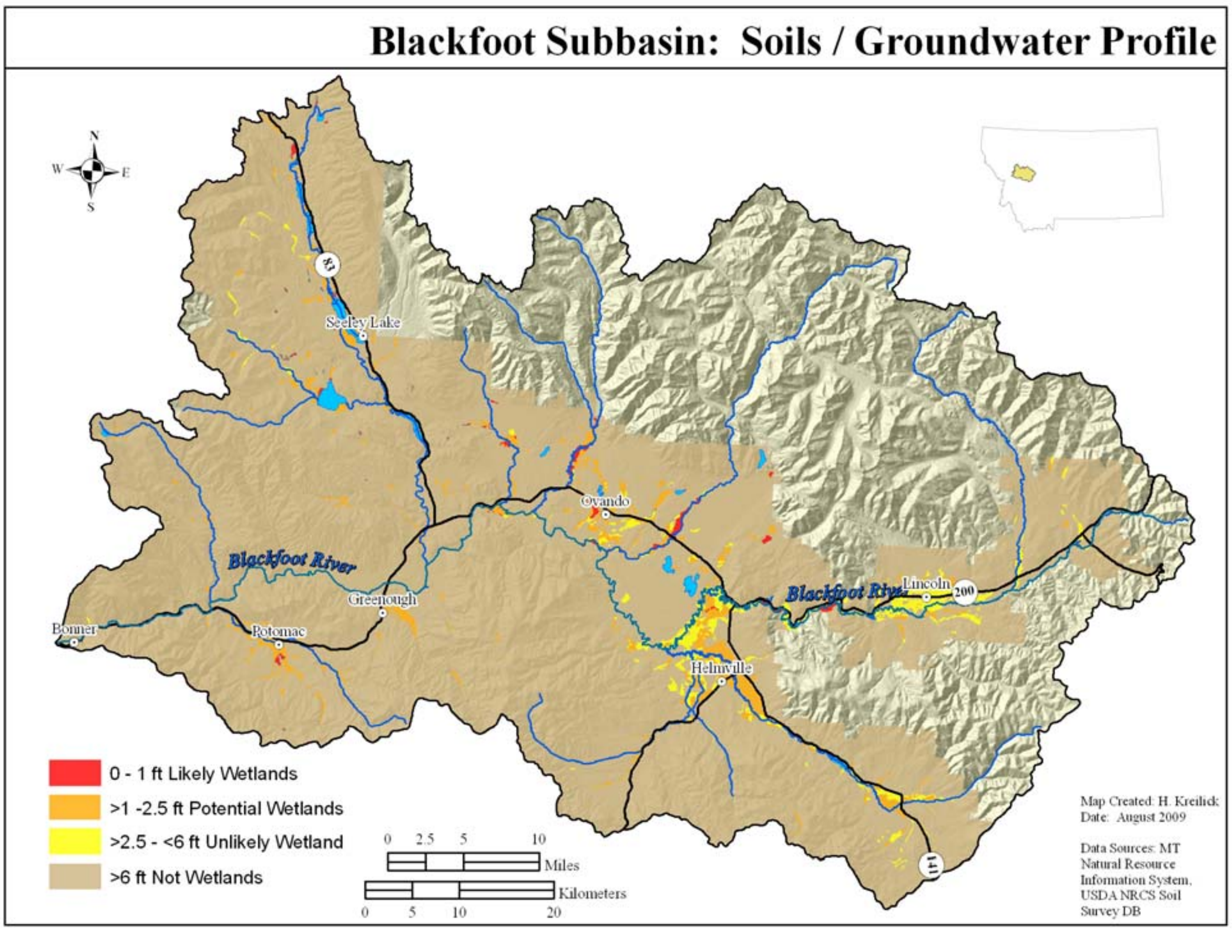
*Lower Blackfoot planning area*
Fifteen soil units are present in the Lower Blackfoot planning area, five of which cover 76% of the planning area (Table 3.3). The most abundant five soil units are gravelly loams and correspond with the location of Quaternary alluvium and glacial deposits. The 10 minor soil units as a group correlate well with exposures of intrusive and extrusive igneous rocks as well as various Belt lithologies.

**Table 3.3 Major Soil Units in the Lower Blackfoot Planning Area, Blackfoot Subbasin.**

| Soil Map Unit Name | Percent Area | Surface Texture |
|---|---|---|
| WINKLER-EVARO-ROCK OUTCROP (MT647) | 25.5% | Gravelly sandy loam |
| WINKLER-EVARO-TEVIS (MT646) | 20.8% | Gravelly loam |
| WALDBILLIG-HOLLOWAY-BATA (MT610) | 13.5% | Gravelly silty loam |
| BIGNELL-WINKLER-CROW (MT046) | 10.4% | Gravelly loam |
| HOLLOWAY-WINKLER-ROCK OUTCROP (MT283) | 5.8% | Gravelly silty loam |

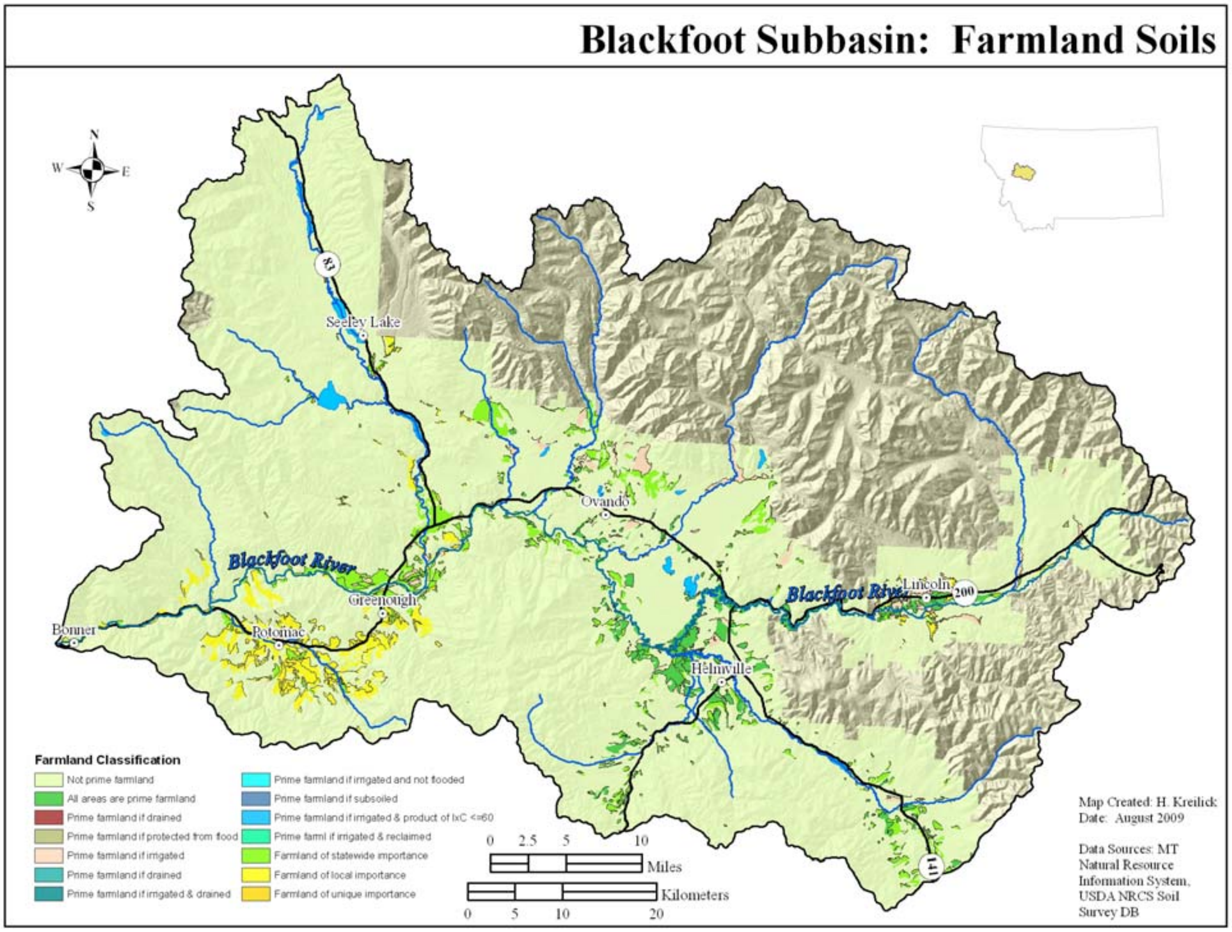
More detailed soils data are available in the Missoula, Powell, and Granite County Soil Survey Geographic (SSURGO) databases.[2] The U.S. Forest Service (USFS) Region 1 Land Type Association database, which covers national forest areas, is a good surrogate for detailed soil data and can assist with identification of soils that are sensitive to natural and human-caused disturbances.

**Figure 3.2 Soils/Groundwater Profile.**




[2] Information on the STATSGO and SSURGO soil geographic databases is available from the Natural Resources Conservation Service (www.nrcs.usda.gov).

**Figure 3.3 Farmland Soils.**




### 3.2.4 Climate

#### 3.2.4.1 Blackfoot Subbasin Climate

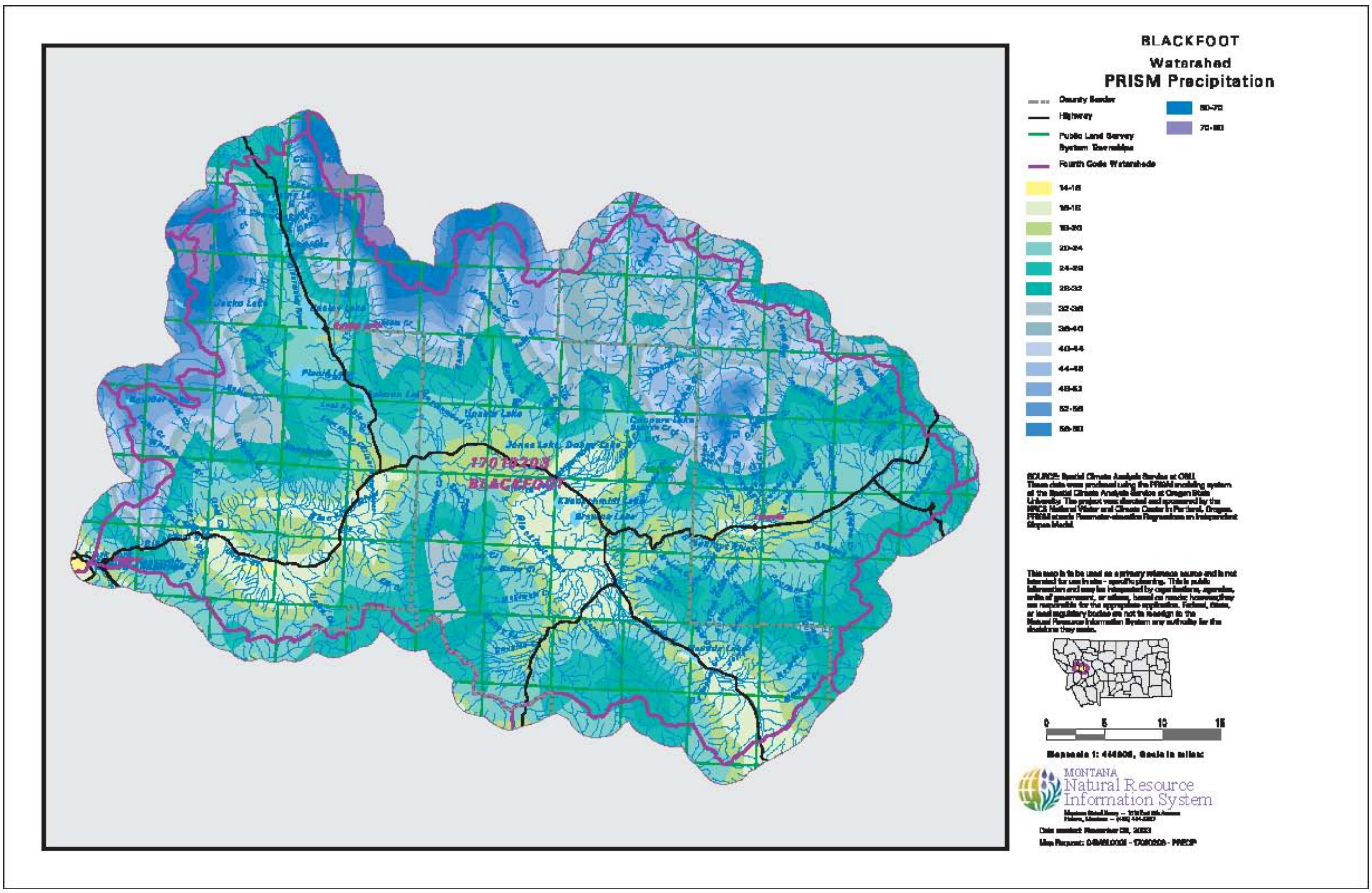
The Blackfoot Subbasin climate is dominated by Pacific maritime characteristics. Moderately moist and cool conditions prevail and cloudy weather is most frequent from late fall through early spring. Valley fog is common during the fall and winter months. The physiography of the nearby Continental Divide can generate extreme winter temperatures in the Blackfoot Subbasin that are more often associated with central Montana's continental climate. The coldest temperature (-70 °F) ever recorded in the lower 48 states occurred at Roger's Pass, approximately 40 miles east of Ovando (Caprio et al. (unknown date)). Occasionally, central Montana winter storm systems are powerful enough to breach the Continental Divide, resulting in strong east winds and blizzard conditions in the subbasin.

Average annual minimum temperatures in the subbasin range from 24 °F (Ovando) to 27 °F (Seeley Lake) and average annual maximum temperatures range from 54 °F (Ovando) to 56 °F (Potomac). Average total annual precipitation ranges from 15 inches (Potomac) to 21 inches (Seeley Lake) and average total annual snowfall ranges from 54 inches (Potomac) to 120 inches

(Seeley Lake). June is the wettest month and snowfall is greatest in January. Higher levels of precipitation and snowfall occur at higher elevations in the subbasin.[3] Figure 3.4 displays precipitation ranges across the subbasin. Figure 3.5 displays 30-year average temperature and precipitation recorded by the Western Regional Climate Center at four sites across the Blackfoot Subbasin.

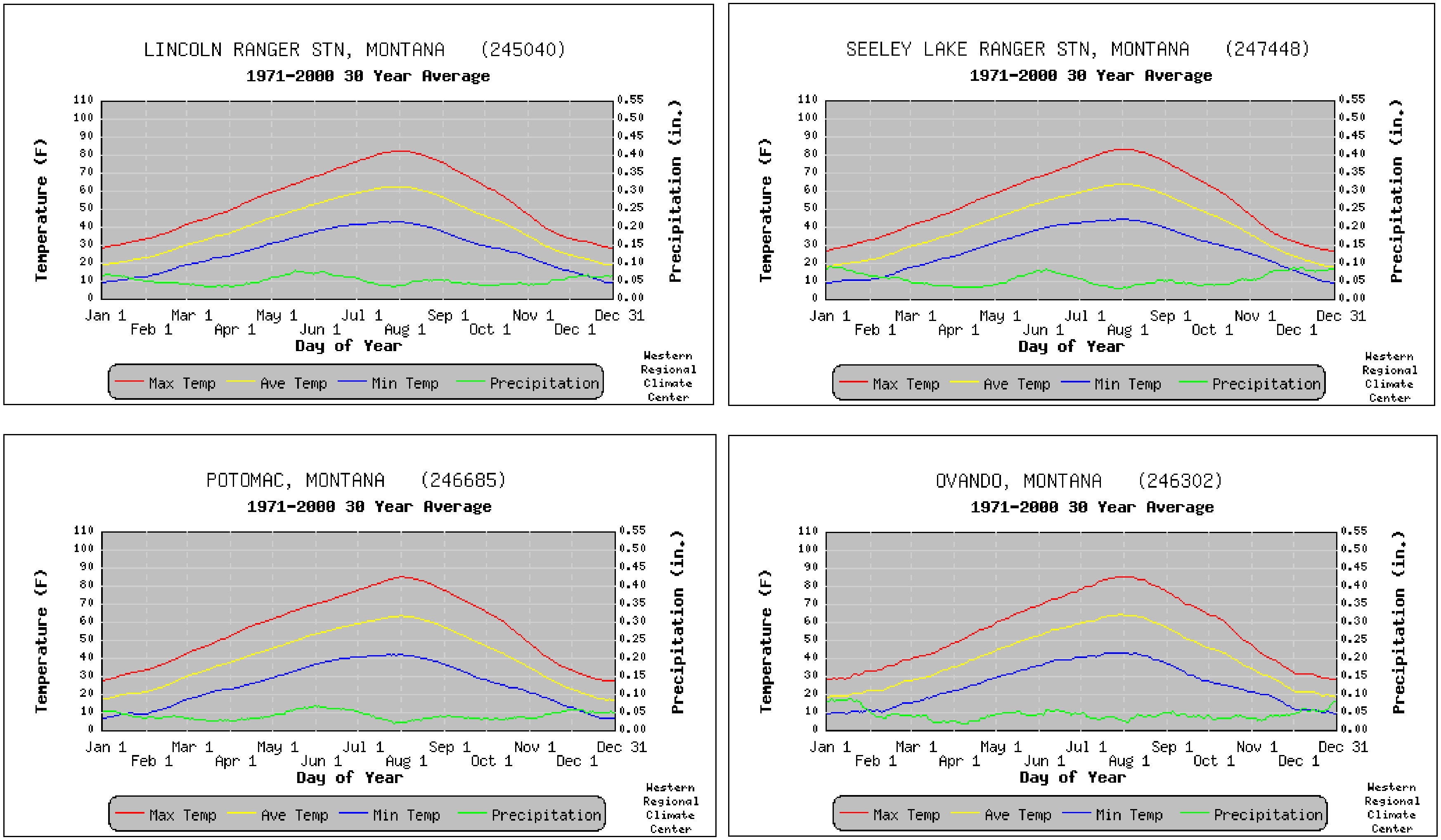
Recent trends in the Blackfoot Subbasin climate have been consistent with anticipated effects of global and regional climate change, including general warming, increased variability in total precipitation and drier summers. For example, peak runoff as measured in streamflow on the Blackfoot River at Bonner since 2000 has been one to three weeks earlier than the mean date of runoff over 72 years of record, indicating warmer spring temperatures.[4] Such climatic changes could have important implications for both aquatic and terrestrial systems in the Blackfoot Subbasin. More information on climate change is provided in Sections 3.2.4.2 and 3.4.4.2.

**Figure 3.4 Precipitation Ranges across the Blackfoot Subbasin.**




[3] Climate data is from the Western Regional Climate Center website (http://www.wrcc.dri.edu/).
[4] Data from the USGS National Water Information System website (http://waterdata.usgs.gov).

**Figure 3.5. Thirty-Year Average Temperature and Precipitation at Four Sites across the Blackfoot Subbasin.**



### 3.2.4.2 Macroclimate Trends

In this discussion, "macroclimate" is the climate occurring over a relatively large geographic area and over a relatively long period of time (i.e., 50 years), as opposed to the microclimate of the Blackfoot Subbasin. The years 1995-2006 rank among the 12 warmest years in the instrumental record of global surface temperature since 1850. The warming trend over the last 50 years is nearly twice that for the last 100 years. In the 20th century, the rate of warming in the northern hemisphere appears to be unprecedented in the past 2,000 years (ISAB 2007).

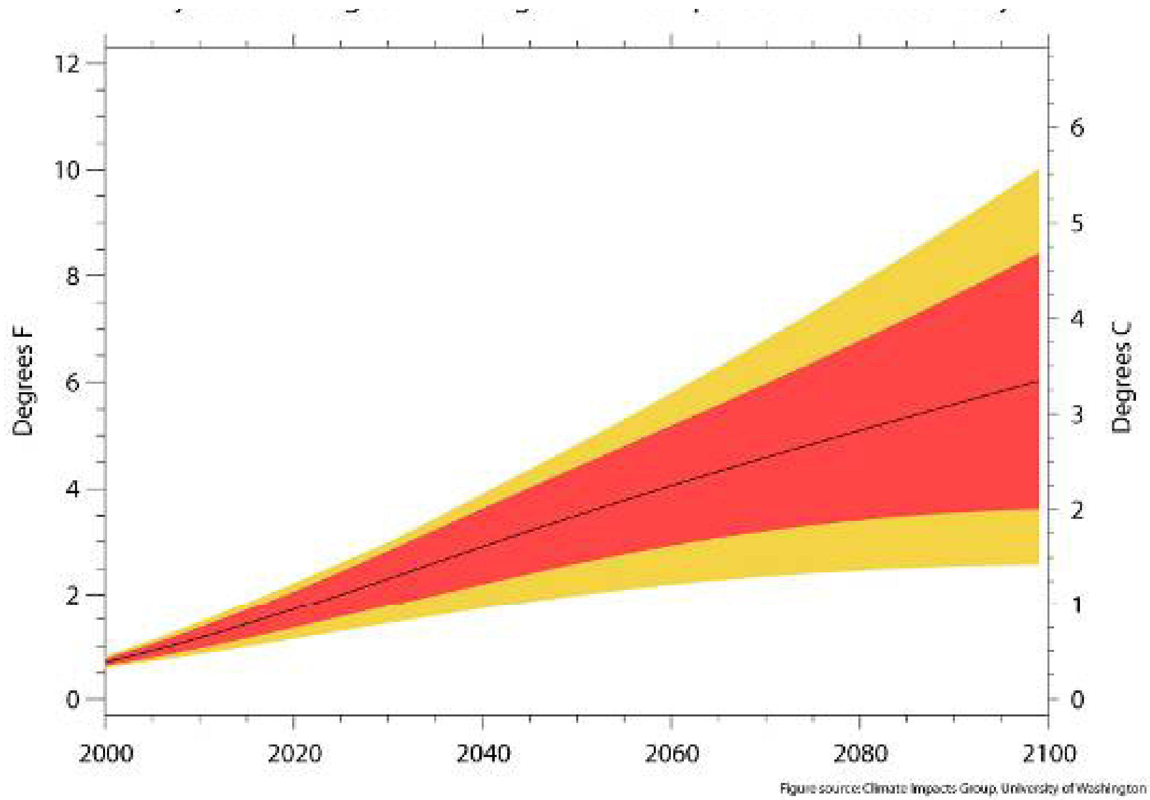
During the 20th century, the average annual temperature in the western United States rose by 1.7 °F, which is 70% more warming than the planet as a whole during the same time period (Kinsella 2008). Climate records show that the Pacific Northwest has warmed about 1.8 ºF since 1900, or about 50% more than the global average warming over the same period. Regularly collected measurements indicate that springtime snow pack from the western Rockies to the Pacific coast and from the central Sierras in California to southern British Columbia declined substantially between 1950 and 1997 in part due to a reduction in precipitation and in part due to rising winter temperatures during this period (ISAB 2007).

Climate models predict continued hot and dry weather well into the future. Global climate models show that average annual temperatures could increase anywhere from 3 to 10 °F by 2100 if nothing is done to reduce carbon dioxide emissions, the primary cause of global warming. Regional average temperatures could be even higher, especially in higher latitudes where scientists predict the most dramatic climate changes will occur. Climate models specific to the northwest United States predict that warming will continue at a rate of 0.18-1.0 °F/decade, or in the range of 1.6-10.0 °F between 2010 and 2100 (Figure 3.6) (ISAB 2007). In the Columbia Basin this warming is likely to result in the following alterations (ISAB 2007):

- More precipitation will fall as rain rather than snow
- Snow pack will diminish and stream flow timing will be altered
- Peak river flows will increase
- Water temperatures will continue to rise

The potential impacts of climate change on aquatic and terrestrial ecosystems are widespread and include changes in hydrology, water temperature, plant community composition and distribution, susceptibility to invasive species invasion and wildfire frequency and severity. Further discussion of the impacts of climate change on Blackfoot Subbasin conservation targets is provided in Section 3.4.4.2.

**Figure 3.6. Projected Changes in Average PNW Temperature – 21st Century.**




### 3.2.5 Water Resources

The Blackfoot River is the key surface water feature in the Blackfoot Subbasin. The Blackfoot is a free-flowing river that flows southwest for 132 river miles from its headwaters at Rogers Pass to its confluence with the Clark Fork River at Bonner. This river system drains a 2,320-square mile watershed through a 3,700-mile stream network of which 1,900 miles are perennial streams capable of supporting fish (BC 2005a). There are several major tributaries to the Blackfoot River, including the Landers Fork, the North Fork of the Blackfoot River, Monture Creek and the Clearwater River in the northern part of the subbasin and Nevada Creek and Poorman Creek in the southern part of the subbasin (Figure 3.7). The subbasin is also home to numerous natural ponds and lakes including Kleinschmidt Lake, Browns Lake, Coopers Lake and the Clearwater chain of lakes (Lake Alva, Lake Inez, Placid Lake, Seeley Lake, and Salmon Lake) (Figure 3.7). Aquatic habitat types found in the Blackfoot Subbasin, according to Montana's Comprehensive Fish and Wildlife Conservation Strategy (MFWP 2005), are listed in Table 3.4.

**Figure 3.7 Major Rivers, Lakes and Streams.**

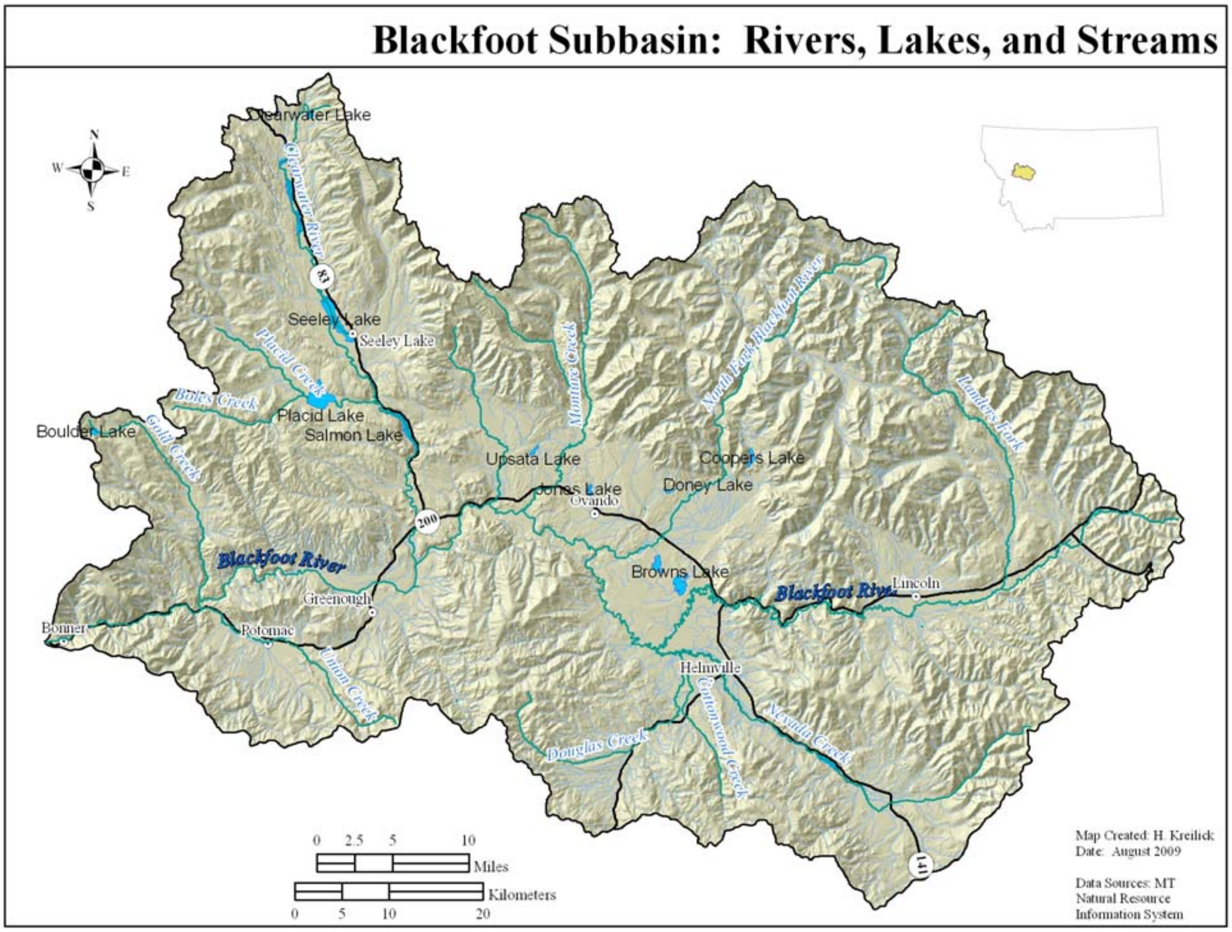
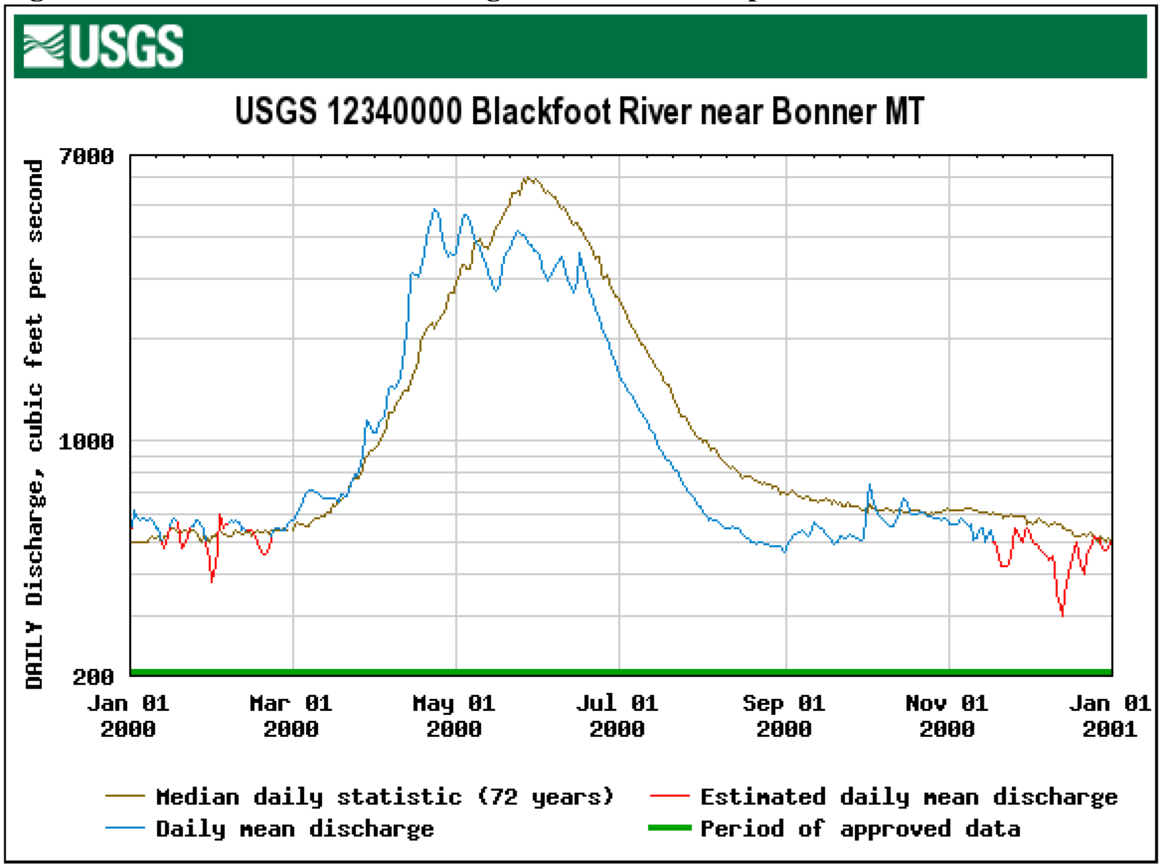



**Table 3.4 Aquatic Habitat Types in the Blackfoot Subbasin.**

| Habitat Type | Acres/Miles |
|---|---|
| Intermountain Valley Rivers | 127 |
| Intermountain Valley Streams | 316 |
| Lowland Lakes | 6,525 |
| Lowland Reservoirs | 390 |
| Mountain Lakes | 2,604 |
| Mountain Reservoirs | 5 |
| Mountain Streams | 3,207 |

Surface water hydrology in the Blackfoot River is driven by 1) winter snowpack accumulation, 2) spring snowmelt runoff and 3) late summer, fall and winter base flows. The historic (72-year) mean daily discharge in the Blackfoot River, measured at the Bonner USGS gage station, is 1,968 cubic feet per second (cfs); the mean peak flow is 6,070 cfs, and the mean low flow is 642 cfs. In 2000, a drought year, the mean daily discharge was 1,261 cfs, peak flow (April) was 4,860 cfs and low flow (September) was 466 cfs, all of which are substantially below the historic means (Figure 3.8). This pattern has been replicated in most years since 2000. In addition, the annual hydrograph since 2000 has been characterized by peak flows occurring one to three weeks earlier and summer flows arriving earlier and dropping lower than the historic means.[5]

**Figure 3.8. Blackfoot River Discharge: Year 2000 Compared to Historic Mean.**




### 3.2.5.1 Water Uses and Modifications

#### 3.2.5.1.1 Water Rights

There are 6,452 water rights in the Blackfoot Subbasin including 3,583 groundwater permits and 2,869 surface water permits. Over 50% of groundwater permits are for domestic uses. Groundwater is also used for stock water, irrigation, lawns and gardens. Although stock water represents the greatest number of surface water permits, the largest volume (65%) of water diverted and consumed is for irrigation. This volume of water covers almost 44,280 irrigated acres and, over the irrigation season, translates to a flow of about 730 cfs in diversions and 365 cfs consumed (CFTF 2004). Irrigation impacts and instream flow problems affect numerous streams and stream reaches in the Blackfoot Subbasin (Pierce et al. 2005). A discussion of stream dewatering in the subbasin is provided in the subbasin threat assessment (Section 3.4.4.11) and a list of dewatered streams in the subbasin is provided in Appendix A. Projected demand for future water use by irrigation depends on the amount of

[5] Data from the USGS National Water Information System website (http://waterdata.usgs.gov).

irrigable lands that remain in the subbasin and the frequency of future droughts. Domestic and municipal demands for groundwater are limited in the Blackfoot Subbasin due to the relatively sparse population (CFTF 2004).

A number of legal and regulatory constraints and tools provide opportunities for addressing the various, potentially conflicting, demands for water in the subbasin. First, in recognition of over-appropriated water rights, the Upper Clark Fork Basin (including the Blackfoot Subbasin) is closed to permits for new surface water uses (Montana Code Annotated (MCA) §85-2-336). In addition, as of 2007, any applicant for a groundwater permit in a closed basin must assess the connectivity of ground and surface water, and if the proposed groundwater source is tributary to surface water, must provide a plan for offsetting any depletions to surface waters. The closure has the practical effect of dramatically reducing demand on ground and surface water supplies. An exemption for small groundwater permits (< 35 gallons/minute, 10 acre-feet) allows some development of groundwater without any assessment of its impact on either aquatic resources or senior water rights.

Another Montana law allows water rights to be severed from the land and changed from one purpose to another, as long as the change will not adversely affect other water users (MCA §85-2-402). The law also allows for temporary changes in water rights to instream uses for the benefit of fisheries (MCA §85-2-408 and 436). MFWP has a limited ability to permanently convert consumptive use rights to instream uses (MCA §85-2-436). Collectively, these legal and regulatory tools can assist in the resolution of future water management issues.

Despite this legal and regulatory framework, there are some specific challenges regarding municipal water use within the Blackfoot Subbasin. Specifically, the community of Seeley Lake faces potential water shortages in the future. As of 2009, Seeley Lake has water rights for up to 350 acre-feet per year, and currently uses about 250 acre-feet year. While Seeley Lake is in the midst of upgrading its infrastructure to improve water delivery to its customers, recent population projections suggest that by 2030, Seeley Lake could reach water demand levels that exceed its water rights (Petersen-Perlman and Shively 2009). Seeley Lake is part of the Upper Clark Fork Basin Closure that precludes issuance of new permits for surface water uses or for tributary groundwater use without mitigation for depletions. In addition, there are few, if any, significant existing surface water rights in the vicinity of Seeley Lake that could be secured and changed to municipal use. Increased water demand in Seeley Lake could, therefore, pose both legal and water management issues in the future.

### 3.2.5.1.2 Dams

The Mike Horse Dam, constructed in the 1940s across the mouth of Beartrap Creek just above its confluence with Mike Horse Creek in the Blackfoot River headwaters, was intended to contain metals-laced tailings from the Mike Horse Mine and other copper, zinc, and gold mines. The mine blew out in 1975, releasing heavy metals into the upper Blackfoot. The safety of the shored-up tailings dam continues to be a threat to water quality in the Blackfoot, and the USFS is moving forward with plans to remove the dam (CFC 2009).

The Milltown dam, a run-of-the-river hydroelectric facility located immediately below the Blackfoot - Clark Fork River confluence, has blocked upstream fish passage on the Clark Fork River and affected natural migrations between the Clark Fork and Blackfoot Rivers since 1907 (BC 2005a). The Milltown Dam has been removed.

A number of small dams in the Blackfoot Subbasin may be seasonal fish passage barriers, including a small dam at the Stimson Lumber Mill at the mouth of the Blackfoot River, the Nevada Creek Dam and dams on the Clearwater Lakes (Seeley Lake and Placid Lake). Fish passage barriers were installed at the outlets of Rainy Lake and Lake Inez in the 1960s in an attempt to control the reintroduction of nongame fish into these lakes following chemical rehabilitation. MFWP is researching the feasibility of removing these barriers (USFWS 2002).

#### 3.2.5.2 Water Quality

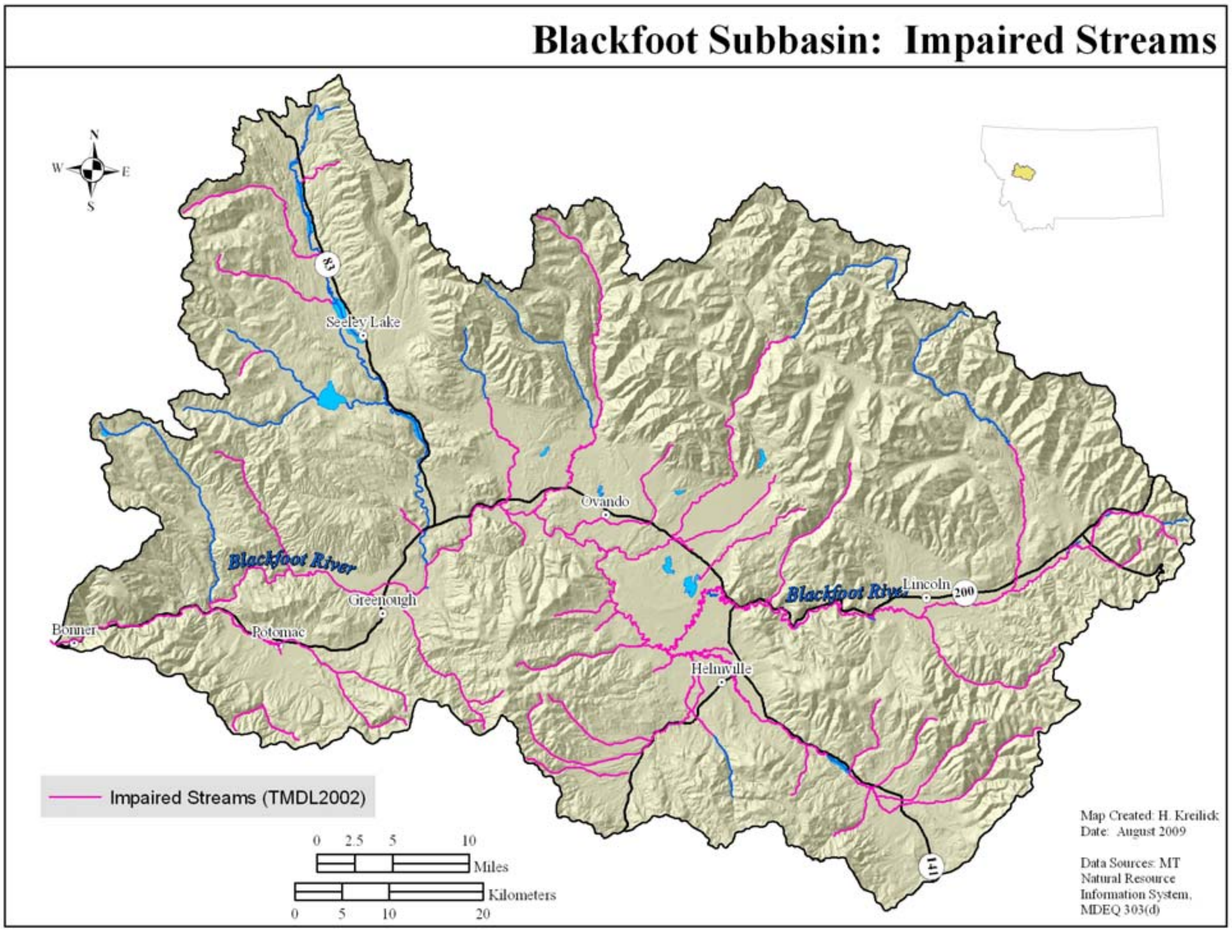
The Blackfoot River and its tributaries provide critical fish and wildlife habitat, irrigation water for agricultural lands, water for domestic use and high quality recreational opportunities for the public—all beneficial uses dependent upon clean water. Naturally high sediment production, low stream flows and drought prone areas and other natural factors account for some impairment issues and compound problems when combined with human influences (BC 2005a).

The major human-caused water quality issues identified in the Blackfoot Subbasin include excess sediment and siltation, instream and riparian habitat alterations, flow alterations, elevated water temperature and elevated nutrients and metals concentrations. Water quality impairment results from a variety of land uses, including mining, excessive timber harvest, grazing in riparian zones, excessive irrigation diversions, poorly designed roads, and unplanned residential development. The impacts of poor water quality are most often reflected in the health of fisheries, which therefore provide a measure of overall watershed health. Impaired water quality can impact recreational uses, crop yields, wildlife health and livestock survival. In severe cases, poor water quality can limit drinking water availability (BC 2005a). Further discussion of water quality impacts in the Blackfoot Subbasin resulting from residential development, silvicultural activities, livestock grazing and mining is provided in the subbasin threat assessment (Section 3.4).

The primary vehicle for addressing water quality impairments in the Blackfoot Subbasin is the voluntary Total Maximum Daily Load (TMDL) planning process. Section 303(d) of the federal Clean Water Act (and related regulations) requires states to assess the condition of surface waters within their borders to identify water bodies that do not fully meet water quality standards. The resulting list of water quality impaired water bodies is known as the 303(d) list. In Montana, MDEQ is responsible for the development of TMDLs. Montana’s approach is to develop TMDLs in the context of comprehensive water quality restoration plans. The goal of a TMDL and water quality restoration plan is to identify causes and sources of water quality impairment in water bodies on the 303(d) list, the level of water quality improvement necessary for a water body to fully support all intended beneficial uses and strategies for achieving restoration goals. To encourage water quality restoration efforts in 303(d)-listed water bodies, various state and federal agencies offer funding in the form of grants and other programs to implement TMDL-identified restoration projects.

Since 1996, 56 water bodies in the Blackfoot Subbasin have been included on Montana's 303(d) list because they do not, according to MDEQ, fully support beneficial uses such as aquatic habitat, recreation and drinking water (Figure 3.9). The status of these water bodies is reassessed every two years by MDEQ.

**Figure 3.9 Impaired Streams.**

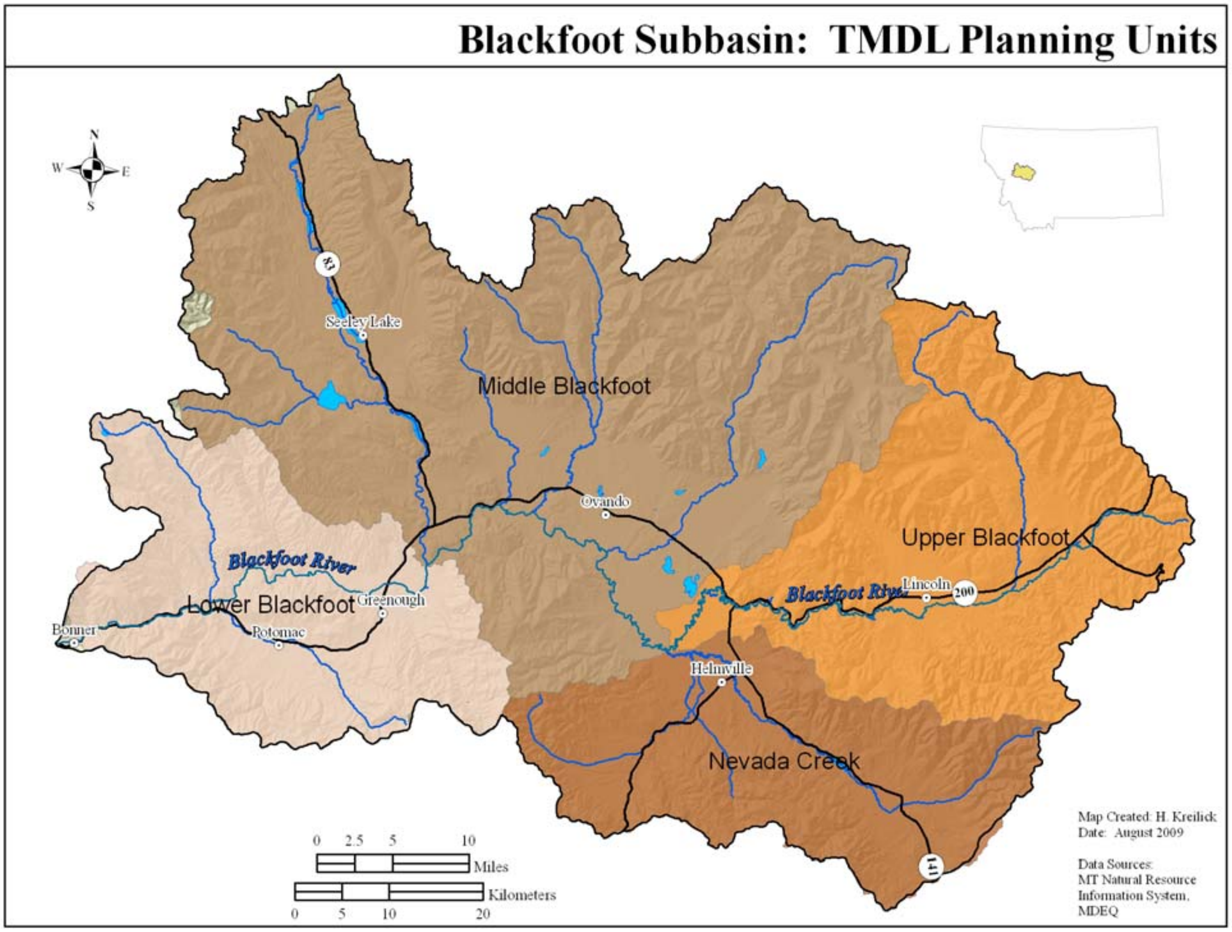



The Blackfoot Subbasin is divided into the following four planning areas for purposes of TMDL development (Figure 3.10):

1. *Blackfoot Headwaters Planning Area*, extending from the Blackfoot Headwaters to the confluence with Nevada Creek;
2. *Middle Blackfoot Planning Area*, including the Blackfoot River drainage from Nevada Creek to the confluence with the Clearwater River;
3. *Nevada Creek Planning Area*, including the Nevada Creek drainage from its headwaters to the confluence with the Blackfoot River; and

4. *Lower Blackfoot Planning Area*, extending from the Clearwater River downstream to the confluence with the Clark Fork River.

**Figure 3.10 TMDL Planning Units.**




In 2000, MDEQ partnered with the Blackfoot Challenge to develop TMDL plans in the Blackfoot Subbasin. TMDL development began in the Headwaters Planning Area in 2001. As of March 2009, TMDL plans have been completed for the Blackfoot Headwaters (MDEQ 2003, 2004) and Middle Blackfoot-Nevada Creek Planning Areas (MDEQ 2008a) and a plan is pending for the Lower Blackfoot Planning Area (MDEQ 2008b). These documents identify causes and sources of water quality impairments in 303(d)-listed water bodies and outline conceptual strategies for addressing identified causes and sources of impairment.

Since the 1990s, BBCTU, in cooperation with a variety of partners in the subbasin including the Blackfoot Challenge, the U.S. Fish and Wildlife Service (USFWS), MFWP, North Powell Conservation District, private landowners and many others, has undertaken a suite of restoration projects that address the impairments identified in the TMDL planning process. See Table 4.2 in the Blackfoot Subbasin Inventory for a complete list of these projects.

There is evidence that, in many instances, water quality has improved in water bodies where restoration has occurred. This has been especially true where projects have targeted high water temperatures. For example, Jacobsen Spring Creek, Wasson Creek, and Kleinschmidt Creek have all shown measurable temperature reductions after completion of restoration projects that have addressed the conditions that lead to high temperatures (e.g. dewatering or livestock-induced channel degradation) (Pierce, 2006, 2008).

In addition to the TMDL effort described above, the Clearwater Resources Council coordinates a lake monitoring program on Seeley Lake, Salmon Lake, Placid Lake, Lake Alva, and Lake Inez. The purpose of this effort is to develop a long-term water quality database to better inform land management and community development decisions that may affect lake water quality (Rieman and Birzell 2008).

In 2010-2011, in partnership with MDEQ, partners will develop an implementation schedule with estimated costs, technical and financial assistance needed to implement restoration practices and management measures.

### 3.2.6 Fish and Wildlife

#### 3.2.6.1 Overview of Fish and Wildlife of the Blackfoot Subbasin

The Blackfoot Subbasin is one of the most biologically diverse and intact landscapes in the western United States. The subbasin supports an estimated 250 species of birds, 63 species of mammals, five species of amphibians, six species of reptiles, and 25 species of fish (MTNHP 2009a). Because of its rural and largely intact nature, the Blackfoot Subbasin retains the full complement of large mammals, many of which have been extirpated from portions of their historic ranges. The subbasin provides excellent habitat for grizzly bear, black bear, elk, mule deer, white-tailed deer, mountain lion, Canada lynx, bobcat, gray wolf, coyote, wolverine, fisher and a wide variety of small mammals. The subbasin also provides high quality breeding, nesting, migratory and wintering habitat for a diversity of bird species, many of which are Species of Concern in Montana (see below). There are currently 12 native fish species and 13 non-native fish species in the Blackfoot Subbasin, as well as several hybrid salmonids (MFIS 2009).[6] Maps characterizing critical fish and wildlife habitat are located in Section 3.3. A complete list of wildlife species found in the Blackfoot Subbasin is provided in Appendix B.

#### 3.2.6.2 Special Status Fish and Wildlife Species

According to the Montana Natural Heritage Program database (MTNHP 2009a) there are 41 animal Species of Concern in the Blackfoot Subbasin (Table 3.5). [7] These include invertebrates, birds, fish, mammals, reptiles and amphibians. Eight of the 14 bird species ranked by Montana Partners in Flight (PIF 2000) as Level I priority species in the state are

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[6] Detailed information on native and exotic fish species present in the Blackfoot Subbasin is provided in Sections 3.3.3.1 and 3.4.4.3.

[7] Species of Concern are plants and animals considered by the Montana Natural Heritage Program to be at risk or potentially at risk. The Species of Concern list is updated as new population status/trend data is obtained (http://www.mtnhp.org).

found in the subbasin: Common Loon, Trumpeter Swan, Harlequin Duck, Columbian Sharp-tailed Grouse, Black-Backed Woodpecker, Flammulated Owl, Olive-sided Flycatcher and Brown Creeper.[8]

Federally listed animal species found in the subbasin include the threatened bull trout, grizzly bear, and Canada lynx. The gray wolf, which was delisted from endangered status in March 2009 and subsequently re-listed in 2010 after litlgation in federal court, the Bald Eagle, which was delisted from threatened status in July 2007, and the fisher, which is a candidate for listing, also occur in the subbasin (USFWS 2009b). The relationship of the Blackfoot Subbasin to Endangered Species Act planning units is as follows:

Bull Trout: For listing purposes, the USFWS divided the range of bull trout into distinct population segments and 27 recovery units. The Blackfoot Subbasin falls within the Clark Fork River Recovery Unit and the Upper Clark Fork Recovery Subunit. Within this subunit, the USFWS identified the both Blackfoot sub-basin and the Clearwater River watershed as core recovery areas (USFWS 2002). The 2002 proposal for cricital habitat described six local populations within the Blackfoot: the Landers Fork, North Fork, and Monture, Cottonwood, Belmont and Gold Creeks; and four within the Clearwater: the West Fork Clearwater, Deer Creek, Morrell Creek, and Placid Creek (USFWS 2002). The bull trout populations within the Clearwater drainage are considered to be distinct from the mainstem Blackfoot populations because the Cleawater population is adfluvial, with the lakes in the Clearwater drainage providing bull trout with foraging, migrating and overwintering habitat (Benson, 2009). The MFWP recovery strategy has tracked closely with both the 2002 and 2010 (see below) descriptions in USFWS recovery plan (Appendix K); except that the state plan identified each watershed where critical habitat is located to be a recovery area (MBTRT 1996; Pierce, 2008).

The Blackfoot Subbasin has been proposed as critical habitat within the Clark Fork River drainage (USFWS 2002), although the current status of this designation is somewhat unclear. In 2005, the USFWS withdrew an earlier critical habitat rule proposal that included much of the Blackfoot as critical habitat, leaving only the mainstem Blackfoot and a small part of the Clearwater drainage listed as critical habitat.

After an Inspector General's report disclosed improprieties at the highest levels of the USFWS in the designation of critical habitat, in January, 2010, the USFWS issued a new desicription of critical habitat. The new description identifies 11 tributaries and reaches of the Blackfoot as critical habitat and 14 lakes, tributaries and reaches of the Clearwater as critical habitat (figures 3.11 and 3.12; USFWS 2010a).

While the designation of critical habitat confers a higher level of protection and scrutiny when federal agencies propose projects within designated critical habitat, in order to assure that there will be no adverse effect from those activities, the USFWS indicates that bull trout habitat within the Blackfoot and Clearwater are all considered occupied and all

[8] Partners in Flight Level I priority species have declining population trends and/or high area importance. These are the species for which Montana has a clear obligation to implement conservation (PIF 2000).

projects that involve federal funds or permits receive full Section 7 consultation. (USFWS 2010b).

**Figure 3.11: Critical Bull Trout Habitat in the Blackfoot Sub-unit.**

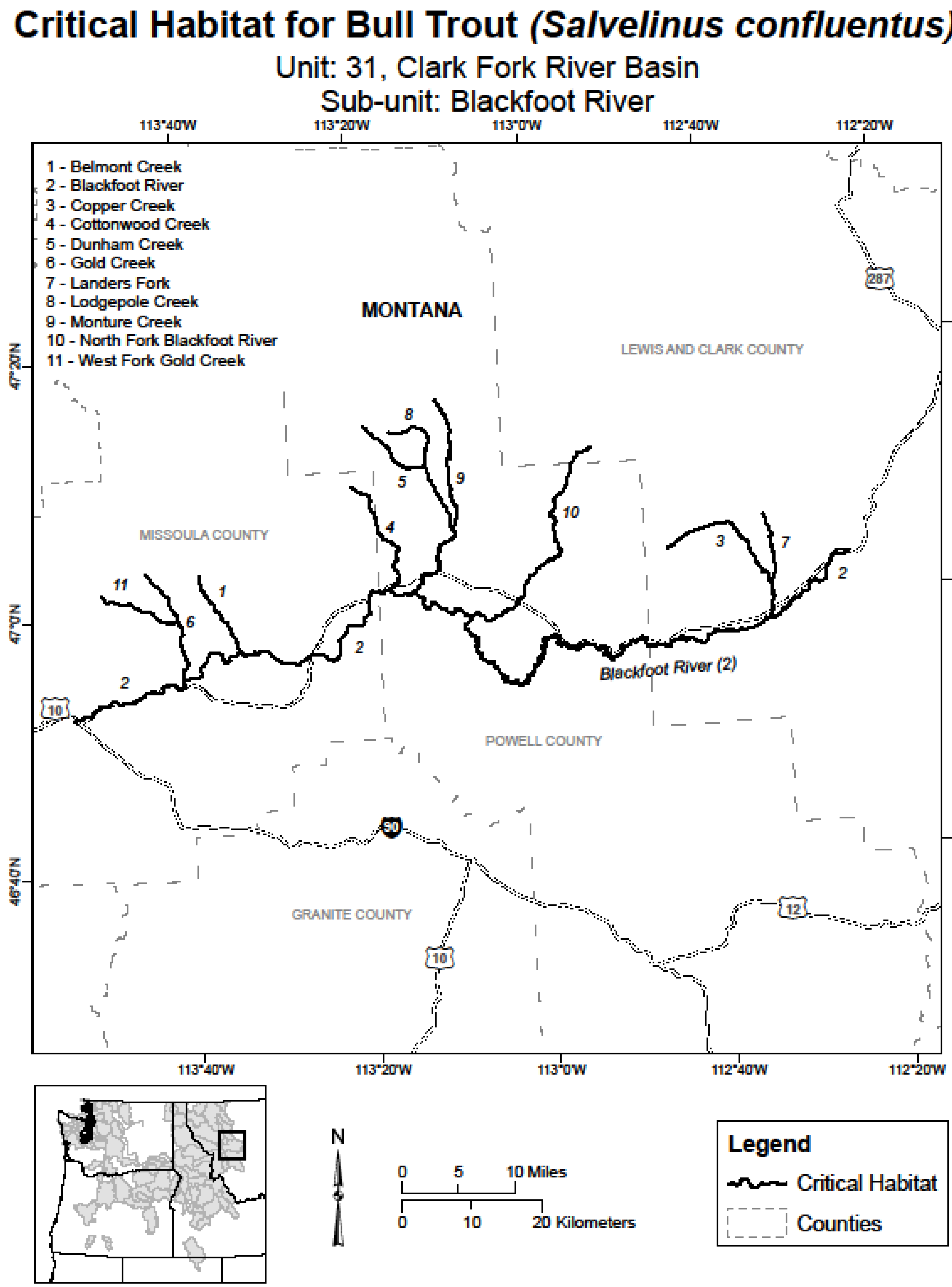
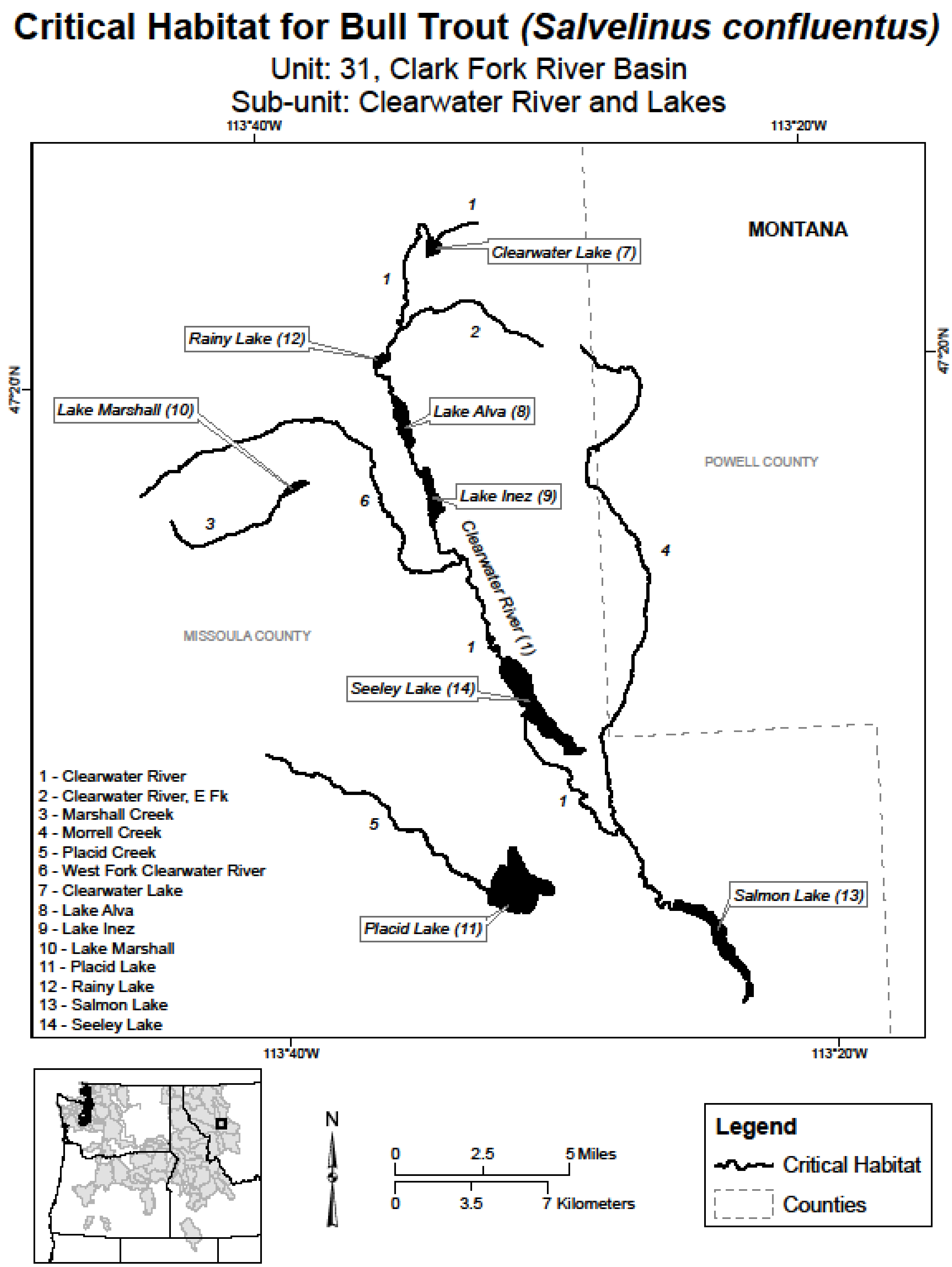


**Figure 3.12 Critical Habitat for Bull Trout in the Clarwater River and Lakes Sub-unit.**



Grizzly Bear: The Grizzly Bear Recovery Plan focuses on the six areas in Idaho, Montana, Washington and Wyoming that have habitat suitable for self-sustaining grizzly populations. The northern portion of the Blackfoot Subbasin (north of Highway 200) lies within the Northern Continental Divide Recovery Zone (USFWS 1993).

Northern Rocky Mountain Gray Wolf: The Northern Rocky Mountain Gray Wolf Recovery Plan established three recovery zones in Montana, Idaho and Wyoming. The Blackfoot Subbasin is in the Northwest Montana Recovery Area (USFWS 1987). In March 2009, the USFWS removed the gray wolf from the list of threatened and endangered species in the western Great Lakes, the northern Rocky Mountain states of Idaho and Montana and parts of Washington, Oregon and Utah (USFWS 2009b). The status of the gray wolf, however, is not yet resolved due to the likelihood of litigation over delisting.

Canada Lynx: The Canada Lynx Recovery Outline categorized lynx habitat and occurrence within the contiguous United States as 1) core areas, 2) secondary areas and 3) peripheral areas. Core areas are defined as the areas with the strongest long-term evidence of the persistence of lynx populations. Core areas have both persistent verified records of lynx occurrence over time and recent evidence of reproduction. Six core areas and one “provisional” core area are identified within the contiguous United States. The Blackfoot Subbasin is located within the Northwestern Montana/Northeastern Idaho Core Area (Ruediger et al 2000).

**Table 3.5 Animal Species of Concern in the Blackfoot Subbasin.**

| Common Name | Scientific Name | MTNHP Rank [1] | PIF Priority Level [2] | USFS Status | BLM Status | Notes |
|---|---|---|---|---|---|---|
| ***BIRDS*** | | | | | | |
| American White Pelican | *Pelecanus erythrorhynchos* | G4 S3B | III | | | |
| Bald Eagle | *Haliaeetus leucocephalus* | G5 S3 | II | Delisted threatened | Special status | Delisted from threatened status on July 9th, 2007. Now designated as Delisted Taxon-Recovered. |
| Black Tern | *Chlidonias niger* | G4 S3B | II | | Sensitive | The largest known black tern colonies in Montana are at Freezout Lake WMA, Benton Lake NWR, Blackfoot WPA, and on the Blackfeet Reservation (PIF 2000). |
| Black-backed Woodpecker | *Picoides arcticus* | G5 S2 | I | Sensitive | Sensitive | |
| Bobolink | *Dolichonyx oryzivorus* | G5 S2B | III | | | |
| Brewer's Sparrow | *Spizella breweri* | G5 S2B | II | | Sensitive | |
| Brown Creeper | *Certhia americana* | G5 S3 | I | | | |
| Caspian Tern | *Hydroprogne caspia* | G5 S2B | II | | | |
| Common Loon | *Gavia immer* | G5 S2B | I | Sensitive | Sensitive | |
| Common Tern | *Sterna hirundo* | G5 S3B | II | | | |
| Flammulated Owl | *Otus flammeolus* | G4 S3B | I | Sensitive | Sensitive | |
| Forster’s Tern | *Sterna forsteri* | G5 S2B | II | | | |
| Franklin’s Gull | *Leucophaeus pipixcan* | G4G5 S3B | II | | Sensitive | |
| Grasshopper Sparrow | *Ammodramus savannarum* | G5 S3B | II | | | |
| Gray-crowned Rosy-Finch | *Leucosticte tephrocotis* | G5 S2B, S5N | | | | |
| Great Gray Owl | *Strix nebulosa* | G5 S3 | III | | Sensitive | |

**Table 3.5 (continued).**

| Common Name | Scientific Name | MTNHP Rank [1] | PIF Priority Level [2] | USFS Status | BLM Status | Notes |
|---|---|---|---|---|---|---|
| ***BIRDS (CONT.)*** | | | | | | |
| Harlequin Duck | *Histrionicus histrionicus* | G4 S2B | I | Sensitive | Sensitive | Harlequin ducks breed locally on mountain streams in the western part of Montana, including the Kootenai, Flathead, Clark Fork, and Blackfoot River drainages. Scattered breeding also occurs along the Rocky Mountain Front and the north edge of Yellowstone National Park (PIF 2000). |
| LeConte's Sparrow | *Ammodramus leconteii* | G4 S3B | III | | Sensitive | Not documented by MTNHP in the Blackfoot Subbasin but likely to occur here according to Partners in Flight (PIF 2000). |
| Lewis's Woodpecker | *Melanerpes lewis* | G4 S2B | II | | | |
| Long-billed Curlew | *Numenius americanus* | G5 S2B | II | | Sensitive | |
| Northern Goshawk | *Accipiter gentilis* | G5 S4 | II | Sensitive | Sensitive | |
| Olive-sided Flycatcher | *Contopus cooperi* | G4 S3B | I | | | |
| Peregrine Falcon | *Falco peregrinus* | G4 S2B | II | Sensitive | Sensitive | Delisted from endangered status on August 25th, 1999. Now designated as Delisted Taxon-Recovered. |
| Sharp-tailed Grouse (Columbian) | *Tympanuchus phasianellus columbianus* | G4T3 S1 | II | | | |
| Trumpeter Swan | *Cygnus buccinator* | G4 S2 | I | Sensitive | Sensitive | |
| Veery | *Catharus fuscescens* | G5 S3B | II | | | |
| White-tailed Ptarmigan | *Lagopus leucura* | G5 S3 | III | | | |

**Table 3.5 (continued).**

| Common Name | Scientific Name | MTNHP Rank [1] | USFS Status | BLM Status | Notes |
|---|---|---|---|---|---|
| ***MAMMALS*** | | | | | |
| Wolverine | *Gulo gulo* | G4 S3 | Sensitive | Sensitive | |
| Canada Lynx | *Lynx canadensis* | G5 S3 | Listed threatened | Special status | Listed as threatened on March 24th, 2000. Critical Habitat designated on September 9th, 2006. |
| Fisher | *Martes pennanti* | G5 S3 | Sensitive | Sensitive | The West Coast Distinct Population Segment (DPS) of the fisher has been added to the candidate species list (Federal Register, 15 April 2004). |
| Gray Wolf | *Canis lupus* | G4 S3 | Delisted endangered | Special status | In March 2009, removed from the list of threatened and endangered species in the western Great Lakes and the northern Rocky Mountain states of Idaho and Montana and parts of Washington, Oregon and Utah (USFWS 2009b). |
| Grizzly Bear | *Ursus arctos* | G4 S2S3 | Listed threatened | Special status | On July 28th, 1975, the grizzly bear was designated as threatened in lower 48 states. In Montana, populations in the Cabinet/Yaak and Northern Continental Divide Recovery areas are listed as threatened. |
| Northern Bog Lemming | *Synaptomys borealis* | G4 S2 | Sensitive | | |
| Preble's Shrew | *Sorex preblei* | G4 S3 | | | |
| Townsend's Big-eared Bat | *Corynorhinus townsendii* | G4 S2 | Sensitive | Sensitive | |
| Fringed Myotis | *Myotis thysanodes* | G4G5 S3 | | Sensitive | |

**Table 3.5 (continued).**

| Common Name | Scientific Name | MTNHP Rank [1] | USFS Status | BLM Status | Notes |
|---|---|---|---|---|---|
| ***FISH*** | | | | | |
| Westslope Cutthroat Trout | *Oncorhynchus clarkii lewisi* | G4T3 S2 | Sensitive | Sensitive | |
| Bull Trout | *Salvelinus confluentus* | G3 S2 | Listed threatened | Special status | Listed as threatened on June 10th, 1998. Critical Habitat designated on September 26th, 2005. |
| ***REPTILES and AMPHIBIANS*** | | | | | |
| Western Skink | *Eumeces skiltonianus* | G5 S3 | | | |
| Western Toad | *Bufo boreas* | G4 S2 | Sensitive | Sensitive | |
| ***INVERTEBRATES*** | | | | | |
| Agapetus Caddisfly | *Agapetus montanus* | G3 S3 | | | |
| Carinate Mountainsnail | *Oreohelix elrodi* | G1 S1 | | | |
| Smoky Taildropper | *Prophysaon humile* | G3 S2S3 | | | |
| Freshwater Sponge | *Ephydatia cooperensis* | G1G3 S1S3 | | | |
| Gillette's Checkerspot | *Euphydryas gillettii* | G2G3 S2 | | | |
| Lyre Mantleslug | *Udosarx lyrata* | G2 S1 | | | |
| Magnum Mantleslug | *Magnipelta mycophaga* | G3 S2S3 | | | |
| Millipede | *Austrotyla montani* | G1G3 S1S3 | | | |
| Millipede | *Corypus cochlearis* | G1G3 S1S3 | | | |

[1] Montana Natural Heritage Program global (G) and state (S) ranks are explained in Appendix C.

[2] Partners in Flight Priority Ranks are as follows: Level I: Declining population trends and/or high area importance. These are the species for which Montana has a clear obligation to implement conservation. Level II: Species with lesser threat or stable/increasing populations in the state compared to Level I species. Montana has a high responsibility to monitor the status of these species and/or to design conservation actions. Level III: Species of local concern (often designated as such by one or more agencies) which rank lower, are not at imminent risk, or which are near obligates for high priority habitat. Presence of these species may serve as added criteria in the design and selection of conservation or monitoring strategies (PIF 2000).

### 3.2.6.3 Non-native Aquatic Animal Species

In this section we focus on the non-native fish, invertebrates, and parasites that are currently found or have the potential to invade aquatic systems in the Blackfoot Subbasin. A brief description of these species is provided below. Further discussion of the threat these species pose to native species and aquatic systems in the subbasin is provided in Section 3.4.4.3.

<u>Non-native fish species</u>

*Brook trout:* Brook trout were brought to the inland American West from northeastern North America for sport fishing and subsistence between 1920 and 1950 (Benhke 2002, MFWP historic files). Resident brook trout are widely distributed in certain tributaries of the Blackfoot Subbasin. However, they are absent from many streams and they are considered rare in the mainstem Blackfoot River below the Landers Fork tributaries (Pierce et al. 2008). Bull trout are commonly misidentified and harvested as brook trout. To correct this problem, angling regulations have been adjusted to catch-and-release for both brook trout and bull trout in the mainstem Blackfoot River. DFWP conducted an angler survey in 2004 that targeted anglers in key fluvial bull trout and WSCT staging and spawning areas. Among the findings of this survey were that while the percentage of anglers properly identifying all five trout species was relatively low (58 percent of resident anglers, 24 percent of non-resident anglers), thecompliance with all fishing regulations was high (Pierce et al 2006).

*Brown trout*: European brown trout, introduced to North America in the 1880s, rapidly became established and quickly replaced native trout in large rivers of the western United States. Brown trout now support popular sport fisheries in many rivers including the Blackfoot River. Brown trout inhabit stream reaches in the foothills and agricultural bottomlands of the Blackfoot Subbasin. They occupy an estimated 15% of the perennial stream network in the Blackfoot Subbasin, including 110 miles of the Blackfoot River mainstem and the lower reaches of many tributary streams (BC 2005a, USFWS 2002, Pierce et al. 2008). They are often a dominant fish in medium-sized, low-elevation tributaries that provide undercut banks and abundant cover. Brown trout co-exist with other salmonids in the larger river reaches where sufficient habitat complexity creates a diversity of niches. Spawning occurs in the upper mainstem Blackfoot River and lower tributary reaches (MFWP files).

*Rainbow trout:* Rainbow trout, a renowned sport fish, has been introduced into coldwater habitats around the world (Fausch et al. 2001). Rainbow trout were introduced to western Montana beginning in the late 1800s (Benhke 2002). Since the implementation of “wild trout management” in Montana in 1979, the distribution of rainbow trout in the Blackfoot Subbasin has diminished and the species is no longer present in the upper Blackfoot River (Spence 1975, Pierce et al. 2008). Stream-dwelling rainbow trout currently inhabit the lower mainstem Blackfoot River and reproduce in the lower portions of the larger tributaries (Pierce et al. 2009). They are also established in certain lakes, reservoirs and private ponds as well as tributaries connected to these environments. Stocking programs have been reviewed, and most lakes and private ponds that historically received hatchery rainbow trout have been converted to westslope cutthroat trout or triploid (sterile) rainbow trout. Currently, rainbow trout are stocked by MFWP in only a few lakes in the Blackfoot Subbasin where interactions with native species are not a concern.

Rainbow trout currently occupy an estimated 15% to 20% of the perennial streams in the lower elevation portions of the Blackfoot Subbasin. They are also present in the upper North Fork Basin portion of the Scapegoat Wilderness area in areas of historical lake plants (Pierce et al. 2008). Rainbow trout are highly susceptible to whirling disease (Bartholemew and Wilson 2002), which is expanding within the range of stream-dwelling rainbow trout in the Blackfoot Subbasin (Pierce et al. 2008, 2009). The expansion of *Myxobolus cerebralis*, the causal agent of whirling disease, is thought to impact rainbow trout densities in the middle Blackfoot River (Pierce et al. 2009).

*Asian carp:* Four species of Asian carp are classified as Priority Class 1 Aquatic Nuisance Species (ANS)[9] in Montana: bighead, black, grass, and silver carp. All four species were introduced to the United States from Asia and have spread accidentally and by deliberate release. Although not currently present in Montana, the Asian carp are considered a serious threat (E. Ryce, pers. comm.).

*Other Fish:* Other non-native fish species present in the subbasin include Yellowstone cutthroat trout, largemouth bass, white sucker, fathead minnow, arctic grayling, kokanee salmon, northern pike, yellow perch, walleye, brook stickleback, and pumpkinseed. Coho salmon, an Aquatic Nuisance Species, has been stocked in Browns Lake. The following fish species, although not yet documented in Montana, are considered Priority Class 1 Aquatic Nuisance Species that would pose a serious threat to native aquatic species and systems in the state: round goby, Eurasian ruffe, tench and zander.

Non-native invertebrates[10]

*New Zealand mudsnail:* Native to freshwater streams and lakes of New Zealand and adjacent small islands, the New Zealand mudsnail was first discovered in the United States in the Snake River in 1987. Since then, it has spread into many water bodies in the western United States and the Great Lakes. Although it is not present in the Blackfoot Subbasin, it has been found in Montana in the Madison River and several other rivers in and near Yellowstone National Park. The snail prefers littoral zones in lakes or slow streams but also survives in high flow environments by burrowing into sediment. It thrives in disturbed watersheds, tolerates siltation and benefits from high nutrient flows. The New Zealand mudsnail is a Priority Class 2 Aquatic

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[9] Aquatic Nuisance Species (ANS) pose a serious threat to native aquatic species and aquatic systems. The federal Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, amended by the National Invasive Species Act of 1996, calls for the development of state and regional management plans to control aquatic nuisance species. The 2002 Montana ANS Management Plan addresses specific aquatic nuisance species, provides a management framework, and sets objectives and actions to prevent and reduce the impact of ANS in Montana. The Montana ANS Management Plan will be updated in 2010.

Priority Class 1 Aquatic Nuisance Species are currently not known to be present in Montana but have a high potential to invade. There are limited or no known management strategies for these species. Appropriate management for this class includes prevention of introductions and eradication of pioneering populations.

[10] Information on non-native invertebrates, parasites, and pathogens is from the USGS Nonindigenous Aquatic Species fact sheets (http://nas.er.usgs.gov) and the Montana ANS website (http://fwp.mt.gov/fishing/fishingmontana/ans).

Nuisance Species in Montana.[11] Densities and distribution throughout Montana are declining with the exception of the Bighorn River where densities are increasing.

*Mud bithynia/faucet snail*: Native to Europe, the mud bithynia was introduced to the Great Lakes Basin in the 1870s. It is now found in the Mid-Atlantic Region, Lake Champlain, across New York, the Potomac River in Virginia, and Chesapeake Bay. According to the USGS Nonindigenous Aquatic Species information system, it is also present in the Blackfoot Subbasin. The mud bithynia is commonly found in freshwater ponds, shallow lakes, and canals.

*Zebra and quagga mussel:* Native to Eastern Europe, zebra and quagga mussels were introduced to the Great Lakes Basin in the late 1980s in ballast water discharge from freighters. The zebra mussel is now found widely in the Mississippi River drainage and also in the western United States (Colorado, Utah and California). The quagga mussel has spread throughout the Great Lakes Basin and to numerous locations in the western United States including Lake Mead, Lake Havasu, Lake Mohave and numerous reservoirs in Colorado and California. Neither mussel has been documented in Montana. Zebra mussels are classified as a Priority Class 1 Aquatic Nuisance Species.

*Other invertebrates:* Other invertebrates classified as Priority Class 1 Aquatic Nuisance Species in Montana include rusty crayfish and spiny waterflea.

Non-native parasites/pathogens

*Whirling disease:* Whirling disease is a Priority Class 2 Aquatic Nuisance Species in Montana. Whirling disease is caused by an exotic parasite *Myxobolus cerebralis*. The parasite was introduced to the United States from Europe in the 1950s and has spread into drainages in 25 states, including over 95 water bodies in Montana. Severe infections in Montana occur in the Madison River, the Missouri River near Helena, Rock Creek near Missoula, the Blackfoot River, and many smaller wild trout streams. In the Blackfoot Subbasin, whirling disease was first detected in 1995 near Ovando and has since increased in distribution and intensity. It now affects the lower 122 miles of the mainstem of the Blackfoot River and at least 17 tributary streams and continues to expand in the lower reaches of certain tributaries (Pierce et al. 2008, 2009, Montana ANS Technical Committee 2002). See Table 3.6 for summary of histological results.

[11] Priority Class 2 Aquatic Nuisance Species are present and established in Montana and have the potential to spread further and there are limited or no known management strategies for these species. These species can be managed through actions that involve mitigation of impact, control of population size, and prevention of dispersal to other waterbodies.

**Table 3.6 Summary of histological results summarized as mean grade infections from sentinel cages placed in the Blackfoot River (top), the confluence areas of basin-fed tributaries (middle) and spring creeks (lower) for 1998-2007.**

| Waterbody | Mean Grade Infection | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Blackfoot River** | **1998** | **1999** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** |
| Blackfoot River-Below Gold Cr | 0.22 | nd | 2.44 | nd | 0.59 | 2.42 | 2.2 | 2.06 | 0 | nd |
| Blackfoot River-Below Elk Cr | nd | nd | 2.3 | nd | 1.59 | nd | 2.3 | nd | 0.64 | 0.22 |
| Blackfoot River-above Clearwater | 1.1 | 0.22 | 3.11 | nd | 2.79 | 3.16 | 3.41 | 2.96 | 2.03 | 1.33 |
| Blackfoot River-Below North Fork | 0.25 | nd | nd | nd | nd | nd | 2.64 | 2.86 | 0.79 | nd |
| Blackfoot River-below Nevada Cr | 0 | 0 | 0.84 | nd | 0.9 | 2.12 | 3.93 | 3.28 | 0.1 | 0.31 |
| Blackfoot River-Below Lincoln | 0 | 0 | 0.6 | nd | 2.44 | nd | nd | 3.89 | 2.25 | nd |
| Blackfoot River-Headwaters | nd | nd | 0 | nd | 0.02 | 0.32 | nd | 0 | 0.07 | 0 |
| **Basin-fed Streams** | | | | | | | | | | |
| Johnson Creek | nd | nd | nd | nd | nd | nd | nd | 0 | 0 | nd |
| West Twin Creek | nd | nd | nd | nd | nd | nd | nd | 0 | 0 | 0 |
| East Twin Creek | nd | nd | nd | nd | nd | nd | nd | 0 | 0 | nd |
| Bear Creek | nd | nd | nd | nd | nd | nd | nd | na | 0 | nd |
| Union Creek | nd | nd | nd | nd | nd | nd | 0 | nd | nd | nd |
| Gold Creek | nd | 0.12 | 0 | nd | 0 | 0 | nd | 0 | 0 | 0 |
| Belmont Creek | nd | nd | 0 | nd | 0.19 | 0.38 | 1.55 | 2.48 | 0.3 | 3.44 |
| Elk Creek | nd | 0 | 0 | nd | 0 | 2.84 | 4.32 | 4.82 | nd | nd |
| Clearwater River | nd | nd | nd | nd | nd | nd | 0 | nd | nd | nd |
| CottonwoodCreek | 3.66 | 4.52 | nd | nd | 4.5 | nd | nd | 3.78 | 3.96 | 4.25 |
| Chamberlain Creek | 0.16 | 2.71 | 3.88 | nd | 2.63 | nd | 4.33 | 3.78 | nd | 1.89 |
| Monture Creek | 0 | 0 | 1.76 | nd | 3.22 | nd | nd | 4.81 | 4.57 | 4.26 |
| Warren Creek | 0.21 | 2.1 | 1.72 | nd | nd | nd | nd | 0.0 | nd | nd |
| North Fork Blackfoot River | 0 | nd | 0 | nd | 0.78 | nd | nd | 0.27 | nd | nd |
| Arrastra Creek | nd | nd | nd | nd | nd | 0.34 | 1.23 | 0.02 | 0.14 | nd |
| Beaver Creek | nd | nd | nd | nd | nd | nd | 0.45 | 0.85 | 0.3 | 0 |
| Poorman Creek | nd | nd | nd | nd | nd | nd | 0.78 | ND | nd | 4.69 |
| Landers Fork | nd | nd | nd | nd | nd | nd | 0.14 | 0 | 0 | 0 |
| Upper Willow Creek | nd | nd | nd | nd | nd | nd | 0 | nd | nd | 0 |
| Wasson Creek | nd | nd | nd | nd | nd | nd | nd | 0 | nd | 0 |
| **Spring Creeks** | | | | | | | | | | |
| Jacobsen Spring Creek | nd | nd | nd | nd | nd | nd | 0.13 | nd | nd | nd |
| Rock Creek | nd | 0 | 2.3 | 3.9 | nd | 3.38 | nd | nd | nd | nd |
| Kleinschmidt Creek | 2.83 | 3.56 | 4.52 | 3.77 | nd | 4.9 | 4.7 | nd | nd | nd |
| Nevada Spring Creek | nd | nd | nd | nd | 0 | nd | 3.66 | 2.22 | 1.94 | nd |
| Grentier Spring Creek | nd | nd | nd | nd | nd | nd | 0.06 | 1 | nd | nd |
| Lincoln Spring Creek | nd | nd | nd | nd | nd | nd | 5 | 4.7 | nd | nd |

*Other parasites/pathogens:* Non-native parasites/pathogens which are not currently present in Montana but have the potential to invade include: heterosporosis (Priority Class 1 ANS), VHS virus, IHN Virus (Priority Class 1 ANS),and Asian Tapeworm (Priority Class 3 ANS).[12]

## 3.2.7 Vegetation

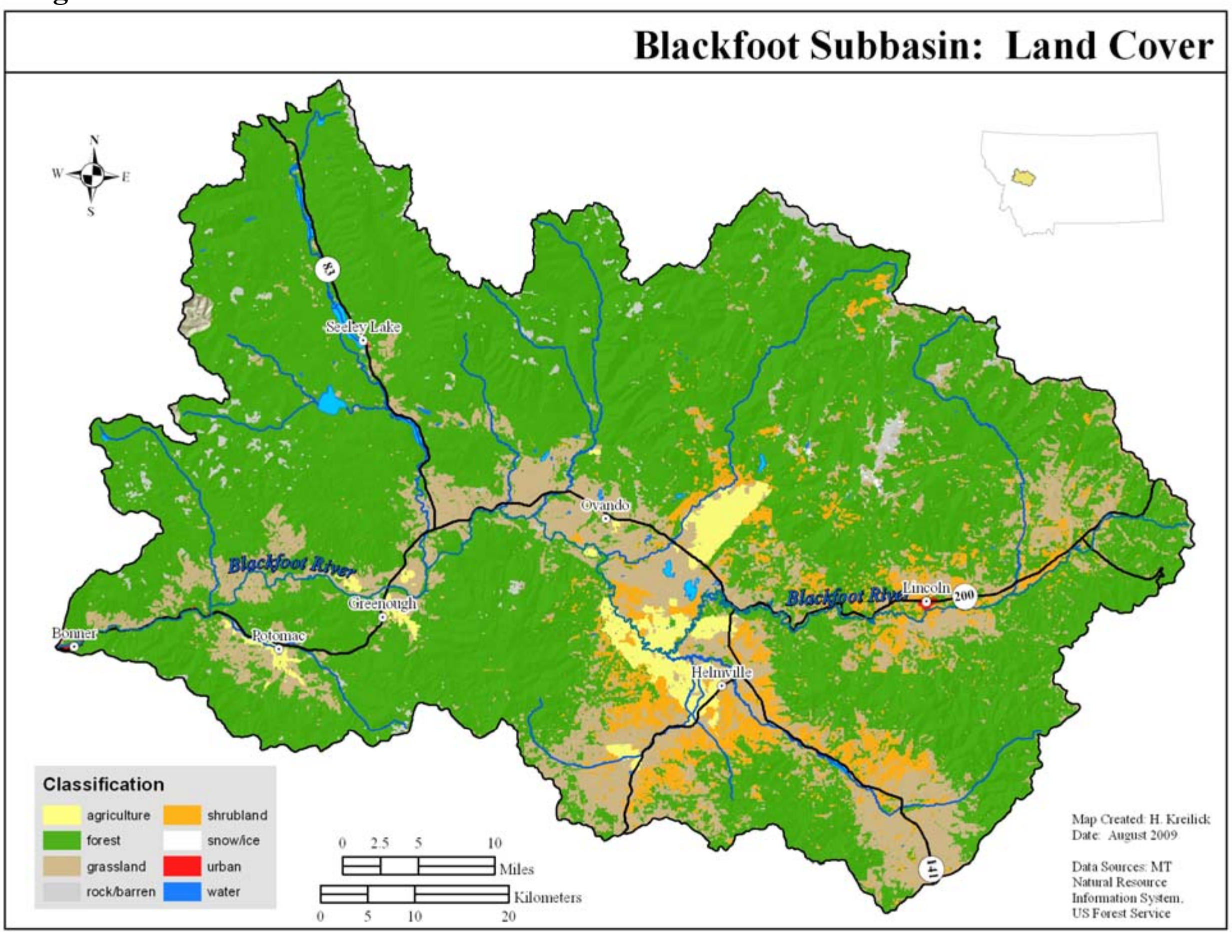
### 3.2.7.1 Overview of Vegetation Types in the Blackfoot Subbasin

Geologic, hydrologic and geographic features in the Blackfoot Subbasin combine to produce a diversity of vegetation communities including prairie grasslands, sagebrush steppe, coniferous

[12] Priority Class 3 Aquatic Nuisance Species are not known to be established in Montana and have a high potential for invasion and appropriate management techniques are available. Appropriate management for this class includes prevention of introductions and eradication of pioneering populations.

forest and extensive wetland and riparian areas. Over 80% of the subbasin is covered with mixed species conifer forests dominated by ponderosa pine, lodgepole pine, Douglas-fir and western larch at the lower elevations and subalpine-fir and spruce in the higher regions, especially on cool, moist, northerly aspects. The remaining portions of the subbasin consist of native bunchgrass prairie (10%), agricultural lands (5%), and a combination of shrublands, wetlands, lakes and streams (5%) (Figure 3.13). Less than 1% of the subbasin is developed (BC 2005b). The greatest source of biological diversity in the subbasin arises from wetland features such as glacial lakes, vernal ponds, fens, basin-fed creeks, spring creeks, marshes and riparian areas (USFWS 2009a). Lesica (1994) estimates that 600 vascular plant species occur within the subbasin, nearly 30% of which are associated with wetlands (Appendix D).

**Figure 3.13 Land Cover Class.**




The Blackfoot Subbasin supports a number of rare plant communities. The *three-tip sagebrush/rough fescue plant association* is common in the Ovando area, yet found nowhere else in the world. The *big sagebrush/rough fescue plant association*, endemic to west- and north-central Montana, is common in the Kleinschmidt Flat area (S. Cooper and S. Mincemoyer, pers. comm.). Expanses of the *Drummond's willow plant association* occur in riparian swamps along Monture Creek and mud sedge, sharp bulrush, mannagrass and fen peatland plant communities are unique to the area's glacial pothole wetlands (USFWS 2009a, MTNHP 2009b).

According to Montana Partners in Flight (PIF 2000), the Blackfoot Subbasin contains all of the highest priority habitats for bird conservation in Montana. These habitats include mixed grassland, sagebrush steppe, dry (ponderosa pine/Douglas-fir) forest, riparian deciduous forest and prairie pothole wetlands. The subbasin also contains four of the seven community types in greatest need of conservation, according to Montana's Comprehensive Fish and Wildlife Conservation Strategy (MFWP 2005). These include grassland complexes, mixed shrub/grass associations, riparian and wetland communities and mountain streams.

### 3.2.7.2 Special Status Plant Species

Thirty plant Species of Concern have been documented by the Montana Natural Heritage Program in the Blackfoot Subbasin (Table 3.7) (MTNHP 2009a).[13] While not documented from the Blackfoot, water howellia (*Howellia aquatilis*), a threatened species listed under the Endangered Species Act, is located immediately north of the subbasin in vernal wetlands in the Swan Valley (MTNHP 2009a).

[13] Species of Concern are plants and animals considered by the Montana Natural Heritage Program to be at risk or potentially at risk. The Species of Concern list is updated as new population status/trend data is obtained (http://www.mtnhp.org).

**Table 3.7 Plant Species of Concern in the Blackfoot Subbasin.**

| Common Name | Scientific Name | MTNHP Rank [1] | USFS Status | BLM Status | Notes |
|---|---|---|---|---|---|
| Austin's knotweed | *Polygonum austiniae* | G5T4 S2S3 | Sensitive | | Sparsely distributed in mountainous areas of MT from the Rocky Mountain Front to the Madison and Gallatin Ranges. Sites are usually on open, gravelly, sparsely-vegetated slopes with shale-derived soils and as such are not generally impacted by human activity. Some sites however, are along forest roads and are susceptible to weed invasion and other disturbances. The probability of finding additional occurrences appears to be good since large areas of suitable habitat across western and central MT remain unsurveyed for the species. |
| beaked sedge | *Carex rostrata* | G5 S1 | Sensitive | | |
| Beck's water-marigold | *Bidens beckii* | G4G5 S2 | Sensitive | Sensitive | Known from 10 occurrences in the western valleys of the state, including 6 moderate to large populations and 1 historical occurrence dating to 1937. However, the species may be more abundant in the state than what current data suggest. Threats and impacts to populations in MT include boating activity, lake shore development, aquatic weeds and use of aquatic herbicides. |
| blunt-leaved pondweed | *Potamogeton obtusifolius* | G5 S2 | Sensitive | | Known from approximately a dozen occurrences in northwest MT. Most occurrences are moderate to large populations and occur in valley and foothill locations in a variety of federal, state and private ownerships. A few populations are on lands managed specifically for their conservation value. Some populations are vulnerable to impacts associated with development, recreation and increased sediment and nutrient loads. |
| Chaffweed | *Centunculus minimus* | G5 S2 | | Sensitive | |
| cliff toothwort | *Cardamine rupicola* | G3 S3 | | | State endemic known from 17 occurrences though many occurrences have not been surveyed for 30 or more years and many are based on a single herbarium specimen. However, the species grows at high elevations in rock and scree fields that generally are not subject to disturbance or other threats. Many populations also occur in designated Wilderness areas, which offer further protection. Additional occurrences likely exist across the known range of the species. |

**Table 3.7 (continued).**

| Common Name | Scientific Name | MTNHP Rank [1] | USFS Status | BLM Status | Notes |
|---|---|---|---|---|---|
| Crawe's sedge | *Carex crawei* | G5 S2 | | Sensitive | Known in MT from 8 occurrences, including 5 moderate to large populations. |
| creeping sedge | *Carex chordorrhiza* | G5 S2 | Sensitive | | |
| crested shieldfern | *Dryopteris cristata* | G5 S2 | Sensitive | | Known from approximately 24 extant occurrences in western MT, mostly on National Forest lands, though State Trust Lands and private lands also host significant populations. The species is vulnerable to hydrologic changes. |
| deer Indian paintbrush | *Castilleja cervina* | G4 SH | | | Known from 3 widely separated historic collections in MT. |
| dense-leaf draba | *Draba densifolia* | G5 S2 | | | Distributed in the western half of MT in 4 moderate to large populations, 6 small occurrences and 9 historical or poorly documented occurrences. Occupied habitats are at moderate to high elevation, which helps to minimize disturbance. However, livestock grazing, invasive weeds and off-road ATV use impact some populations. |
| divide bladderpod | *Lesquerella klausii* | G3 S3 | | | State endemic restricted to central-MT with the majority of populations occurring in the Big Belt Mountains and extending north to the southern end of the Rocky Mountain Front. Many large populations exist and the species typically occurs on gravelly slopes that are not usually subject to human disturbance. |
| English sundew | *Drosera anglica* | G5 S2S3 | Sensitive | | Known from over two dozen populations in the state, most of which are moderate to large-sized, healthy populations. Most occurrences are on federally managed lands with several in designated Wilderness areas, research natural areas or Glacier National Park which help to protect the occurrences from many potential threats. The species may be negatively impacted by fire. Plants are also sensitive to and negatively impacted by trampling of peat mats on which the species grow. |

**Table 3.7 (continued).**

| Common Name | Scientific Name | MTNHP Rank [1] | USFS Status | BLM Status | Notes |
|---|---|---|---|---|---|
| fringed bog moss | *Sphagnum fimbriatum* | G5 S1 | | | |
| green-keeled cottonsedge | *Eriophorum viridicarinatum* | G5 S3 | | | |
| Hall's rush | *Juncus hallii* | G4G5 S2 | Sensitive | | |
| Howell's gumweed | *Grindelia howellii* | G3 S2S3 | Sensitive | Sensitive | Howell's gumweed occurs on vernally moist, lightly disturbed soil adjacent to ponds and marshes, as well as disturbed sites, such as roadsides and grazed pastures. It is a regional endemic known only from Missoula and Powell Counties, MT and Benewah County, ID and is considered globally threatened. It is known from over 60 mapped occurrences in MT, although most populations are small and many occur on roadsides or other similarly disturbed habitat. It is native to glacial wetlands in the subbasin. Occurrences may drift from place to place or from year to year and, as a result, many occurrences may be ephemeral. These attributes make determination of population numbers as well as the number of populations difficult. Invasive weeds are a threat to many occurrences, as the habitat occupied by *G. howellii* is also favorable for many weedy species. Application of herbicides to control these weeds, especially along roadsides may also have a direct, negative impact. |
| hutchinsia | *Hutchinsia procumbens* | G5 S1 | | Sensitive | |
| linear-leaved sundew | *Drosera linearis* | G4 S1 | Sensitive | | Only known from 4 populations in MT though all are moderate to large-sized occurrences that are located in either the Bob Marshall Wilderness or Indian Meadows Research Natural Area. These areas afford all known populations some protection from disturbance. |

**Table 3.7 (continued).**

| Common Name | Scientific Name | MTNHP Rank [1] | USFS Status | BLM Status | Notes |
|---|---|---|---|---|---|
| Missoula phlox | *Phlox kelseyi var. missoulensis* | G2 S2 | Sensitive | | A state endemic that occurs on open, exposed, limestone-derived slopes. Known from 16 occurrences, most of which are moderate to large-sized populations. Populations occur on a mix of ownerships, including private lands that host several occurrences. The Waterworks Hill population of Missoula is infested with several noxious weeds and heavy recreational trail use also occurs within the occupied habitat. Other populations appear to be at much less risk though some impacts from development, recreation and invasive weeds are likely. |
| moonwort | *Botrychium spp.* | G1G2G3 S1S3 | | | This is a general record for *Botrychium* species tracked by MTNHP and not specific for any particular species. MTNHP tracks and maintains observation data for all *Botrychium* species in the state excluding *B. multifidum* and *B. virginianum* which are fairly common and readily identifiable from all other *Botrychium* species. |
| moss | *Tetraplodon mnioides* | G4 S1 | | | |
| moss | *Scorpidium scorpioides* | G4G5 S2 | Sensitive | Sensitive | |
| pale sedge | *Carex livida* | G5 S3 | | | Listed as a *Species of Potential Concern*. |
| pygmy water-lily | *Nymphaea tetragona ssp. leibergii* | G5 S1 | | | Known from 4 extant occurrences in western valleys and one historical collection from Salmon Lake. Populations are susceptible to impacts from development, recreation, siltation and aquatic weeds. |
| small yellow lady's-slipper | *Cypripedium parviflorum* | G5 S3 | Sensitive | Sensitive | Listed as a *Species of Potential Concern*. Known from over 60 occurrences thought to be extant and an additional ~12 historical or poorly documented sites across the western half of MT. Many occurrences have small population numbers, though approximately two dozen occurrences are moderate to large populations. Populations occur on variety of federal, state and private ownerships with varied land uses and management. Appears to be tolerant to some disturbances at low levels and the number of populations scattered over a wide area reduces the risk to the species. A loss of populations or a significant decline in numbers may warrant a re-listing as a Species of Concern in MT. Moderate to large occurrences should be managed to maintain habitat and viable population numbers. |

**Table 3.7 (continued).**

| Common Name | Scientific Name | MTNHP Rank [1] | USFS Status | BLM Status | Notes |
|---|---|---|---|---|---|
| sphagnum | *Sphagnum riparium* | G5 S1 | | | |
| water bulrush | *Scirpus subterminalis* | G4G5 S2 | Sensitive | | Over a dozen known occurrences in western MT, most of which are moderate to large-sized populations primarily on National Forest lands. Populations are potentially vulnerable to changes in water levels or increases in nutrient and sediment loads associated with development, agriculture or adjacent timber harvesting. |
| watershield | *Brasenia schreberi* | G5 S1S2 | Sensitive | | Restricted in MT to shallow waters in the valleys of the northwest corner of the state, where it is known from 8 occurrences, including 6 relatively high quality populations. Potential threats to the species include boating activity, aquatic weeds, and several populations are subject to runoff from adjacent agricultural fields, though it is uncertain if this has negatively impacted any populations. |
| Western Joepye-weed | *Eupatorium occidentale* | G4 S2 | Sensitive | Sensitive | This peripheral species in MT is known from a handful of small to large populations in the extreme western part of the state. Minor impacts associated with a rock quarry at one location and rock climbing at another location are possible. Otherwise, few threats have been documented for the species in MT. |

[1] Montana Natural Heritage Program global and state ranks are explained in Appendix C.

### 3.2.7.3 Non-native Plant Species

One of the most challenging natural resource issues in the Blackfoot Subbasin is the spread of noxious and invasive plants. "Noxious weeds" are non-native species that can directly or indirectly injure agriculture, navigation, fish, wildlife, or public health (Montana Summit Steering Committee and Weed Management Task Force 2005). Landowners, managers and biologists are particularly concerned about the effects of noxious weeds on the structure, organization and function of ecosystems (Olson 1999). Noxious weeds impact the ecological and economic integrity of the Blackfoot Subbasin in a variety of ways (Olson 1999):

- Noxious weeds can outcompete and alter the relative abundance of native plant species by producing abundant seed, growing quickly and exploiting the soil profile for water and nutrients. A lack of natural predators furthers the competitive advantage of noxious weeds.
- Noxious weeds can contribute to soil erosion and alter soil properties by outcompeting native bunchgrasses that naturally bind the soil and producing secondary compounds that may hinder soil microfauna and microfauna from feeding on living roots.
- Noxious weeds impact wildlife by altering the native plant communities they depend on for survival.
- Noxious weed invasion can reduce carrying capacity for livestock, an important land use in the Blackfoot Subbasin. Noxious weeds reduce net returns by increasing operating expenses (for control measures), decreasing returns, or both.

Twenty out of 32 state listed noxious weeds are established in the Blackfoot Subbasin (Table 3.8). Twelve state listed noxious weeds have not yet been identified in the Blackfoot Subbasin, but are considered a high threat. "Invasive" plants, such as cheatgrass and common mullein, are non-native species that spread quickly and can be equally or more difficult to manage as noxious weeds.[14]

**Table 3.8 State-Listed Noxious Weed Species Established in the Blackfoot Subbasin.** [1]

| Common name | Scientific Name | Infestation Level |
|---|---|---|
| spotted knapweed | *Centaurea stoebe* | *Widespread, well-established, infesting 25-50% of potential range* |
| leafy spurge | *Euphorbia esula* | |
| yellow toadflax | *Linaria vulgaris* | |
| hound's-tongue | *Cynoglossum officinale* | |
| Canada thistle | *Cirsium arvense* | |
| oxeye daisy | *Leucanthemum vulgare* | |

[14] For more information on the distinction between noxious and invasive species, the State of Montana's classification process and control recommendations, see http://agr.mt.gov/weedpest/noxiousweeds.asp.

**Table 3.8 (continued).**

| Common name | Scientific Name | Infestation Level |
|---|---|---|
| St. Johnswort | *Hypericum perforatum* | *Widespread, well-established, infesting 25-50% of potential range.* |
| sulfur cinquefoil | *Potentilla recta* | |
| field bindweed | *Convolvulus arvensis* | |
| common tansy | *Tanacetum vulgare* | |
| Dalmatian toadflax | *Linaria dalmatica* | |
| yellowflag iris | *Iris pseudacorus* | *Occur in isolated populations, infesting 10-25% of potential range.* |
| meadow hawkweed | *Hieracium pretense, H. floribundum, H. piloselloides* | |
| orange hawkweed | *Hieracium aurantiacum* | |
| tall buttercup | *Ranunculus acris* | |
| diffuse knapweed | *Centaurea diffusa* | |
| hoary allysum | *Berteroa incana* | |
| Russian knapweed | *Acroptilon repens* | |
| purple loosestrife | *Lythrum salicaria and L. virgatum* | |
| blueweed | *Echium vulgare* | |

Since 1994, the Blackfoot Challenge Weeds Committee has coordinated and implemented a holistic strategy for managing undesirable, invasive and noxious weeds in the subbasin. Combining action with education, the core of the program is the locally-led Weed Management Areas program, where neighbors work across property boundaries to manage weeds. Almost 475,000 acres are under active weed management with 380 private landowners participating in the project. Integrated weed management strategies include herbicides, biocontrol, revegetation, multi-species grazing, hand pulling, plowing, mowing, prevention and early detection rapid response.

In 1997, an INVADERS taskforce (Rice et al. 1997) identified non-native plant species that have the potential to become significant problem plants over the next five decades in the Blackfoot Subbasin. Table 3.9 includes a short list of eight well-known weeds that have been established in the northwestern United States since the 1930s and are well described in the weed management literature (Whitson et al. 2002). These species have a high potential to become significant problem plants unless new occurrences are detected early and eradicated. This list also includes well-known weeds that are relatively common but not presently classified as “noxious” in

Montana (although some of these species may be classified as noxious in the future). Table 3.10 includes an alert list of 22 recently invading or less well-known weeds that are not yet classified as noxious by the state of Montana but have high potential to become significant problem plants in the Blackfoot Subbasin during the next half century.

**Table 3.9 Noxious and Invasive Weeds with a High Potential to Become Problem Plants in the Blackfoot Subbasin (Rice et al. 1997).**

| Common name | Scientific Name |
|---|---|
| absinth wormwood | *Artemisia absinthium* |
| yellow starthistle* | *Centaurea solstitialis* |
| rush skeletonweed* | *Chondrilla juncea* |
| poison hemlock | *Conium maculatum* |
| scotch broom* | *Cytisus scoparius* |
| common teasel | *Dipsacus fullonum* |
| dyer's woad* | *Isatis tinctoria* |
| tansy ragwort* | *Senecio jacobaea* |
| Eurasian watermilfoil | *Myriophyllum spicatum* |
| Whitetop* | *Cardaria draba* |
| Japanese knotweed* | *Polygonum cuspidatum* |

* State-listed noxious weed species.

The Nonindigenous Aquatic Species database maintained by the USGS (http://nas.er.usgs.gov) lists three non-native aquatic plants that are present in the Blackfoot Subbasin: yellow iris (mentioned above), flowering rush, and white water-lily. Although not currently present in the subbasin, the following aquatic plants have been identified by the Aquatic Nuisance Species Task Force (http://www.anstaskforce.gov) as potential invaders that would detrimentally impact aquatic systems in Montana: hydrilla, Brazilian elodea, egeria, Eurasian watermilfoil, curly pondweed, purple loosestrife and salt cedar. Of these potential invaders, Eurasian watermilfoil is the only species that is currently present in the state of Montana.

**Table 3.10 Alert List for Recently Invading or Less Well-Known Weeds and Risk Ratings[1] for Blackfoot Subbasin Habitats (Rice et al. 1997).**

| Plant Name | | Risk Rating by Habitat Type | | | | | |
|---|---|---|---|---|---|---|---|
| **Common Name** | **Scientific Name** | **Agriculture** | **Grassland** | **Forest** | **Riparian** | **Wetland** | **Disturbed areas** |
| velvetleaf* | *Abutilon theophrasti* | possible | possible | possible | | | High |
| jointed goatgrass* | *Aegilops cylindrica* | possible | possible | | | | High |
| bishop's goutweed | *Aegopodium podagraria* | Uncertain | | | | | |
| small bugloss* | *Anchusa arvensis* | possible | possible | possible | | | High |
| common bugloss | *Anchusa officinalis* | possible | possible | possible | | | High |
| weedy orache* | *Atriplex heterosperma* | Uncertain | | | | | |
| white bryony | *Bryonia alba* | | | possible | possible | | Possible |
| plumeless thistle | *Carduus acanthoides* | high | high | possible | high | | High |
| dwarf snapdragon* | *Chaenorrhinum minus* | possible | possible | possible | | | High |
| trailing crownvetch | *Coronilla varia* | possible | possible | possible | possible | | High |
| sand rocket | *Diplotaxis muralis* | Uncertain | | | | | |
| Russian olive | *Elaeagnus angustifolia* | | | | limited | limited | |
| babysbreath | *Gypsophila paniculata* | possible | possible | possible | possible | | High |
| bluebuttons | *Knautia arvensis* | possible | possible | possible | | | High |
| malcolm stock* | *Malcolmia africana* | possible | possible | | | | High |
| scentless chamomile | *Matricaria maritima* | high | possible | | possible | | High |
| cultivated knotweed | *Polygonum polystachyum* | possible | | | high | | High |

**Table 3.10 (continued).**

| Plant Name | | Risk Rating by Habitat Type | | | | | |
|---|---|---|---|---|---|---|---|
| **Common Name** | **Scientific Name** | **Agriculture** | **Grassland** | **Forest** | **Riparian** | **Wetland** | **Disturbed areas** |
| sakhalin knotweed | *Polygonum sachalinense* | possible | | | high | | High |
| European buckthorn | *Rhamnus cathartica* | limited | | limited | limited | | Limited |
| self salsify* | *Scorzonera laciniata* | Uncertain | | | | | |
| puncturevine | *Tribulus terrestris* | possible | possible | possible | | | High |
| syrian beancaper | *Zygophyllum fabago* | possible | possible | | | | High |

* An asterisk following the common name indicates species which grow primarily as annuals

[1]The ratings are: **High** - the species has high potential to become an important weed in this environment within the Blackfoot River drainage. **Possible** - initial indications are that the species could become a weed of this environment, but current information is limited for specific conditions within the Blackfoot drainage. Further analysis may be warranted. **Limited** - the species is not expected to affect extensive areas of the Blackfoot drainage in the near future, but could become a localized weed under certain conditions. **Uncertain** - current information is inadequate to assess risk. Further analysis may be warranted.

### 3.2.8 Ecological Relationships

In the preceding sections, we described the aquatic and terrestrial resources that characterize the Blackfoot Subbasin. Ecological function in the subbasin is shaped by the innumerable relationships between species and ecological communities and the biological and physical processes that support and sustain them. Ecological relationships between aquatic and terrestrial species and communities are particularly relevant to subbasin planning in the Blackfoot. The Blackfoot Subbasin contains an extensive network of lakes, ponds, herbaceous wetlands and perennial and intermittent streams that exist within a matrix of grassland, shrubland and forest communities. As such, the aquatic and terrestrial environments in the Blackfoot Subbasin are inextricably linked. Many, if not most, subbasin wildlife species use a combination of aquatic, riparian, wetland and upland habitats. Riparian and wetland areas, which represent the interface between aquatic and terrestrial environments, are the most productive wildlife habitats in the subbasin. In western Montana, 59% of land bird species use riparian and wetland habitats for breeding purposes, and 36% of those breed only in riparian or wetland areas (Mosconi and Hutto 1982).

Research conducted in a variety of locations around the world shows that streams and their adjacent riparian zones are connected by "reciprocal flows" of materials, energy, and organisms (Baxter et al. 2005). Stream systems are subsidized by influxes of organic litter (e.g., leaves), woody debris, nutrients, and invertebrates from adjacent riparian and terrestrial environments. Terrestrial invertebrates can provide a substantial and even dominant portion of the annual energy budget for drift-feeding fishes, such as salmonids. Likewise, riparian and terrestrial systems are subsidized by streams through the emergence of adult insects and energy and nutrients imported by migrating fish. Birds, bats, lizards, spiders and other riparian consumers benefit from this export greatly: prey originating instream contributes 25% to 100% of the energy (carbon) to some terrestrial species (Baxter et al. 2005). Similar stream-terrestrial connections undoubtedly exist in the Blackfoot Subbasin, although these relationships have not been explored in this system.

Stream ecosystems are also tied to the ecological characteristics of upland terrestrial ecosystems well beyond the riparian zone. The structure, composition, and patterns in forest communities directly influence hydrologic process such as the amount and timing of stream flows. Forests are the source of woody debris that can be routed to streams through landslides, avalanches and debris flows. Wildfire, timber harvest and other natural disturbance and land use activities that alter forest structure and composition can have profound effects on the dynamics and quality of stream habitats. Considerable interest is now focused on the restoration of more natural patterns, processes and disturbances such as wildfire in forest ecosystems because of the potential significance for aquatic ecosystems (e.g., Bisson et al. 1995, Naiman and Turner 2000).

Instream relationships among native and non-native fish can factor into the structure of food webs and the availability of terrestrial prey to native salmonids. Research in northern Japan demonstrates that changes in the relative abundance of native (Dolly Varden) and non-native (rainbow trout) salmonids impact the availability of terrestrial invertebrate prey to the native fish. In this study, rainbow trout usurped the terrestrial prey subsidy previously available to Dolly Varden, causing a more than 75% decrease in the biomass of terrestrial invertebrates in Dolly Varden diets and causing them to shift to foraging for insects on the stream bottom (Baxter et al.

2007). Similar changes might be expected with changes in the relative abundance of native and non-native salmonids in the Blackfoot Subbasin.

Relationships between bears and fish have been documented in the Blackfoot Subbasin. MFWP has documented black bear fishing activity at Big Sky Lake near Woodworth, where the primary food source is an introduced run of rainbow trout. MFWP has also documented bears fishing on Monture Creek at bull trout redd sites. There are unverified reports of bear fishing activity in Chamberlin Creek and at the inlet of Browns Lake (J. Jonkel, pers. comm.).

Evidence of the types of relationships described above helps to shape a more holistic view of aquatic and terrestrial ecosystems. To a large extent, the health of aquatic habitats in the subbasin is contingent upon sustainable land use in riparian, wetland, and upland habitats. Incompatible forestry and agricultural practices, unplanned development, and other land uses in terrestrial environments can degrade aquatic habitats by altering runoff patterns, rates of sedimentation, stream morphology, water chemistry, and water temperature. Similarly, aquatic habitat function and quality can impact terrestrial habitats and species. By focusing conservation and restoration efforts in the Blackfoot Subbasin on a range of aquatic and terrestrial species and ecological communities, (see Blackfoot Subbasin Management Plan, Section 5.0), we are intending to provide an umbrella of protection for the myriad ecological processes and relationships, both documented and undocumented, that sustain the overall ecological health of the subbasin.

### 3.2.9 Socioeconomic & Land Use Characteristics

#### 3.2.9.1 Settlement History

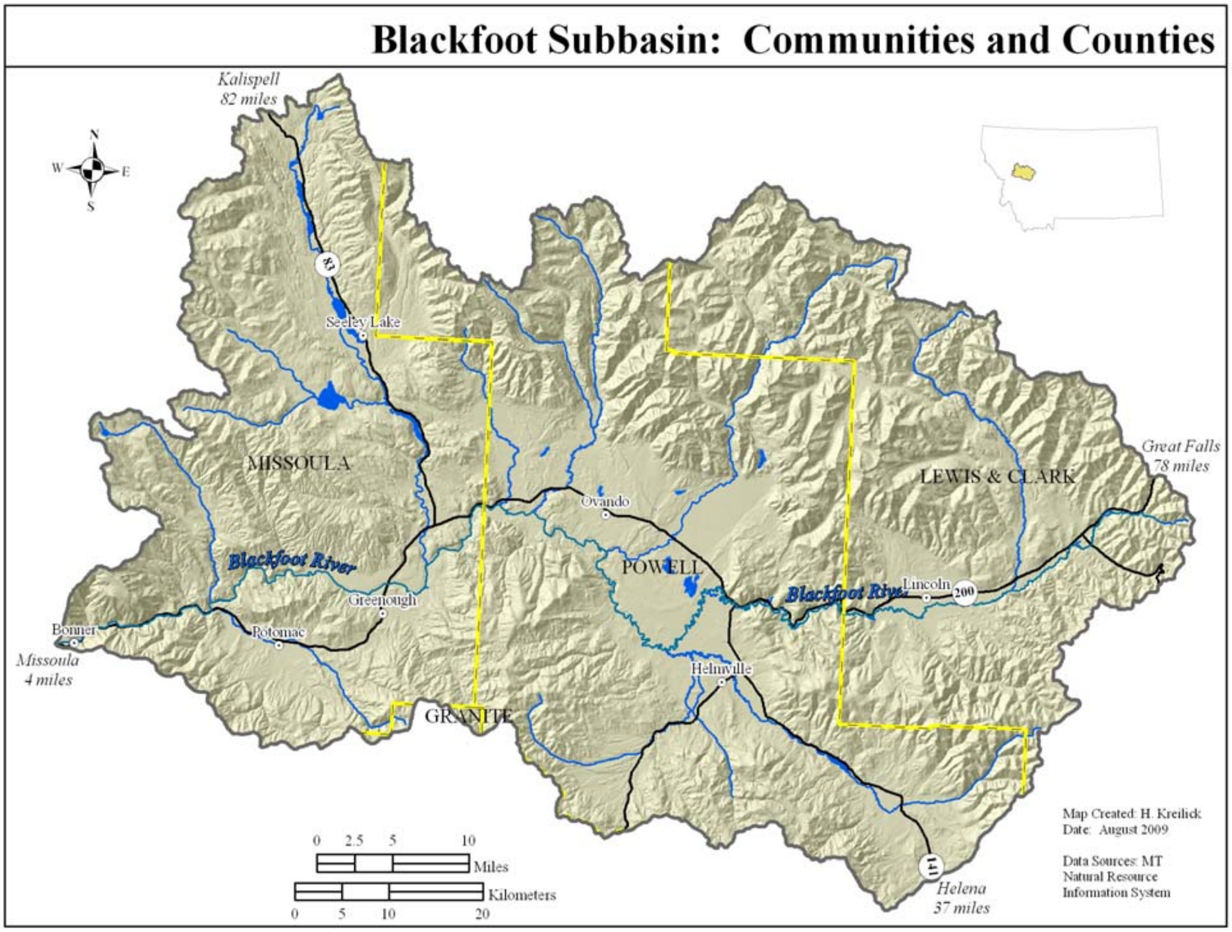
Prior to the arrival of white settlers in the 1800s, the Blackfoot Valley was occupied by the indigenous peoples of western Montana for thousands of years. The Kootenai, Salish, Nez Perce, Shoshone, Blackfeet and Crow tribes utilized the valley, known as *Cokahlahishkit* or the "Road to the Buffalo," for its plant, animal stone, and mineral resources and for cultural ceremonies. The importance of the Ovando area is documented both in Pend d'Oreille and Salish oral histories and in the archaeological record. The trail up the Blackfoot River was used by the Pend d'Oreille and Salish to access the Rocky Mountain Front for buffalo hunting at least twice a year. Trails led north to what is now the Bob Marshall Wilderness and south to the Clark Fork Valley. Just before the western movement of settlers, many groups of Pend d'Oreille and Salish occupied these valleys year-round. The open valleys of the Ovando area had sufficient resources to sustain a large group and were vital for camping, horse grazing, plant collection, hunting, and other activities (BCCA Council and BC 2008).

White settlers arrived in the Blackfoot in the 1800s. The Blackfoot landscape provided opportunities for ranching, farming, logging, hunting, and food and firewood gathering. By 1885, Montana's first large-scale logging operation began in the Blackfoot Valley. Gold was discovered in the area in the 1890s and massive mining operations, including the Mike Horse Mine, were set up to retrieve the valuable metal. In the following decades, miners staked claims to more than 150 gold, silver and copper mines and ranchers grazed their cattle on the valley's lush native grass. Heavy logging continued not only to support mining operations, but also to aid in the construction of the Transcontinental Railroad (BCCA Council and BC 2008, Curtis 2005).

### 3.2.9.2 Population

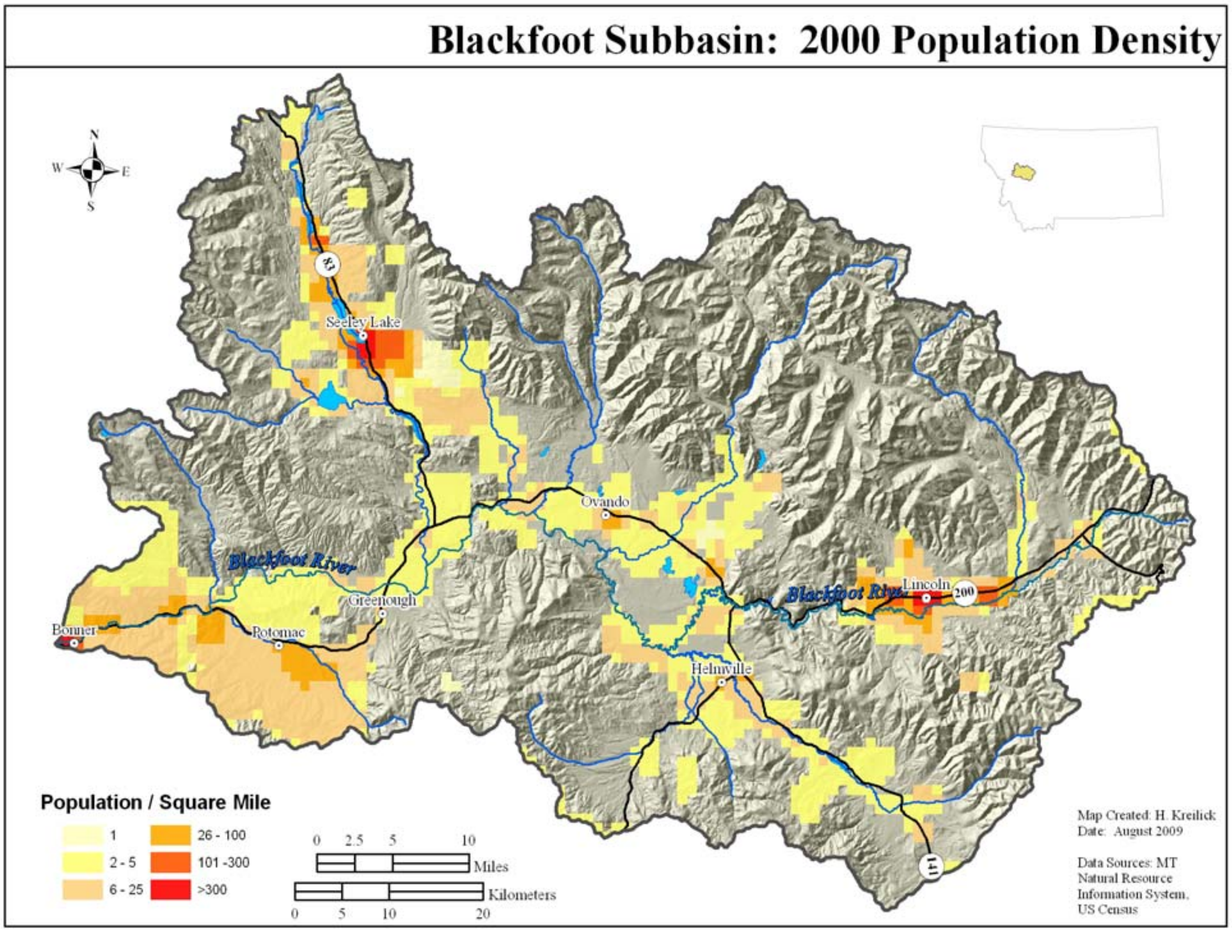
The Blackfoot Subbasin includes the communities of Lincoln, Helmville, Ovando, Seeley Lake, Greenough, Potomac, and Bonner and spans portions of Missoula, Powell, and Lewis & Clark Counties (Figure 3.14). There are approximately 8,100 people and 2,500 households in the subbasin. In this 1.5 million-acre subbasin, this amounts to less than one person per square mile (Figure 3.15). The population is spread throughout the valley, with population densities reaching 300 people per square mile in Seeley Lake, Potomac, and Bonner. The middle and high elevation portions of the subbasin remain largely undeveloped. In 1995, between 8% and 18% of the current residents of the Blackfoot Subbasin had their primary residence located out of state (BC 2005b).

**Figure 3.14 Communities and Counties.**




While many western Montana valleys experience rapid population growth, the rate of population growth in the Blackfoot Subbasin remains modest. The population in the subbasin is projected to increase to approximately 8,680 by 2010 (BC 2005b). Much of the population increase in the Blackfoot is attributable to in-migration from other states. New residents are attracted to the Blackfoot because of its outstanding scenic beauty, intact landscapes, abundance of wildlife, recreational opportunities, rural character and proximity to the urban centers of Missoula and Helena.

**Figure 3.15 2000 Population Density.**




### 3.2.9.3 Land Ownership

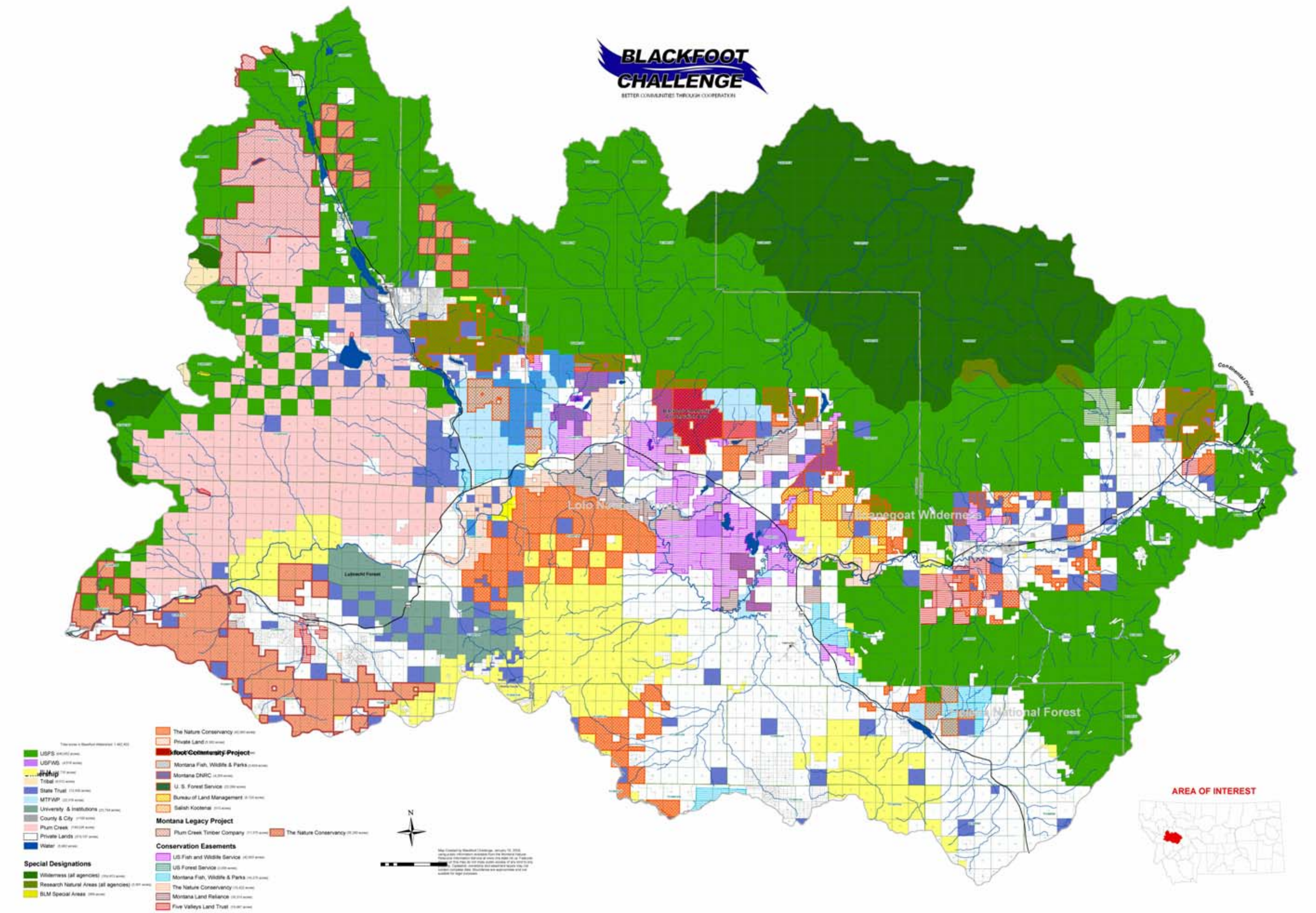
Land ownership in the Blackfoot Subbasin is 54% federal (USFS, USFWS, BLM), 10% state (DNRC, MFWP, University of Montana), 31% private and 5% corporate timber company (Figure 3.16). Most of the middle and high elevation forested lands within the subbasin are administered by the USFS. Private lands are concentrated in the low elevation portions of the subbasin. Land ownership patterns in the Blackfoot Subbasin have changed in recent years due to large-scale transfers of Plum Creek Timber Company (PCTC) lands. In 2003, the Blackfoot Challenge and The Nature Conservancy initiated the Blackfoot Community Project, which involved the purchase and re-sale of 89,215 acres of PCTC lands based on a community-driven disposition plan.[15] The lands encompassed all PCTC lands from the Blackfoot River headwaters near Rogers Pass to the Clearwater drainage. Approximately 75% of the lands have been or will be transferred into federal or state ownership and 25% into private ownership. In 2008, The Nature Conservancy and The Trust for Public Land entered into another agreement with PCTC,

[15] See the Blackfoot Challenge website (www.blackfootchallenge.org) for more information on the Blackfoot Community Project.

the Montana Legacy Project, to purchase 312,500 acres of timberland in western Montana.[16] As part of the Legacy Project, a total of 71,754 acres in the Clearwater and Potomac valleys of the Blackfoot Subbasin will be purchased and resold to public agencies and/or private buyers. The majority these lands are intended to be re-sold to the USFS and DNRC.

[16] See the Montana Legacy Project website (see www.themontanalegacyproject.org) for more information.

**Figure 3.16 Land Ownership and Conservation Easements.**

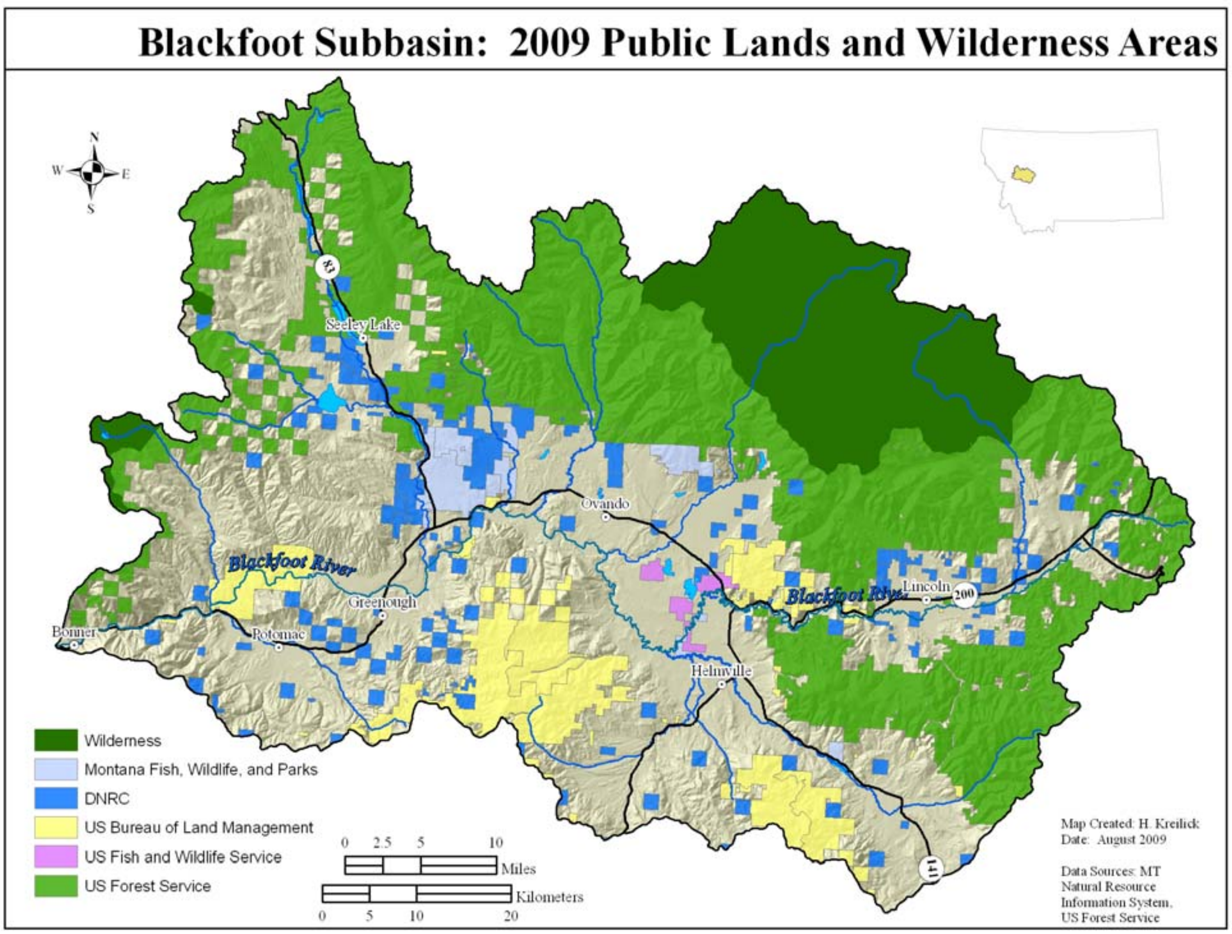


### 3.2.9.4 Land Use and Economy

Land use and land use change within the Blackfoot Subbasin is the result of complex interactions between geographic, socioeconomic and legal (ownership) characteristics of the subbasin. Consistent with its largely rural nature, dominant land uses in the subbasin include agriculture, timber harvest and recreation. A finer scale assessment, however, particularly within subbasin communities, reveals a range of land uses including residential and commercial development, transportation, communication and utilities, institutional and government facilities and public and private outdoor recreation (e.g., golf courses, resorts, and parks).

The majority of private land in the subbasin is located on the valley floor, where ranching remains the principle land use. Approximately 14.5% of the total acreage in the subbasin is used for agriculture. The subbasin supports 44,280 irrigated acres and 180,283 grazing acres (BC 2005b). Public lands in the subbasin are mixed-use areas for recreation, wildlife habitat, grazing, timber management and research. The Blackfoot is home to the Scapegoat Wilderness area and the eastern edge of the Rattlesnake Wilderness area that together cover 164,400 acres (11%) of the 1.5 million-acre subbasin (Figure 3.17). The Scapegoat Wilderness is adjacent to the Bob Marshall Wilderness Complex. Together, the Scapegoat and Bob Marshall cover about 1.5 million acres of federally protected lands.

**Figure 3.17 Public Lands and Wilderness.**



The presence of expansive open space in the subbasin provides an abundance of outdoor recreational opportunities, from hunting and fishing to hiking and snowmobiling. Public access to streams, lakes and public lands is highly valued. There are 25 state stream-side and lake-side Fishing Access Sites, 789 miles in the groomed snowmobile system, and 20 campgrounds on state and federal lands in the subbasin. In 2008, 36 ranches in the Blackfoot representing 68,668 acres were enrolled in the MFWP Block Management Program, providing public access for big game hunting. The river itself, a world-renowned native trout fishery, is used for angling, summer camping, and floating. MFWP is in the process of drafting a recreation management plan for the Blackfoot River and the North Fork of the Blackfoot River that will guide recreation management now and into the future (MFWP 2009). The proposed plan is based on the recommendations of the River Recreation Advisory for Tomorrow (RRAFT) Citizen Advisory Committee.

Timber harvest on public lands has declined substantially in the past three decades. Although production from private timberlands has remained relatively constant over that same period of time (BC 2005b), recent market-driven fluctuations continue to impact the amount of timber harvest in the subbasin. In 2008, the Stimson Mill in Bonner ceased operations, laying off over 100 employees. The mill had been active since1886, when the first logs were floated down the Blackfoot River. Owned by the Anaconda Company for nearly 40 years, it was reputed to be one of the oldest continuously operating mills in the country. In Seeley Lake, Pyramid Mountain Lumber continues to operate but faces the same lumber market pressures as other mills across the northwest.

Mining has historically been a major land use in the Blackfoot Subbasin. Today, there are several abandoned mining sites where reclamation is vital to the long-term health of the watershed. Like many rural communities, the traditional resource extraction economy in the Blackfoot Subbasin is being augmented, and in some places replaced, by a “new economy” based on services, particularly recreation, tourism, and new businesses made possible due to advances in telecommunications. The Blackfoot continues to attract retired professionals, providing transfer and investment income components to the subbasin economy (see *Rural Way of Life*, Section 3.3.3.8).

### 3.2.9.5 Conservation Legacy

The Blackfoot Subbasin has a history of pioneering innovative land management strategies to support working landscapes and the fish and wildlife that depend on them. Recognizing the strong tie between land and livelihood, private landowners have played a key role in conservation projects for over three decades. One of the earliest efforts involved developing Montana’s enabling legislation for conservation easements, with the first conservation easement in Montana signed in the Blackfoot Valley in 1976.

In 1992, the Blackfoot River was listed as one of the ten most endangered rivers in the United States due to a century of unsustainable practices including mining, livestock grazing and timber harvest. The impacts to water quality and fisheries of the Blackfoot associated with these land uses generated interest in river management and enforcement via top-down, agency-led planning and decision-making. Housing development, increased recreational use and the spread of noxious weeds were also beginning to impact the overall health of the river. A few key landowners responded with a non-regulatory approach to conservation on the Blackfoot River by developing a recreation corridor and an innovative walk-in hunter program on private lands, demonstrating the effectiveness of community-based conservation and creative solutions that meet both public and private land management objectives.

Due to public-private partnerships and the legacy of cooperation, the Blackfoot has seen limited residential subdivision or unplanned development, unlike many other valleys in western Montana. In Powell County, located in the heart of the Blackfoot Subbasin, development regulations divide the county into four Agricultural Districts. Each of these districts has minimum lot sizes and specified allowable uses, creating what is essentially county-wide zoning. Agricultural District 3, which encompasses Powell County in the Blackfoot Subbasin, has minimum lot sizes of 160 acres. This District was established out of concern from the community over the rate at which family farms were being sold and converted to second homes.

Many working cattle ranches in the subbasin are still intact and over 24% of private lands (108,000 acres) in the subbasin are permanently protected from subdivision and residential development by conservation easements (Figure 3.15). Many Blackfoot landowners also protect habitat and wildlife values through land and water stewardship practices, including sustainable grazing management, stream and wetland protection and restoration, water conservation measures and sustainable resource use (BC 2005b). As a result of large, working ranches, extensive public land, development regulations and conservation easements in the Blackfoot Subbasin, habitat fragmentation has been limited and the biological diversity of the subbasin has been largely maintained (TNC and BC 2007).

At the landscape level, new strategies are being developed to work across political boundaries and leverage financial and technical resources. As part of the Blackfoot Community Project, for example, partners developed the 41,000-acre Blackfoot Community Conservation Area (BCCA) that involves community forest ownership of 5,609 acres and cooperative ecosystem management across public and private lands. As a multiple-use demonstration area, this project will pilot innovative access, land stewardship and restoration practices through management by a 15 member community-based council.

## 3.3 Conservation Targets

In this section we outline the process used by subbasin technical work groups to select and assess the viability of the eight focal conservation targets in the Blackfoot Subbasin. We then provide background information on each conservation target and present the results of each conservation target viability assessment.

### 3.3.1 Conservation Target Selection Process

The subbasin planning process in the Blackfoot began with identification of priority conservation targets. Conservation targets, which may include ecological systems, ecological communities, species or other important natural or cultural resources, represent the overall biodiversity of a landscape and the reasons why it is important for conservation (Low 2003). Identifying the right set of conservation targets is the foundation for all subsequent steps in the subbasin planning process. The targets selected ultimately determine the conservation objectives and strategic actions implemented in the subbasin—in other words, which critical threats must be abated and what types of conservation and ecological restoration must be performed.[17] In the Blackfoot Subbasin, conservation targets fall into the following three categories (adapted from Low 2003):

1. **Ecological Communities**: Ecological communities are groupings of co-occurring species, including natural vegetation associations and alliances, which share common ecological attributes or conservation requirements. Ecological community targets may have special conservation or management requirements due to distinct locations, ecological process or threats. Examples include *herbaceous wetlands* or *low elevation ponderosa pine/western larch forest*. Ecological communities provide the "coarse filter" for conserving the representative array of species and natural communities at a landscape scale. These are referred to as "nested targets." Often, conserving an ecological community will lead to conserving a rare species or natural community that is embedded within the system.

2. **Species**: Species targets have ecological attributes or conservation requirements not adequately captured within the ecological community targets. Types of species targets may include:
   - globally imperiled and endangered native species (e.g., species ranked G1 to G3 by natural heritage inventories);
   - species of special concern due to vulnerability, declining trends, disjunct distributions, or endemism;
   - focal species, including keystone species, wide-ranging regional species and umbrella species (e.g., grizzly bear);
   - major groupings of targeted species that co-occur on the landscape, share common ecological processes, share similar threats or have similar conservation requirements (e.g., native salmonids); or
   - globally significant examples of species aggregations, such as a migratory shorebird stopover area aggregation.

3. **Other Significant Resources**: Beyond the biodiversity targets described above, there may be other natural or cultural resources—such as groundwater supplies, productive farmland, Wilderness areas or cultural features—that are important to partners engaged in conserving an area.

The Blackfoot Subbasin technical work groups identified eight conservation targets within the subbasin (Table 3.11). Of these, five are ecological community targets, two are species targets and one is a cultural resource target. All of the targets include nested targets that are expected to benefit from conservation of the main targets. These eight conservation targets were selected not only because of their individual value and concern, but also because they, together with the nested targets, represent a high percentage of the total biodiversity and conservation value in the Blackfoot Subbasin. Conserving and/or restoring these targets will help to ensure the viability of

[17] Appendix B in *Landscape-Scale Conservation: A Practitioner's Guide* (Low 2003) provides a one-page decision support tool for selecting conservation targets.

the species, natural systems and rural way of life that make the Blackfoot Subbasin unique and that contribute to the larger-scale significance of the Crown of the Continent Ecosystem. Detailed target and nested target descriptions are provided in Section 3.3.3.

**Table 3.11 Conservation Targets and Associated Nested Targets in the Blackfoot Subbasin.**

| Conservation Target | Nested Targets |
|---|---|
| **Native salmonids** | westslope cutthroat trout; bull trout; western pearlshell mussel |
| **Herbaceous wetlands** | herbaceous wetland-associated bird, plant, amphibian and invertebrate Species of Concern |
| **Moist site and riparian vegetation** | riparian-dependent birds |
| **Native grassland/sagebrush communities** | grassland/sagebrush-associated bird and plant Species of Concern; ungulate winter range |
| **Low elevation ponderosa pine/western larch forest** | low elevation ponderosa pine/western larch forest-associated birds; ungulate winter range |
| **Mid to high elevation coniferous forest** | Mid to high elevation coniferous forest-associated birds; forest carnivores; whitebark pine |
| **Grizzly bears** | Habitat connectivity for wildlife |
| **Rural way of life** | Sustainable natural resource-based livelihoods; healthy/resilient communities |

### 3.3.2 Assessing Conservation Target Viability

The purpose of the Blackfoot Subbasin Plan is to develop strategies for conserving *viable* occurrences of native species and ecological systems across the subbasin. Viability indicates the ability of a conservation target to persist for many generations. After selecting a representative list of focal conservation targets for the Blackfoot Subbasin, the subbasin technical work groups conducted a viability assessment for each target. The viability assessment process, including definitions of terms, is outlined below (adapted from Low 2003).[18]

**Step 1. Identify Key Ecological Attributes**
*Key ecological attributes* are factors that are critical for the long-term viability of a conservation target. These are factors that, if degraded, would seriously jeopardize the target's ability to persist for a century or longer. Although there are many attributes that could describe all the characteristics of a target, the goal of the viability assessment is to identify a small set of ecological attributes that are critical to each target's long-term viability. Key ecological attributes are identified based on ecological models, the scientific literature, local scientific data and/or

[18] For more information on assessing conservation target viability, see *Landscape-Scale Conservation: A Practitioner's Guide* (Low 2003).

comparative data from other areas or similar types of targets and expert opinion. Key ecological attributes fall under the following three categories:

- *Size* is a measure of the area or abundance of the conservation target's occurrence. For ecological systems and communities, size is simply a measure of the occurrence's patch size or geographic coverage. For animal and plant species, size takes into account the area of occupancy and number of individuals. Minimum dynamic area, or the area needed to ensure survival or re-establishment of a target after natural disturbance, is another aspect of size.
- *Condition* is an integrated measure of the composition, structure and biotic interactions that characterize the occurrence. This includes attributes such as reproduction, age structure, biological composition (e.g., presence of native versus exotic species; presence of characteristic patch types for ecological systems), structure (e.g., canopy, understory, and ground cover in a forested community) and biotic interactions (e.g., levels of competition, predation, and disease).
- *Landscape context* includes two factors: ecological processes and connectivity. Ecological processes that maintain a target may include hydrologic regimes (e.g., flooding), fire regimes and many kinds of natural disturbance. Connectivity includes such factors as species targets having access to habitats and resources needed for life cycle completion, fragmentation of ecological communities and systems and the ability of a target to respond to environmental change through dispersal, migration or re-colonization.

**Step 2. Select Indicators to Measure Each Key Ecological Attribute**
In order for each key ecological attribute to be assessed, the basis for its measurement must be established. These measures are called *indicators*. Indicators must be measurable and therefore frequently involve some type of quantitative assessment—such as number of acres, recruitment, age classes, percent of cover or frequency of fire regime. Other indicators may involve measurable elements that are not numerical, such as the seasonality of fire or flooding regime. Indicators form the basis for monitoring changes in conservation target viability over time. They should therefore be efficient and affordable to measure.

**Step 3. Rate the Current Status of Each Indicator**

The next step in assessing viability of conservation targets involves determining the current health of each key ecological attribute. This is accomplished by using a simple grading scale to rate the status of each indicator selected in Step 2. This four-part grading scale provides a sufficient degree of distinction among the four scores and allows for a reasonable confidence level, while recognizing the tremendous lack of information and research that would be needed to provide more precise grades for most targets. A description of the ratings follows:

| | |
|---|---|
| ***Very Good*** | The indicator is functioning within an ecologically desirable status, requiring little human intervention for maintenance within the natural range of variation (i.e., is as close to "natural" as possible and has little chance of being degraded by some random event). |
| ***Good*** | The indicator is functioning within its range of acceptable variation, although it may require some human intervention for maintenance. |
| ***Fair*** | The indicator lies outside of its range of acceptable variation and requires human intervention. If unchecked, the target will be vulnerable to serious degradation. |
| ***Poor*** | Allowing the indicator to remain in this condition for an extended period will make restoration or preventing extirpation practically impossible (i.e., it will be too complicated, costly, and/or uncertain to reverse the alteration). |

Ideally, over time, a set of quantitative benchmarks should be established for each of these four ratings for each key ecological attribute. These benchmarks should state clearly where the indicator being measured would fall within each level. However, the scientific information needed to establish these benchmarks is often lacking or inadequate. In these cases, well-informed expert opinion is used to determine a credible first iteration of the benchmarks and assessment of the current rating. Benchmarks and ratings will be modified as new information is available.

**Step 4. Determine the Desired Status of Each Indicator**

The final step in assessing viability is to determine a desired future rating for each indicator. The gap between the current and desired future indicator ratings helps technical work groups determine which conservation targets are in need of the most immediate attention, and drives the development of conservation objectives and strategic actions outlined in the Blackfoot Subbasin Management Plan (Section 5.0). The benchmarks used to quantify the ratings also provide a mechanism for measuring changes in conservation target viability over time as strategic actions are implemented in the subbasin. Assessing the ecological health of conservation targets in this way is an iterative process; key ecological attributes, indicators and ratings will all be refined over time.

### 3.3.3 Conservation Target Descriptions and Viability Assessments

#### 3.3.3.1 Native Salmonids

*Nested Targets: westslope cutthroat trout; bull trout; western pearlshell mussel*

The Blackfoot River and its tributaries support native westslope cutthroat trout and bull trout, both of which are Species of Concern in Montana (MTNHP 2009b, Shepard et al. 2005). Bull trout is federally listed as threatened under the Endangered Species Act (USFWS 2002). Abundance and distribution of native trout in the Blackfoot River and its tributaries vary greatly (Pierce et al. 2008). This variation can be explained by variation in life-history forms, natural geological/environmental conditions, human influences (such as environmental degradation and historic fishery exploitation), hybridization and interspecific competition among non-native fishes (Swanberg 1997, Schmetterling 2001, Pierce et al. 2007, 2008). With the general exception of high mountain lakes, these species are widely distributed across the broad gradients found in streams, rivers and lakes and represent the range of aquatic environments in the Blackfoot Subbasin. Because westslope cutthroat trout and bull trout are sensitive to changes in water quality (e.g., temperature and sediment) and other physical habitat characteristics (Behnke 2002, Shepard et al. 2005, MBTRT 2000), they are excellent indicators of the overall health of the Blackfoot River ecosystem. Conservation and restoration of these target species and their habitats will provide secondary benefits to other native fishes and aquatic organisms found throughout the subbasin.

Between 1988 and 2006, the MFWP, in cooperation with other entities, engaged in a basin-wide inventory of fish populations  and habitat assessments. These investigations encompass the distribution and abundance of native and nonnative fish. In addition MDFWP has extensively surveyed channel (i.e., physical habitat) condition. These include stream temperatures, stream habitat surveys on Blackfoot tributaries (assessing pool/riffle conditions, pool frequency, and large woody debris), substrate composition, stream discharge, overhead canopy vegetation, stream bank stability, stream degradation and Rosgen channel type (Pierce et al, 2008). In addition, DFWP, in cooperation with other researchers, has examined the distribution and severity of whirling disease in the Blackfoot sub-basin (Pierce et al, 2008, 2009). Comprehensive telemetry studies emphasizing the life histories of migratory bull trout, westslope cutthroat trout, and rainbow trout have been competed basin-wide (Swanberg, 1997; Schmetterling, 2001, 2003, Pierce 2007; Benson, 2009).  A telemetry study of mountain whitefish is currently underway (Pierce, 2008). Finally, DFWP has engaged in extensive WSCT genetic investigations. The sum of these investigations, which have occurred on the mainstem and on all major tributaries, have provided the foundation for a steadily evolving native trout recovery strategy (MBTRT 1997; MFWP, 2005b; Pierce et al 2008; USFWS 2002, 2010).

The data collection since 1989 has resulted in a description of each tributary, including a description of its fisheries, its habitat impairments, past restoration, and current or planned restoration (MFWP, 2005b; Pierce et al, 2008). The impairments to each stream that lend themselves to potential restoration efforts are summarized in Appendix M. To date, the sum of these evaluations provide the basis for a hierarchical restoration priority system that establishes native salmonid priorities on 182 inventoried streams within the Blackfoot Subbasin (Figure 3.18). The 2008 effort was an expansion and refinement of an earlier, 2005 ranking effort (Pierce, 2005). Table 3.12 describes the ranking of streams for native fish values. The prioritization effort involved ranking all 182 water bodies by a hierarchical point system that includes native fish values, total fisheries values, total biological values, and total values (Appendix J). The goal of this ranking scheme was to guide the limited resources of the Blackfoot Cooperators to a common set of biologically important tributaries, emphasizing the recovery of native salmonids primarily on private land (Id).

For streams with documented bull trout use, streams were awarded points based on whether a stream supports bull trout spawning, or rearing, and whether a stream is a designated "core area" bull trout stream (Appendix J). For example, a stream that supports spawning, rearing, or is designated a "core" bull trout stream, receives the maximum of 40 biological points. Streams that support bull trout rate a higher priority than other streams because of the bull trout's status as threatened under the ESA and the state and federal priorities for the recovery of bull trout populations; the high potential for improvement in the Blackfoot, and the downstream and sympatric benefits to other species resulting from bull trout recovery (Id).In addition, the ranking system provides points for the technical feasibility of restoration, the potential to improve downstream water quality, and the likelihood of landowner cooperation. The relatively high priority given to the protection and restoration of bull trout is reflected in Table 3.12, where the fifteen highest priority restoration streams with high restoration potential are located either in critical bull trout habitat (FWS 2010) or in a "core area" for the recovery of bull trout, which include tributaries connected to critical habitat (MTBTRT 2000).

The ranking criteria of a stream for westslope cutthroat trout depends on whether it supports fluvial cutthroat or resident cutthroat. Streams supporting fluvial cutthroat rank higher than streams that support only resident cutthroat (Appendix J). In addition to these criteria, the technical feasibility of restoration on a stream, the potential for a stream to contribute stream flows within the basin, and the potential for landowner cooperation, all play into the ranking system (Id).Fluvial WSCT streams ranked higher than streams supporting resident fish because of "1) the precarious status of the fluvial life-history, 2) high sport fish value to the Blackfoot River, and 3) downstream and sympatric benefits to other species resulting from WSCT recovery efforts. Streams with fluvial WSCT status (20 points) were those identified through 1) telemetry studies, 2) direct observations of fluvial-sized fish by FWP fisheries personnel, or 3) direct tributaries to the Blackfoot River and biologically connected during high flows periods" (Appendix J).

**Figure 3.18. Native Fish Restoration Priorities for the Blackfoot River (Pierce et al 2008).**

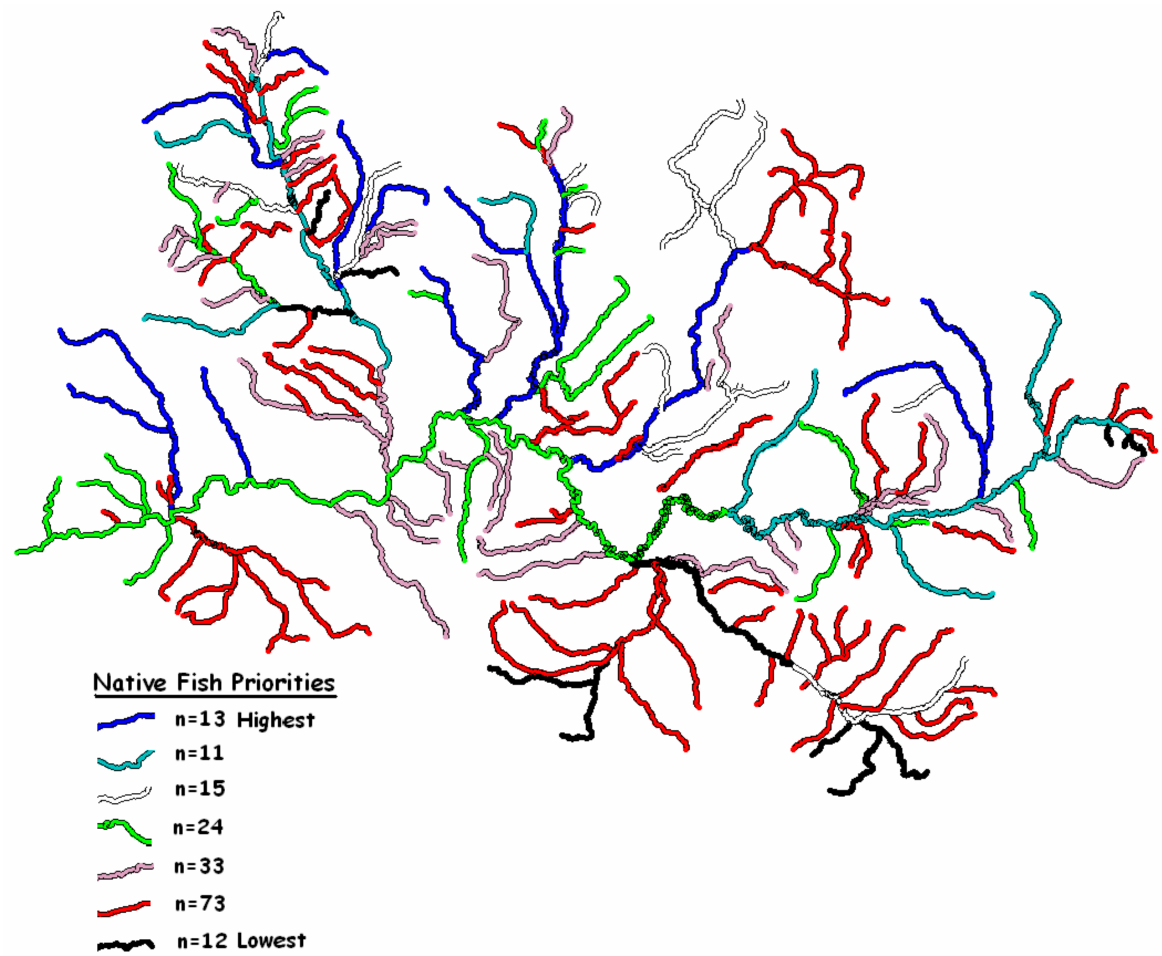


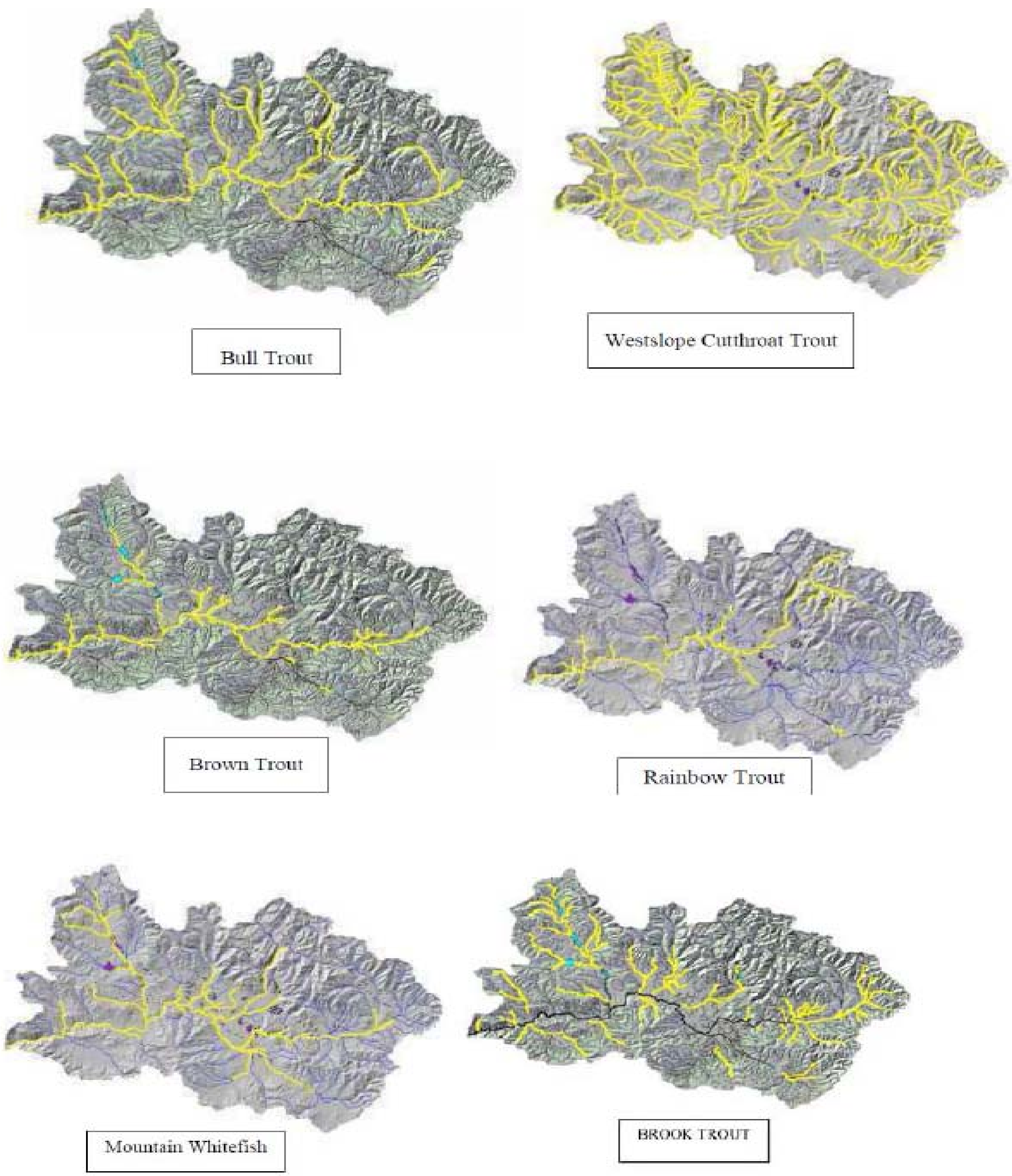
**Table 3.12. Native fish priority streams sorted alphabetically high to low priority.**

| Stream Name | Native Species Total Score | Stream Name | Native Species Total Score | Stream Name | Native Species Total Score | Stream Name | Native Species Total Score |
|---|---|---|---|---|---|---|---|
| Belmont Creek | 60 | East Twin Creek | 30 | Bear Gulch | 10 | Seeley Creek | 10 |
| Clearwater Section 2 | 60 | Ender's Spring Creek | 30 | Bertha Creek | 10 | Shaue Gulch | 10 |
| Clearwater Section 3 | 60 | Grantier Spring Cr. | 30 | Blanchard NF | 10 | Sheep Creek | 10 |
| Clearwater Section 4 | 60 | Hogum Creek | 30 | Braziel Creek | 10 | Shingle Mill Creek | 10 |
| Copper Creek | 60 | Inez Creek | 30 | Broadus Creek | 10 | Smith Creek | 10 |
| Cottonwood Cr. (R.M.43) | 60 | Johnson Creek | 30 | Buffalo Gulch | 10 | Sourdough Creek | 10 |
| Dunham Creek | 60 | McCabe Creek | 30 | Burnt Bridge Creek | 10 | Stonewall Creek | 10 |
| E.F. Clearwater | 60 | Saurekraut Creek | 30 | California Gulch | 10 | Sucker Creek | 10 |
| Gold Creek | 60 | Spring Cr.(Cottonwood) | 30 | Camas Creek | 10 | Swamp Creek | 10 |
| Gold Creek, W,F | 60 | Trail Creek | 30 | Chicken Creek | 10 | Tamarack Creek | 10 |
| Landers Fork | 60 | Unnamed tributary | 30 | Chimney Cr. (Douglas) | 10 | Theodore Creek | 10 |
| Monture Creek below the Falls | 60 | West Twin Creek | 30 | Chimney Cr. (Nevada) | 10 | Uhler Creek | 10 |
| Morrell Creek | 60 | Yellowjacket Creek | 30 | Clear Creek | 10 | Union Creek | 10 |
| North Fork Blackfoot River below the Fa | 60 | Basin Spring Creek | 20 | Cold Brook Creek | 10 | Vaughn Creek | 10 |
| W.F. Clearwater | 60 | Bear Creek trib. to N.F. | 20 | Colt Creek | 10 | Warm Springs Cr. | 10 |
| Alice Creek | 50 | Bear Creek (R.M.37.5) | 20 | Cooney Creek | 10 | Warren Creek | 10 |
| Arrastra Creek | 50 | Benedict Creek | 20 | Cottonwood Cr. (Nev.) | 10 | Warren Creek, Doney Lake trib | 10 |
| Blackfoot River 1 | 50 | Blanchard Creek | 20 | Dobrota Creek | 10 | Washington Creek | 10 |
| Blackfoot River 2 | 50 | Chamberlain EF | 20 | Douglas Creek | 10 | Washoe Creek | 10 |
| Blind Canyon Creek | 50 | Chamberlain WF | 20 | East Fork of North Fork | 10 | Wedge Creek | 10 |
| Boles Creek | 50 | Clearwater Section 1 | 20 | Finley Creek | 10 | Willow Cr. (lower) | 10 |
| Lodgepole Creek | 50 | Elk Creek | 20 | First Creek | 10 | Wilson Creek | 10 |
| Poorman Creek | 50 | Fawn Creek | 20 | Frazier Creek | 10 | Auggie Creek | 0 |
| Cabin Creek | 40 | Findell Creek | 20 | Frazier Creek, NF | 10 | Bear Trap Creek | 0 |
| Canyon Creek | 40 | Fish Creek | 20 | Gallagher Creek | 10 | Black Bear Creek | 0 |
| Clearwater Section 5 | 40 | Keep Cool Creek | 20 | Game Creek | 10 | Buck Creek | 0 |
| Dry Creek | 40 | Lincoln Spring Cr. | 20 | Gleason Creek | 10 | Drew Creek | 0 |
| Dry Fork of the North Fork | 40 | Little Fish Creek | 20 | Grouse Creek | 10 | Finn Creek | 0 |
| East Fork of Monture | 40 | Little Moose Creek | 20 | Hoyt Creek | 10 | Halfway Creek | 0 |
| Hayden Creek | 40 | McDermott Creek | 20 | Humbug Creek | 10 | Horn Creek | 0 |
| Kleinschmidt Cr. | 40 | Middle Fork of Monture Cre | 20 | Indian Creek | 10 | Mike Horse Creek | 0 |
| Marshall Creek | 40 | Moose Creek | 20 | Jacobsen Spring Creek | 10 | Nevada Cr. (lower) | 0 |
| Nevada Cr.(upper) | 40 | N.F. Placid Creek | 20 | Jefferson Creek | 10 | Owl Creek | 0 |
| Rock Creek | 40 | Nevada Spring Cr. | 20 | Lost Horse Creek | 10 | Paymaster Creek | 0 |
| Salmon Creek | 40 | Pearson Creek | 20 | Lost Pony Creek | 10 | Sheep Creek | 0 |
| Snowbank Creek | 40 | Placid Creek | 20 | Lost Prairie Creek | 10 | Slippery John Creek | 0 |
| Spring Creek (N.F.) | 40 | Seven up Pete Cr. | 20 | McElwain Creek | 10 | Strickland Creek | 0 |
| Bear Creek (R.M.12.2) | 30 | Shanley Creek | 20 | Mitchell Creek | 10 | Sturgeon Creek | 0 |
| Beaver Creek | 30 | Wales Creek | 20 | Mountain Creek | 10 | Ward Creek | 0 |
| Blackfoot River 3 | 30 | Wales Spring Creek | 20 | Murphy Creek | 10 | | |
| Blackfoot River 4 | 30 | Wasson Creek | 20 | Murray Creek | 10 | | |
| Blackfoot River 5 | 30 | Willow Cr. (upper) | 20 | North Fork above the Falls | 10 | | |
| Blackfoot River 6 | 30 | Yourname Creek | 20 | Pass Creek | 10 | | |
| Burnt Cabin Creek | 30 | Anaconda Creek | 10 | Rice Creek | 10 | | |
| Camp Creek | 30 | Archibald Creek | 10 | Richmond Creek | 10 | | |
| Chamberlain Creek | 30 | Arkansas Creek | 10 | Sawyer Creek | 10 | | |
| Deer Creek | 30 | Ashby Creek | 10 | Scotty Creek | 10 | | |
| Dick Creek | 30 | Bartlett Creek | 10 | Second Creek | 10 | | |

Factors that impact native salmonid viability in the Blackfoot Subbasin include non-native fish introductions (USFWS 2002, Shepard et al. 2005), metals and other chemical contamination (Stratus Consulting 2007), elevated temperatures, nutrient inputs, stream dewatering (Pierce et al 2005), stream and riparian habitat alteration (Marler 1997, Pierce et al. 1998), incompatible grazing management (Fitzgerald 1997, BC 2005a), sub-standard road crossings and other migration barriers into tributaries (Pierce et al. 2007, 2008). Within the Blackfoot Subbasin, the majority of inventoried streams exhibit some level of physical and/or biological impairment (BC 2005a, Pierce et al. 1997, 2005, 2008). The level of impairment varies substantially within and among streams. A detailed discussion of water quality in the subbasin is provided in Section 3.2.5.2.

While functional tributaries play an essential role in the life stages (migration, spawning and rearing) of all fluvial Blackfoot River fish (Swanberg 1997, Schmetterling 2001, Pierce et al. 2007), altered and degraded tributaries generally inhibit movement and reduce spawning and rearing success, contributing to suppressed populations and inadequate recruitment of multiple species over large areas of the river (Peters 1990, Pierce et al. 1997, 2008). Since 1990, restoration partners in the Blackfoot Subbasin have undertaken cooperative habitat restoration tied to fisheries recovery, with over 700 projects completed to date involving more than 200 individual landowners (BC 2005a, Pierce et al. 2008). Because tributaries provide critical spawning and rearing areas, restoration of degraded tributaries has become the primary method of restoring river populations (BC 2005a, Pierce et al. 1997, 2008). Protective harvest regulations that began in 1990 and changes in non-native fish stocking programs have also helped to increase densities of Blackfoot native salmonids in the mainstem Blackfoot River (Pierce et al. 1997). Much work, however, remains in order to recover and stabilize these species, particularly across tributary environments (Pierce and Podner, 2006, Pierce et. al, 2008). Figure 3.19 describes salmonid distribution within the Blackfoot sub-basin.

**Figure 3.19 Distribution of Six Salmonids within the Blackfoot Subbasin.**



**Nested target: bull trout**

In Montana, bull trout are native to rivers, streams and lakes in the Columbia River (Kootenai, Clark Fork, Bitterroot, Blackfoot, Flathead, and Swan drainages) and Saskatchewan River (St. Mary and Belly drainages) basins (MBTRT 2000). The bull trout is a long-lived species, generally believed to reach sexual maturity between five and seven years of age (Thomas 1992). It spawns in small to intermediate size (second to fourth-order) streams between late August and early October, building nests, or redds, in which it buries its eggs. Bull trout spawning redds are commonly constructed in alluvial stream reaches where upwelling groundwater is available to aerate and thermally protect the buried eggs from severe icing (Swanberg 1997, Pierce and Podner, 2006, Pierce et. al, 2008). The hatched fry do not emerge from the redds until the following spring (Thomas 1992, MBTRT 2000).

MFWP has extensively studied the life history of fluvial bull trout in the Blackfoot Sub-basin (Swanberg 1997; Pierce et al, 2008; MBTRT, 1997; BC 2005(a); Benson, 2009). The life histories of Montana bull trout include both resident and migratory strategies. Resident bull trout spend their entire lives in (or near) their small natal streams. In the Blackfoot Subbasin, most bull trout exhibit migratory life histories. This strategy involves an out-migration to larger rivers (fluvial) or lakes (adfluvial) where fish grow to maturity before returning to their natal tributaries to spawn. Migratory bull trout of the Blackfoot Subbasin commonly move long distances (> 70 miles) in response to environmental changes (e.g., river warming) or for spawning (Swanberg 1997, Pierce et al. 2004). Fluvial bull trout currently inhabit at least 16 Blackfoot River tributary streams. The three major bull trout population groups in the Blackfoot Subbasin are 1) Upper Blackfoot Basin upstream of Nevada Creek (mostly fluvial stocks), 2) Clearwater River Basin (mostly adfluvial stocks ), and 3) Lower Blackfoot Basin (outside of the Clearwater) below Nevada Creek (mostly fluvial stocks). Figure 3.17 shows generalized distribution of bull trout in the Blackfoot Subbasin.

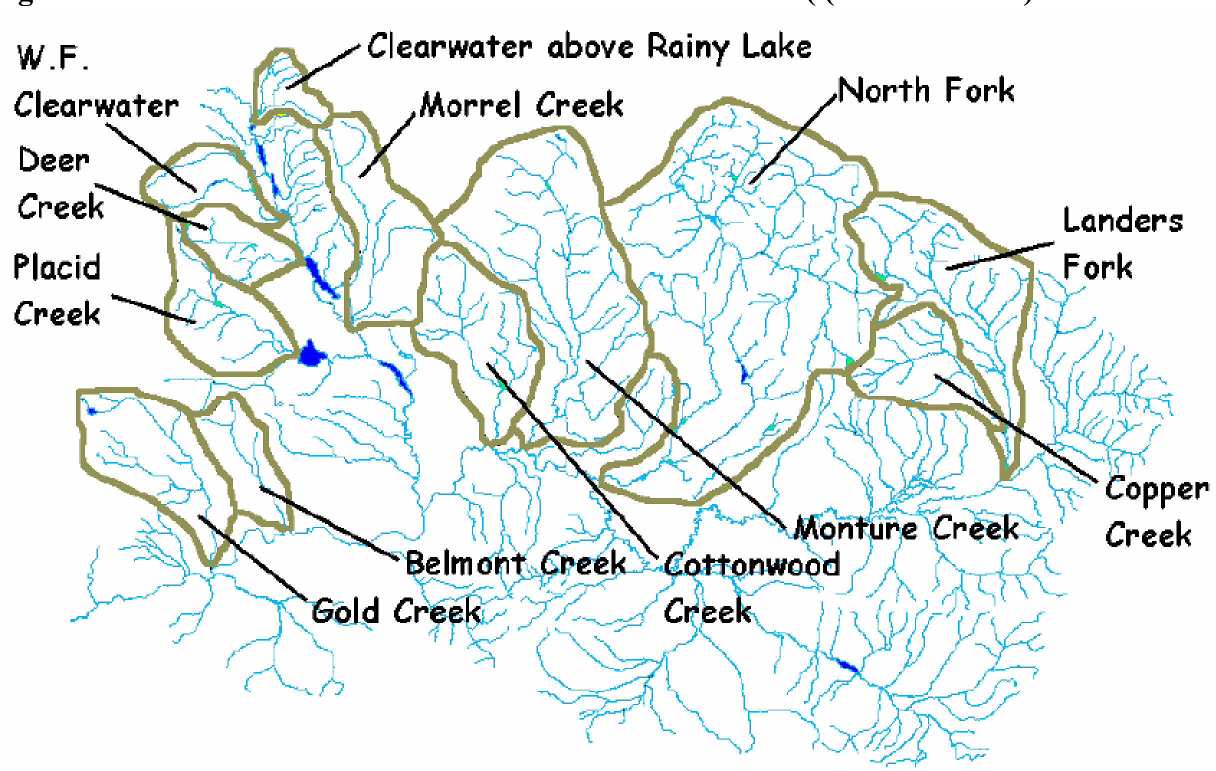
Bull trout abundance and distribution in the Blackfoot Subbasin has declined from historic levels (MBTRT 2000, USFWS 2002). This decline is attributable to a variety of factors, including habitat loss and degradation from land and water management practices. (USFWS, 2002, 2010; Appendix K), population isolation and fragmentation from dams and other fish passage barriers; competition, predation and hybridization with introduced, non-native fish species (e.g., northern pike, lake trout, brook trout and others) (Pierce, 2001); historical overharvest; and poaching (Peters 1990; Pierce et al. 1997; MTBTRT 2000, USFWS 2010).

Within the category of land and water management practices, the 2002 USFWS Bull Trout Recovery Plan for the Clark Fork Recovery Unit Describes a more specific set of impacts that encompass the effects of historic forestry practices (increased sedimentation, increased peak flows, thermal modifications, loss of woody instream debris, channel instability, and increased access by anglers and poachers); livestock grazing (riparian damage, increased sedimentation), irrigation demand (destabilization of stream channels, interruption of migratory corridors, thermal impacts, entrainment of fish into ditches); and mining (water quality degradation). (USFWS, 2002). The restoration partners in the Blackfoot sub-basin have identified much the same array of limiting factors over the past two decades and have inventoried limiting factors on 182 tributaries within the sub-basin (Pierce, 2008; Appendix J,). More detailed descriptions of the source of those impacts are found in the progress reports that DFWP has published since the early 1990s. Those factors are summarized in Table 3.22.

Within the subbasin, bull trout densities are very low in the upper Blackfoot River but increase downstream of the North Fork. Including the Clearwater subbasin, bull trout occupy about 25% of the Blackfoot Subbasin, or about 400 total miles of stream and all mainstem lakes interconnected with the Clearwater River (Pierce et al. 2008, L. Knotek, pers. comm.).

As part of its bull trout recovery effort, the Montana Bull Trout Recovery Team identified the following areas within the Blackfoot as "core areas:" Monture Creek, the North Fork Blackfoot River, Copper Creek, Landers Fork, Cottonwood Creek, Belmont Creek, Gold Creek, Morrell Creek, Deer Creek, Placid Creek, the West Fork Clearwater River and the Clearwater River above Rainy Lake (Figure 3.19). This description provided the basis for the USFWS description of bull trout critical habitat in its 2002 bull trout draft recovery plan for the Clark Fork basin and ultimately the final rule on designation of critical bull trout habitat (USFWS, 2002, 2010). While the map depicted in figure 3.20 does not include all the waterbodies depicted n the 2010 proposed designation of critical habitat (Figures 3.11 and 3.12), DFWP has been conducting habitat and fish population surveys on those waterbodies (Pierce, 2008), and will likely modify the map in 3.20 based upon that data collection (Pierce, personal communication, 2010).

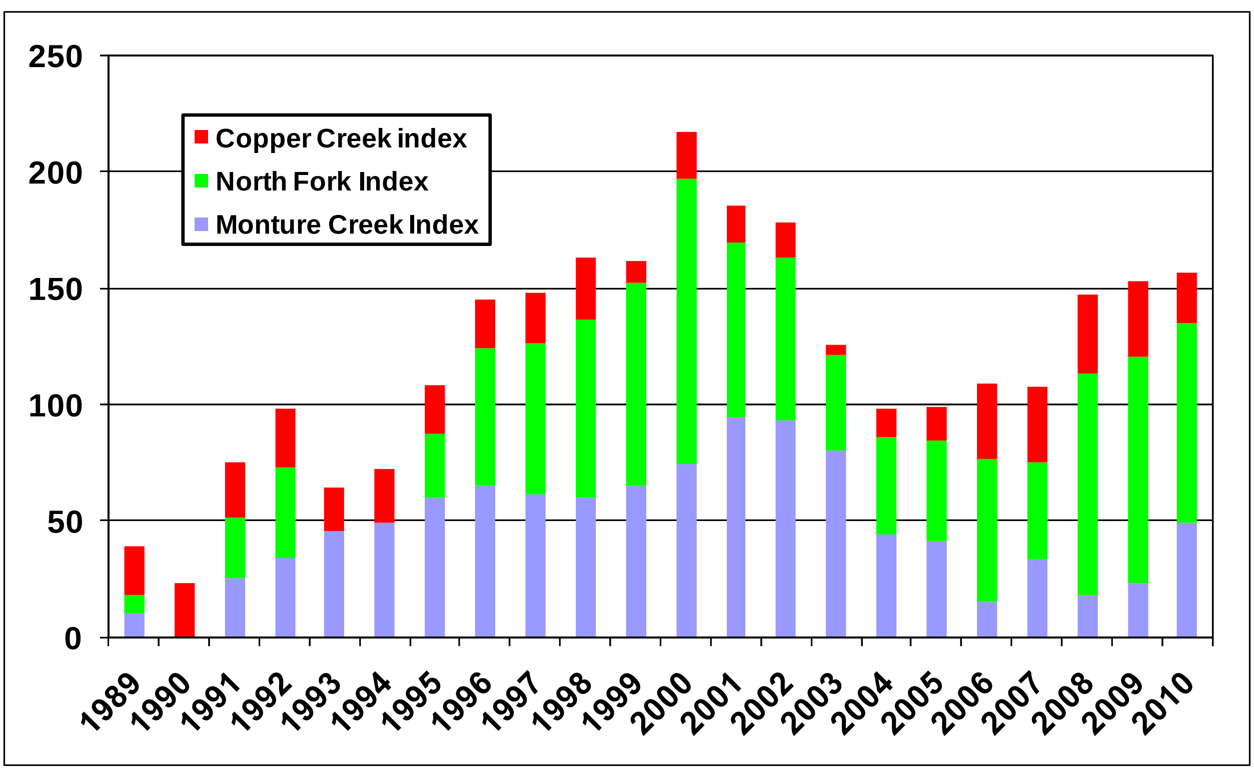
**Figure 3.20. Bull trout "core areas" for the Blackfoot Basin ( (MBTRT 1996).**




MFWP began bull trout population estimates in key locations in the Blackfoot subbasin, starting in 1988, and has maintained a comprehensive program of population estimates since then

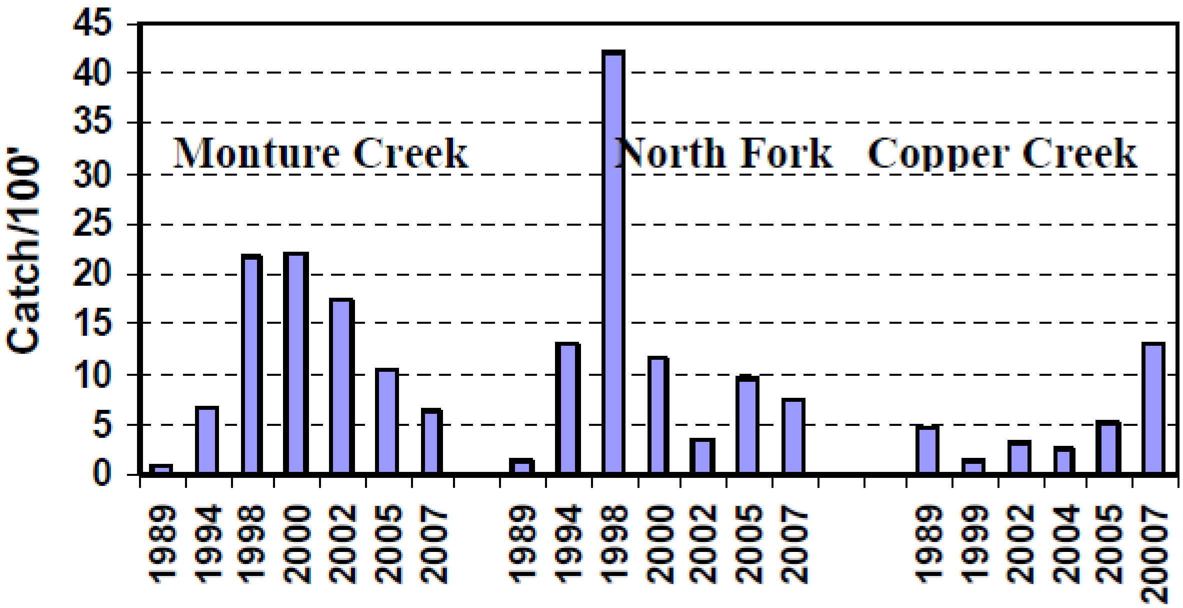
((Peters and Spoon 1989; Peters et al 1990; Pierce et al 2008). Population monitoring has included redd counts in all principle spawning streams and population monitoring sites throughout the Blackfoot River and tributaries supporting bull trout. Since 1989, MFWP has conducted redd counts on Monture Creek, the North Fork of the Blackfoot, and Copper Creek (Pierce et al. 2008) Bull trout redd counts in the Clearwater River began in.2002 on Morrell Creek, and in 2007 on the East Fork and West Fork of the  Clearwater River (Ladd Knotek, personal communication, 2010).  Bull trout spawner abundance is indexed by the number of identifiable female bull trout nesting areas (redds). Data indicate that Monture Creek has an upward trend from 10 redds in 1989 to an average of 51 redds in subsequent years (Pierce et al. 2008). The North Fork also shows an upward trend from eight redds in 1989 to an average of 58 redds between 1989 and 2008. The Copper Creek drainage (including Snowbank Creek) has experienced a resurgence of bull trout redds—from 18 in 2003 to 117 in 2008— since the 2003 Snow Talon Fire. The total number of redds counted in these three streams (Monture Creek, North Fork, and Copper Creek) increased from 39 in 1989 to 217 in 2000. With the onset of drought, bull trout redd counts then declined to 147 in 2008. Even with the onset of drought, however, numbers have remained substantially above the 1989 baseline (Figure3.21). These changes are attributed to protective regulations first enacted in 1990, restoration actions in spawning streams during the 1990s and a period of sustained drought between 2000 and the present (Pierce et al. 2008). On the East Fork of the Clearwater redd counts improved from 6 to 20 after the removal of a migratory barrier on Rainy Lake; redd counts on the West Fork of the Clearwater have ranged between 30 and 60; and Morrell Creek redd counts have ranged from 25 to 55 (Ladd Knotek, personal communication, 2010).

**Figure 3.21. Bull trout redd counts for index reaches in three primary fluvial bull trout streams, 1989-2007. (Pierce et al.  2008)**



In addition to the redd counts, MFWP has monitored juvenile bull trout populations in the three streams described in Figure 3.20 above. The data indates that except for Copper Creek juvenile bull trout populations increased dramatically in the 1990s, and have shown decline between 1998 and 2007 (Figure 3.21).

**Figure 3.22. CPUE for juvenile bull trout near spawning sites of three primary spawning streams, 1989-2007. (Pierce et al. 2008).**




The Viability assessment in table 3.13 awaits completion of the analysis to the 6th field HUC of salmonid habitat. Pending the completion of that viability assessment, planners in the sub-basin continue to rely on the assessments of habitat and species condition that have emerged from the two-decades-long data-gathering and analysis that has attended the Blackfoot River habitat restoration effort and which has been summarized in periodic progress reports (e.g. see Pierce, 2008) and in the Native Fish Conservation Prioritization Strategy (Appendix J). The key attributes and indicators described in Table 3.12 come directly from the research effort that has been ongoing since 1990 (Pierce, 2008). While the current information has not yet been organized into the template described below, much of the information to populate the viability assessment resides in the DFWP progress reports. The fisheries working group has developed a map of 6th field HUCs for the Blackfoot Subbasin, and expects to organize the known data into the viability assessment to the 6th field HUC in the winter of 2010-2011 (Ryen Aasheim, personal communication, 2010).

**Table 3.13 Bull Trout Viability Assessment.** [1]

| | | Indicator Ratings | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Key Attribute** [2] | **Indicator** | **Poor** | **Fair** | **Good** | **Very Good** | **Current Rating** | **Desired Rating** | **Comments** |
| **Condition**: *Abundance* | Redd counts or population estimates (extrapolated to adults) | Spawning adults occur only occasionally, or adult members are unknown | Spawning adults low or highly variable (average < 10 or vary substantially between < and > 10; but are consistently present) | Spawning adults common (average > 10 but < 100) | Spawning adults consistently abundant (average > 100) | To be determined | To be determined | This element of condition is a bull trout population demographic characteristic influencing the risk of local extinction. |
| **Condition**: *Life History Expression* | Number of migratory forms expressed | No migratory life histories. Local population is isolated by permanent impassible barrier; OR life history expression unknown | Migratory life history occurs, but relative abundance is low or adult access is blocked or limited during typical migration periods | Migratory life history occurs, but access through corridors or to rearing areas occasionally limited | All potential migratory life histories are abundant or dominant | To be determined | To be determined | This element of condition is a bull trout population demographic characteristic influencing the risk of local extinction. |

**Table 3.13 (continued).**

| | | Indicator Ratings | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Key Attribute** | **Indicator** | **Poor** | **Fair** | **Good** | **Very Good** | **Current Rating** | **Desired Rating** | **Comments** |
| **Condition**: *Resilience* | Trends in population growth or survival | Population is declining and or habitat is in poor condition and non-natives are abundant or dominate the community OR nothing is known about resilience | Population is stable at low to moderate abundance and or habitat is degraded, but not destroyed. Non-natives may be relatively abundant, but not dominant | Population is stable at moderate abundance or growing slowly. When reduced in abundance population slowly rebuilds. Habitat is in good condition and non-natives are not present or rare. | Population is stable and moderate-high abundance, or when reduced has the capacity to rebuild quickly. Habitat is in excellent condition and expected to stay that way. Non-native salmonids are not important. | To be determined | To be determined | This element of condition is a bull trout population demographic characteristic influencing the risk of local extinction. |
| **Size**: *Extent of habitat networks within the 6th code* | Length of suitable spawning/ rearing habitat | Length of the interconnected stream network supporting spawning and rearing habitat is < 3 km. | Length of the interconnected stream network supporting spawning and rearing habitat is between 3 and 10 km. | Length of the interconnected stream network supporting spawning and rearing habitat is between 10 and 20 km | Length of the interconnected stream network supporting spawning and rearing habitat is > 20 km | To be determined | To be determined | |
| **Landscape Context**: *Water Quality* | Temperature, sediment and chemical contaminants | One or more elements is functioning at unacceptable risk | Two or more elements are functioning at risk, none at unacceptable risk | Two elements are functioning acceptably, one is functioning at risk | All three elements are considered functioning acceptably | To be determined | To be determined | This would be based on the USFS Assessment for change in peak/base flows and drainage network increase encompassing 6th field (subwatershed). Additional data on water diversion may be used to consider condition & FWP Dewatered Stream list/Minimum instream flow model. |

**Table 3.13 (continued).**

| | | Indicator Ratings | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Key Attribute** | **Indicator** | **Poor** | **Fair** | **Good** | **Very Good** | **Current Rating** | **Desired Rating** | **Comments** |
| **Landscape Context**: *Habitat Structure* | Large wood, width-depth, floodplain connectivity, stream bank conditions | One or more elements is functioning at unacceptable risk | Two or more elements are functioning at risk, none at unacceptable risk | Three elements are functioning acceptably, one is functioning at risk | All four elements are considered functioning acceptably | To be determined | To be determined | Based on USFS Assessment encompassing 6th codes. These are only some of the elements in habitat and channel condition. Substrate, pools and off channel habitat are presumably correlated or represented. |
| **Landscape Context**: *Hyrdology* | Flow and hydrology | One or more elements is functioning at unacceptable risk | Two or more elements are functioning at risk | One is functioning acceptable and one is functioning at risk | Both elements are considered functioning acceptably | To be determined | To be determined | Based on USFS Assessment for change in peak/base flows and drainage network increase encompassing 6th code. |
| **Landscape Context**: *Barriers* | Physical barriers | Permanent barriers exclude adult movement to spawning habitat in > 75% of the 6th field spawning habitat. | Temporary or partial impediments or barriers may exist for juvenile and adult movements; or permanent barriers may exist that exclude adult migrants from 25%-75% of the 6th field spawning habitat. | No barriers to adult movement, or they exclude < 25% of the 6th field spawning habitat. Temporary or partial impediments or barriers may occasionally exist for juvenile movement. | There are no barriers or impediments to fish migration from the 6th field to the lake or river environment where migratory life histories could be expected to rear or stage. | To be determined | To be determined | Presumably would be based on USFS inventory of fish passage barriers. |

[1] Based on local populations, not across entire subbasin. The native salmonids technical work group configured this table to assess viability down to the 6th field HUC. After acquiring the maps that describe the basin to the 6th code, the work group will apply this viability assessment to streams at that level.
[2] See Appendix E for definitions of key attributes used in this assessment.

**Nested target: westslope cutthroat trout**
In Montana, the historical range of westslope cutthroat trout included all of Montana west of the Continental Divide as well as the upper Missouri River drainage (Shepard et al. 2005). Historical accounts suggest that westslope cutthroat trout were once abundant in the river systems of western Montana (Lewis 1805; Shepard et al. 2005).

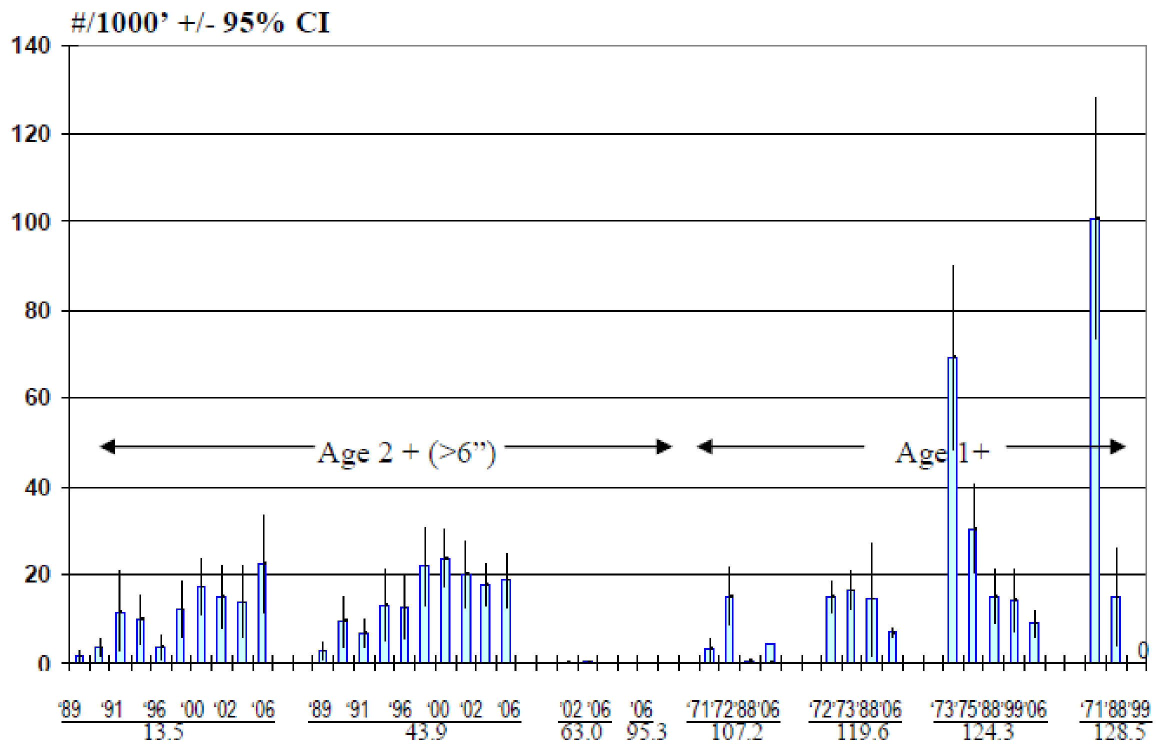
As with bull trout, Montana has been monitoring westslope cutthroat trout in the Blackfoot subbasin since 1989 (Peters et al, 1989; Pierce et al. 2008). This has included population estimates on both the mainstem Blackfoot River and on most of its tributaries (Pierce et al. 2008; Figure 3.23). Westslope cutthroat trout are distributed throughout the Blackfoot Subbasin, inhabiting the mainstem and about 90% (> 150) of headwater tributaries (Pierce et al. 2008). The three major westslope cutthroat population groups in the Blackfoot Subbasin are 1) Upper Blackfoot Basin upstream of Nevada Creek, 2) Clearwater River Basin, and 3) Lower Blackfoot Basin (outside of the Clearwater) below Nevada Creek. Figure 3.17 shows generalized distribution of westslope cutthroat trout in the Blackfoot Subbasin.

Westslope cutthroat trout have three life history forms similar to bull trout: adfluvial (lake dwelling), fluvial (river dwelling), and resident (stream dwelling). While resident fish spend their entire lives in tributary streams, migratory cutthroat trout will migrate >70 miles between wintering areas in rivers and spawning areas in tributary streams (Schmetterling 2001, Schmetterling 2003, Pierce et al. 2007). Westslope cutthroat spawning and rearing streams are small to intermediate in size (first through fourth-order), where large wood sorts gravel and diversifies spawning habitat conditions (Schmetterling 2000). Migratory juvenile cutthroat trout inhabit small tributaries for two to three years before moving downstream to mature in a river environment (Behnke 1992). At about five years of age, fluvial fish then return to their natal streams to spawn (Schmetterling 2001, Pierce et al. 2007). Juvenile cutthroat trout commonly overwinter in the interstitial spaces of larger substrate, though larger fish also aggregate in deep pools. In the Blackfoot River, adult cutthroat trout occupy deep and slow moving pools during winter (Schmetterling 2001, Pierce et al. 2007).

Westslope cutthroat trout have declined over much of their historic range within the last century (Behnke 1992, Shepard et al. 2003, 2005). Westslope cutthroat trout historically occupied about 56,500 miles of habitat within the United States. The species currently occupies an estimated 33,500 miles, or 59%, of historically occupied habitats (Shepard et al. 2003). In general, densities in tributaries decline in the downstream direction because of habitat degradation, historic fishery exploitation, and interactions with non-native trout (Shepard et al. 2005, USFWS 2009a). Despite this rangewide trend, the Blackfoot Subbasin supports a nearly basin-wide distribution of westslope cutthroat trout with ~90% of their historic range occupied compared with ~39% statewide (Pierce et al. 2008). Westslope cutthroat trout densities in the lower mainstem of the Blackfoot River have generally increased between 1989 and 2008, despite an increase in angler pressure in recent years (MFWP angler pressure estimates 1989-2007). Like bull trout, increasing densities of westslope cutthroat trout relate to protective angling regulations enacted in 1990 and restoration actions targeting important spawning and rearing streams. Westslope cutthroat declines in the Blackfoot River upstream of Lincoln correspond with the release of toxic mine waste and related population collapse downstream of the upper Blackfoot

Mining complex (Spence 1975; Peters 1990; Pierce et al. 2008; figure 3.22). Westslope cutthroat trout habitat restoration has occurred in Monture, Chamberlain, Gold, Dunham, McCabe, Morrell, Cottonwood, Pearson, Wasson, Arrastra, Poorman, Spring, and Snowbank Creeks and in the North Fork of the Blackfoot River.

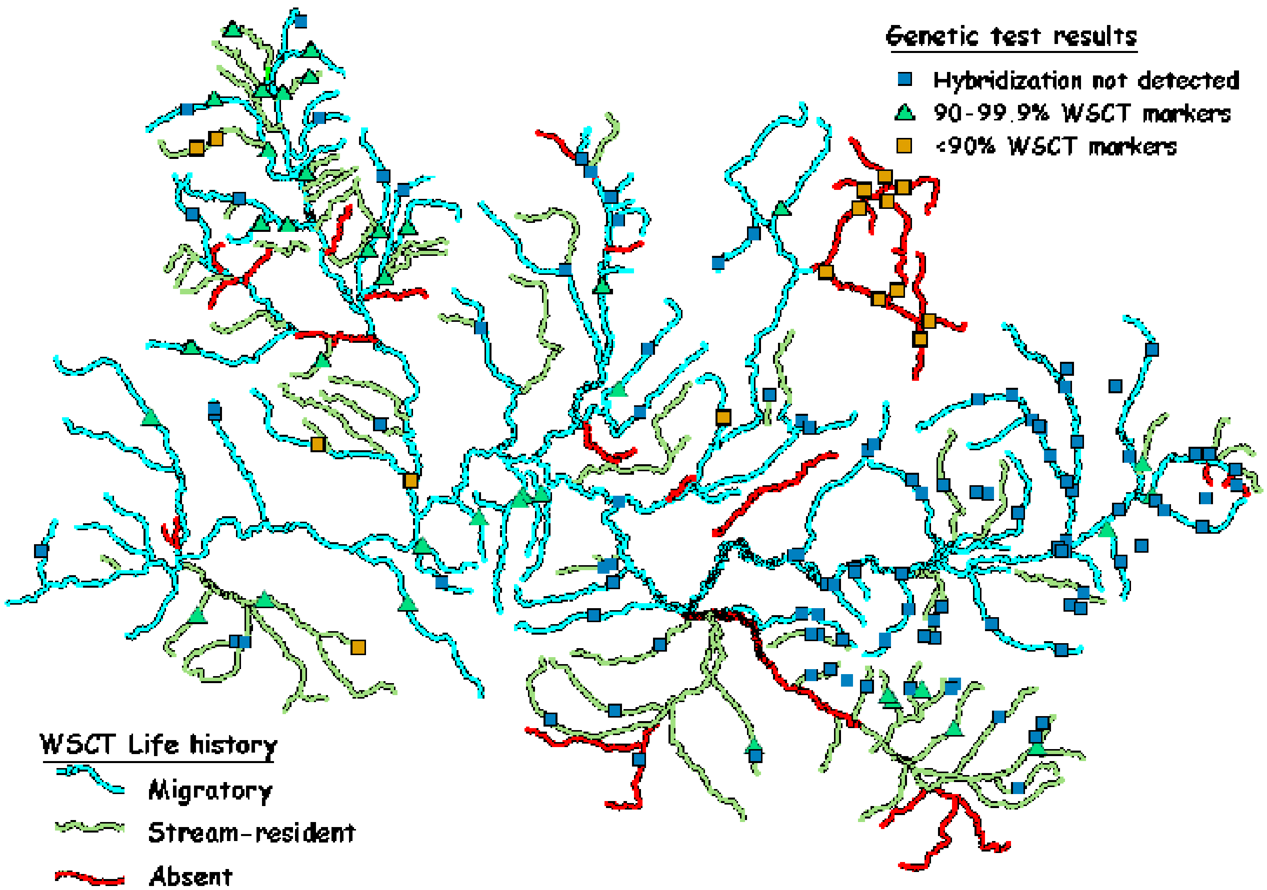
**Figure 3.23. WSCT densities at eight sampling locations on the Blackfoot River. The horizontal axis shows the year of the survey and the river-mile mid-point of the survey. (Pierce et al. 2008)**




Hybridization and other interactions with non-native fish remain serious threats to westslope cutthroat trout viability (Muhlfeld et al. 2009). In 2001, MDFWP identified the illegal introduction of non-native species—in particular northern pike--as a substantial threat to native salmonid species within the Blackfoot sub-basin (Pierce, 2001). Milltown dam and the Clearwater drainage were identified as significant source of northern pike predation (Id.). Prior to the removal of Milltown Dam, MFWP initiated a pike eradication effort in Milltown Dam (Schmetterling, 2001; Knotek, 2005). With the removal of Milltown dam, that source of predation from northern pike has largely abated (D.A. Schmetterling, personal communication, 2010).

MFWP has conducted genetic investigations of westslope cutthroat trout since 1999 (Pierce et al 2000; 2001; 2002; 2004, 2006, 2008). Rangewide, genetically unaltered westslope cutthroat trout occupy between 13% and 35% of currently occupied habitats (Shepard et al. 2003). In the Blackfoot, about 40% of the current westslope cutthroat trout population has tested as genetically pure (Pierce et al. 2008). The upper Blackfoot basin upstream of the Nevada Creek confluence is a region of high genetic purity (Figure 3.24).

**Figure 3.24. Generalized WSCT life history traits and summary of genetic test results. (Pierce et al. 2008)**




The Viability assessment in table 3.14 awaits completion of the analysis to the 6th field HUC of salmonid habitat. Pending the completion of that viability assessment, planners in the sub-basin continue to rely on the assessments of habitat and species condition that have emerged from the two-decades-long data-gathering and analysis that has attended the Blackfoot River habitat restoration effort and which has been summarized in periodic progress reports (e.g. see Pierce, 2008) and in the Native Fish Conservation Prioritization Strategy (Appendix _J). The key attributes and indicators described in Table 3.14 come directly from the research effort that has been ongoing since 1990 (Pierce, 2008). While the current information has not yet been organized into the template described below, much of the information to populate the viability assessment resides in the DFWP progress reports. The fisheries working group has developed a map of 6th field HUCs for the Blackfoot Subbasin, and expects to organize the known data into the viability assessment to the 6th field HUC in the winter of 2010-2011 (Ryen Aasheim, personal communication, 2010).

## Table 3.14 Westslope Cutthroat Trout Viability Assessment. [1]

| | | Indicator Ratings | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Key Attribute** [2] | **Indicator** | **Poor** | **Fair** | **Good** | **Very Good** | **Current Rating** | **Desired Rating** | **Comments** |
| **Condition**: *Abundance* | population estimates) | Spawning adults occur only occasionally, or adult members are unknown | Spawning adults low or highly variable (average < 10 or vary substantially between < and > 10; but are consistently present) | Spawning adults common (average > 10 but < 100) | Spawning adults consistently abundant (average > 100) | To be determined | To be determined | This element of condition is a bull trout population demographic characteristic influencing the risk of local extinction. |
| **Condition**: *Life History Expression* | Number of migratory forms expressed | No migratory life histories. Local population is isolated by permanent impassible barrier; OR life history expression unknown | Migratory life history occurs, but relative abundance is low or adult access is blocked or limited during typical migration periods | Migratory life history occurs, but access through corridors or to rearing areas occasionally limited | All potential migratory life histories are abundant or dominant | To be determined | To be determined | This element of condition is a bull trout population demographic characteristic influencing the risk of local extinction. |
| **Condition**: *Genetic Integrity* | Genetic data | < 90% pure | 90-98% pure | Some hybridization, 98-99.9% pure | Unaltered/pure | To be determined | To be determined | Available information indicates hybridization is primarily limited to F1. When post F1 hybridization does occur, it does not appear to progress to full introgression. |

**Table 3.14 (continued).**

| | | Indicator Ratings | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Key Attribute** | **Indicator** | **Poor** | **Fair** | **Good** | **Very Good** | **Current Rating** | **Desired Rating** | **Comments** |
| **Condition**: *Resilience* | Trends in population growth or survival | Population is declining and or habitat is in poor condition and non-natives are abundant or dominate the community OR nothing is known about resilience | Population is stable at low to moderate abundance and or habitat is degraded, but not destroyed. Non-natives may be relatively abundant, but not dominant | Population is stable at moderate abundance or growing slowly. When reduced in abundance population slowly rebuilds. Habitat is in good condition and non-natives are not present or rare. | Population is stable and moderate-high abundance, or when reduced has the capacity to rebuild quickly. Habitat is in excellent condition and expected to stay that way. Non-native salmonids are not important. | To be determined | To be determined | |
| **Size**: *Extent of habitat networks within the 6th code* | Length of suitable spawning/ rearing habitat | Length of the interconnected stream network supporting spawning and rearing habitat is < 3 km. | Length of the interconnected stream network supporting spawning and rearing habitat is between 3 and 10 km. | Length of the interconnected stream network supporting spawning and rearing habitat is between 10 and 20 km | Length of the interconnected stream network supporting spawning and rearing habitat is > 20 km | To be determined | To be determined | |
| **Landscape Context**: *Water Quality* | Temperature, sediment and chemical contaminants | One or more elements is functioning at unacceptable risk | Two or more elements are functioning at risk, none at unacceptable risk | Two elements are functioning acceptably, one is functioning at risk | All three elements are considered functioning acceptably | To be determined | To be determined | This would be based on the USFS Assessment for change in peak/base flows and drainage network increase encompassing 6th field (subwatershed). Additional data on water diversion may be used to consider condition & FWP Dewatered Stream list/Minimum instream flow model. |

**Table 3.14 (continued).**

| | | Indicator Ratings | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Key Attribute** | **Indicator** | **Poor** | **Fair** | **Good** | **Very Good** | **Current Rating** | **Desired Rating** | **Comments** |
| **Landscape Context**: *Habitat Structure* | Large wood, width-depth, floodplain connectivity, stream bank conditions | One or more elements is functioning at unacceptable risk | Two or more elements are functioning at risk, none at unacceptable risk | Three elements are functioning acceptably, one is functioning at risk | All four elements are considered functioning acceptably | To be determined | To be determined | Based on USFS Assessment encompassing 6th codes. These are only some of the elements in habitat and channel condition. Substrate, pools and off channel habitat are presumably correlated or represented. |
| **Landscape Context**: *Hyrdology* | Flow and hydrology | One or more elements is functioning at unacceptable risk | Two or more elements are functioning at risk | One is functioning acceptable and one is functioning at risk | Both elements are considered functioning acceptably | To be determined | To be determined | Based on USFS Assessment for change in peak/base flows and drainage network increase encompassing 6th code. |
| **Landscape Context**: *Barriers* | Physical barriers | Permanent barriers exclude adult movement to spawning habitat in > 75% of the 6th field spawning habitat. | Temporary or partial impediments or barriers may exist for juvenile and adult movements; or permanent barriers may exist that exclude adult migrants from 25%-75% of the 6th field spawning habitat. | No barriers to adult movement, or they exclude < 25% of the 6th field spawning habitat. Temporary or partial impediments or barriers may occasionally exist for juvenile movement. | There are no barriers or impediments to fish migration from the 6th field to the lake or river environment where migratory life histories could be expected to rear or stage. | To be determined | To be determined | Presumably would be based on USFS inventory of fish passage barriers. |

[1] Based on local populations, not across entire subbasin. The native salmonids technical work group configured this table to assess viability down to the 6th field HUC. After acquiring the maps that describe the basin to the 6th code, the work group will apply this viability assessment to streams at that level.

[2] See Appendix E for definitions of key attributes used in this assessment.

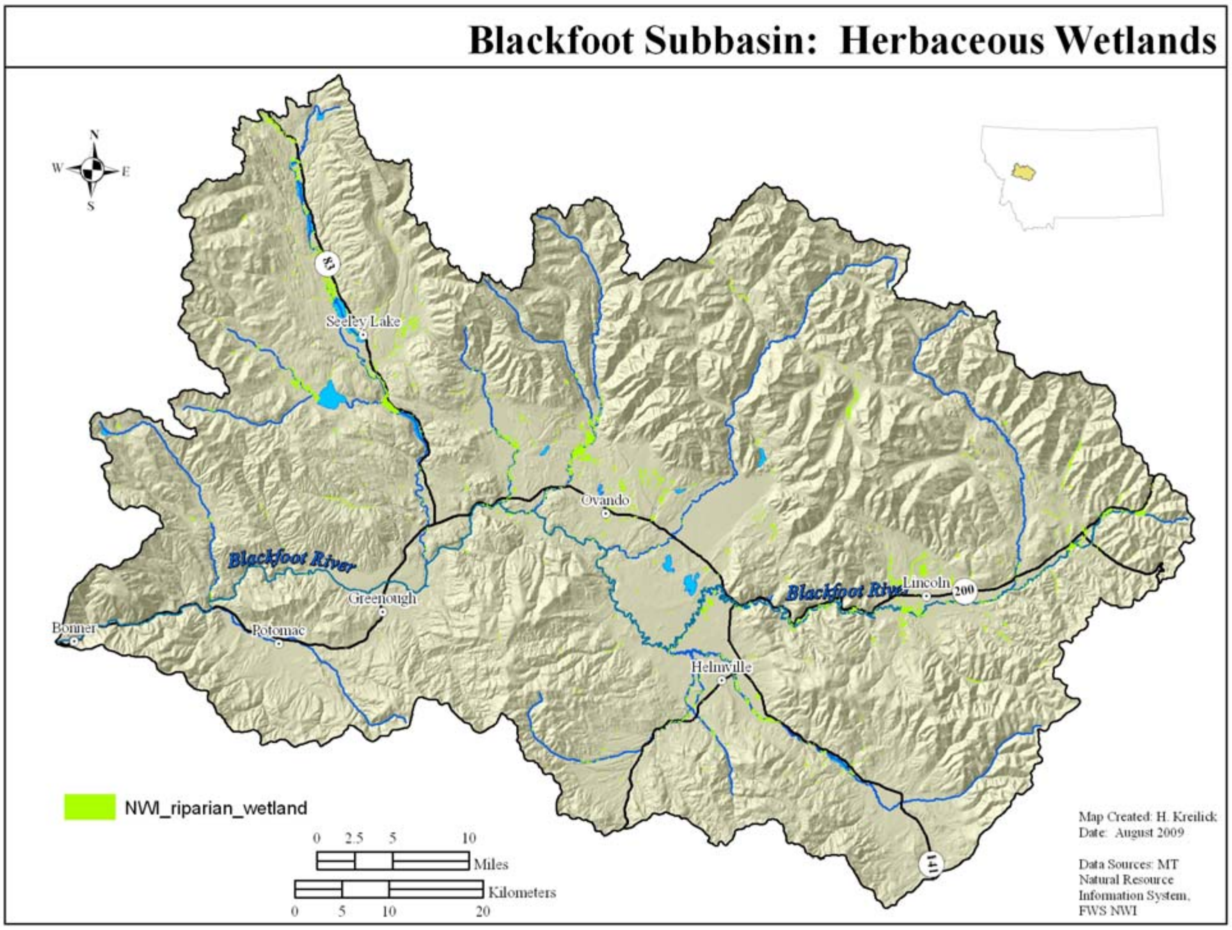
**Nested target: western pearlshell mussel**
The western pearlshell mussel, a Species of Concern in Montana, is Montana's only coldwater stream mussel and the only native mussel found on the west side of the state. This mussel species appears to have crossed the continental divide in Montana from west to east with its salmonid host, the westslope cutthroat trout. Montana's populations of western pearlshell mussel may be significantly declining and becoming less viable due to decreased stream flows, stream warming, eutrophification due to agricultural runoff and siltation from incompatible land uses. Impoundments and diversions are also continued threats in many of the rivers in this species' range. Previously reported western pearlshell mussel beds in the larger rivers (e.g., Blackfoot, Big Hole, Bitterroot, Clark Fork) are extirpated from those drainages or are at such low densities that long-term viability is unlikely (MFWP 2005, MTNHP 2009b). In 2009, DFWP initiated studies of western pearlshell distribution in the Blackfoot River drainage; in 2010, DFWP re-introduced western pearlshell mussels into a key, recently restored stream in the upper basin (Pierce, personal communication, 2010).

## 3.3.3.2 Herbaceous Wetlands

*Nested Targets: herbaceous wetland-associated bird, plant, amphibian and invertebrate Species of Concern*

Hundreds of seasonal and permanent wetlands dot the Blackfoot Subbasin landscape (Figure 3.25). Wetland densities may exceed 100 distinct wetlands per square mile throughout portions of the subbasin. Herbaceous wetlands mainly occur on private land in the prairie-dominated valley bottom. As a result of their location, many of these wetlands are vulnerable to a variety of human impacts such as ditching, draining and plowing.

**Figure 3.25 Herbaceous Wetlands.**




Herbaceous wetland density in the Blackfoot is due in large part to glaciers and remnant chunks of glacial ice that formed hundreds of depressions, or glacial potholes, across the Blackfoot Valley floor. Glacial pothole wetlands are isolated wetlands that fill from winter snow melt, spring rains and/or groundwater springs. Many dry out completely or in part by the end of summer, although the larger ponds and lakes are maintained year-round by springs. Many of these glacial potholes are lined with fine silts and clays that restrict water drainage, creating marshes, fens, wet meadows and other wetland communities dominated by herbaceous vegetation. Salinity in pothole wetlands varies greatly, creating unique associations between water and vegetation. In the Ovando Valley, for example, wetlands occurring near the northern forested communities contain relatively fresh water, while southern wetlands are more alkaline. Fen peatlands are a rare alkaline wetland type in Montana that occur in glacial potholes in the middle Blackfoot. The Potomac Valley, bisected by Union Creek, supports a large, low-gradient fen/grassland association. Herbaceous wetlands also occur throughout the Clearwater and Lincoln Valleys of the Blackfoot Subbasin.

Herbaceous wetlands are a great source of biological diversity in the Blackfoot Subbasin. It is estimated that 600 vascular plant species occur within the subbasin, nearly 30% of which are associated with wetlands (Lesica 1994). Herbaceous wetlands also provide important habitat for a range of vertebrate and invertebrate species. Herbaceous wetlands are, for example, an important component of grizzly and black bear habitat in the subbasin (BCCA Council and BC 2008).

**Nested target: herbaceous wetland-associated bird Species of Concern**
Glacial pothole wetland complexes in the subbasin are of particular importance to breeding and migratory birds including several state Species of Concern (USFWS 2009a, MTNHP 2009b). Brief descriptions of three of these species are provided below.

*Black Tern*: Breeding Black Terns have been documented in 12 Montana counties (MFWP 2005). Although breeding Black Tern colonies are located throughout many areas of Montana, these locations are scattered and limited to sites with appropriate habitat, size and vegetative composition. Little information is known about Black Tern migratory patterns in Montana. Black Tern breeding habitat in Montana consists mostly of wetlands, marshes, prairie potholes and small ponds (MFWP 2005). Over 100 nesting pairs of Black Terns have been documented in the Blackfoot Subbasin (G. Neudecker, pers. comm.). One of the known Black Tern colonies in Montana is on the Blackfoot Waterfowl Production Area (MTNHP 2009b).

*Common Loon:* Northwestern Montana supports the highest density of nesting Common Loons in the western United States. A Montana Partners in Flight Level I Priority Species (PIF 2000), the Common Loon occurs throughout Montana during migration.[19] Breeding, however, is restricted to the northwestern corner of the state (Lenard et al. 2003). Most breeding occurs on glacial lakes > 13 acres in size and < 5,000 feet in elevation. Small islands or herbaceous shoreline areas are used for nesting and sheltered, shallow coves with abundant insects and small fish are used as nursery areas (Skaar 1990). Most lakes inhabited by loons are relatively oligotrophic and have not undergone significant siltation or other hydrological changes. The loon population of northwest Montana is limited primarily by the quantity and quality of nesting habitat (PIF 2000). During the nesting period, human caused disturbance can cause loons to leave the nest, resulting in nest failure. For this reason, relatively remote and undisturbed lakes are considered important for loon populations to

[19] Ecological and management information on this and other bird species mentioned in the Blackfoot Subbasin Plan is available in the Partners in Flight Bird Conservation Plan Montana (PIF 2000) and Montana's Comprehensive Fish and Wildlife Strategy (MFWP 2005).

persist. The Blackfoot Subbasin, with numerous undisturbed lakes and ponds, provides nesting habitat for loons. Successful reproduction in the subbasin is documented each year through monitoring of known nesting pairs (BC 2005b).

*Sandhill Crane*: Although not ranked as a Species of Concern by MTNHP, the Sandhill Crane is a species of note in the Blackfoot Subbasin. Herbaceous wetlands and open grasslands in the subbasin provide excellent habitat for Sandhill Cranes. In the Ovando Valley, the Sandhill Crane population has grown from ~100 birds in 1988 to over 514 birds in 2003. The Potomac Valley also supports a large, breeding Sandhill Crane population (G. Neudecker, pers. comm., MTNHP 2009b).

*Trumpeter Swan:* The Trumpeter Swan is also a Montana Partners in Flight Level I Priority Species (PIF 2000). The breeding range of Trumpeter Swans in Montana includes the extreme southwestern corner of the state (Beaverhead County), along the Rocky Mountain Front (Lewis and Clark County), and the Flathead Indian Reservation (USFWS 1995, MTNHP 2009b). Trumpeter Swan breeding habitat includes lakes and ponds and adjacent marshes containing sufficient water to maintain submergent and emergent vegetation through the nesting season (MTNHP 2009b, Mitchell 1994). In an effort to restore a breeding Trumpeter Swan population to the Blackfoot Subbasin, the Blackfoot Challenge, working cooperatively with USWFS and MFWP, has released 112 Trumpeter Swans in the subbasin between 2005 and 2009. Twenty-two (20%) of these birds are known to be dead. Eight appear to have died from severe intestinal parasitism and emaciation; three died from power line strikes; three died from legal hunting; two were illegally shot; four died of unknown causes; and two were killed by predators. Thirty-six (32%) birds were seen alive in 2009. The remainder of the release birds were not observed in 2009 and their status is unknown (E. Caton and G. Neudecker, pers. comm.).

**Nested target: herbaceous wetland-associated plant Species of Concern**
Seven plants listed as Montana Species of Concern are associated with wetlands of the Blackfoot Subbasin: Beck’s water marigold, watershield, small yellow lady’s-slipper, crested shieldfern, pygmy water-lily, blunt-leaved pondweed and Howell's gumweed (MTNHP 2009a). More information on these species is provided in Table 3.7.

**Nested target: herbaceous wetland-associated amphibian Species of Concern**
The western toad, a Species of Concern in Montana (MTNHP 2009b), has been documented in the Blackfoot Subbasin. Habitats used by western toads in Montana include low elevation beaver ponds, reservoirs, streams, marshes, lake shores, potholes, wet meadows and marshes, as well as high elevation ponds, fens, and tarns. Surveys conducted since the early 1990s indicate that the western toad has undergone regional population declines in Montana and elsewhere in the western United States. Limiting livestock access to known breeding sites and avoiding use of fertilizers, herbicides, and pesticides within at least 100 meters of breeding sites can reduce impacts on this species (MTNHP 2009b).

**Nested target: herbaceous wetland-associated invertebrate Species of Concern**
Although invertebrates are not well studied in the Blackfoot Subbasin, there are a number of invertebrate Species of Concern and Potential Species of Concern associated with herbaceous

wetlands west of the Continental Divide. Data on these species are maintained by the Montana Natural Heritage Program and provided in Appendix F.

**Table 3.15 Herbaceous Wetlands Viability Assessment.**

| | | Indicator Ratings | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Key Attribute** | **Indicator** | **Poor** | **Fair** | **Good** | **Very Good** | **Current Rating** | **Desired Rating** | **Comments** |
| **Size** (*Areal extent*): Number, distribution and size of wetlands by wetland type | Number, distribution and size of wetlands by wetland type compared to HRV[1, 2] | < 80% intact | 80-90% intact | 90-95% intact | > 95% intact | good | very good | Use ASCS flyover data; NWI/aerial photo interpretation. Baseline inventory is needed to determine accuracy of these indicator ratings. |
| **Landscape Context** (*Functional Hydrologic Regime*): Intactness of wetland hydrology | Areal extent of filled or drained wetlands by wetland type | < 80% intact | 80-90% intact | 90-95% intact | > 95% intact | good | very good | NRCS SSURGO soils database may be used to determine historical extent of hydric soils. |
| **Condition** (*Intactness*): Lack of human-caused disturbance | Percent of physically disturbed wetlands by wetland type | < 25% intact | 25 to 50% intact | 50 to 75% intact | > 75% intact | fair | good | "Disturbance" includes physical and physiological impacts from human activities (e.g., grazing recreational use, draining, filling). |
| **Condition** (*Native vegetation community intactness*) | Extent and proportion of exotic invasive species | < 25% intact | 25 to 50% intact | 50 to 75% intact | > 75% intact | fair | good | This indicator rating scale is for individual wetlands. Includes exotic pasture grasses and annual grasses. |
| **Condition** (*Reproductive Success of Common Loons*) | Territory occupancy and fledging rate of loons | < 10 occupied territories; < 0.4 chicks per pair fledged | 10-12 occupied territories: 0.4-0.5 chicks per pair fledged | 12-15 occupied territories: 0.5-0.6 chicks per pair fledged | > 15 occupied territories: > 0.6 chicks per pair fledged | good | very good | This indicator is a measure of *disturbance* by humans and other factors. Rating numbers developed from Common Loon monitoring data (Hammond 2009). Ratings apply to herbaceous wetlands *and* to larger lakes used for loon nesting. |

**Table 3.15 (continued).**

| | | Indicator Ratings | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Key Attribute** | **Indicator** | **Poor** | **Fair** | **Good** | **Very Good** | **Current Rating** | **Desired Rating** | **Comments** |
| **Condition** (*Reproductive Success of Trumpeter Swans*) | Nesting and fledging rate of Trumpeter Swans | < 2 nests; < 1 chick fledged per nest | 2-4 nests; 1-1.5 chicks fledged per nest | 5-7 nests; 1.5-2 chicks fledged per nest | > 7 nests; > 2 chicks fledged per nest | poor | very good | This indicator is a measure of *disturbance* by humans and other factors. Rating numbers developed from Trumpeter Swan monitoring data (UM Watershed Health Clinic and USFWS 2005). Ratings apply to herbaceous wetlands *and* to larger lakes used for swan nesting. |

[1] HRV refers to "historic range of variability," or the range of critical ecological processes and conditions that have characterized particular ecosystems over specified time periods (i.e., 100-1,000 years ago) and under varying degrees of human influences. An understanding of HRV allows managers to understand the dynamic nature of ecosystems, the processes that sustain and change ecosystems, the current state of the ecosystem in relationship to the past and the possible ranges of conditions that are feasible to maintain. HRV is a useful tool for determining a range of desired future conditions and for establishing the limits of acceptable change. Best available science and on the ground expertise are used to determine HRV. Once the HRV is established for an area, it can be compared to existing vegetative conditions to determine departures from HRV. This information can aid conservation and resource management planning.

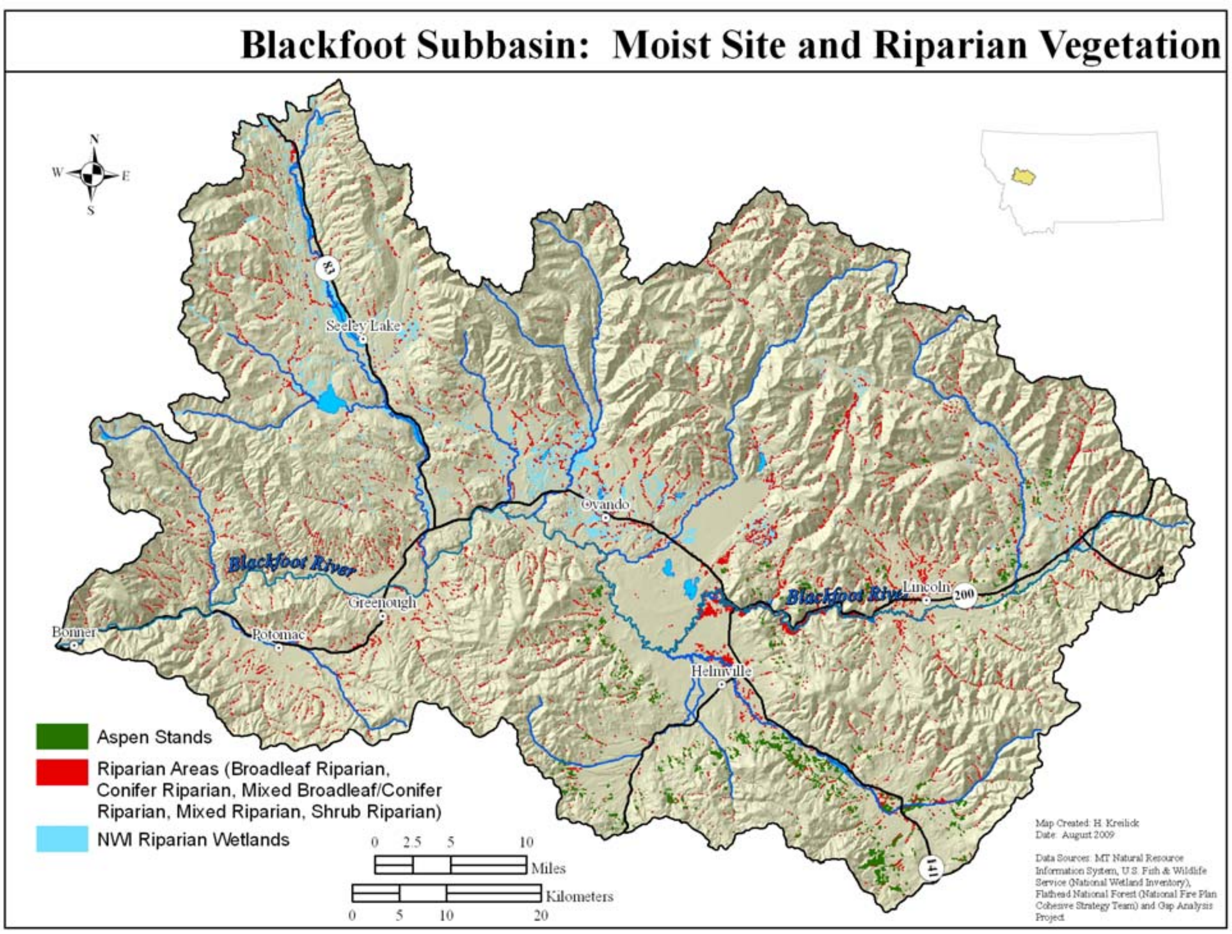
[2] In this case, HRV refers to the historic number, distribution and size of wetlands by wetland type in the subbasin. Collecting this baseline information is a high priority strategic action listed under conservation objectives 4-8 in the Blackfoot Subbasin Management Plan (Section 5.0).

### 3.3.3.3 Moist Site and Riparian Vegetation

*Nested Targets: riparian-dependent birds*

Riparian communities occur along 1,900 miles of creeks, streams, and rivers in the Blackfoot Subbasin (Figure 3.26). Vegetation is typically dominated by black cottonwood, aspen, Engelmann spruce, and/or shrub (willow, birch, alder and dogwood) plant communities. Large willow swamps, for example, occur along Cottonwood and Monture Creeks and riparian cottonwood forests occur along the North Fork and the mainstem of the Blackfoot River. Riparian cottonwood forests develop in river and stream corridors on alluvial bars created by dynamic flows of spring runoff and mature into forests that eventually alter the direction of water flow. These forests keep waters cool in summer and support a variety wildlife species (MFWP 2005). Riparian and wetland communities support the greatest concentration of plants and animals in Montana and serve as a unique transition zone between aquatic and the terrestrial environments (MFWP 2005). Riparian communities provide crucial wildlife habitat in the Blackfoot Subbasin as well as important stream stability and fishery functions.

**Figure 3.26 Moist Site and Riparian Vegetation.**



Intact riparian vegetation helps to filter sediment, prevent erosion and stabilize streambanks, store water and recharge aquifers and dissipate stream energy (Karr and Schlosser 1978, Plats 1979, Marlow and Pogacnik 1985).

Moist site vegetation in the subbasin includes aspen groves and cottonwood, willow, alder and other woody plant communities not directly associated with surface water systems. Large aspen groves found throughout the subbasin provide essential habitat for a variety of wildlife species including elk, mule deer, and cavity-nesting birds. These communities are located at all elevations but make up the greatest aerial extent within the prairie-dominated valley bottoms and draws where groundwater is at or near the surface for at least a portion of the growing season (Figure 3.26). Aspen communities, like riparian and wetland communities, are highly productive habitat for wildlife and plants in the Rocky Mountain region.

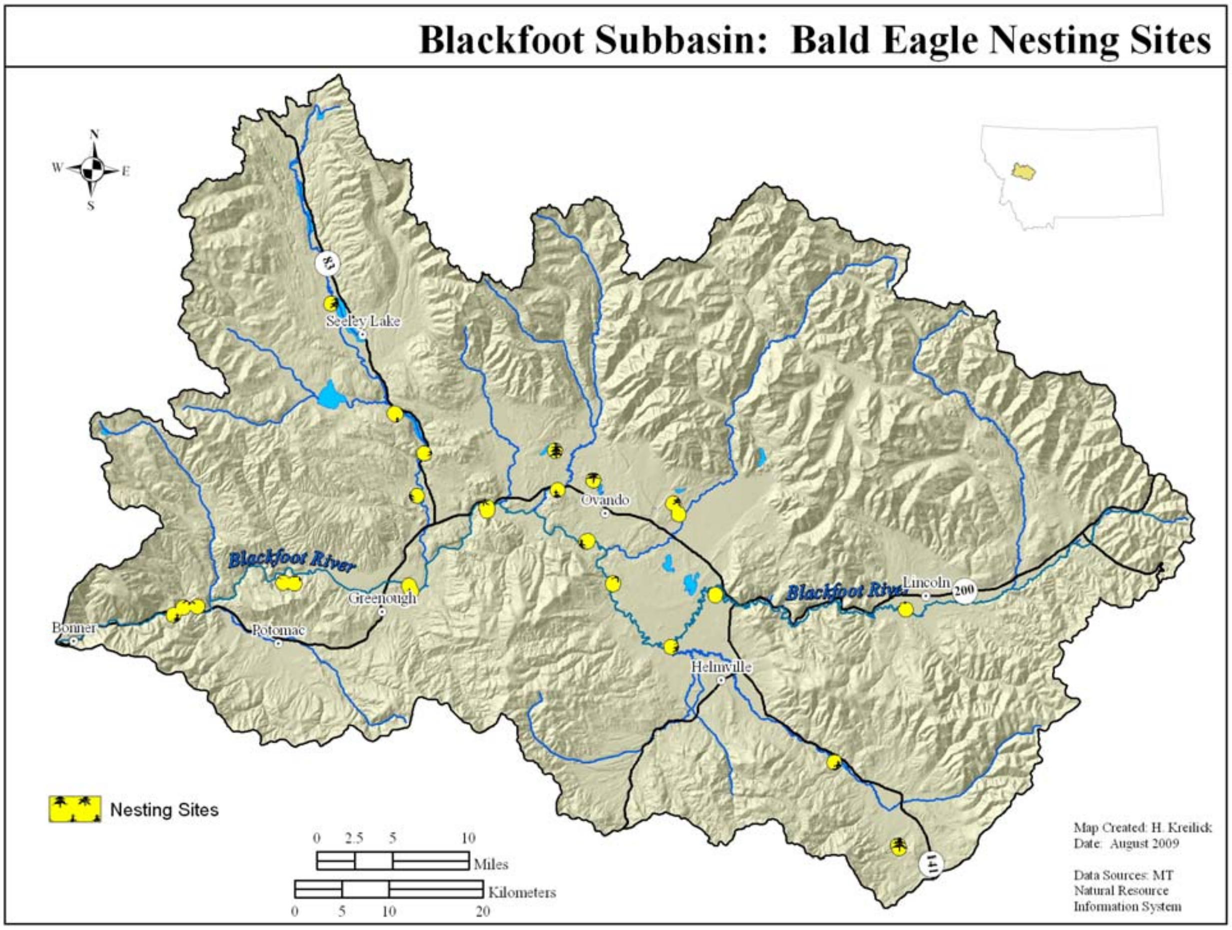
All of the woody plant dominated wetland types encountered in the Blackfoot Subbasin have been subjected to a variety of human impacts since European settlement (ca. 1880) including flood control, clearing, ditching, beaver control, fire control and grazing pressure. These disturbances have resulted in a subbasin-wide reduction in coverage and health of these community types.

**Nested target: riparian-dependent birds**

Riparian and wetland areas typically support more species of breeding and migratory birds than any other habitat in the West, even though they account for less than 1% of the landscape. In addition, a large proportion of declining bird species and Species of Concern are dependent upon riparian and wetland habitats. Bird communities can serve as indicators of ecosystem health because they reflect an integration of a broad array of ecological conditions, including water quality, productivity, landscape integrity and vegetation structure and composition. Species that indicate intact riparian systems in the Blackfoot Subbasin include Veery, Red-eyed Vireo, Bullock's Oriole, American Redstart, Bald Eagle, Osprey and American Dipper. Riparian zones along small-order streams support different species than riparian bottomlands (e.g., Willow Flycatcher, Wilson's Warbler). Brief descriptions of Bald Eagle and Veery, both Species of Concern in Montana (MTNHP 2009b), are provided below.

> *Bald Eagle:* After serious population declines in the late 1960s and 1970s, the Bald Eagle was listed as a threatened species in the Rocky Mountain states. The species was delisted from threatened status in July 2007 (USFWS 2009b). Bald Eagles prefer late successional forests and shorelines adjacent to open water lakes and rivers. The Montana Bald Eagle Working Group characterized quality habitat as mature forest stands of low to moderate canopy closure consisting of cottonwood, Douglas-fir, ponderosa pine or mixed conifers. Forest stands with nest sites should be 20 acres or larger and be located within one mile of open water. Stands should contain at least two suitable nest trees and more than three perch trees (MBEWG 1991). The Blackfoot River provides year round habitat for Bald Eagles, including a number of nest sites (Figure 3.27).

**Figure 3.27 Bald Eagle Nesting Sites.**




*Veery:* Veerys breed in moist, low elevation deciduous forests with a dense understory. They are also found in thick and wide willow or alder riparian habitat (PIF 2000). Veerys have a strong preference for deciduous riparian habitats in many areas (Moskoff 1995). Although Veery populations have increased in the northern Rockies, its preference for large riparian stands with dense understories and its susceptibility to Brown-headed Cowbird nest parasitism make it a vulnerable species (PIF 2000). Mosconi and Hutto (1982) found a negative response to grazing when comparing heavy versus light grazing intensity.

**Table 3.16 Moist Site and Riparian Vegetation Viability Assessment.**

| | | Indicator Ratings | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Key Attribute** | **Indicator** | **Poor** | **Fair** | **Good** | **Very Good** | **Current Rating** | **Desired Rating** | **Comments** |
| **Landscape Context** (*Functioning natural disturbance regime*): Fire, flooding, browsing, beaver | Composition and structure of native plant community | < 25% of HRV[1] | 25-50% of HRV | 51-75% of HRV | > 75% of HRV | fair | good | HRV refers here to historic composition and structure of native plant community. |
| **Condition** (*Intactness*): Lack of human disturbance | Percent physically disturbed | < 25% intact | 25 to 50% intact | 51 to 75% intact | > 75% intact | fair | good | "Human disturbances" include grazing, bank alteration, draining, chemical use, etc. |
| **Condition** (*Native vegetation community not invaded by exotic plants*) | Extent and proportion of exotic invasive species | < 25% intact native plant community | 26 to 50% intact native plant community | 51 to 75% intact native plant community | > 75% intact native plant community | fair | good | Use USFS Region 1 noxious weed risk assessment (Mantas 2003). |
| **Size** (*Aerial Extent*): Number, size, or area of moist site and riparian vegetation | Miles/acres of current moist site and riparian vegetation relative to HRV | < 25% of HRV | 25-50% of HRV | 51-75% of HRV | > 75% of HRV | fair | good | HRV refers here to historic extent (miles/acres). |

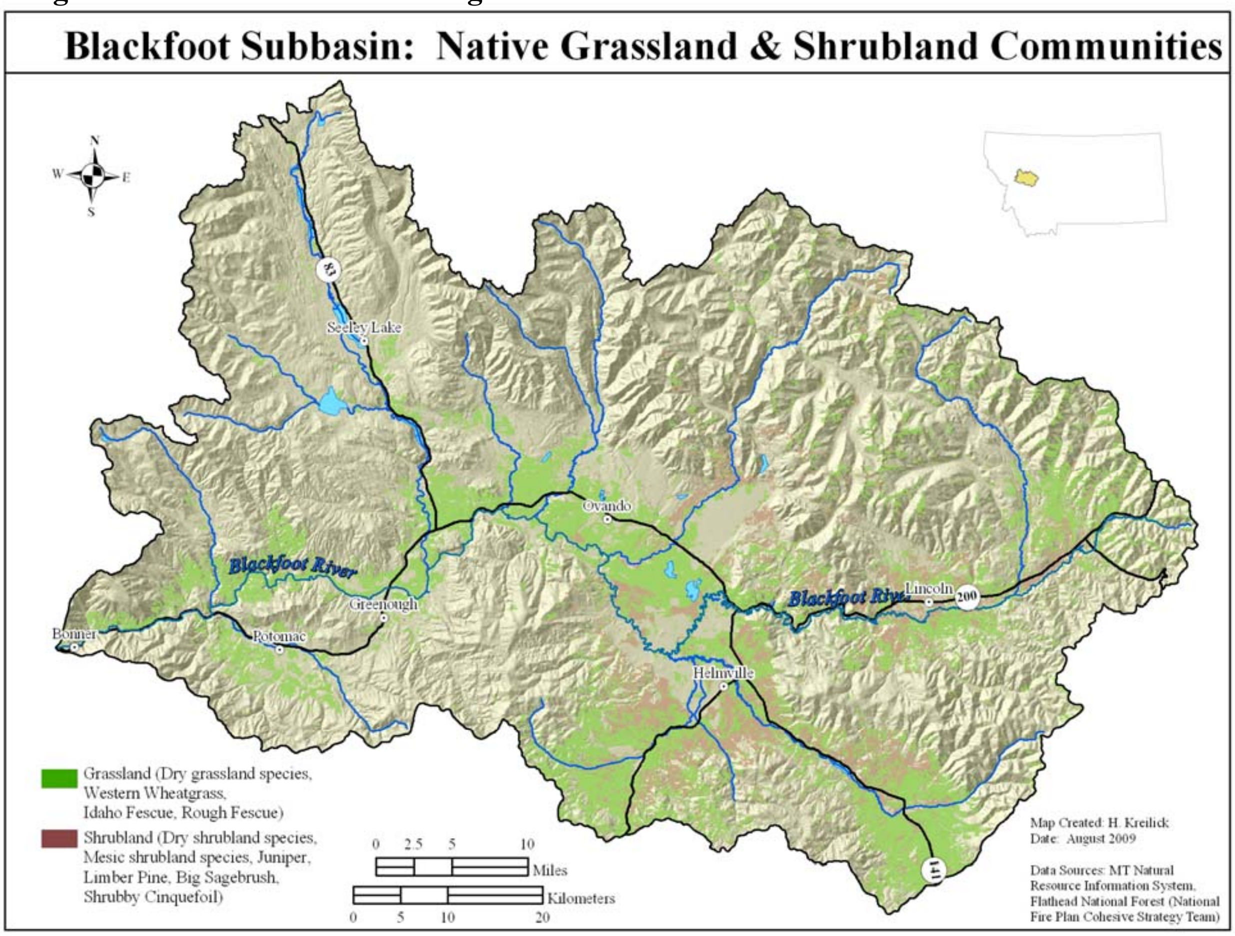
[1] HRV refers to "historic range of variability." A definition of HRV is provided in Table 3.12

## 3.3.3.4 Native Grassland/Sagebrush Communities

*Nested Targets: grassland/sagebrush-associated bird and plant Species of Concern; ungulate winter range*

Sweeping expanses of native bunchgrass prairie are one of the most striking visual elements of the Blackfoot Subbasin. Sagebrush and grassland areas in the subbasin were targeted by early European settlers for grazing and farm lands. Today, the majority of native grassland/sagebrush communities are located on private land in the subbasin (Figure 3.28). Large bunchgrass prairies occur throughout the valley bottoms. The dominant bunchgrass is rough fescue; other common native grasses include bluebunch wheatgrass, Idaho fescue, prairie junegrass and several species of needle grass. The big sagebrush-dominated plant community type is most prevalent in the middle Blackfoot Valley south of the Blackfoot River. Native grassland and sagebrush communities often occur in a matrix throughout the valley. Grassland complexes are associated with more terrestrial species in greatest need of conservation than any other community type in Montana (MFWP 2005). Information on rare grassland/sagebrush communities known to occur in the Blackfoot Subbasin is provided in Section 3.2.7.1.

**Figure 3.28 Native Grassland/Sagebrush Communities.**



Fire is critical to maintaining native grassland/sagebrush communities. The historic fire regime in rough fescue communities, for example, was characterized by frequent return-interval (five to ten years), low severity fires. The historic fire regime in sagebrush communities was characterized by longer return-interval (>25 years), stand-replacing fires. The exclusion of fire from these communities has resulted in the encroachment of tree seedlings that eventually shade out and eliminate native bunchgrasses. In native grasslands, a longer fire return interval has resulted in an increase in sagebrush cover in some portions of the subbasin.

**Nested target: grassland/sagebrush-associated bird Species of Concern**
Grassland bird populations are declining throughout North America. Factors contributing to the decline include habitat loss and conversion (PIF 2000). A variety of Montana bird Species of Concern are associated with native grassland/sagebrush communities in the Blackfoot Subbasin. A brief description of five of these species follows.

*Columbian Sharp-tailed Grouse:* Native grassland/sagebrush communities in the Blackfoot Subbasin provide habitat for Columbian Sharp-tailed Grouse, a Montana Partners in Flight Level I Priority Species (PIF 2000). A Sharp-Tailed Grouse subspecies, the Columbian Sharp-tailed Grouse has undergone significant rangewide decline. Historically, they ranged in suitable habitats from British Columbia south through eastern Oregon and Washington, Idaho, western Montana, Wyoming, and Colorado, and northern Utah, Nevada, and California. They have now been extirpated from Oregon, California and Nevada and currently occupy less than 10% of their historic range. Remaining populations are small and widely separated from other populations. Idaho has the best remaining populations, which include 75% of the remaining birds. In Montana, there are two known remnant populations: 1) in the Tobacco Valley near Eureka and 2) in the Blackfoot Valley near Helmville. A self-sustaining population of Columbian Sharp-tailed Grouse needs thousands of acres of suitable habitat (Ulliman et al. 1998). Neither of the two remnant populations in Montana, however, currently has enough contiguous habitat to support viable populations over the long term. The conversion of native grassland and shrub/grass communities to agriculture and other incompatible land uses has been primarily responsible for the reduction in Columbian Sharp-tailed Grouse populations. Much of the remaining historical habitat that has not been converted to other uses has been degraded by fire (too much in some areas; not enough in other areas), invasion of non-native annual vegetation and excessive grazing by livestock (Ulliman et al. 1998, PIF 2000).

*Long-billed Curlew:* The Long-billed Curlew is one of the most threatened shorebird species on the continent (National Audubon Society 2007). It is a Species of Concern in Montana (MTNHP 2009b) and is included on the National Audubon Society's Watch List (National Audubon Society 2007). North America's largest shorebird, the Long-billed Curlew is found throughout the northwestern states where sufficient native grassland remains for nesting sites. In Montana, Long-billed Curlews breed and migrate throughout the state but do not overwinter here. Long-billed Curlews prefer well-drained native grasslands, sagebrush and agricultural land with gently rolling topography (PIF 2000). They use their long, curved bills to feed on grasshoppers and other insects. They seem to require large blocks of grasslands: Bicak et al. (1982) found that territories averaged 35 acres in size. The North American Long-billed Curlew population has declined as suitable nesting habitat has been converted to incompatible land uses (PIF 2000, Lenard et al. 2003). In Montana, much of the suitable Long-billed Curlew breeding habitat is fragmented and unprotected (Redmond in Clark et al. 1989). Small population size and negative population trends, combined with threats of habitat degradation on both breeding and wintering grounds, make the Long-billed Curlew a high conservation priority (National Audubon Society 2007).

*Brewer's Sparrow:* Brewer's Sparrows are characteristic of native grassland/sagebrush habitat and nest in large, living sagebrush, mainly using shrubs >20 inches tall (Peterson and Best 1985). Their nests are near the ground, and are usually located in the finest branches of new growth near the tips of branches, so shrubs in good vigor are important to nesting (PIF 2000). They show strong site fidelity, returning year to year to nest in the same area (Wiens and Rotenberry 1985). Brewer's Sparrows are vulnerable to parasitism by Brown-headed Cowbirds, especially where the sagebrush landscape has been fragmented by agriculture and pastures. Reductions in sagebrush cover and vigor from control actions such as burning or herbicides reduces or eliminates habitat suitability for the species. The long-term viability of Brewer's Sparrows in Montana will depend on the maintenance of large stands of sagebrush in robust condition (PIF 2000).

*Grasshopper Sparrow:* Grasshopper Sparrows breed from southern British Columbia to southern Maine and south to southern California, central Texas and central Georgia. The majority of Grasshopper Sparrows are found in the Great Plains from North Dakota to Texas and east to Illinois. Grasshopper Sparrows prefer grasslands of intermediate height (Vickery 1996). They use both native grasslands and tame pastures (Wilson and Belcher 1989) and have occasionally been found using cropland, but at much lower densities than within grasslands (Smith 1968, Ducey and Miller 1980, Best et al. 1997). The Grasshopper Sparrow has experienced rangewide population declines due to habitat fragmentation and incompatible land use practices (PIF 2000).

*Bobolink:* The Bobolink is a migratory bird that breeds in the grasslands of North America and winters in South America (Jaramillo and Burke 1999). Within the western United States, distribution is discontinuous and spotty with large areas lacking birds. Bobolinks rely on dense, tall grasslands for nesting. Bobolinks are found in native grasslands as well as non-native, tame pastures, hayfields, wet meadows and old fields that are characterized by relatively dense, tall grass (PIF 2000). Bobolinks are area-sensitive and prefer large grasslands (Helzer 1996).

**Nested target: grassland/sagebrush-associated plant Species of Concern**
At least two plant Species of Concern occur in native grassland/sagebrush communities in the Blackfoot Subbasin: Missoula phlox and Howell's gumweed (MTNHP 2009b). More information on these species is provided in Table 3.7.

**Nested target: ungulate winter range**
Critical habitat for sustaining elk populations in the Blackfoot Subbasin ranges from high elevation Wilderness areas to private valley lands and includes a mosaic of aspen stands, serviceberry and native bunchgrass prairies (Figure 3.29). Native grassland/sagebrush communities provide critical forage for ungulates during the winter months. The elk population

in the Blackfoot has increased over the last 15 years. MFWP estimates that there are approximately 6,000 elk in the Blackfoot Subbasin. The Blackfoot-Clearwater Wildlife Management Area currently provides winter range for 1,200 elk, 800 mule deer, and 800 white-tailed deer (J. Kolbe, pers. comm.).

**Figure 3.29 Ungulate Winter Range.**

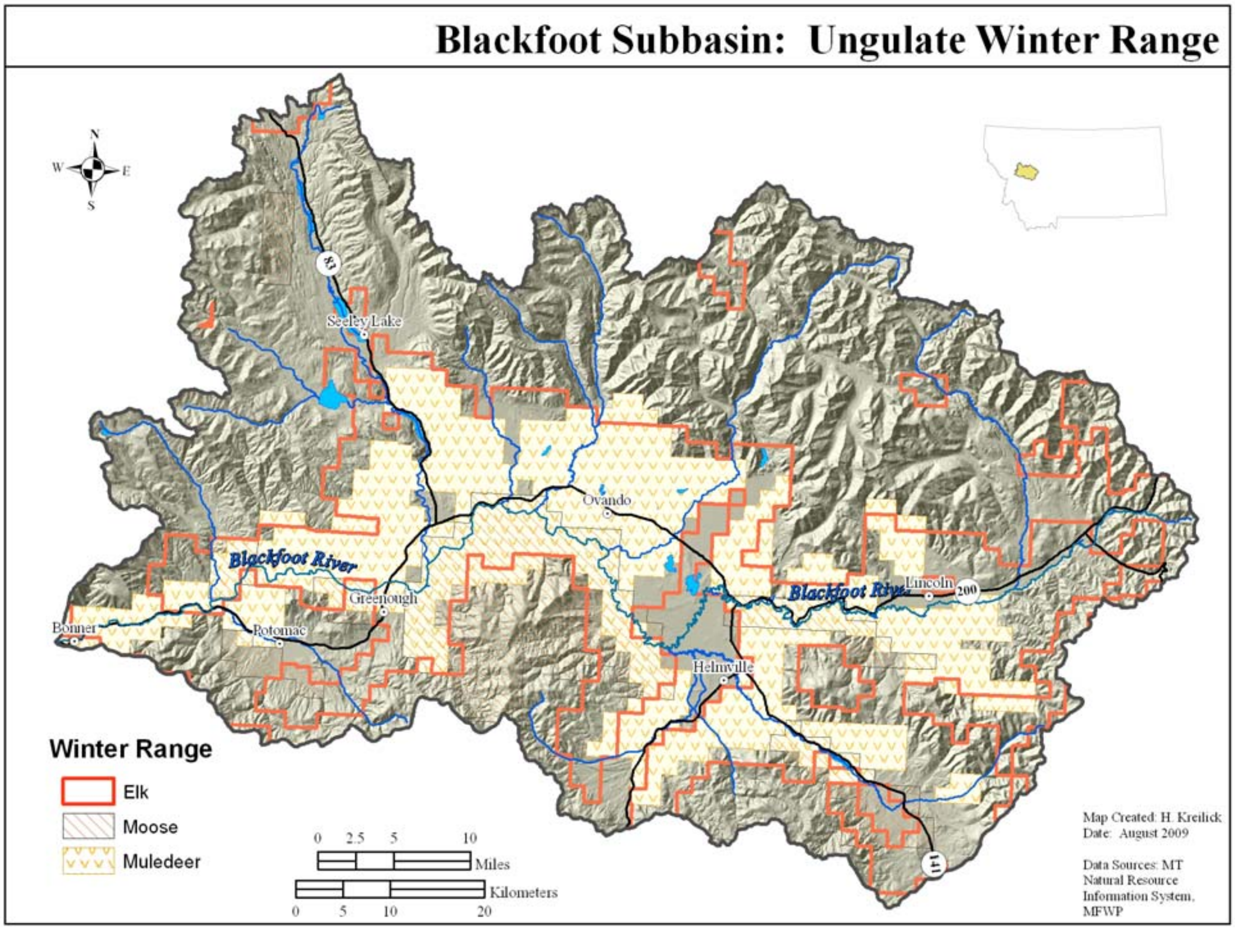


**Table 3.17 Native Grassland/Sagebrush Communities Viability Assessment.**

| | | Indicator Ratings | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Key Attribute** | **Indicator** | **Poor** | **Fair** | **Good** | **Very Good** | **Current Rating** | **Desired Rating** | **Comments** |
| **Landscape Context** (*Functioning fire regime*) | Fire Return Interval (FRI) | FRI < 25% of HRV[1] | FRI at 25 to 50% of HRV | FRI at 51-75% of HRV | FRI at > 75% of HRV | poor | good | Historic FRI was 5-10 years in rough fescue grassland and > 25 years in sagebrush. Longer FRI and grazing practices have probably increased sagebrush cover in some places in the valley. |
| **Condition** (*Native vegetation community intactness*) | Composition and structure of native plant community | < 25% of HRV | 25-50% of HRV | 51-75% of HRV | > 75% of HRV | fair | good | HRV refers here to historic structure and composition. |
| **Condition** (*Native plant community not invaded by exotic plants*) | Extent and proportion of exotic invasive species | < 25% intact native plant community | 25 to 50% intact | 51 to 75% intact | > 75% intact | poor | good | Includes exotic pasture grasses and annual grasses. Use USFS Region 1 noxious weed risk assessment (Mantas 2003). |
| **Size** (*Areal Extent*): Area/size of grasslands/ sagebrush by vegetation type | Acres of grassland/sage-brush habitats throughout the subbasin in historic locations | < 25% of HRV | 25-50% of HRV | 51-75% of HRV | > 75% of HRV | fair (?) | good (?) | HRV refers here to historic extent (acreage). Ratings take into account acreage lost due to conifer encroachment. Baseline inventory is needed to determine accuracy of these indicator ratings. |

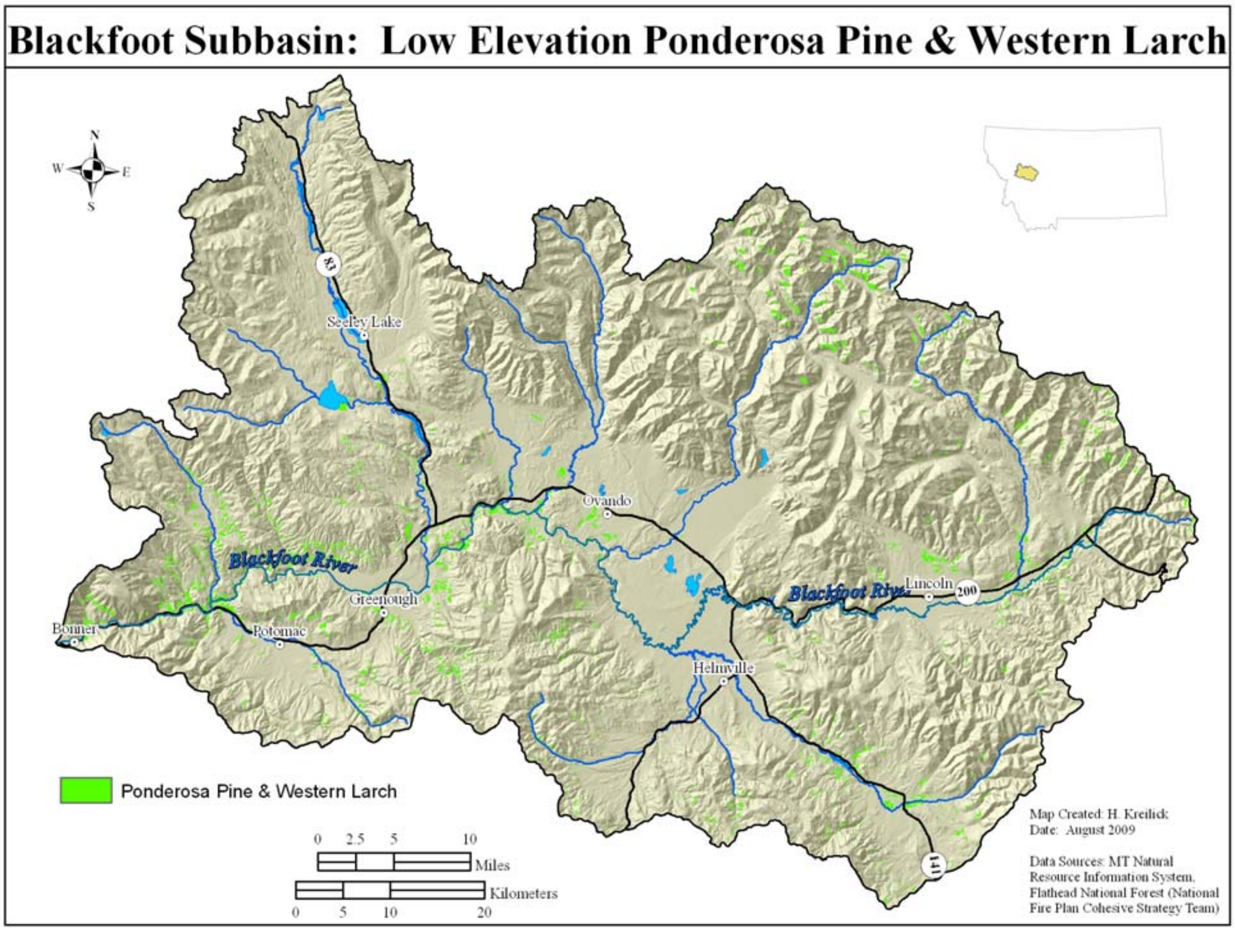
[1] HRV refers to "historic range of variability." A definition of HRV is provided in Table 3.12.

### 3.3.3.5 Low Elevation Ponderosa Pine/Western Larch Forest

*Nested targets: low elevation ponderosa pine/western larch forest-associated birds; ungulate winter range*

Relatively dry and warm conditions prevail at low elevations and on gentle slopes in the Blackfoot Subbasin, giving rise to forest cover types dominated by ponderosa pine and western larch. The ponderosa pine forest type occurs on dry, forested sites within the Blackfoot Subbasin. The open-grown western larch forest type occurs on slightly more mesic. Low elevation ponderosa pine/western larch forests are distributed across many land ownerships in the subbasin, but are found primarily on USFS, DNRC, Plum Creek Timber Company and Nature Conservancy lands (Figure 3.30).

**Figure 3.30 Low Elevation Ponderosa Pine/Western Larch Forest.**



Historically, these forests were more open-grown than forests at mid to high elevations. This structure was created and perpetuated by frequent (5-25 year mean return interval), low to moderate severity fires that burned primarily in the understory (Morgan et al. 1998). In these open stands, fire-resistant ponderosa pine and western larch trees grew to very large diameters (up to and exceeding 36 inches). The forest understory was characterized by light fuel loads and native perennial grasses. This is especially true for mature, widely-spaced stands of ponderosa pine with relatively low stand densities (trees/acre). Downed woody fuels in such stands usually consisted of widely scattered, large trees (deadfalls) and concentrations of needles, twigs, branches, bark flakes and cones near the base of individual trees (Fisher and Bradley 1987). The western larch type also supported low densities of small-statured shrubs. Some researchers suggest that some low elevation ponderosa pine systems may be better characterized by mixed severity than by low severity fire regimes (Agee 1993, Shinneman and Baker 1997, Brown et al. 1999, Veblen 2000, Schoennagel et al. 2004, Baker et al. 2007, Hessburg et al. 2007). High severity fires were likely part of this mix (Hutto 2008).

Most low elevation ponderosa pine/western larch forests in the subbasin have been harvested over the past 125 years, and many of the large diameter trees have been removed. In addition, nearly 100 years of fire control has resulted in a dramatic shift in forest density, structure, composition and age class distribution away from the historic range of conditions. Due to this combination of harvest history and fire suppression, many low elevation forests in the Blackfoot Subbasin today are comprised of closely-spaced, small diameter ponderosa pine and Douglas-fir at stand densities higher than historic conditions. These current stand conditions make this forest type prone to drought stress, insects, disease and stand-replacing fires.

**Nested target: low elevation ponderosa pine/western larch forest-associated birds**
Species associated with low elevation ponderosa pine/western larch forests in the Blackfoot Subbasin include Flammulated Owl, Lewis's Woodpecker, Pygmy Nuthatch, and Solitary (Cassin's) Vireo. A brief description of two of these species, both Montana Species of Concern (MTNHP 2009b), follows.

*Flammulated Owl:* The Flammulated Owl, a Montana Partners in Flight Level I Priority Species (PIF 2000), breeds from southern British Columbia to southern Mexico (McCallum 1994). In Montana, the first Flammulated Owl nesting record was not documented until 1986 (Holt et al. 1987). Most Montana breeding records are from west of the Continental Divide. Breeding habitat for Flammulated Owls consists primarily of low to mid-elevation, open ponderosa pine and/or western larch forest (PIF 2000). Flammulated Owls nest primarily in cavities excavated by Pileated Woodpeckers and Northern Flickers in large trees and snags. Due to this affiliation, they are tied to the preferred nesting trees of these two species. In northwestern Montana, Pileated Woodpeckers in particular are strongly associated with mature to old-growth western larch and ponderosa pine forests, making these important habitats for Flammulated Owls as well (Holt and Hillis 1987, Reynolds and Linkhart 1992, McClelland and McClelland 1999).

*Lewis's Woodpecker:* The breeding range of the Lewis's Woodpecker extends from southwestern Canada south to southern New Mexico and Arizona, west to western California, and east to eastern Colorado, approximating the distribution of ponderosa pine in North America. The Lewis's Woodpecker generally winters in the southern portion of its breeding range north to southwestern Oregon, central Utah and central Colorado (Tobalske 1997). Lewis's Woodpeckers have been recorded during the breeding season in all parts of Montana except the northeastern quarter (Lenard et al. 2003). The three primary breeding habitats of Lewis's Woodpeckers in Montana and elsewhere are open ponderosa pine forest, burned coniferous forests and open riparian woodland (particularly cottonwood) (Bock 1970, Linder 1994, Vierling 1997). Lewis's Woodpeckers are commonly associated with an open forest canopy that permits flycatching, dense understory shrub coverage to generate an abundance of insects and large snags for nesting (Bock 1970, Linder 1994). This species is considered a burn specialist due to its relatively high nesting success and high breeding densities in burned ponderosa pine forests (Saab and Vierling 2001, Gentry and Vierling 2007, Saab et al. 2007). In unburned forests, necessary snag and understory conditions are generally found in older, open stands that lack a dense layer of subcanopy trees. Lewis's Woodpecker populations in North America have declined in recent decades (PIF 2000).

**Nested target: ungulate winter range**

Low elevation forests in the Blackfoot Subbasin are a key component of ungulate winter range, providing thermal cover and lower snow depths. Maintaining connectivity between these low elevation forests and native grassland/sagebrush communities (see Section 3.3.3.4) is important for ensuring the functionality of winter range habitat in the subbasin. See Figure 3.29.

**Table 3.18 Low Elevation Ponderosa Pine/Western Larch Forest Viability Assessment.**

| | | Indicator Ratings | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Key Attribute** | **Indicator** | **Poor** | **Fair** | **Good** | **Very Good** | **Current Rating** | **Desired Rating** | **Comments** |
| **Landscape Context/Condition** (*Functioning disturbance regime*): Fire | Appropriate species composition and structure in the understory and overstory relative to historic conditions | < 25% of HRV[1] | 25-50% of HRV | 51-75% of HRV | > 75% of HRV | poor | good (by year 2058) | HRV refers here to historic structure and composition.<br>Indicator includes down and standing dead wood. |
| **Landscape Context/Condition** (*Patch Size and Distribution of Age Classes*) | Patch Dynamic Analysis: Departure from HRV for all cover types and age classes | < 25% of HRV | 25-50% of HRV | 51-75% of HRV | > 75% of HRV | poor | good (by year 2108) | HRV refers here to historic patch size and distribution of age classes. |

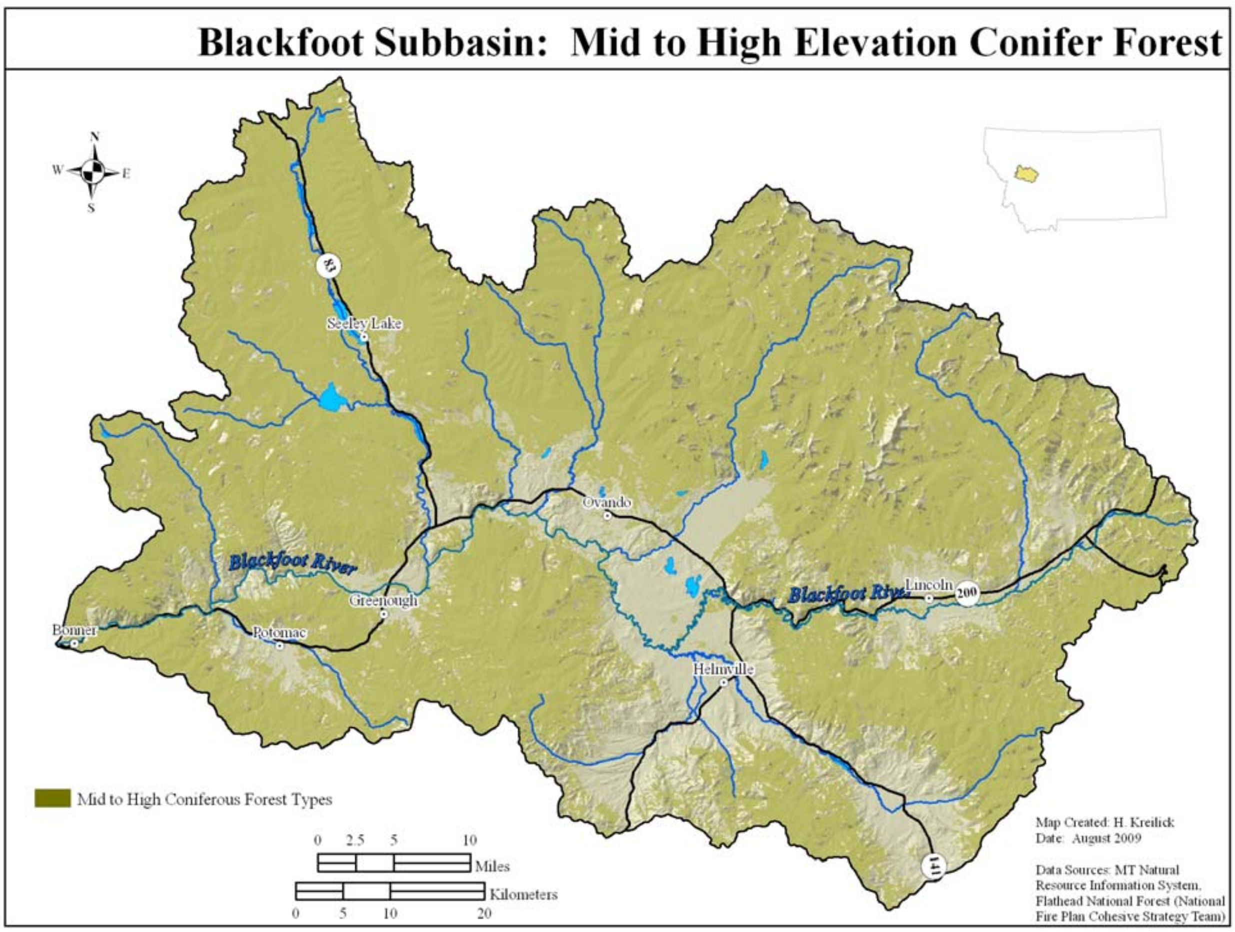
[1] HRV refers to "historic range of variability." A definition of HRV is provided in Table 3.12.

## 3.3.3.6 Mid to High Elevation Coniferous Forest

*Nested Targets: mid to high elevation coniferous forest-associated birds; forest carnivores; whitebark pine*

Mixed coniferous forest vegetation dominates at mid to upper elevations in the Blackfoot Subbasin (Figure 3.31). This forest type is found primarily on USFS and BLM lands, with smaller amounts on DNRC, Plum Creek Timber Company and Nature Conservancy lands. Depending on aspect, elevation and slope, various cover types occur including lodgepole pine, subalpine fir/Engelmann spruce and subalpine fir/whitebark pine. Western larch and Douglas-fir may also be significant components within these types. Whitebark pine is most common in subalpine areas. Forest structure, composition, and age class distribution varies with time since the most recent disturbance (timber harvest or fire). Older stands generally have continuous forest canopy cover. Down and standing dead wood is an important component of this forest type.

**Figure 3.31 Mid to High Elevation Coniferous Forest.**



Until recently, much of the mid-elevation forested land in the Blackfoot Subbasin was owned by corporate timber companies. Mid-elevation forests have been heavily roaded and harvested over the past 50 years and noxious weeds have invaded many of the disturbed sites. As a result of timber harvest and road building, species composition, structure, and age class distribution in mid-elevation forests have been significantly altered from historic conditions. In high elevation forests, white pine blister rust has also contributed to the departure from historic conditions.

Suppression of naturally occurring wildfires in the last 100 years has further affected composition, structure and age class distribution in both mid and high elevation forest types. The historic fire regime in mid and high elevation coniferous forests was characterized by mixed-fire frequency and severity, including either some infrequent severe fire events or patches of severe fire during fire events that occurred at intermediate frequencies (Schoennagel et al. 2004, Baker et al. 2007, Sherriff and Veblen 2007). Disturbed forest conditions are necessary for the maintenance of many plant and animal species (Hutto 2008). The Black-Backed Woodpecker, for example, is nearly restricted in its distribution to burned forest conditions (see below). There is a need, therefore, to manage for and maintain mixed and high severity fire in mid and high elevation forests in the Blackfoot Subbasin (D. Hutto, pers. comm.).

**Nested target: mid to high elevation coniferous forest-associated birds**

*Black-backed Woodpecker:* The Black-backed Woodpecker, a Montana Partners in Flight Level I Priority Species (PIF 2000) and Montana Species of Concern (MTNHP 2009b), occurs in mid to high elevation mixed conifer forests from New England and eastern Canada, across Canada to southern Alaska and south in the Rocky Mountains to Wyoming. It is a resident species in the forested habitats of Montana from the Rocky Mountain Front westward. The Black-backed Woodpecker is considered a sensitive, special concern, or management indicator species by most Montana agencies because of its strong association with burned forest conditions (Hutto 1995b, Dixon and Saab 2000, PIF 2000, Hutto and Young 2002, Hutto 2008). It is strongly associated with dying or dead trees infested with beetles. Mature and old-growth forests containing patches of beetle infested trees may provide habitat to support baseline populations of Black-backed Woodpeckers when burned areas are not available (Goggans et al. 1988).

*Olive-sided Flycatcher:* The Olive-sided Flycatcher, a Montana Partners in Flight Level I Priority Species (PIF 2000), generally occurs in mid to high elevation coniferous forests throughout the mountains of western North America (Altman 1997). It breeds throughout western Montana. Olive-sided Flycatchers have been found to be more abundant in disturbed than in undisturbed forests in the northern Rocky Mountains, including early postfire and logged (both partial cut and clearcut) habitats (Tobalske et al. 1991, Hutto and Young 1999). They appear to require large residual snags and/or live trees for foraging and singing perches (Altman 1997). Olive-sided Flycatcher populations appear to be in decline. In the northern Rocky Mountains, populations declined approximately 3% from 1966 to 1996, and approximately 5.8% within Montana over the same period (Sauer et al. 1997, PIF 2000).

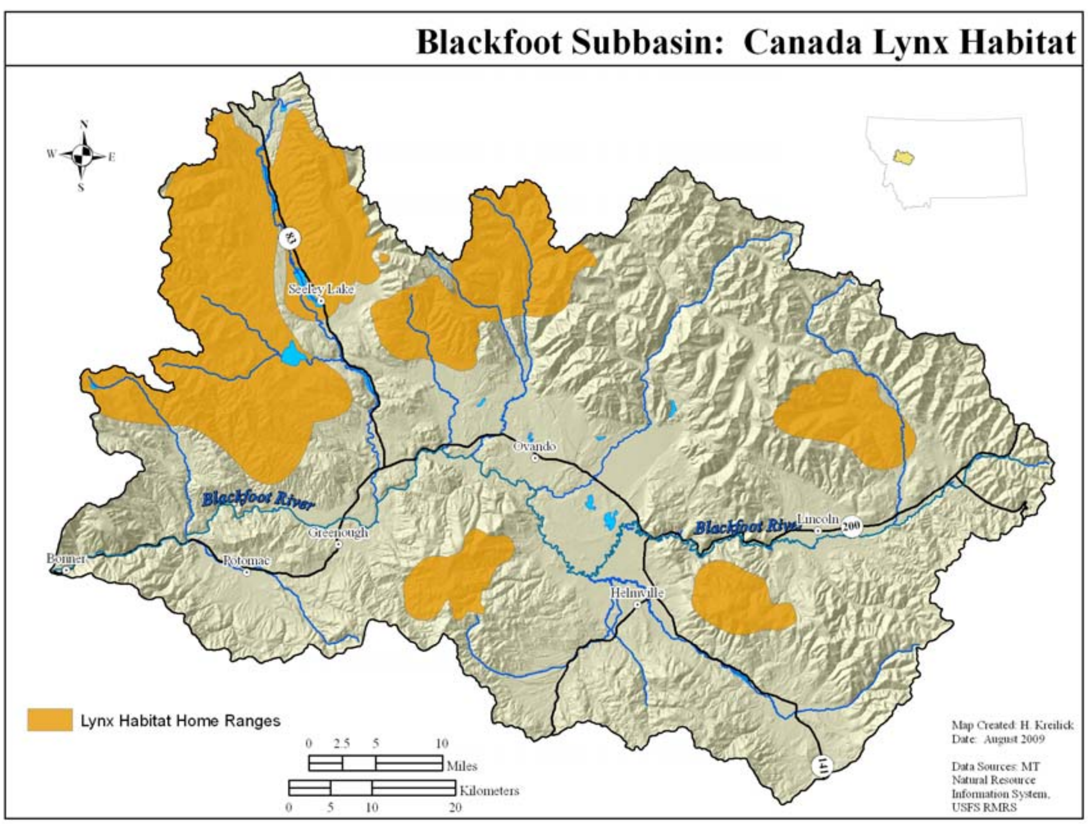
*Northern Goshawk:* Northern Goshawks in western Montana and northern Idaho have been found to nest in mature to old-growth conifer forests (Hayward and Escano 1989). Douglas-fir and western larch seem to be the preferred species for nesting in the northern Rockies (Hayward et al. 1990). A survey of 316 nests in northern Idaho, Montana, western North Dakota, and northwestern South Dakota indicated that 60% of nest sites were in the Douglas-fir forest type, followed in order of prevalence by lodgepole pine (16%), ponderosa pine (14%), hemlock/spruce (4%), and small percentages of hardwood and mixed conifer types (USFWS 1998, PIF 2000). The Northern Goshawk is a Species of Concern in Montana (MTNHP 2009b).

**Nested target: forest carnivores**

Wide-ranging forest carnivores such as Canada Lynx, wolverine, and fisher require large areas of intact mid to high elevation coniferous forest to fulfill their life history needs.

*Canada lynx*: The Blackfoot Subbasin is a stronghold for the federally threatened Canada lynx in the northern Rocky Mountains (Figure 3.32). Based on ongoing research in the Upper and Middle Blackfoot, lynx populations appear stable, although low reproductive rates are characteristic of this population. Since 1998, over 80 lynx have been monitored in the subbasin, providing information on habitat use, reproduction, mortality and movement. This research has shown that the Blackfoot Subbasin contains some of the most critical habitat for lynx in the continental United States. Large, intact spruce/subalpine fir forests above 4,000 feet in the subbasin provide high quality habitat for lynx and for snowshoe hares, the primary lynx food source. Regenerating forest stands are often used as foraging habitat during the snow-free months while older, multi-storied stands serve as denning and year-round habitat (BC 2005b, J. Kolbe pers. comm.).

**Figure 3.32 Canada Lynx Habitat.**



*Wolverine:* The wolverine, a Species of Concern in Montana (MTNHP 2009b), was nearly extinct in Montana during the early 1900s but has been increasing in numbers and range since then. Recovery originated in northwestern Montana and subsequently spread to its current range (Newby and Wright 1955, Newby and McDougal 1964). Wolverines are generally solitary, wide-ranging and occur at relatively low densities. In Montana, the mean annual wolverine home range is 163 square miles for males and 150 square miles for females (Hornocker and Hash 1981). Available evidence indicates that juveniles disperse usually around 20 to 60 miles from their natal range, though dispersal movements of more than 180 miles are known (Gardner et al. 1986). Wolverines are limited to alpine tundra and boreal and mountain forests (primarily coniferous) in the western mountains, particularly in large wilderness or other essentially roadless areas. Dispersing individuals, however, have been found far outside of usual habitats (MTNHP 2009b). Tracking data, sightings and trapper harvest indicate that wolverines are well distributed throughout suitable habitat in the Blackfoot Subbasin (J. Kolbe, pers. comm.).

*Fisher:* The fisher is also a Species of Concern in Montana (MTNHP 2009b). Although fisher were purportedly extirpated from the state by the 1930s, recent genetic research indicates that native remnant populations persisted in the Bitterroot and Blackfoot Watersheds (Vinkey et al. 2006). Efforts in 1959 and 1960 resulted in the establishment and augmentation of native populations in Lincoln, Granite, and Missoula counties. Within the Blackfoot Subbasin, fisher have been trapped in the Clearwater drainage, the Lincoln Valley, and the Garnet Mountains in recent decades. Recent genetic hair-snare surveys (USFS, unpublished data 2007) have confirmed fisher populations in the Clearwater drainage and Lincoln Valley portions of the Blackfoot as recently as 2007. A wide-ranging mammal, fisher home ranges have been estimated at 4 to 300 square miles. Fishers have been recorded moving up to 56 miles in three days (Ruggiero et al. 1994, J. Kolbe, pers. comm.).

**Nested target: whitebark pine**

Whitebark pine is a common component of subalpine forests and a dominant species of treeline and krummholtz habitats. It occurs in almost all major mountain ranges of western and central Montana. Whitebark pine occupies a critical niche in western ecosystems by producing large seeds that are extremely nutritious and important in food chains of an estimated 110 animals. Whitebark pine seeds are especially important components of grizzly bear, black bear, red squirrel, and Clark's Nutcracker diets (Kendall & Arno 1989, Schmidt 1992, Reinhart et al. 2001). Populations of whitebark pine in Montana and across most of western North America have been severely impacted by past mountain pine beetle outbreaks and by white pine blister rust, an introduced pathogen.[20] As a result, there have been major declines in whitebark pine populations across large areas of its range. Additionally, encroachment and increased competition from other trees (primarily subalpine fir) have occurred as a result of fire suppression in subalpine habitats.

[20] More information on white pine blister rust is provided in Section 3.4.4.3.

**Table 3.19 Mid to High Elevation Coniferous Forest Viability Assessment.**

| | | Indicator Ratings | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Key Attribute** | **Indicator** | **Poor** | **Fair** | **Good** | **Very Good** | **Current Rating** | **Desired Rating** | **Comments** |
| **Landscape Context/Condition** (*Functioning disturbance regime*): Fire | Appropriate species composition and structure in the understory and overstory relative to HRV[1] | < 25% of HRV | 25-50% of HRV | 51-75% of HRV | > 75% of HRV | fair | Good | HRV refers here to historic species composition and structure.<br>Age class distribution and condition have shifted in the Blackfoot.<br>Indicator includes down and standing dead wood. |
| **Condition** (*Cone producing whitebark pine stand*) | Amount and distribution of cone producing whitebark pine stands | < 25% of HRV | 25-50% of HRV | 51-75% of HRV | > 75% of HRV | poor | fair/good | HRV refers here to historic amount and distribution of cone producing whitebark pine stands.<br>Note that white pine blister rust is an introduced pathogen and not part of HRV. More ecological and status information is required to refine ratings. |
| **Landscape Context/Condition** (*Patch size and distribution of age classes*) | Patch dynamic analysis: departure from HRV | < 25% of HRV | 25-50% of HRV | 51-75% of HRV | > 75% of HRV | fair | good | HRV refers here to historic patch size and distribution of age classes. |

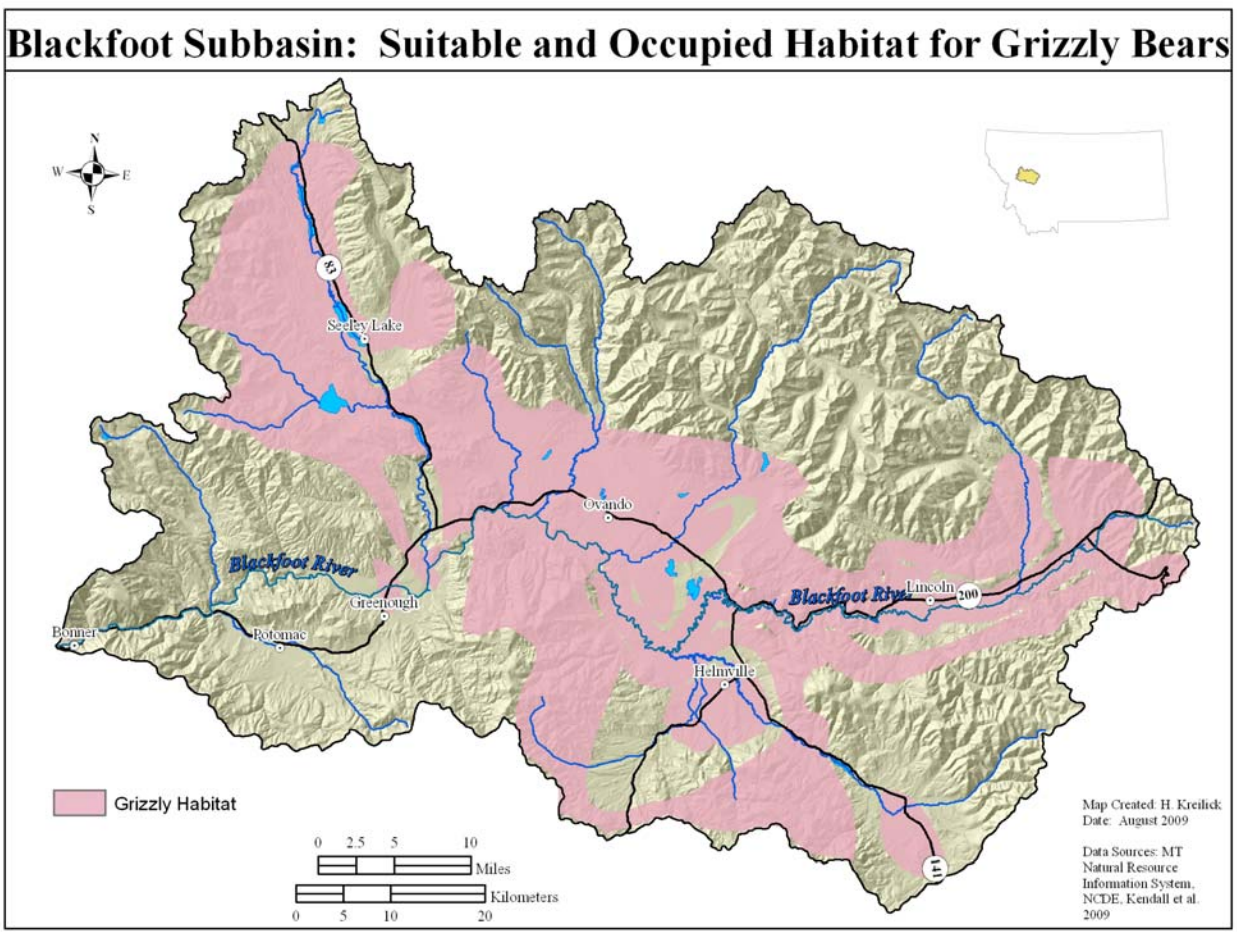
[1] HRV refers to "historic range of variability." A definition of HRV is provided in Table 3.12.

## 3.3.3.7 Grizzly Bear

*Nested Targets: habitat connectivity for wildlife*

Grizzly bears are currently listed as a federally threatened species in the Northern Continental Divide Ecosystem (NCDE) (USFWS 2009b). The NCDE is an area of the northern Rocky Mountains with large blocks of protected public land containing some of the most pristine and intact environments found in the contiguous United States. The NCDE supports the largest population of grizzly bears in the lower 48 states. Despite dramatic losses of habitat throughout North America, the grizzly bear has maintained a presence in Montana and occurs in portions of the Blackfoot Subbasin. The Blackfoot Subbasin is the southern boundary for the NCDE grizzly bear recovery zone. The Grizzly Bear Recovery Plan (USFWS 1993) includes most of the Blackfoot Subbasin as suitable and/or occupied habitat (Figure 3.33).

**Figure 3.33 Suitable and Occupied Habitat for Grizzly Bears.**



The USGS Northern Divide Grizzly Bear Project, designed to estimate population size and distribution, confirmed the presence of 29 individual grizzly bears in the Blackfoot Subbasin in 2003 and 2004. The USGS estimates that at least 40 bears are present during all or part of the year in the subbasin. In recent years, grizzly bear activity has increased in the subbasin. This area appears to be an important habitat link for grizzlies that are re-colonizing historic ranges to the south of the subbasin. Maintaining habitat connectivity is critical to sustaining grizzly bear life histories and maintaining sustainable subpopulations within the southern portion of the NCDE.

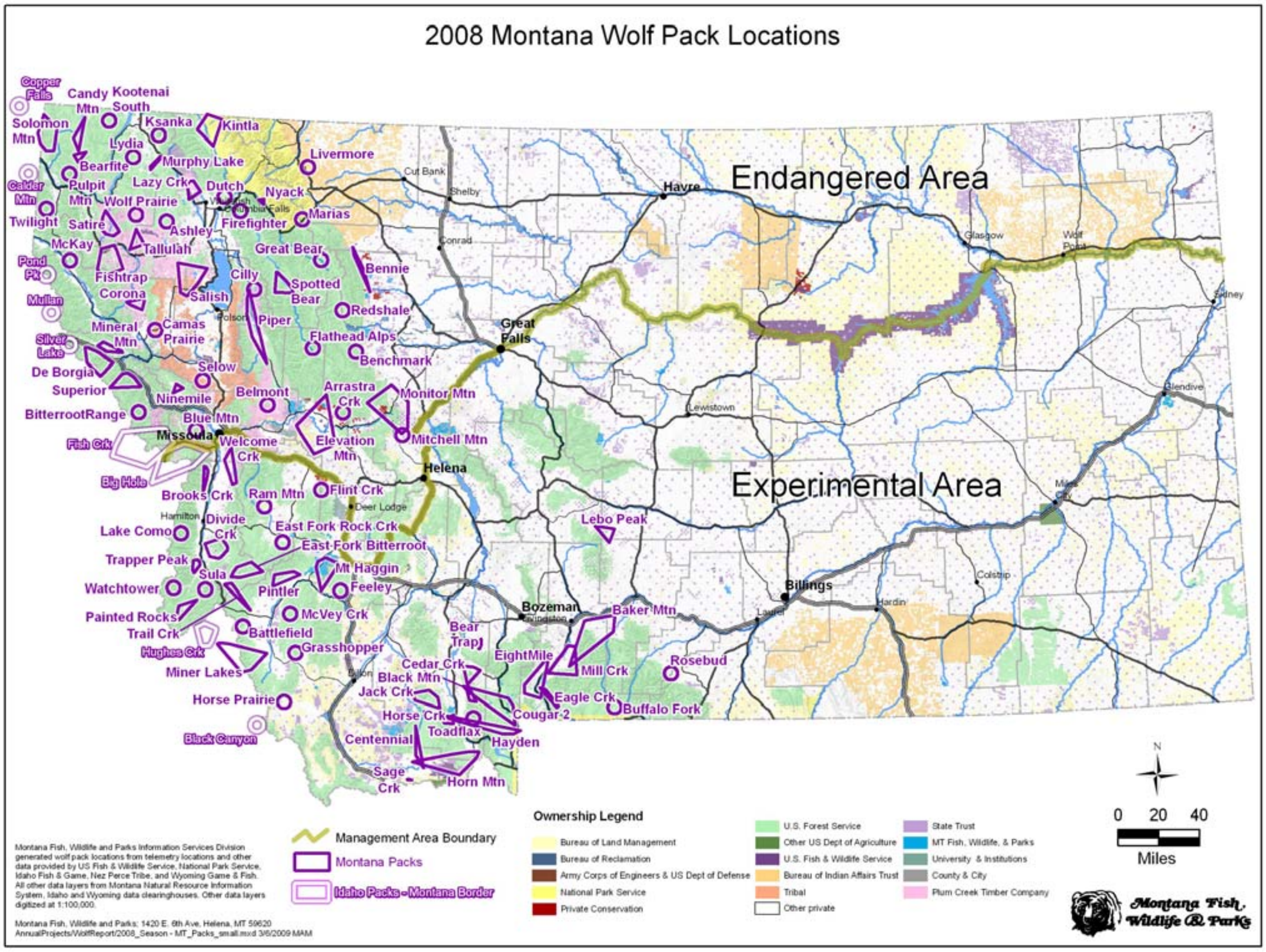
Grizzlies breed, forage and migrate throughout the subbasin and den above 6,500 feet. They move from high mountain elevations to lower valley bottoms to forage seasonally for available food. Lakes, ponds, fens and spring-fed creeks, common in portions of the valley floor, provide excellent bear habitat. Additionally, the vegetation found along certain reaches of the Blackfoot River and its tributaries provide bears with cover, food and natural movement corridors. While grizzlies are taxonomically classified as carnivores, they are opportunistic and omnivorous in practice, eating a variety of forbs, roots, seeds, berries, insects, fish, birds and mammals. Important food sources found in the Blackfoot include chokecherries, serviceberries, hawthorns and rosehips.

As grizzly bears expand in population and spend more time on private agricultural lands in the Blackfoot, particular attention must continue to be focused on preventative management to reduce human-bear conflicts, protect human safety and reduce impacts to rural livelihoods. These efforts include securing bear attractants and installing electric fencing around agricultural food sources (beehives, sheep bedding grounds and calving areas) (J. Jonkel and S. Wilson, pers. comm.).

**Nested target: habitat connectivity for wildlife**
The Blackfoot Subbasin lies in a region which contains some of the best remaining habitat for many of North America's threatened or sensitive species including grizzly bear, gray wolf, wolverine, Canada lynx and native salmonid species. The location of the Blackfoot Subbasin in relation to larger ecosystems, such as the NCDE and the Yellowstone-to-Yukon region, adds to the importance of the area for maintaining large-scale connectivity for wildlife species. The subbasin provides crucial links for wildlife moving between the NCDE and other landscapes to the south. The Blackfoot River corridor and the entire subbasin serve as a complex network of linkage zones for wildlife moving in and out of the Bob Marshall/Scapegoat Wilderness Complex, the Mission Mountains Wilderness and between the lower Clark Fork drainage and the Garnet and Sapphire Ranges. Maintenance of the subbasin area as a linkage between large protected areas is important to many wildlife species including elk, moose, white-tailed and mule deer, fisher, Canada lynx, bobcat, pine marten, wolverine, mountain lion and wolf. Within the subbasin, maintaining connectivity at smaller scales, such as between elk summer and winter range, is also critical to preserving the diversity and abundance of wildlife species and overall ecosystem function.

The Blackfoot Subbasin lies at the confluence of three federally-designated gray wolf recovery areas: Northwestern Montana, Central Idaho and the Greater Yellowstone. Gray wolves in the Blackfoot are natural dispersers from wolf populations in Canada, moving southward from the Glacier National Park and Bob Marshall Wilderness Complex (Oakleaf et al. 2006). In 2007, MFWP confirmed the first resident wolf pack (Elevation Mt. Pack) in the Blackfoot Subbasin. Subsequent livestock depredations by this pack ensued in April 2008 and resulted in three confirmed and one probable calf loss, and the subsequent removal of four wolves by wildlife management authorities. As of 2009, MFWP has confirmed the presence of four resident wolf packs and estimates that at least 25 to 35 wolves inhabit the subbasin, Arrastra Creek, Elevation Mountain, Belmont and more recently the Ovando Mountain Pack (Figure 3.34). The Blackfoot Valley also serves as an important wolf movement corridor between the NCDE and the Bitterroot Ecosystem to the south.

**Figure 3.34 2008 Montana Wolf Pack Locations.**




More information on elk, mule deer and white-tailed deer in the subbasin is provided in Section 3.3.3.4. More information on Canada lynx, wolverine, and fisher is provided in Section 3.3.3.6.

**Table 3.20 Grizzly Bear Viability Assessment.**

| | | Indicator Ratings | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Key Attribute** | **Indicator** | **Poor** | **Fair** | **Good** | **Very Good** | **Current Rating** | **Desired Rating** | **Comments** |
| **Landscape Context** (*Habitat Connectivity*) | Linkage zone intactness for wildlife movement | lose most | lose a lot, keep a little | lose some, keep some | maintained functionality of all wildlife linkage zones | very good | very good | Linkage zones or number of barriers should be defined so that this could be measured quantitatively for the subbasin. Indicators = highways and development. |
| **Landscape Context** (*Secure Available Habitat*) | "Available habitat" | < X % of available habitat is secure | X to X % of available habitat is secure | X to X % of available habitat is secure | > X % of available habitat is secure | very good | very good | Use USFS Cumulative Effects Model (CEM) to determine amount and distribution of available habitat and refine ratings. |
| **Condition** (*Population demographics*): Reproduction | Reproductive success of mothers and survivorship of cubs | 0 verified females with young of the year | 1 verified female with young of the year | 2 verified females with young of the year | > 3 verified females with young of the year | good | very good | Number of females with young already tracked at NCDE scale. Animals to south of Highway 200 are not part of NCDE population estimate, but area still managed by MFWP. |
| **Condition** (*Population demographics*): Human-caused mortality | Number of human-caused breeding female deaths annually | > 3 breeding female deaths (this is a trend) | 1-2 breeding female deaths | 0 breeding female deaths in a year | 0 breeding female deaths for 2 years in a row | fair | good | Referring to mortalities caused by hunters, highways, and malicious killing incidents. Mortality is good indicator of human presence/development. |
| **Condition** (*Human/grizzly bear conflicts*) | Incidence of human-grizzly conflicts with grizzlies | > 25 conflicts | 10 to 25 conflicts | 5 to 10 conflicts | up to 5 conflicts | good | very good | Includes incidents involving agricultural/residential attractants and recreation/hunter conflicts. |

**Table 3.20 (continued).**

| | | Indicator Ratings | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Key Attribute** | **Indicator** | **Poor** | **Fair** | **Good** | **Very Good** | **Current Rating** | **Desired Rating** | **Comments** |
| **Size** (*Population size and trend*) | Population trend monitoring and DNA studies | declining population | slight decline | stable trend | increasing population | very good | very good | Already tracked at NCDE scale. Population numbers should be tracked in the Blackfoot, but within the larger context of the NCDE population. |

### 3.3.3.8 Rural Way of Life

*Nested Targets: sustainable natural resource-based livelihoods; healthy/resilient communities*

The Blackfoot Subbasin has provided critical ecological resources and functions to centuries of human communities from Native American Salish, Kootenai, Nez Perce, Shoshone, Blackfeet and Crow tribes to homesteaders and ranchers of European descent and present day residents. Recognizing the important interaction between natural resources and human communities, the subbasin planning team included *rural way of life* as an eighth conservation target. To define this target and its significance in the subbasin, it is necessary to examine the rural restructuring that is occurring across the Rocky Mountain West and the associated changes to communities that have historically been closely connected to natural resources and working landscapes.

The Rocky Mountain West is a region characterized by high alpine rugged mountains, large tracts of public land, clear running rivers and streams, large working ranches and a complex mosaic of habitats that support grizzly bear, gray wolf, Canada lynx and many other charismatic species. These regional characteristics are the substance behind many contentious political, economic and community debates related to natural resource preservation, conservation and sustainable use. Many argue that the controversies are a result of the shifting dynamics of the West—its history and value to old-timers versus newcomers. Terms like "the old west," "the new west," and "the next west;" "range-riding cowboy" and "web-surfing modem cowboy;" "working landscapes;" "amenity-based economy," "resort communities," and "recreation-based economy" all allude to the shift in culture and values (Brick et al. 2001, Wilkinson 1992, Decker 2001, Jungwirth 2001). Riebsame (2001) characterizes the new geography of the West as the "gentrified range of hobby ranchers and New West homesteaders." From resource production—and, in some places, exploitation—to resource conservation, communities in the West are exploring tradeoffs between natural resource protection and community sustainability.

According to population census data, the Rocky Mountain West is undergoing some of the highest growth rates in the United States. According to demographers and economists, the factors contributing to this rapid growth include 1) businesses and jobs shifting away from cities due to information technology and a more mobile population, 2) the region's newness as an economic development center and 3) the quality of life (Power 1996, Cromartie and Wardwell 1999, Riebsame et al. 1997). Stohlgren (1999), who examined population growth in several Rocky Mountain states and cities, found that the population of Jackson Hole, Wyoming increased by 260% between 1950 and 1990 and, closer to this study, the population of Missoula, Montana increased by 91% during the same time period.

In many places, shifting population dynamics, telecommunication, technology and global markets have created an "urban economy in a rural setting" (Rasker 2001). Both an influx of urban refugees and retirees means that the landscape is changing to a competitive, global and knowledge-based economy. Today, for example, over one-third of the personal income in the

Intermountain West is from nonlabor sources (e.g., investment and retirement and savings) (Rasker 2001).

The shift in demographics not only affects the land, as discussed later (see *Unplanned Residential and Resort Development*, Section 3.4.4.1), but also affects social and economic factors that are linked to natural resource-based communities, such as the loss of working farms and ranches, timber contracts, mills and infrastructure linked to these industries. In some areas, the use of zoning, county planning and conservation easements (a voluntary land protection tool employed by agencies and land trusts to conserve land) has reduced the opportunity for generational landowners to buy land or homes in the communities they were raised in due to larger parcel sizes. In other areas of the West, new and wealthy landowners have created quasi-nature preserves, keeping locals off their land with no trespassing signs. Numerous studies explore the relationships between property rights, value shifts and land use. Jackson-Smith and others (2005), for example, point out that landowners without farming and ranching backgrounds may depend less on their land for resource productivity than generational landowners, instead paying more attention to the cumulative impacts of aesthetic and environmental qualities across the landscape.

The Blackfoot Subbasin is experiencing many of the same changes as other rural communities across the West. New landowners are moving to the subbasin, bringing a range of values, skills and resources that provide potential benefits to the subbasin, including academic/professional knowledge, transfer or investment income and wealth and political sophistication. Many are welcomed, especially when they become active community members or leaders, participate in and organize local functions and fundraisers, serve on local community organization boards, spend time and money in local restaurants and businesses, and, most importantly, build long-lasting friendships and relationships with their neighbors. Others face barriers with generational landowners for a variety of reasons. Some new landowners, for example, have been quick to make decisions about land use and public access without fully understanding the impacts on natural resources and rural communities. Others take land out of production, "preserving" it for its amenity values. Some simply are not present, given that the ownerships are seasonal or absentee-based. Lastly, there is concern by rural residents over the fact that many of the seasonal or absentee landowners are not required to pay state income tax to benefit the local economy. Despite the mixed feelings, there is general recognition that the subbasin is changing and that efforts must be made to bridge old/new and rural/urban values.

In addition to changing demographics, it is important to highlight that the Blackfoot Subbasin is comprised of seven very distinct communities (Bonner, Greenough, Helmville, Lincoln, Ovando, Potomac and Seeley Lake) with different histories, landscapes and cultures. This diversity provides both challenges and opportunities to defining the rural way of life and associated indicators of community viability from a socioeconomic perspective. The proximity of the subbasin to the urban centers of Missoula and Helena (both approximately 60 miles away from the central portion of the valley) also influence the changing nature of the rural communities. The convenience of airports, hospitals/healthcare facilities and access to the internet will likely mean that many of the Blackfoot communities will not decrease in population.

The Blackfoot Challenge's mission is to coordinate efforts that conserve and enhance the natural resources and rural way of life of the Blackfoot River Valley for present and future generations. The central question for partners practicing resource conservation and communities within the Blackfoot Subbasin is: can the communities retain their rural character in the midst of a changing west and a globally- and technologically-connected world? To address this question and assess the viability of the rural way of life in the Blackfoot Subbasin, representatives from the seven communities might complete a conservation target viability assessment (see Section 3.3.2) to 1) confirm or edit the following nested targets as key socioeconomic attributes of the subbasin rural way of life, 2) define indicators to measure each attribute, 3) rate the current status of each indicator, and 4) determine the desired status of each indicator.

Unlike key ecological attributes defined in Section 3.3.2, key *socioeconomic* attributes are factors that are critical for the long-term viability of societies (Belsky 2009). In the context of "rural" and "rural way of life," this refers to areas with the following characteristics:

- relatively low population density
- located in relatively isolated or remote areas
- a large percentage of household income is from natural-resource based livelihoods (e.g., agriculture, ranching, forestry, hunting)
- the pace of life is slower than in cities
- strong ties exist between community members, social institutions (e.g., schools and other civic institutions) and the surrounding natural environment

It is important to note that the above definition of "rural" and "rural way of life" is highly generic. Differences will emerge within and across the seven distinct communities in the Blackfoot Subbasin, as discussed previously. The key to defining and choosing indicators related to the rural way of life is both resilience and sustainability (Belsky 2009).

The nested targets below have been identified based on current theory and models from the social scientific literature, available local social scientific data and/or comparative data from other areas and expert opinion.

**Nested target: sustainable natural resource-based livelihoods**

Although this nested target needs to be examined by community members with data collected from the subbasin, it can be loosely defined as the continued existence and support of industries such as agriculture, forestry, outfitting and recreation and the businesses that support these industries. In exploring indicators and opportunities to promote sustainable natural resource-based livelihoods, experts recommend that communities do not return to the old economy of resource production or seek large companies to move to small towns (Rasker, 2001). Instead, they advocate developing the physical and fiscal infrastructure to support local business and entrepreneurship, including seeking funds for education, infrastructure, and start-up capital. Possible indicators to measure progress in this area include:

1) Developing baseline and recent trend information that addresses how the different sectors are able to stay in business (and pass the business and knowledge on to the next generation);
2) Exploring the degree to which agriculture and forestry businesses are seeking economic diversification with value-added services and producing multiple products (e.g., animal processing, specialty meats, local marketing, utilization of small diameter wood products from restoration/fuel reduction treatment);
3) Defining the local benefit of these livelihoods in terms of product consumed or purchased and/or jobs in the subbasin;
4) Promoting businesses that:
    a. Link resource use/natural amenities to the economy (e.g., recreation, guest-ranching, inns and restaurants, eco-tourism and/or the "restoration" economy)
    b. Capitalize on global markets and public demand (e.g., wind energy development)
    c. Develop new technologies to support a natural resource-based economy; and,
5) Exploring the relationship between conservation, local economy and community by creating new markets for the protection and stewardship of open space and healthy habitat and broadening the profit and income base versus complete reliance on government programs or philanthropy.

**Nested target: healthy/resilient communities**

The emphasis here is on the capacity of a community to continually create and improve its physical and social resources and environments and to be able to respond to new conditions. At the core is the concept of "social capital", which is the ability of people and institutions within a community to come together and support each other to work through differences and define and accomplish common goals. The literature on the subject and ideas expressed in the Blackfoot Subbasin share many common themes and principals. Possible indicators of the viability of this nested target, as discussed by Edelman and Burke (2004) and Kenyon (2005), include:

1) A stable and/or increasing population;
2) Education (i.e., schools), keeping and attracting young people;
3) Accessible healthcare services and opportunities to care for the aging population;
4) Affordable housing;
5) Cultural "hubs" for community connection, conversation and relationships, e.g., restaurants, cafes, bars, churches, social organizations (Sew and So Club, Blackfoot Cattlewomen's Association), community centers, events ($4^{th}$ of July Celebration, Births/Weddings/Funerals); and,
6) Low crime rates and public safety through rural fire departments and emergency response teams.

The Healthy Cities and Communities Coalition emphasizes the following seven pillars to a resilient and/or healthy community:

1) Practices ongoing dialogue
2) Generates leadership

3) Shapes its future
4) Embraces diversity
5) Knows itself
6) Connects people and resources
7) Creates a sense of community

Although rural way of life is not included in the threat assessments outlined in the following pages, conservation objectives and strategic actions undertaken in the subbasin will take into account the needs of local communities.

### 3.3.4 Summary of Viability

All conservation targets within the Blackfoot Subbasin were determined to have a current viability rating of *good*, *fair* or *poor*, suggesting that each conservation target will require some degree of human intervention in order to persist under current conditions (Table 3.21). In Section 3.4 (Threat Assessment), we analyze and describe the most important factors impacting conservation target viability in the subbasin. In Section 5.0 (Management Plan), we outline a set of conservation objectives and strategic actions to mitigate these threats and maintain or restore conservation target viability.

**Table 3.21 Viability Summary for Blackfoot Subbasin Conservation Targets.**[1]

| Conservation Targets | Landscape Context | Condition | Size | Viability Rank |
|---|---|---|---|---|
| | Grade | | | |
| Native Salmonids [2] | Poor | Good | Fair | **Fair** |
| Herbaceous Wetlands | Good | Poor | Good | **Fair** |
| Moist Site and Riparian Vegetation | Fair | Fair | Fair | **Fair** |
| Native Grasslands/Sagebrush Communities | Poor | Poor | Fair | **Poor** |
| Mid to High Elevation Coniferous Forest [3] | Fair | Fair | - | **Fair** |
| Low-Elevation Ponderosa Pine/Western Larch Forest [3] | Poor | Poor | - | **Poor** |
| Grizzly Bear | Very Good | Fair | Very Good | **Good** |
| **Subbasin Biodiversity Health Rank** | | | | **Fair** [4] |

[1] The viability assessment for the rural way of life target has not yet been completed; depending on methods chosen for the assessment, different criteria other than landscape context, condition and size may be used.

[2] Viability ratings for native salmonids are subject to change pending review at 6th field HUC scale.

[3] Forest work group did not consider size as a key attribute for forest targets.

[4] Subbasin biodiversity health rank subject to change based on the variables noted above.

## 3.4 Threat Assessment

### 3.4.1 Overview

After identifying conservation targets and assessing target viability, technical work groups identified the most critical factors that currently impact or have the potential to impact target viability over the next ten years. The process entailed identifying and ranking *stresses* affecting each conservation target and *threats*, or the causes of each stress. The threat assessment process, including definitions of terms, is outlined below (adapted from Low 2003).[21]

**Step 1: Identify Stresses**
In the first step of the subbasin threat assessment, technical work groups identified stresses affecting each conservation target.[22] Stresses destroy, degrade or impair a conservation target by impacting a key ecological attribute[23] relating to its size, condition or landscape context. Stresses are caused directly or indirectly by human activities. Technical work groups identified 19 stresses that negatively impact subbasin conservation targets (see Tables 3.22-3.28).

**Step 2: Identify Threats (Sources of Stresses)**
Threats represent the proximate cause of a stress. Most threats are rooted in incompatible human uses of land, water and natural resources. Many threats are driven by social, economic, or political underlying causes. Technical work groups identified 20 threats that represent the proximate cause(s) of each subbasin stress (see Tables 3.22-3.28).

**Step 3: Rank Threats**
After identifying the threats that affect each conservation target, technical work groups then ranked each one according to its *contribution* and *irreversibility* relative to each stress. *Contribution* refers to the expected contribution of the threat, acting alone, to the full expression of a stress under current circumstances. Contribution ratings indicate whether the threat is a very substantial, moderate or relatively insignificant cause of a stress. Contribution ratings are:

| | |
|---|---|
| ***Very High*** **(VH)** | The source is a very large contributor to the particular stress. |
| ***High*** **(H)** | The source is a large contributor to the particular stress. |
| ***Medium*** **(M)** | The source is a moderate contributor to the particular stress. |
| ***Low*** **(L)** | The source is a low contributor to the particular stress. |

[21] For more information on the threat assessment process, see *Landscape-Scale Conservation: A Practitioner's Guide* (Low 2003).

[22] *Stresses* are analogous to *limiting factors,* a term used by NPPC to describe the problems that impede the desired biological performance of a conservation target (NPPC 2001).

[23] *Key ecological attributes* are factors that are critical for the long-term viability of a conservation target. These are factors that, if degraded, would seriously jeopardize the target's ability to persist for a century or longer. Key ecological attributes for each conservation target are described in the Blackfoot Subbasin Viability Assessment, Section 3.3.2.

*Irreversibility* ratings indicate whether the threat produces a stress that is irreversible, reversible at extremely high cost, or reversible with moderate or little investment. Irreversibility ratings are:

| | |
|---|---|
| ***Very High*** **(VH)** | Not reversible (e.g., wetlands converted to a shopping center). |
| ***High*** **(H)** | Reversible, but not practically affordable (e.g., wetland converted to agriculture). |
| ***Medium*** **(M)** | Reversible with a reasonable commitment of resources (e.g., ditching and draining of wetland). |
| ***Low*** **(L)** | Easily reversible at relatively low cost (e.g., off road vehicles trespassing in wetland). |

### 3.4.2 Conservation Target Threat Assessments

Individual threat assessments for each subbasin conservation target illustrate the relationship between conservation targets, stresses, and threats in the subbasin (Tables 3.22-3.28). An understanding of both stresses and threats is necessary to develop effective conservation objectives and strategic actions that will maintain and/or improve the long-term viability of conservation targets in the subbasin. Narrative descriptions of each threat are provided in Section 3.4.4.

**Table 3.22 Native Salmonids Threat Assessment.**

| Threats (Causes) ↓ | | Stresses (Effects) → | | | | | |
|---|---|---|---|---|---|---|---|
| | | Water Quality Impairments | Habitat Access/ Connectivity Impairments | Physical Habitat Impairments | Altered Hydrologic Regime | Riparian Vegetation Impairments | Non-Natives, Exotics and/or Parasites Invasion |
| **Mining** | Contribution | M | L | M | L | L | n/a |
| | Irreversibility | H | H | H | H | H | n/a |
| **Incompatible Grazing** | Contribution | H | L | H | M | VH | M |
| | Irreversibility | M | M | M | M | M | H |
| **Physical Road Issues** | Contribution | VH | VH | H | M | M | M |
| | Irreversibility | M | M | M | M | M | H |
| **Incompatible Forestry Practices** | Contribution | M | L | H | H | H | M |
| | Irreversibility | H | M | M | M | M | H |
| **Unplanned Residential and Resort Development** | Contribution | M | L | L | M | L | M |
| | Irreversibility | H | H | H | H | M | H |
| **Drainage and Diversion Systems** | Contribution | H | H | M | H | M | M |
| | Irreversibility | M | M | M | M | M | M |
| **Channel Alteration** | Contribution | H | L | H | M | H | M |
| | Irreversibility | M | M | M | M | M | H |
| **Non-Motorized Recreational Use** | Contribution | L | M | L | L | L | H |
| | Irreversibility | L | M | L | L | L | H |
| **Exotic/Invasive Species** | Contribution | L | M | M | n/a | M | H |
| | Irreversibility | L | L | L | n/a | H | H |
| **Climate Change** | Contribution | H | M | M | VH | M | H |
| | Irreversibility | H | M | M | M | M | H |

**Table 3.23 Herbaceous Wetlands Threat Assessment.**

| Threats (Causes) ↓ | | Stresses (Effects) → Altered hydrologic regime | Altered physical habitat condition | Altered native plant species, composition, and/or structure | Altered distribution, areal extent, patch size of community types | Degradation or loss of wildlife habitat | Reduced diversity of wetland types |
|---|---|---|---|---|---|---|---|
| **Incompatible Grazing** | Contribution | L | H | H | L | L | L |
| | Irreversibility | M | M | M | M | L | L |
| **Drainage and diversion Systems** | Contribution | VH | H | H | L | H | VH |
| | Irreversibility | M | M | M | L | L | M |
| **Exotic/Invasive Species** | Contribution | L | M | VH | L | M | H |
| | Irreversibility | M | M | M | L | M | M |
| **Motorized Vehicle Use** | Contribution | n/a | L | L | n/a | L | n/a |
| | Irreversibility | n/a | M | M | n/a | M | n/a |
| **Conversion to Agriculture** | Contribution | H | VH | VH | H | H | H |
| | Irreversibility | M | M | M | M | M | M |
| **Filling of Wetlands** | Contribution | H | H | H | M | M | H |
| | Irreversibility | H | H | M | M | H | M |
| **Existing Crop Production** | Contribution | H | VH | H | H | M | H |
| | Irreversibility | M | M | M | M | M | M |
| **Incompatible Forestry Practices** | Contribution | n/a | L | L | L | L | n/a |
| | Irreversibility | n/a | M | M | M | M | n/a |
| **Climate Change** | Contribution | H | L | H | H | H | H |
| | Irreversibility | VH | VH | VH | VH | VH | VH |

**Table 3.24 Moist Site and Riparian Vegetation Threat Assessment.**

| Threats (Causes) ↓ | | Stresses (Effects) → Altered hydrologic regime | Altered disturbance regime (fire, grazing, browsing, flooding, beaver) | Altered native plant species, composition, and/or structure | Altered distribution, areal extent, patch size of community types |
|---|---|---|---|---|---|
| **Channel Alteration** | Contribution | M | H | M | L |
| | Irreversibility | M | M | M | M |
| **Unplanned Residential and Resort Development** | Contribution | M | H | H | M |
| | Irreversibility | H | H | VH | H |
| **Conversion to Agriculture** | Contribution | L | L | M | L |
| | Irreversibility | H | H | H | H |
| **Lack of Fire** | Contribution | n/a | VH | H | H |
| | Irreversibility | n/a | M | H | H |
| **Incompatible Grazing** | Contribution | M | H | H | H |
| | Irreversibility | M | M | M | M |
| **Drainage and diversion Systems** | Contribution | VH | L | L | L |
| | Irreversibility | M | M | M | M |
| **Exotic/Invasive Species** | Contribution | n/a | n/a | VH | M |
| | Irreversibility | n/a | n/a | H | M |
| **Altered Wildlife Use Patterns** | Contribution | n/a | M | H | M |
| | Irreversibility | n/a | M | M | M |
| **Climate Change** | Contribution | H | VH | H | VH |
| | Irreversibility | VH | VH | VH | VH |

Table 3.25 Native Grasslands/Sagebrush Communities Threat Assessment.

| Threats (Causes) ↓ | | Stresses (Effects) → | | | |
|---|---|---|---|---|---|
| | | Altered fire regime | Altered Grazing Regime (domestic & wild) | Altered native plant species, composition, and/or structure | Altered distribution, areal extent, patch size of community types |
| Lack of Fire | Contribution | VH | M | H | H |
| | Irreversibility | M | M | M | M |
| Conversion to Agriculture | Contribution | M | H | H | H |
| | Irreversibility | M | H | H | M |
| Incompatible Grazing | Contribution | M | VH | H | H |
| | Irreversibility | M | M | M | M |
| Exotic/Invasive Species | Contribution | M | H | VH | H |
| | Irreversibility | M | M | H | H |
| Unplanned Residential and Resort Development | Contribution | H | M | M | H |
| | Irreversibility | H | VH | VH | H |
| Motorized Vehicle Use | Contribution | n/a | n/a | M | n/a |
| | Irreversibility | n/a | n/a | H | n/a |
| Altered Wildlife Use Patterns | Contribution | L | M | L | L |
| | Irreversibility | L | M | M | M |
| Climate Change | Contribution | VH | H | H | VH |
| | Irreversibility | VH | VH | VH | VH |

**Table 3.26 Low Elevation Ponderosa Pine/Western Larch Forest Threat Assessment.**

| Threats (Causes) ↓ | | Stresses (Effects) → Altered fire regime | Degradation or loss of wildlife habitat (for forest carnivores) | Altered native plant species, composition, and/or structure (limited recruitment of ponderosa pine and larch) | Altered distribution, areal extent, patch size of community types |
|---|---|---|---|---|---|
| **Incompatible Forestry Practices** | Contribution | L | VH | VH | H |
| | Irreversibility | M | M | M | M |
| **Lack of Fire** | Contribution | VH | H | H | VH |
| | Irreversibility | M | M | M | M |
| **Physical Road Issues** | Contribution | M | n/a | L | H |
| | Irreversibility | M | n/a | M | M |
| **Motorized Vehicle Use** | Contribution | L | n/a | n/a | M |
| | Irreversibility | M | n/a | n/a | M |
| **Unplanned Residential and Resort Development** | Contribution | H | H | H | H |
| | Irreversibility | VH | VH | VH | VH |
| **Climate Change** | Contribution | VH | VH | n/a | n/a |
| | Irreversibility | VH | VH | n/a | n/a |
| **Epidemic Levels of Native Insects and Pathogens** | Contribution | L | M | M | n/a |
| | Irreversibility | H | H | H | n/a |
| **Exotic/Invasive Species** | Contribution | M | M | n/a | H |
| | Irreversibility | M | M | n/a | M |

**Table 3.27 Mid to High Elevation Coniferous Forest Threat Assessment.**

| Threats (Causes) ↓ | | Stresses (Effects) → Altered fire regime | Non-functioning whitebark pine stands | Altered native plant species, composition, and/or structure | Altered distribution, areal extent, patch size of community types | Degradation or loss of wildlife habitat |
|---|---|---|---|---|---|---|
| **Lack of Fire** | Contribution | H | H | H | H | H |
| | Irreversibility | M | M | L | M | M |
| **Incompatible Forestry Practices** | Contribution | L | H | n/a | VH | H |
| | Irreversibility | M | M | n/a | M | M |
| **Physical Road Issues** | Contribution | L | n/a | n/a | L | H |
| | Irreversibility | M | n/a | n/a | M | M |
| **Motorized Vehicle Use** | Contribution | L | n/a | n/a | n/a | M |
| | Irreversibility | M | n/a | n/a | n/a | M |
| **Exotic/Invasive Species** | Contribution | L | L | VH | n/a | H |
| | Irreversibility | M | M | H | n/a | H |
| **Unplanned Residential and Resort Development** | Contribution | L | L | n/a | L | L |
| | Irreversibility | VH | VH | n/a | VH | VH |
| **Climate Change** | Contribution | VH | VH | H | n/a | n/a |
| | Irreversibility | VH | VH | H | n/a | n/a |
| **Epidemic Levels of Native Insects and Pathogens** | Contribution | L | M | L | L | L |
| | Irreversibility | H | M | H | H | H |

**Table 3.28 Grizzly Bear Threat Assessment.**

| Threats (Causes) ↓ | | Stresses (Effects) → | | | | | |
|---|---|---|---|---|---|---|---|
| | | Loss of connectivity from the COCE to other historic ranges | Degradation or loss of wildlife habitat | Loss of habitat connectivity in the Blackfoot Subbasin | Decreasing reproduction (fitness) | Loss of genetic viability | Loss of population viability |
| **Physical Road Issues** | Contribution | VH | VH | VH | n/a | VH | VH |
| | Irreversibility | H | H | H | n/a | H | H |
| **Incompatible Grazing** | Contribution | M | M | M | n/a | M | M |
| | Irreversibility | L | L | L | n/a | L | L |
| **Human-Caused Mortality** | Contribution | n/a | n/a | n/a | VH | VH | VH |
| | Irreversibility | n/a | n/a | n/a | VH | VH | VH |
| **Presence of Bear Attractants** | Contribution | n/a | n/a | n/a | M | M | H |
| | Irreversibility | n/a | n/a | n/a | M | M | M |
| **Motorized Vehicle Use** | Contribution | VH | VH | H | H | H | VH |
| | Irreversibility | H | H | M | M | M | M |
| **Mining** | Contribution | M | M | M | M | M | M |
| | Irreversibility | VH | VH | VH | VH | VH | VH |
| **Non-motorized Recreational Use** | Contribution | M | M | M | M | M | M |
| | Irreversibility | M | M | M | M | M | M |
| **Unplanned Residential and Resort Development** | Contribution | VH | VH | VH | VH | VH | VH |
| | Irreversibility | VH | VH | VH | VH | VH | VH |
| **Exotic/Invasive Species** | Contribution | n/a | H | n/a | n/a | n/a | n/a |
| | Irreversibility | n/a | VH | n/a | n/a | n/a | n/a |
| **Lack of Human Tolerance** | Contribution | H | H | H | H | H | H |
| | Irreversibility | M | M | M | M | M | M |
| **Climate Change** | Contribution | M | M | H | H | M | H |
| | Irreversibility | VH | VH | VH | VH | VH | VH |

### 3.4.3 Summary of Threats

Table 3.29 provides a synthesis of all 20 subbasin threats and illustrates the relative impact of each threat to individual targets and to the subbasin as a whole. The highest ranking threats are those that that have the greatest impact on the greatest number of conservation targets in the subbasin. Although low ranking threats may not have a large impact on the subbasin as a whole, they can have a disproportionately large impact on a single conservation target (e.g., the threat of human-caused mortality to grizzly bears).

The cumulative impact of threats results in an overall subbasin threat rank of *very high*, indicating that all of the conservation targets face some threat of degradation or destruction across portions of the subbasin over the next ten years. A *very high* rating suggests that, without conservation action, the viability of conservation targets within the subbasin will decline. This synthesis provides the foundation for development of the Blackfoot Subbasin Management Plan (Section 5.0). Conservation objectives and strategic actions outlined in the Management Plan are designed to abate the critical threats in the subbasin, thereby ensuring the long-term viability of conservation targets.

**Table 3.29 Summary of Threats to Blackfoot Subbasin Conservation Targets.**

| Targets → <br> Threats ↓ | | Native Salmonids | Herbaceous Wetlands | Moist site and Riparian Vegetation | Native Grasslands and Sagebrush Communities | Mid to High-Elevation Coniferous Forest | Low-Elevation Ponderosa Pine and Larch Forest | Rural Way of Life | Grizzly Bear | **Overall Threat Rank** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| 1 | Unplanned Residential and Resort Development | High | | High | High | Medium | Very High | Very High | High | Very High |
| 2 | Climate Change | Very High | High | High | High | High | Very High | High | High | Very High |
| 3 | Exotic/Invasive Species | High | High | Medium | High | High | High | High | Medium | High |
| 4 | Lack of Fire | | | High | High | Medium | Very High | High | | High |
| 5 | Incompatible Forestry Practices | High | Low | | | Medium | Very High | | | High |
| 6 | Physical Road Issues | High | | | | Medium | High | | High | High |
| 7 | Conversion to Agriculture | | High | Medium | High | | | | | High |
| 8 | Mining | High | | | | | | | High | High |
| 9 | Motorized Vehicle Use | | | Medium | Medium | Medium | Medium | | High | Medium |
| 10 | Incompatible Grazing | High | Medium | Medium | Medium | | | | Low | Medium |
| 11 | Drainage and Diversion Systems | High | Medium | Medium | | | | | | Medium |
| 12 | Channel Alteration | High | | Medium | | | | | | Medium |
| 13 | Epidemic Levels of Native Insects and Pathogens | | | | | Medium | High | | | Medium |

**Table 3.29 (continued).**

| Targets → / Threats ↓ | | Native Salmonids | Herbaceous Wetlands | Moist site and Riparian Vegetation | Native Grasslands and Sagebrush Communities | Mid to High-Elevation Coniferous Forest | Low-Elevation Ponderosa Pine and Larch Forest | Rural Way of Life | Grizzly Bear | Overall Threat Rank |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| 14 | Non-motorized Recreational Use | High | | | | | | | Medium | Medium |
| 15 | Existing Crop Production | | Medium | | | | | | | Low |
| 16 | Filling of Wetlands | | Medium | | | | | | | Low |
| 17 | Lack of Human Tolerance | | | | | | | | Medium | Low |
| 18 | Human-Caused Mortality | | | | | | | | Medium | Low |
| 19 | Altered Wildlife Use Patterns | | | | Low | | | | | Low |
| 20 | Presence of Bear Attractants | | | | | | | | Low | Low |
| **Threat Status for Targets and Subbasin** | | **Very High** | **High** | **High** | **High** | **High** | **Very High** | **High** | **High** | **VERY HIGH** |

### 3.4.4 Description of Threats

In the following pages, we describe 20 subbasin threats and their impacts on subbasin conservation targets. Although these threats are considered obstacles to sustaining viable occurrences of native fish, wildlife and habitats in the subbasin, they also present excellent opportunities for collaboration and conservation action. In the Blackfoot Subbasin, these types of natural and community resource challenges have historically spurred cooperation and communication to better manage and protect natural resources and rural way of life. Many of the factors considered subbasin threats (e.g., incompatible forestry practices, incompatible grazing) can, in fact, be used as progressive management tools when practiced sustainably. By embracing these opportunities, partners in the subbasin will be better able to sustain a landscape that is ecologically and socioeconomically resilient and adaptive.

#### 3.4.4.1 Unplanned Residential and Resort Development – Very High [24]

*Targets Affected:* native salmonids, moist site and riparian vegetation, native grassland/sagebrush communities, low elevation ponderosa pine/western larch forest, mid to high elevation coniferous forest, grizzly bears, rural way of life

*Description:* Community members and conservation partners recognize that development is not inherently detrimental. In fact, in portions of the subbasin, there is a critical need for sustainable development and affordable housing to support rural communities and the rural way of life. This threat refers to *unplanned* residential and resort development that is *dispersed*. Dispersed development refers to construction of structures and associated infrastructure, such as driveways and outbuildings, outside of existing towns and on lands that were previously unimpacted by permanent human habitation.

*Implications:* Disturbance from unplanned, dispersed development affects all conservation targets in the subbasin. Some of these impacts are highlighted below:

- Many new homes and resorts built in the subbasin are “view properties” situated in low and mid-elevation forests, native grassland/sagebrush communities, and riparian habitats along the Blackfoot River and its tributary streams. New construction in these areas results in direct habitat loss, fragmentation and degradation.

- When development occurs in close proximity to streams and rivers, riparian vegetation may be impaired and the natural flooding regime that helps to maintain riparian communities may be altered. Dispersed residential development can have multiple impacts on riparian communities, particularly in light of the fact that there is currently no stream setback zoning in any of the three Blackfoot Subbasin counties. Under Montana law, counties can adopt stream setback zoning ordinances, but the issue of stream setbacks is a politically charged one that invokes issues of property rights. Recent attempts to pass statewide legislation to require setbacks on certain streams failed in the

[24] Overall (subbasin-wide) threat ranks from Table 3.25 are provided next to each threat.

2009 legislature. While setbacks may be an effective way to reduce riparian encroachment, the issue is sufficiently contentious as to make this a highly uncertain remedy.

- Residential and resort development and associated human activity near streams, lakes, and rivers can also impact native salmonids. Increased water use can lead to reduced stream flows, elevated stream temperatures, and further constraints on rearing habitats and migratory corridors. In and downstream of Seeley Lake, for example, urbanization, septic systems and channel encroachment pose a direct threat to water quality and native salmonid habitat.[25] Throughout the USFWS-designated Upper Clark Fork Recovery Unit, growth and residential development are considered to be among the greatest threats to the recovery of bull trout. Impacts to spawning and rearing streams are of particular concern (USFWS 2002). Some of these impacts may be partially mitigated by an active program to acquire conservation easements to protect fragile lands in riparian zones. Missoula County subdivision regulations require developers to map areas with riparian vegetation and create a management plan for those areas (Missoula County 2008). This regulation is limited in its scope and extent in terms of protection for riparian areas and can be difficult to enforce. Missoula County Rural Initiatives is currently evaluating multiple regulatory and non-regulatory mechanisms for providing better riparian protection.[26]

- Dispersed development leads to an increase in open road density and road use. Numerous studies have shown the negative effects of open road densities on wildlife, which include wildlife displacement and increased mortality due to wildlife-vehicle collisions (Trombulak and Frissell 2000).

- Resorts, homes and associated infrastructure and human activity create new sites and new opportunities for noxious and invasive weeds, especially new invaders.

- Dispersed development results in expansion of the wildland-urban interface (WUI), or the zone where structures and other human development are within the vicinity of forests and other wildlands. Expansion of the WUI increases the threat of wildfire to human life and property, thereby increasing the demand for fire suppression and raising the cost of infrastructure for fire fighting and emergency services. Continued fire suppression is a particular threat to subbasin forest targets (especially low elevation forests where the majority of development is located) that have been altered from their historic structure and composition after ~100 years of fire suppression and logging. Where residences are dispersed throughout forest habitats, efforts to allow the natural process of fire to return, even on a small scale, are problematic. Instead, the focus shifts to reducing the threat of wildfire via pre-commercial thinning and other fuels reduction projects. This type of forest management may not generate the revenue of a commercial timber sale, and it may reduce habitat for Canada lynx and other interior forest species.

[25] There are current efforts underway to upgrade the water treatment facility in the town of Seeley Lake and to fund a wastewater treatment facility.

[26] See http://www.co.missoula.mt.us/rural/StreamProtection/index.htm for more information.

- Dispersed development leads to degradation and loss of habitat for grizzly bears, Canada lynx, wolverine, fisher and other wildlife species, many of which are nested subbasin conservation targets.[27] Riparian zones, for example, provide excellent habitat and cover for bears moving throughout the subbasin, but they are also among the most desired locations for building (Lolo National Forest 2003). For wide-ranging species, unplanned development leads to loss of habitat connectivity within the subbasin and, on a larger scale, between the Crown of the Continent Ecosystem and other historic or potential ranges. An increase in development also leads to more frequent conflicts between bears and people due in large part to the increased presence of bear attractants. Human garbage, dog food and bird seed can condition and habituate bears, leading to more interactions and conflicts with people. These factors can lead to human-caused grizzly bear mortality, which in turn results in a decrease in grizzly bear reproduction and loss of population and genetic viability.

#### 3.4.4.2 Climate Change – Very High

*Targets Affected:* native salmonids, herbaceous wetlands, moist site and riparian vegetation, native grassland/sagebrush communities, low elevation ponderosa pine/western larch forest, mid to high elevation coniferous forest, grizzly bears, rural way of life

*Description:* Climate change is caused by the emission of heat-trapping gases – mostly carbon dioxide ($CO_2$) – from vehicles, industry, power plants, and deforestation. As these gases build up, they act like a thick blanket, heating the planet, changing the climate, and threatening human health, the economy, and the natural environment. The terms *global warming* and *climate change* are often used interchangeably, but the two phenomena are different. *Global warming* is the rise in global temperatures due to an increase of heat-trapping carbon emissions in the atmosphere. *Climate change,* on the other hand, is a more general term that refers to changes in many climatic factors (such as temperature and precipitation) around the world. These changes are happening at different rates and in different ways.[28]

*Implications:* The potential impacts of climate change in the Blackfoot Subbasin are widespread. Throughout the region, warmer temperatures have already resulted in upward latitudinal and elevational movement for many insects, birds, trees and forbs. Species dependent on high-elevation habitats—islands limiting the dispersal options for many plants and animals living there—are especially vulnerable in a warming climate. The pika, a small mammal of high elevation habitats, has been shown to stop feeding at temperature thresholds now common throughout Montana summers, with even short periods of exposure to temperatures of 88 °F being directly lethal (Smith 1974). As glaciers and alpine snow fields melt in Montana, so does the specialized habitat for bird species such as the White-tailed Ptarmigan and both Black and Gray-crowned Rosy Finches. Climate change in Montana is also diminishing habitat for forest

[27] Nested subbasin conservation targets are described in Section 3.3.3.
[28] Overview of climate change is from The Nature Conservancy's Climate Change Initiative website (http://www.nature.org/initiatives/climatechange).

carnivores, such as Canada lynx, whose hunting success is associated with snow conditions that are now changing with winter warming (Stenseth et al. 2004), and for high elevation forest plants such as whitebark pine, an important food source for grizzly bears and other birds and mammals throughout the Crown of the Continent and Greater Yellowstone Ecosystems (Kendall & Arno 1990). Whitebark pine is susceptible to increased mortality as the incidence of drought, high elevation wildfire, and mountain pine beetle attacks, all associated with a warming climate, increase (Hanna et al. 2009).

A warming climate also appears to be affecting species migrations on a large scale. Over the last 40 years, during which the United States has experienced an average January temperature rise of 5 °F, 60% of bird species wintering in North America have moved northward an average of 35 miles. Northward movement was documented for 19 bird species that occur in Montana, including movement of hundreds of miles for some species (Spruce Grouse: 316 miles; Cedar Waxwing: 190 miles; Northern Flicker: 192 miles; Northern Pintail: 90 miles; Red-tailed Hawk: 82 miles). According to researchers, global warming is the only explanation for why so many birds over such a broad area are wintering in more northern locales. Since warming has been most pronounced in the north, states such as Montana have recorded an influx of more southern species and could see some northern species retreat into Canada as ranges shift (Hanna et al. 2009).

While wildfire is natural within ecological systems and favors regeneration of many native species, the intensity and frequency of fires across the landscape will likely increase due to the combined effects of warming climate and increased tree densities from fire suppression. Wildfire frequency and intensity have already increased in the northwest United States, and nearly all climate projections predict that this fire trend will continue and increase. Insect infestations, such as those of the mountain pine bark beetle, will likely increase over time (ISAB 2007), which will kill more trees and increase combustible fuels.

Very little is known about how climate change will affect vegetation communities. New research in the western United States suggests that, in some cases, climate change may cause a shift in dominance toward invasive species while in other cases, climate change may lead to a retreat of some invasive species (Bradley et al. 2009).

Changes in hydrology and temperature may negatively affect stream habitats and aquatic species. This is especially true for salmonid species. Several projections of the potential impact of climate change on cool and cold water fishes have been completed. One of these analyses suggests that temperature increases alone will render 2% to 7% of current trout habitat in the Pacific Northwest unsuitable by 2030, 5% to 20% by 2060, and 8% to 33% by 2090 (Kinsella 2008, ISAB 2007). In the Columbia Basin, recent projections of the loss of suitable bull trout habitat as a result of climate warming range from 22% to 92% (ISAB 2007). Climate change has the potential to affect most freshwater life history stages of bull trout and other fall-spawning species. Increased frequency and severity of flood flows during winter can affect over-wintering juvenile fish and incubating eggs in the streambed. Eggs of fall-spawning fish such as bull trout suffer an increased risk of mortality from winter flooding and fry run the risk of premature emergence during warmer winters (ISAB 2007).

Although climate change ranks among the highest threats to subbasin conservation targets, the subbasin technical work groups elected not to focus specific strategic actions on abating this threat. Rather, through subbasin planning, our goal is to build resilience in ecological systems and communities throughout the subbasin so that, even as climate conditions change, the subbasin may support its full range of native biodiversity and ecological processes. Building resilience includes maintaining intact, interconnected landscapes and restoring fragmented or degraded habitats. For the most part, the threat of climate change originates outside of the subbasin and will therefore require large-scale (or landscape level) solutions that extend beyond subbasin boundaries (see *External Threats* in Section 3.4.5).

### 3.4.4.3 Exotic/Invasive Species – High

*Targets Affected:* native salmonids, herbaceous wetlands, moist site and riparian vegetation, native grassland/sagebrush communities, low elevation ponderosa pine/western larch forest, mid to high elevation coniferous forest, grizzly bears

*Description:* Since European settlement, many non-native species have been introduced to the Blackfoot Subbasin. These exotic species represent a variety of life forms and affect multiple conservation targets. In their native habitats, plant and animal populations are kept in check by predators, food supply and other natural controls. However, when a species is introduced (accidentally or intentionally) into a new landscape, it has the potential to spread unchecked, displacing native species and causing ecological disruption. All habitats are vulnerable to these invasions, from grasslands and forests to lakes, rivers and wetlands. Invasive species damage the lands and waters that native plants and animals need to survive, as well as local economies. Worldwide, the estimated damage from invasive species totals more than $1.4 trillion – five percent of the global economy.[29] In the Blackfoot, existing invasive species must be aggressively managed to limit impacts to conservation target species and communities. At the same time, the potential for new invaders in the subbasin must be mitigated through preemptive actions.

*Implications:* The implications of exotic and invasive species in the subbasin vary depending on the invader and the conservation target species or community affected. Significant invaders (and potential invaders) in the Blackfoot Subbasin are discussed below.

<u>Non-native fish species</u>
Introduction of non-native fish species in rivers, streams, and lakes in the Blackfoot Subbasin poses great concern for the viability of native salmonids and aquatic ecosystems. The tools available to mitigate this threat are limited and, in many cases, there is strong public opposition to controlling or eliminating fish (salmonids, in particular) that are considered valuable for sport fisheries. Still, this issue is a high priority: intact native fish ecosystems are increasingly rare and substantial resources must be allocated to protecting and restoring those that remain (USFWS

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[29] Information on worldwide impacts of invasive species is from The Nature Conservancy's Invasive Species Initiative website: http://www.nature.org/initiatives/invasivespecies.

2002). Background information on non-native fish in the Blackfoot Subbasin is provided in Section 3.2.6.3. A brief discussion of the threats associated with each species is provided below.

*Brook trout:* Brook trout have vastly increased their distribution and abundance and now pose a threat to native cutthroat trout and bull trout. Brook trout have replaced populations of both species in certain waters (Rieman et al. 2006, Dunham et al. 2002, Leary et al. 1983).

*Brown trout:* Brown trout are suspected to adversely affect bull trout (Pratt and Huston 1993), although the nature of the negative interaction between bull trout and brown trout, which is thought to include elements of competition and predation, is not well understood. Recent work in Japan shows that brown trout can hybridize with chars closely related to bull trout (Kitano et al. 2009); a result that could lead to further erosion of reproductive potential in depressed bull trout populations. The influence of habitat improvement efforts in the Blackfoot Subbasin on the relative abundance of brown trout and bull trout is being investigated under the current MFWP monitoring program (Pierce et al. 2004, Pierce and Podner, 2006, Pierce et al. 2008). These investigations suggest that both westslope cutthroat trout and bull trout are expanding and brown trout are declining in certain streams where restoration actions have led to suitable habitat conditions for native fish. Angling regulations in the Blackfoot Subbasin have been liberalized to focus angler harvest on brown trout.

*Rainbow trout:* Hybridization with rainbow trout is believed to be the greatest threat across the range of native westslope cutthroat trout (Behnke 2002). Hybridization has occurred primarily in the lower Blackfoot Subbasin within the range of naturalized rainbow trout (Pierce et al. 2008). In a recent study, hybrid offspring of rainbow trout and westslope cutthroat trout were shown to have dramatically reduced reproductive success (Muhlfeld et al. 2009).

*Asian carp:* All four species of Asian carp (bighead, black, grass, and silver) listed as Priority Class 1 Aquatic Nuisance Species[30] in Montana grow quickly and feed voraciously on a variety of aquatic species including mollusks, aquatic insects, and plankton. The impacts of Asian carp in the United States vary by species, but are likely to include competition with native species for food resources, eliminating vegetation, increasing nutrients, eradicating habitat for native fishes and impacting native mussel and snail populations.

*Other Fish:* MFWP no longer stocks largemouth bass (or other warmwater fish) within the Blackfoot Subbasin and only plants arctic grayling and kokanee salmon on a very limited basis. Interactions between largemouth bass and native salmonids are unknown. Illegal stocking of northern pike, yellow perch and walleye has occurred in the Blackfoot Subbasin, and poses a significant risk to native species in some areas including the Clearwater lakes (MBTSG 1995, USFWS 2002).

[30] Priority Class 1 Aquatic Nuisance Species are currently not known to be present in Montana but have a high potential to invade. There are limited or no known management strategies for these species. Appropriate management for this class includes prevention of introductions and eradication of pioneering populations (see Section 3.2.6.3).

Non-native invertebrates[31]

Only one of the species listed in this section (New Zealand mudsnail) is currently found in Montana, and none of these species are currently found in the Blackfoot Subbasin. Although the likelihood of introduction varies by species, all have the potential to be introduced to the state and to the subbasin and therefore warrant attention as potential threats to the viability of native salmonids and aquatic systems in the subbasin.

*New Zealand mudsnail*: New Zealand mudsnails degrade habitat due to their high reproductive capacity and the subsequent impacts on invertebrate food sources. Abundant snail populations may outcompete other grazers and inhibit colonization by other macroinvertebrates. Effects of the New Zealand mudsnail on native aquatic invertebrates are being documented in the Madison River and in Darlington Ditch, a small stream along the lower Madison River (Montana ANS Technical Committee 2002).

*Mud bithynia/faucet snail:* The mud bithynia has been known to reduce species richness of mollusks in Oneida Lake, NY, although it also decreases in abundance after colonization by invasive zebra mussels. It has also been known to infest municipal water supplies.

*Zebra and quagga mussel*: In addition to their fouling impacts on human infrastructure (e.g., colonizing and restricting water flow in water supply pipes, engine cooling systems, irrigation systems and fishing gear), zebra and quagga mussels can have severe impacts on the ecosystems they invade by filtering substantial amounts of phytoplankton and suspended particulates from the water. Water clarity increases with filtration, causing an increase in light penetration and a proliferation of aquatic plants that can change species dominance and alter the entire ecosystem. Ecological effects radiate throughout the aquatic system, including impacts to macroinvertebrates and fish. Although zebra and quagga mussels are not currently present in Montana, they could easily survive overland transport to Montana while attached to boat hulls or in live wells, engine cooling systems or bait buckets. In the western United States, zebra and quagga mussels have significant potential to disrupt irrigation systems, fish passage facilities, and cause ecological and economic damage (Montana ANS Technical Committee 2002).

Non-native parasites/pathogens

Whirling disease is a current threat to aquatic systems in the Blackfoot Subbasin. Whirling disease affects fish in the trout and salmon family. By damaging cartilage, whirling disease can kill young fish directly, or cause diseased fish to swim in an uncontrolled whirling motion. This can make it impossible for them to escape predators or to effectively seek food. Habitat for the intermediate host worm (*Tubifex tubifex*) is associated with areas of fine sediment and warm water temperatures. Mainstem and lower tributary areas appear to be the most vulnerable sites, although the distribution of suitable habitat might expand through further habitat degradation and warming linked to reduced stream flows and climate change. Once established in a stream, the parasite cannot be eradicated, nor can its intermediate host, without significantly damaging the ecosystem (Pierce et al. 2008, Montana ANS Technical Committee 2002).

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[31] Information on non-native invertebrates, parasites, and pathogens is from the USGS Nonindigenous Aquatic Species fact sheets (http://nas.er.usgs.gov) and the Montana ANS website (http://fwp.mt.gov/fishing/fishingmontana/ans).

Other parasites and pathogens listed in Section 3.2.6.3 do not currently exist in Montana but warrant careful attention to avoid potential introduction. More information is available on the Nonindigenous Aquatic Species fact sheets (http://nas.er.usgs.gov/).

Non-native plants

Among the noxious weeds present in the Blackfoot Subbasin, some, such as spotted knapweed, infest tens of thousands of acres. Others, such as leafy spurge, are limited in their geographic distribution but are nearly impossible to eradicate due to their extensive root systems and herbicide resistance. A detailed discussion of non-native plants in the Blackfoot Subbasin is provided in Section 3.2.7.3. Appendix G provides a list of weeds classified by the State of Montana as "noxious." Table 3.7 lists noxious weeds established in the Blackfoot Subbasin. Table 3.8 lists well-known weeds with high potential to become problem plants in the subbasin, and Table 3.9 includes an alert list for recently invading or less well-known weeds, along with risk ratings for Blackfoot Subbasin habitats.

Tame, naturalized pasture grasses fall into a category of "quasi-desirable" non-native plants. They are valuable for agriculture and are routinely planted for such purposes. Several of these species, however, such as Kentucky bluegrass and smooth brome, are sod-forming and spread aggressively into grassland and wetland communities where they compete for resources with native species. Another highly invasive species affecting wetlands is reed canarygrass, although authorities question whether reed canarygrass is native or non-native to this region.

Although not classified as a noxious weed in Montana, cheatgrass is a weed of concern in many parts of the state, including the Blackfoot Subbasin. In recent years, cheatgrass has established and spread on undisturbed, dry, scabby sites across low elevations in the subbasin. Cheatgrass is only palatable to livestock during a very short period in the spring. It is extremely flammable and therefore a significant fire hazard. In many situations, cheatgrass can impose significant economic costs, reducing crop yields and lowering weight gain of grazing livestock.

The spread of exotic plants into subbasin plant communities alters species composition and structure and, in many cases, degrades habitat for wildlife. Forest management activities such as timber harvest and road building can disturb soils, particularly at low elevations, and increase the spread and establishment of invasive species in these forests. Improper herbicide application may also impact native plant communities and water quality. Managing invasive species drains resources away from ranches and farms, impacting the rural way of life in the Blackfoot Subbasin.

The spread of non-native aquatic plants can also cause significant economic and ecological problems. Non-native plants that colonize aquatic communities compete with and often displace native species. Hydrilla and Eurasian watermilfoil, for example, are both well known for their ability to alter physical and biological functions of aquatic systems. Emergent species such as purple loosestrife reduce wildlife cover and habitat. Saltcedar degrades wetlands, completely drying up some lakes, ponds and river areas. Although none of these plants is currently present in the Blackfoot Subbasin, all have the potential to be introduced and therefore warrant attention as potential threats to the viability of native plants and plant communities in the subbasin. Pathways for introduction of aquatic plant species include boats and trailers, the aquarium trade, nursery and garden centers, and mail order and internet suppliers (Montana ANS Technical Committee 2002).

White pine blister rust

White pine blister rust, a disease caused by the non-native fungus *Cronartium ribicola*, poses a major threat to high elevation whitebark pine stands and their ecosystems. The rust fungus was introduced in shipments of nursery stock from Europe to the United States and Canada in the late 1800s and early 1900s (Hoff & Hagel 1989, USDA Forest Service 1991). The fungus thrives in cool, wet environments and attacks whitebark pine and other five-needle pine species across their ranges, causing galls that eventually girdle branches and stems. Gooseberry and currant species serve as alternate hosts.

An estimated 80% to 90% of whitebark pines in Glacier National Park and the Bob Marshall Wilderness area, just north of the Blackfoot Subbasin, are infected with blister rust (Schmidt 1992). In the Blackfoot Subbasin, whitebark pine occupies only an estimated five percent of the total forest cover. This limited distribution makes it a high conservation priority. Whitebark pine seeds are an important dietary component for many species of birds and mammals (Kendall & Arno 1989, Schmidt 1992, Reinhart et al. 2001). For grizzly bears, seasonal variation in food supply can influence mortality. In Yellowstone National Park, variation in seasonal production of whitebark pine seed was correlated with grizzly bear mortality. Grizzly bear deaths nearly doubled during years when whitebark pine seed crops failed, causing bears to forage in lower elevations that are often dominated by human uses and contain attractants that can lead to an increased frequency of contact with humans, conflicts, and eventual mortality (Pease and Mattson 1999).

Different approaches have been used to address white pine blister rust, including breeding of rust-resistant seedlings (Neuenschwander et al. 1999, Sniezko et al. 2000, Hunt 2002) and gooseberry and current eradication programs in eastern forests (Tainter & Baker 1996). Because whitebark pine is not a commercially important species for timber, however, it has not received much attention in terms of resistance breeding (Campbell 2004).

### 3.4.4.4 Lack of Fire – High

*Targets Affected:* moist site and riparian vegetation, native grassland/sagebrush communities, low elevation ponderosa pine/western larch forest, mid to high elevation coniferous forest

*Description:* Federal and state land management agencies have been very successful at suppressing wildfires throughout the United States for over 100 years. In the Blackfoot Subbasin, the lack of fire has impacted a range of vegetation communities, from the prairie-dominated lowlands to high elevation coniferous forests. The lack of fire in these communities has contributed greatly to altered plant species composition and structure as well as altered and degraded wildlife habitat.

*Implications:* Fire suppression has affected vegetation target communities throughout the Blackfoot Subbasin. A discussion of the effects of fire exclusion on subbasin targets is provided in individual conservation target descriptions (Sections 3.3.3.4-3.3.3.6). To summarize, fire exclusion in low elevation ponderosa pine/western larch forests, in combination with timber harvest practices over the past century, has greatly altered forest species composition, age class distribution, and structure. In the absence of fire, many low elevation forests in the Blackfoot Subbasin are characterized by closely-spaced, small diameter trees. Increased tree density in forest stands leads to water stress, increased susceptibility to insects, diseases, and stand-replacing fires, and generally reduced resiliency of trees.

Because the historic fire return interval is longer in mid to high elevation coniferous forests than in low elevation ponderosa pine/western larch forests, lack of fire in this forest type has not had as drastic an effect on stand composition. Lack of fire (in combination with timber harvest) has, however, significantly altered the historic age class distribution, structure, patch size and distribution of mid to high elevation coniferous forest stands. Historically, fire created a mosaic of forest patches of various size and age classes across the landscape. Without this natural disturbance process, patches have become larger and more uniform.

Severe fire was likely a component of the historic fire regime in both low and mid to high elevation coniferous forests (Hutto 2008). Fire exclusion, however, has permitted a buildup of forest fuels (both downed woody debris and ladder fuels) so that much larger expanses of forest are susceptible to stand replacing fires. Some areas have also become more susceptible to insect infestations in the absence of fire. In high elevation coniferous forests, whitebark pine stands infected with white pine blister rust are more susceptible to wildfire.

Historic fire regimes in native grassland/sagebrush communities were also characterized by frequent, low to moderate severity fires (Morgan et al. 1998). In the absence of frequent wildfires, native grassland/sagebrush communities are lost to conifer encroachment. Some types of moist site and riparian vegetation, most notably quaking aspen stands, are rejuvenated or even established by fire. In the absence of periodic fires, these aspen stands grow decadent, exhibit poor clonal regeneration, and may eventually be encroached upon and replaced by other woody plant species, particularly conifers.

### 3.4.4.5 Incompatible Forestry Practices – High

*Targets Affected:* native salmonids, herbaceous wetlands, low elevation ponderosa pine/western larch forest, mid to high elevation coniferous forest

*Description:* Forestry has been a dominant land use in the Blackfoot Subbasin for over 100 years. Many drainages in the subbasin have been logged. Incompatible forestry practices with impacts on forest, riparian and aquatic habitats include road construction, log skidding, harvest in riparian areas, clear-cutting, terracing and log drives on the Blackfoot and Clearwater Rivers (MBTSG 1995, USFWS 2002). Although these activities occurred predominantly in the past, present activities occasionally exacerbate historical problems. For over 10 years, public land management agencies and industrial timber companies have followed Forest Best Management Practices (BMPs) mitigating many of these resource impacts.

*Implications:* Over 100 years of logging in low elevation ponderosa pine/western larch forests and mid to high elevation coniferous forests has resulted in the removal of many large diameter trees and an overall shift in forest structure, composition and age class distribution away from the historic range of conditions. In aquatic communities, the impacts of past forestry practices include increased sediment in streams, increased peak flows, hydrograph and thermal modifications, loss of instream woody debris and channel stability, and increased accessibility for anglers and poachers (USFWS 2002). Impacts associated with past forestry practices are major contributing causes of bull trout decline. Silvicultural impairment to water quality has been noted in the following drainages (MDHES 1994, USFWS 2002):

| | | |
|---|---|---|
| Bear Creek | Belmont Creek | Black Bear Creek |
| Blanchard Creek | Blanchard Creek | Braziel Creek |
| Buffalo Gulch | Camas Creek | Chamberlain Creek |
| Cottonwood Creek | Deer Creek | Dunham Creek |
| East Fork Ashby | Elk Creek | Gallagher Creek |
| Jefferson Creek | Keno Creek | Marcum Creek |
| McElwain Creek | Monture Creek | Murray Creek |
| Poorman Creek | Richmond Creek | Rock Creek |
| Union Creek | Upper Nevada Creek | Wales Creek |
| Ward Creek | Warren Creek | Washington Creek |
| Washoe Creek | West Fork Ashby | Yourname Creek |
| North Fork Blackfoot | West Fork Clearwater | Blackfoot River (Landers Fork to Monture Creek) |

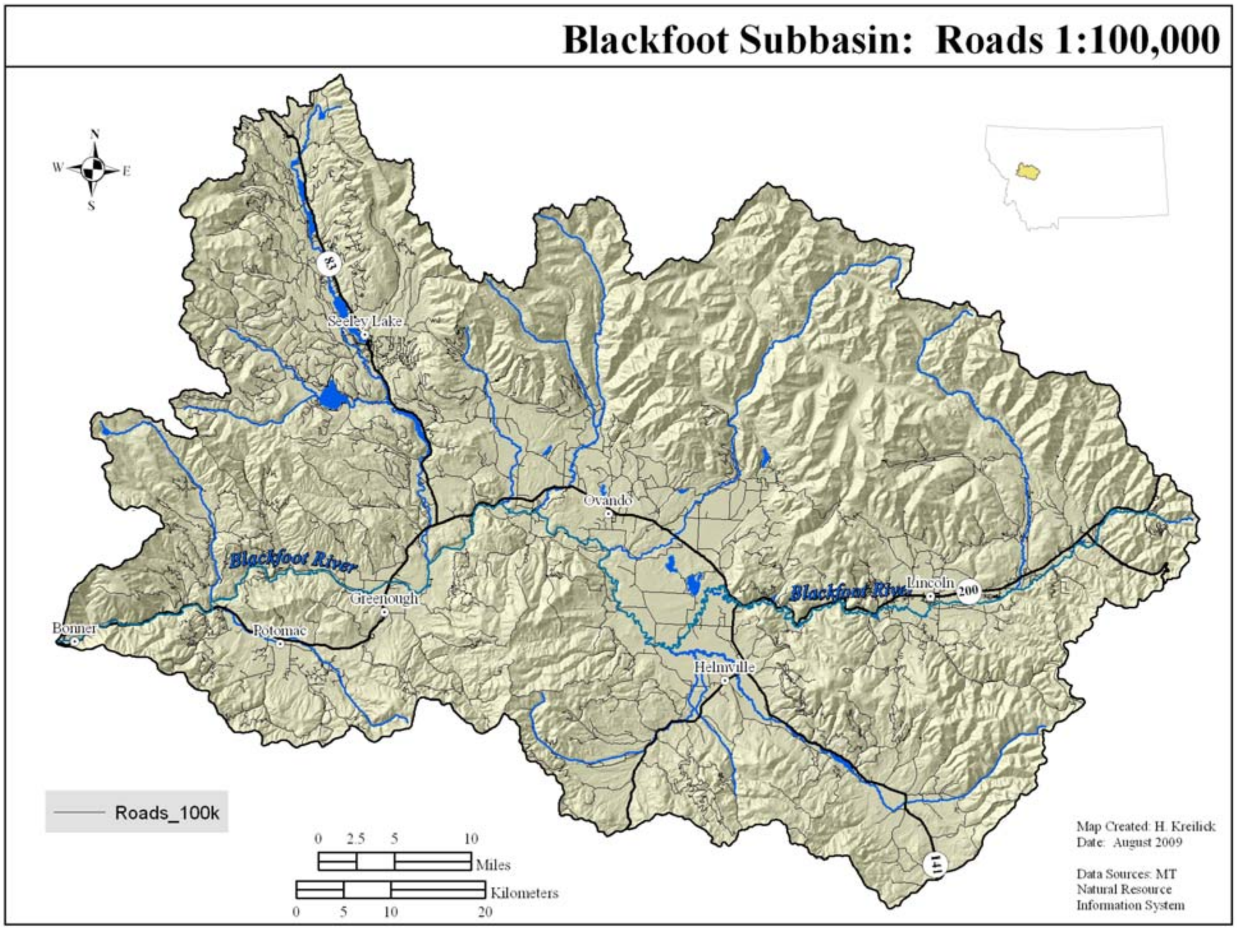
Current forestry practices can also negatively impact terrestrial and aquatic habitats in the subbasin. Current forestry practices to reduce the risk of fire in the wildland-urban interface, for example, can negatively affect subbasin forest types if they do not follow an ecosystem restoration prescription. Impacts of current forestry practices on herbaceous wetlands include piling slash in wetlands, road building in and near wetlands, failure to maintain buffers around wetlands and driving through wetlands. These activities are prohibited by Forest BMPs; however some may still occur on private lands.

### 3.4.4.6 Physical Road Issues – High

*Targets Affected:* native salmonids, low elevation ponderosa pine/western larch forest, mid to high elevation coniferous forest, grizzly bears

*Description:* Roads and road density are key factors affecting both terrestrial and aquatic systems in the Blackfoot Subbasin. Although the Blackfoot Subbasin includes substantial roadless areas, including parts of two federally-designated Wilderness areas, portions of the subbasin have extensive road networks associated mainly with past timber harvesting on national forest and private timber company lands (Figure 3.35). The Highway 200 corridor along the mainstem Blackfoot River and the associated county road system are also key parts of the subbasin road network. As new homes are built away from the main highway corridor, the subbasin road network expands, impacting water quality, wildlife and weed management. For the purposes of the Blackfoot Subbasin Plan, this threat refers to the physical presence of roads. The impacts of road use on subbasin conservation targets are addressed in the *motorized vehicle use* threat.

**Figure 3.35 Roads 1:100,000.**




*Implications:* High road density is correlated with declines in aquatic habitat quality and native salmonids (USFS 1996). Road construction methods during the late 19th and early 20th centuries that involved stream/river channelization and straightening negatively affected aquatic habitat in the subbasin. Today, there are significant legacy effects of old roads including passage barriers, sediment production and unstable slopes (USFWS 2002). In addition, insufficient funding to maintain the existing road system has resulted in maintenance deficiencies, even on some well-designed roads, compounding the impacts of the existing road system (MDHES 1994, USFWS 2002).

Roads negatively affect water quality through chronic erosion of road surfaces and episodic failures of culverts at road-stream crossings that result in road sediments washing into streams (Lolo National Forest 2003). Improperly designed or installed culverts create barriers to the movement of aquatic organisms and water and other natural materials, fragmenting and isolating populations, limiting access to spawning and rearing habitat, and altering the character of channels and associated habitats. Channel incisement associated with roads can also limit habitat access and impair habitat quality. Threats to native salmonids and aquatic habitat associated with Highway 200 and other heavily used roads in the subbasin include the risk of toxic spills and impacts associated with road grading, sanding, deicing and other road maintenance activities (USFWS 2002).

Roads and development are inextricably linked: roads facilitate new development and new development leads to expansion of the road network. The dispersed subbasin road network fragments forest habitat and facilitates the spread of noxious weeds. Habitat fragmentation by roads negatively impacts grizzly bears, bull trout, westslope cutthroat trout and other wide-ranging animals in the subbasin (e.g., Canada lynx, fisher, wolverine and gray wolf), leading to direct loss of habitat, loss of habitat connectivity within the subbasin and between the subbasin and adjacent habitats, and, ultimately, decreased population viability.

Impacts of roads on grizzly bears include: 1) direct mortality (collisions and human-caused death from encounters through an increase in the frequency and lethality of contact between people and bears), 2) displacement, 3) habituation and 4) habitat perforation and fragmentation. In the Blackfoot Subbasin, the presence of attractants for grizzly bears includes garbage at rest stops and homes, road-killed big game, tractor trailer food-cargo spills and roadside/highway-enhanced vegetation such as berries and grass. These food sources increase the susceptibility of grizzly bears to direct highway mortality. There have been three documented road-killed grizzlies in the Blackfoot Subbasin, one possible road-kill, several reports of collisions, and multiple reports of near misses (J. Jonkel, pers. comm.). The threat of vehicle mortality has widespread implications for grizzly bear reproduction, large-scale habitat connectivity and genetic viability.

### 3.4.4.7 Conversion to Agriculture – High

*Targets Affected:* herbaceous wetlands, moist site and riparian vegetation, native grassland/sagebrush communities

*Description:* Agriculture is a critical component of the Blackfoot Subbasin economy. Ranchers play a vital role in conserving natural resources and the rural way of life in the subbasin. Roughly 14.5% of the total acreage in the Blackfoot is used for agriculture with livestock grazing characterizing the most common agricultural practice. This threat refers specifically to *new plowing and draining* in critical habitats within the Blackfoot Subbasin. Due to the conservation and restoration partnerships that started in the 1990s in the subbasin, new plowing and draining in critical habitats rarely occurs on private lands. The threat is listed as high to reinforce the implications listed below.

Implications: Conversion of ecologically critical habitats to agriculture results in habitat loss and degradation. In herbaceous wetlands, draining often occurs, altering the surface and groundwater regimes that sustain these communities. Agricultural activity in or near riparian zones can result in bank destabilization, elevated water temperatures and increased sediment loads, among other problems (MBTSG 1995, USFWS 2002). Conversion to agriculture can also result in displacement of wildlife. The conversion of native grassland/sagebrush communities to agriculture, for example, is the primary factor responsible for the rangewide reduction in Columbian Sharp-tailed Grouse populations (Ulliman et al. 1998, PIF 2000).

### 3.4.4.8 Mining – High

*Targets Affected:* native salmonids, grizzly bears

*Description:* Numerous mines have been developed in the southern and eastern portions of the Blackfoot Subbasin. Mining in the headwaters of the Blackfoot River began in the mid-1800s. A variety of minerals including gold, silver, lead and copper were recovered from numerous small placer and hard rock mining operations (USFWS 2002). The Mike Horse Mine was the largest of several mines in the Heddleston District located between Lincoln and Rogers Pass. It produced gold, silver and lead during the first half of the 1900s. Continued exploration of the area after the Mike Horse Mine was closed in 1955 revealed a large deposit of copper and molybdenum. The Mike Horse tailings dam breached in 1975, resulting in acute and chronic contamination of the upper Blackfoot River (Stratus Consulting 2007), collapse of fisheries (Spence 1975, Peters and Spoon 1989, Pierce and Podner 2000, Pierce et al 2008), downstream movement of heavy metals, and biological uptake of toxins within the aquatic food web (Moore et al. 1991). The headwaters location of the mine and the toxic nature of existing contaminants continue to pose significant ecological risks to the mainstem Blackfoot River (Stratus Consulting 2007). The Heddleston Mining District has been the focus of some mine reclamation activity since 1993 (MDEQ 2003), although these have not addressed the ecological risks to the Blackfoot River (Stratus Consulting 2007).

The potential exists for new mining activity in the Blackfoot Subbasin. A large open-pit gold mine (the McDonald Gold Project) was proposed near Lincoln, but blocked by a 1999 state law resulting from a successful citizen-sponsored ballot initiative prohibiting new cyanide heap leach mining projects (USFWS 2002).

*Implications:* The legacy effect of past mining activities continues to impact aquatic habitat and fisheries in the subbasin. Impacts include the direct loss of aquatic habitat and, particularly in the upper portions of the drainage, chemical contamination. Mine drainage continues to contaminate waters in the Blackfoot Subbasin headwaters (Spence 1975, MBTSG 1995, Stratus Consulting 2007), although inflows of limestone groundwater below Lincoln enhance the river's buffering capacity against changes in pH and the effects of metals (Ingman et al. 1990). Impairment to water quality from mining activities has been noted in the following drainages (MDHES 1994, USFWS 2002, Pierce et al. 2008):

| | | |
|---|---|---|
| Blackfoot River (headwaters to Nevada Creek) | Beartrap Creek | Buffalo Gulch |
| Day Gulch | Douglas Creek | East Fork Ashby Creek |
| Elk Creek | Gleason Creek | Humbug Creek |
| Jefferson Creek | Keep Cool Creek | Mike Horse Creek |
| Moose Creek | Poorman Creek | Sandbar Creek |
| Sauerkraut Creek | Seven Up Pete Creek | Stonewall Creek |
| Union Creek | Upper Nevada Creek | Washington Creek |
| Washoe Creek | West Fork Ashby | Willow Creek |

Any new mining activity in the Blackfoot Subbasin could pose a threat to native salmonids and aquatic habitat. New mining activity in the subbasin could also negatively affect grizzly bears. Depending on the size and type of mining operation, negative impacts could include: 1) direct habitat loss, 2) habitat degradation, 3) displacement of grizzly bears, 4) increased risk of habituation/food conditioning at the mine site (depending on how attractants are managed) and 5) cumulative negative impacts resulting from increased human population growth, development and recreation pressure in grizzly bear habitat.

### 3.4.4.9 Motorized Vehicle Use (On and/or Off Road) – Medium

*Targets Affected:* herbaceous wetlands, moist site and riparian vegetation, native grassland/sagebrush communities, low elevation ponderosa pine/western larch forest, mid to high elevation coniferous forest, grizzly bears

*Description:* Motorized vehicle use is one of many current uses in the subbasin. In particular, snowmobile, ATV and motorcycle use provide not only opportunities for recreation, but are also travel methods for private and public land managers and contractors accessing more remote areas. This threat primarily addresses motorized vehicle use on subbasin roads that have not been designated for public or administrative use as well as off-road motorized vehicle use. Impacts associated with the physical road network are described in Section 3.4.4.6.

*Implications*: Motorized vehicle use can directly impair vegetation communities, particularly off-road use in sensitive riparian areas, wetlands, grasslands and other plant communities. Use of motorized water craft in larger lakes and ponds may negatively impact Common Loons (a Species of Concern in Montana) and other wildlife. Motorized boats facilitate the spread of non-native species (invertebrates, plants and sometimes fish), cause erosion from their wake and can contribute to the petrochemical pollution of waters. Motorized vehicle use (both on and off-road) can also facilitate the spread of noxious weeds into native grasslands, forests and other plant communities and promote erosion and sedimentation in wetland and aquatic habitats.

Both on and off-road motorized vehicle use can result in disturbance to wildlife. Road density is usually higher at low elevations where grizzlies are concentrated in the spring. Road access management decisions, therefore, can impact grizzly bears (Lolo National Forest 2003). Roads open to vehicle travel, especially during the spring, can displace grizzly bears, resulting in impairment of grizzly bear breeding and feeding. Road access can increase the frequency and lethality of contact between grizzlies and people. Hunting, ATV recreation and recreational road use by people who may be armed increases the probability that people will kill bears through: 1) self-defense killing from real or perceived risk of injury by bears, 2) malicious killing, and 3) mistaken identity killing of grizzly bears by black bears hunters. In some situations, private and public partners are employing increased human presence as a tool to deter grizzly and/or wolf-human conflicts.

Snowmobile trails are used by local clubs for recreation. Most large groups practice riding between communities and stay on the trails. In some areas, potential (and generally unintended) disturbance-related effects of snowmobile activity on grizzly bears include: 1) in-the-den disturbance, 2) disturbance at den emergence, 3) disturbance post emergence and 4) displacement from suitable denning habitat (Craighead and Craighead 1972). Potential impacts of snowmobile activity on Canada lynx include: 1) improved winter access and increased trapping mortality and 2) increased competition by bobcats and coyotes facilitated by compacted snowmobile trails (Ruediger et al. 2000). Potential impacts of snowmobile activity on wolverines include: 1) disturbance at the natal den and subsequent loss of recruitment and 2) improved access that facilitates increased take of legally trapped wolverines (Lolo National Forest 2000).

### 3.4.4.10 Incompatible Grazing – Medium

*Targets Affected:* native salmonids, herbaceous wetlands, moist site and riparian vegetation, native grassland/sagebrush communities, grizzly bears

*Description:* For centuries, grazing by ungulates (bison, deer, and elk) and livestock (cattle and sheep) has been a dominant land use and management tool in the Blackfoot Subbasin. Today, land managers recognize the important connections between grazing and vegetation management. Public and private landowners in the subbasin are experimenting with rest-rotation and temporary and permanent fencing practices to manage for healthy vegetation and reduce noxious weeds. One ranch has been using goats and sheep to reduce spotted knapweed for nearly 10 years. The threat of *incompatible* grazing includes such practices as overgrazing by both ungulates and livestock, locating cattle feed lots and calving yards along streams, and accessibility of calving yards to grizzly bears.

*Implications:* Historical cattle grazing in the Blackfoot Subbasin is a significant cause of bull trout decline. Although grazing impacts have decreased in recent years as a result of cooperative efforts between landowners and agencies, 65 streams or stream reaches in the Blackfoot Subbasin are still impacted by grazing practices or cattle feedlots (Pierce et al. 2008). Livestock grazing is of particular concern to native salmonids where allotments are located along spawning and rearing streams (USFWS 2002).

Loss of riparian vegetation due to excessive livestock grazing can result in reduced stream bank stability, increased erosion and sedimentation, and elevated water temperatures (Rieman and

McIntyre 1993, Ehrhart and Hansen 1998). Rieman and McIntyre (1993) concluded that temperature is a critical habitat characteristic for bull trout. Temperatures in excess of 59 °F are thought to limit bull trout distribution in many systems (Fraley and Shepard 1989). Excessive livestock grazing in riparian areas can also result in over-widened and unproductive stream habitat. Excessive livestock browsing of deciduous woody species in moist site and riparian vegetation communities can result in a lack of recruitment in young age classes and deviation from historic community composition and structure.

Incompatible grazing practices may also contribute to the spread of non-native species in native grassland/sagebrush communities, herbaceous wetlands, moist site and riparian communities, and other plant communities. Habitat degradation, including loss of native plant species diversity, can increase with season-long grazing or other incompatible grazing strategies. Overgrazing in uplands can result in reduced residual cover for nesting birds.

The major impact of incompatible livestock practices on grizzly bears is site conflicts resulting from access to calving yards, livestock feed and other livestock-related attractants (e.g., crystal licks, molasses licks, granaries). Such site conflicts often result in death to bears, particularly when repeated conflicts occur. Livestock operations that maintain large blocks of open rangeland can provide many benefits to the long-term conservation of grizzly bears, not the least of which is the maintenance of open space and habitats that support a wide variety of wildlife, including grizzlies. At the same time, livestock operators can suffer losses from bear depredation. These losses tend to be directed at sheep, calves and sometimes apiaries (MFWP 2006).

### 3.4.4.11 Drainage and Diversion Systems – Medium

*Targets Affected:* native salmonids, herbaceous wetlands, moist site and riparian vegetation

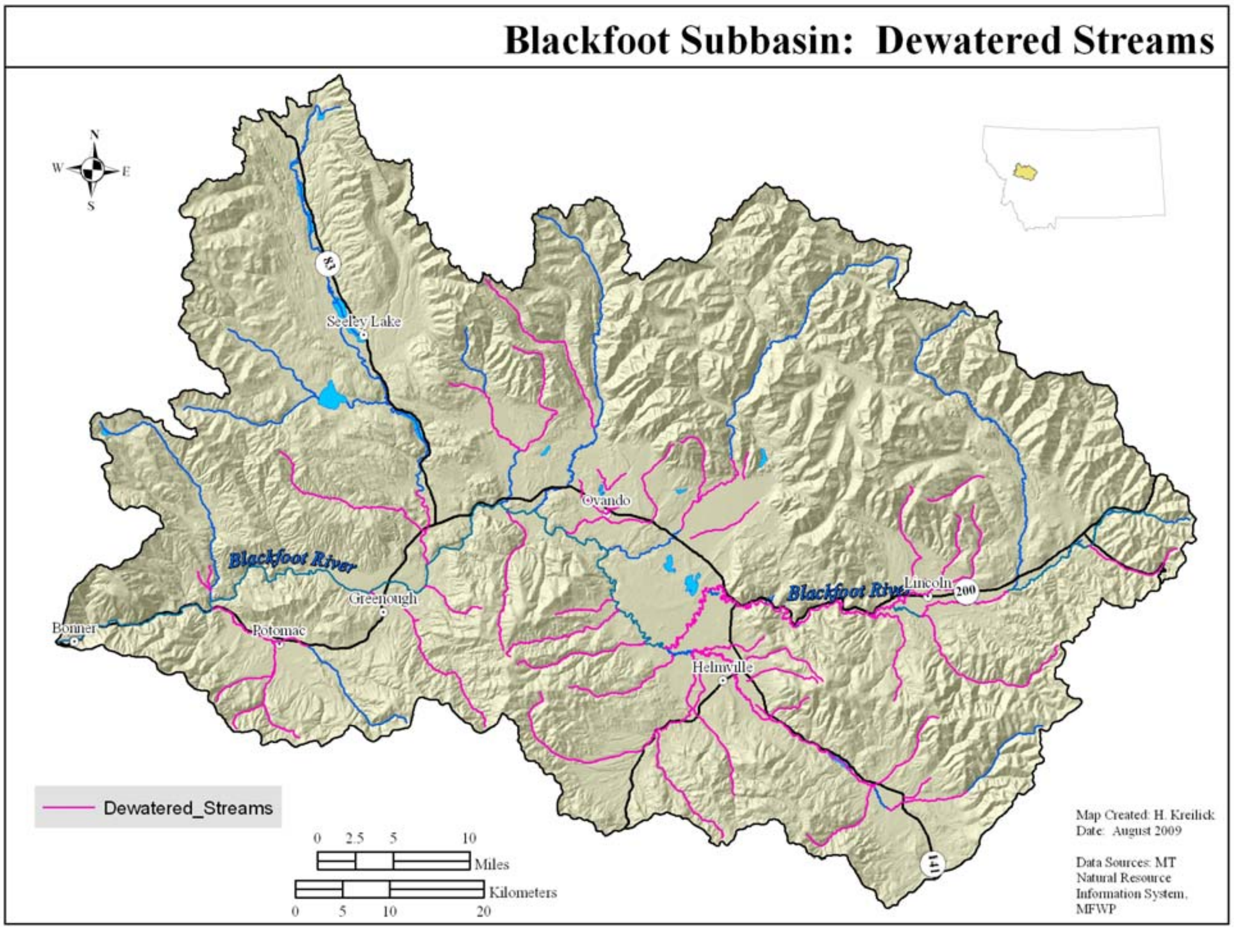
*Description:* Stream dewatering occurs naturally but is exacerbated in many cases by human activity. Drainage and diversion systems impact aquatic, wetland and riparian communities by altering the surface and groundwater flows that sustain them. Water is diverted from the Blackfoot River and its tributaries primarily for crop and livestock production. Coupled with the effects of an extended drought, stream dewatering is of great concern to both fisheries and water quality in the subbasin (BC 2005a).

*Implications:* Irrigation impacts and instream flow problems affect numerous streams and stream reaches in the Blackfoot Subbasin (Pierce et al. 2005).[32] Diversions for irrigation can reduce flow, destabilize stream channels, interrupt migratory corridors (via blockages and dewatering) and entrain migrating fish (USFWS 2002). Lack of instream flows from dewatering and drought increases water temperature, limits fish passage, reduces survival and increases the spread of diseases among fish. In addition, lack of instream flows limits the transportation of sediment, nutrients and metals through the system leading to higher concentrations of these materials and impairments to water quality (MDEQ 2004, 2008a, 2008b).

[32] A detailed discussion of water rights in the Blackfoot Subbasin is provided in Section 3.2.5.1.1.

Within the Blackfoot Subbasin, 194 river miles are periodically or chronically dewatered (Pierce et al. 2005) (Figure 3.36) (Appendix A). Natural dewatering occurs on 17 streams and 49 river miles. The upper Blackfoot River, for example, naturally becomes dewatered downstream of the Landers Fork. Human-caused dewatering occurs on about 45 streams and 165 river miles. The middle Blackfoot River, for example, includes 34 miles of human-related dewatering, most notably up and downstream of Nevada Creek. A combination of both natural and human-related dewatering occurs on eight streams (BC 2005a). In favorable flow years, the lower Blackfoot River from the North Fork to the mouth generally maintains flows sufficient to meet minimal aquatic needs and to satisfy relatively junior instream flow water rights. In low flow years, however, the lower Blackfoot may fall to less than 50% of minimum instream flow needs (BC 2005a).

**Figure 3.36 Dewatered Streams.**




Elevated water temperatures are common to streams that are heavily diverted and/or subject to receiving irrigation return flows (Pierce and Peters 1990, USFWS 2002). Water temperatures exceed the tolerance limits for bull trout in portions of many of these streams. Within the Blackfoot Subbasin, elevated water temperatures are found in Nevada, Douglas, Nevada Spring, Cottonwood, Willow, Union, and Elk Creeks and in the Clearwater River (MBTSG 1995, USFWS 2002, Pierce, 2004, 2006, 2008).

### 3.4.4.12 Channel Alteration – Medium

*Targets Affected:* native salmonids, moist site and riparian vegetation

*Description:* Channel alteration is associated with road corridors and levees that may constrain the channel migration zone. Stream banks have been armored in areas where natural bank erosion may threaten structures built too close to the channel, or where stream energy has been displaced by restrictions or channelization upstream. Channels have been intentionally straightened in areas where channel migration threatens property or structures and in an effort to gain access to or use of floodplain or stream migration zones. Some streams in the subbasin have been channelized for mining purposes or to drain wet meadows and increase hay production. Channel encroachment is caused mainly by development and land conversion for agricultural purposes.

*Implications*: Channel alteration and encroachment lead to riparian vegetation impairments, water quality impairments and physical habitat impairments (e.g., habitat elements and channel condition), all of which pose threats to native salmonid viability. Channel alteration also impacts the natural flood regime, which affects the viability of riparian vegetation communities. Forty streams in the Blackfoot Subbasin are currently identified with altered channels (Pierce et al. 2008).

Historically, the impact of channel encroachment was greatest in the valley-bottom agricultural lands. More recently, the impacts are associated with residential and resort development adjacent to streams. Landowners can exacerbate impacts by removing riparian vegetation or altering stream banks to gain stream access, improve views or protect vulnerable property within the flood plain and active channel migration zone.

### 3.4.4.13 Epidemic Levels of Native Insects and Pathogens – Medium

*Targets Affected:* low elevation ponderosa pine/western larch forest, mid to high elevation coniferous forest

*Description:* Significant insect threats in the Blackfoot Subbasin include the mountain pine beetle in lodgepole, ponderosa, and whitebark pine, the Douglas-fir bark beetle in Douglas-fir, and the western pine beetle in ponderosa pine.

*Implications:* The abovementioned beetles are at epidemic proportions in subbasin forests, largely as a result of drought conditions since 2000. Insect infestations in subbasin forests have resulted in significant mortality of coniferous tree species. Impacts of extensive tree mortality include increased risk of severe wildfires and, in the case of whitebark pine, reduced seed production and loss of this food source for grizzly bears and other subbasin wildlife.

### 3.4.4.14 Non-Motorized Recreational Use - Medium

*Targets Affected:* native salmonids, grizzly bears

Description: Outdoor recreation and tourism is a major component of the Blackfoot Subbasin economy. The area is renowned for its high quality fishing, hunting, camping, hiking, river floating, wildlife viewing, and sightseeing opportunities. Many of these outdoor activities are made possible by public ownership of large tracts of mountainous habitat and additional access provided by many private landowners (MFWP 2006). There are, however, a range of impacts associated with non-motorized recreational use.

*Implications*: For salmonids, angler pressure and poaching are the two primary threats associated with recreational use in the Blackfoot. The Blackfoot River is one of the most popular fisheries in the Upper Clark Fork region. The average number of angling days/year between 2001 and 2007 was 36,489 (MFWP 2008). Illegal stocking of non-native fish, such as northern pike, largemouth bass and walleye, is another side-effect of recreational angling that threatens native species in the subbasin. The mainstem of the Blackfoot River is also extremely popular for non-angling recreation (e.g., picnicking, sunbathing, boating), particularly in the lower reaches closer to Missoula. Both angling and non-angling river recreation have impacts on aquatic and riparian habitat in the subbasin (MFWP 2008). Fish stocking, boating and angling can all contribute to the spread of whirling disease, an exotic parasite that affects fish in the trout and salmon family (Montana Water Center 2009). MFWP is in the process of drafting a recreation management plan for the Blackfoot River and the North Fork of the Blackfoot River that will guide recreation management now and into the future (MFWP 2009). The proposed plan is based on the recommendations of the River Recreation Advisory for Tomorrow (RRAFT) Citizen Advisory Committee.

For grizzly bears, negative bear-human interactions are the primary threat associated with non-motorized recreational use. Recreationists have largely unhindered access to millions of acres of undeveloped land in the Blackfoot Subbasin, much of which is currently occupied by grizzly bears. As numbers of bears and outdoor recreationists increases, contact between bears and people is likely to increase as well. These encounters could lead to injuries or death for both humans and bears (MFWP 2006). Backcountry camps used by hikers and hunters may be sources of bear attractants. Because habituation to humans often results in bear removals or death, high levels of human use in certain areas may eventually preclude bear use.

### 3.4.4.15 Existing Crop Production – Low

*Targets Affected:* herbaceous wetlands

*Description:* There are over 44,000 irrigated acres in the subbasin (CFTF 2004). Most of the existing cropland in the subbasin is located on the valley floor. This threat is again primarily of historic interest. In fact, in the recent past there has been more conversion of traditional agricultural land (grazing or hay production) back to herbaceous wetland communities than conversion of wetlands to cropland production.

*Implications:* In the past, crop production resulted in the loss and/or degradation of herbaceous wetland communities across the Blackfoot Valley floor. Crop production practices that can negatively impact herbaceous wetlands include draining and plowing, result in hydrologic alteration and water quality impairment in wetlands through increased nutrient inputs.

### 3.4.4.16 Filling of Wetlands - Low

*Targets Affected:* herbaceous wetlands

*Description:* It is estimated that about one-fourth of Montana's wetlands have been lost because of agriculture and urbanization. As mentioned above, this threat is primarily of historic interest as there has been recent conversion of traditional agricultural land (grazing or hay production) back to herbaceous wetland communities.

*Implications:* Filling of herbaceous wetlands reduces the number, size, distribution and diversity of this important habitat, resulting in degradation and/or loss of many important wetland functions, such as (McCarthy 2001):

- Holding and gradually releasing water into the soil and into adjacent streams or water bodies during low flow periods of the year (maintaining late summer stream flows is critical for irrigating crops, watering livestock, sustaining fisheries and recharging aquifers).
- Enhancing water quality by absorbing and holding toxins and nutrients before they enter nearby lakes, streams or groundwater. Wetlands also filter sediments, which protects water quality and prolongs the life of irrigation pumps, and reduces siltation of ponds and irrigation ditches.
- Supporting rare plants and vegetation that stabilizes shorelines and acts as a flood buffer.
- Decomposing organic matter and incorporating nutrients back into the food chain.
- Providing habitat for birds, mammals, reptiles and amphibians.
- Providing shallow water for freshwater fish to spawn, shelter and feed.

### 3.4.4.17 Lack of Human Tolerance – Low

*Targets Affected:* grizzly bears

*Description:* Some residents of the Blackfoot Subbasin are ideologically opposed to having grizzly bears reoccupy private lands and therefore do not feel it necessary to accommodate bears. Intolerance of grizzly bears results from such factors as:

- Fear for personal safety and safety of children/family
- Perceived or real threat of loss of personal property (e.g., livestock, beehives)
- Perceived loss of recreational opportunity (e.g., loss of favorite fishing hole due to fear of encountering grizzlies in river/creek bottoms)
- Perceived loss of intergenerational equity (some parents do not allow their children to roam freely).
- Negative perceptions and intolerance of grizzly bears that can result in refusal to adopt coexistence practices.

*Implications:* A lack of public and political support can result in human practices and behaviors that lead to human-bear conflicts, which in turn can lead to grizzly bear deaths. In some situations, residents believe that bear management is the sole responsibility of state wildlife management entities. Unfortunately, this shifts the burden to engage in bear-friendly behavior away from the public. The willingness of humans to coexist with grizzly bears is critical to the recovery and long-term viability of this threatened species.

Because lack of human tolerance is a threat to grizzly bear viability in the Blackfoot Subbasin, wildlife managers, the Blackfoot Challenge and their partners have worked hard in recent years to mitigate this threat. The subbasin grizzly bear work group assigned lack of human tolerance a threat rank of "medium" based on their experiences with community members throughout the basin. Hundreds of community members take part in a variety of programs that have reduced grizzly bear-human conflicts by 84% since 2003 to the present. While the grizzly bear work has not directly measured human tolerance for grizzly bears in the subbasin, the number of complaints, concerns or discussions regarding grizzly bears is virtually nonexistent. Because this threat only affects one conservation target, the overall threat rank to the subbasin is "low."

### 3.4.4.18 Human-Caused Mortality – Low

*Targets Affected:* grizzly bears

*Description:* Humans kill grizzly bears for a variety of reasons including self defense, mistaken identity killing during legal black bear hunting season, management removal of bears from conflicts, collision with vehicles, or killing for malicious purposes (poaching) (MFWP 2006). In the NCDE, between 2000 and 2004, roughly one-third of known mortality was from illegal killing. Certain locations seem to have greater densities of illegal killing, suggesting localized poaching activity. This type of poaching is not for the bear parts trade, but is likely the work of an individual or individuals that engage in vandal-type killing of bears for a variety of unknown reasons (S. Wilson, pers. comm.).

*Implications:* Human-caused mortality is a major limiting factor for long-term grizzly bear recovery. The decline of grizzly bear populations in the United States and the southern Canadian Rockies is clearly linked to human causes, as human-grizzly bear conflicts are often a precursor to mortality (Mattson et al. 1996). A synthesis of long-term grizzly bear radio collar studies in the United States and southern Canada showed that between 1974 and 1996, approximately 85% of known bear mortality was attributed to humans (Mattson et al. 1996). McLellan et al. (1999) found that undetected grizzly bear deaths were typically due to non-hunting human causes and that between 1975 and 1997, malicious killing was the major cause of grizzly bear death in Montana. Moreover, these same researchers determined that for every known human-caused mortality, it is likely that another undetected mortality occurs (McLellan et al. 1999).

Grizzly bear mortality in the United States tends to be spatially concentrated on the periphery of core habitats, particularly in portions of Montana like the Blackfoot Subbasin (USFWS 2003). Core habitats refer to lands that contain self-sustaining populations of grizzly bears. There are generally a mix of multiple use national forest lands, national parks, and designated Wilderness areas. Lands on the periphery of core areas are less secure, low elevation habitats. They are typically privately owned agricultural lands that contain a variety of unnatural bear foods (S. Wilson pers. com.). Upon emergence from the den, bears move considerable distances from high, snow covered elevations to lower elevations to reach palatable, emerging vegetation on avalanche chutes or to feed on winter-killed or weakened ungulates on foothill winter ranges. Similar movement patterns often occur in the fall due to ripening of fruit and berries at lower elevations. These movement patterns often bring bears near areas of human habitation, increasing the incidence of human/bear conflicts and human-caused grizzly bear mortality (MFWP 2006).

Because human-caused mortality is a serious and long-term threat to grizzly bear viability in the Blackfoot Subbasin, wildlife managers, the Blackfoot Challenge and their partners have worked directly on mitigating this threat. Since 2004 there have been no grizzly bears mortalities resulting from management related incidents or conflicts. For this reason, the subbasin grizzly bear work group assigned human-caused mortality a threat rank of “medium.” Because this threat only affects one conservation target, the overall threat rank to the subbasin is “low.”

### 3.4.4.19 Altered Wildlife Use Patterns - Low

*Targets Affected:* moist site and riparian vegetation, native grassland/sagebrush communities

*Description:* Historic patterns of wildlife use in native plant communities have been altered due to a variety of human land use activities in the subbasin. These changes have occurred largely since European settlement when a variety of relatively high impact land uses began, including logging, mining and agriculture.

*Implications:* Wildlife use patterns in vegetation communities change when degradation occurs such as plowing of native prairie, excessive livestock grazing, non-native plant invasion, draining of wetlands or disturbance next to wetlands such as roads. If degradation of vegetation communities occurs on a small scale (i.e., < 20% of a landscape), the impact to wildlife is generally minimal. If degradation occurs on a larger scale, certain species of wildlife may no longer be able to use that landscape. If historic wildlife use patterns are altered significantly enough, species (both plants and animals) composition and structure in native vegetation communities can shift.

### 3.4.4.20 Presence of Bear Attractants – Low

*Targets Affected:* grizzly bears

*Description:* Attractants like garbage, livestock feed, bird seed, beehives, calving areas and other bear food sources associated with humans and human settlements are a major cause of repeated human-grizzly bear conflicts in the subbasin (J. Jonkel, pers. com., Mattson 1990). Under certain conditions, grizzly bears can kill significant numbers of cattle and sheep (Murie 1948, Johnson and Griffel 1982, Knight and Judd 1983, Jorgensen 1983, Brown 1985). Grizzly bears apparently prefer to kill livestock in the following approximate order: swine, ewes, lambs, calves and yearling cattle, cows, horses, and bulls (Mattson 1990) but site specific situations also influence the type of livestock grizzlies prefer. Forestry operations also provide opportunities for grizzly bears to be attracted to food and garbage and to become food conditioned (Lolo National Forest 2003).

*Implications*: Attractants located in high quality bear habitat result in human–grizzly bear conflicts on private land (Wilson et al. 2005; Wilson et al. 2006). Chronic conflict situations from attractants lead to bears being trapped and relocated or removed from the ecosystem. In the NCDE, 49% of known, human-caused grizzly bear mortality results from human foods or livestock (USFWS 2006). Excessive human-caused mortality can result in a decrease in grizzly bear genetic and population viability.

Removing or securing attractants is a simple yet critical step in fostering human-bear coexistence. In Montana, researchers have called for a reduction in the availability of anthropogenic food sources and attractants on privately owned lands to reduce conflicts and mortalities, particularly for female grizzly bears (Mace and Waller 1998). Action item #1 in the Grizzly Bear Recovery Plan (USFWS 1993) is to "reduce human-bear conflicts," most of which occur on private lands. The Blackfoot Challenge is currently working with ranchers and other private landowners to reduce conflicts by removing livestock carcasses in the spring and fencing calving areas and bee yards. These efforts have successfully reduced grizzly bear/human conflicts in the subbasin in the last six years by 84% (S. Wilson, pers. com.). One individual failing to secure bear attractants, however, can precipitate a chain of events that leads to a bear becoming more familiar with people and their dwellings. Also, as time goes by without conflict, people can become complacent. It is through awareness of the risk, and by responding accordingly, that risks can be minimized and support for grizzlies in Montana can increase (MFWP 2006).

Because the presence of bear attractants is a serious, dynamic and long-term threat to grizzly bear viability in the Blackfoot Subbasin, wildlife managers, the Blackfoot Challenge and partners have focused directly on securing or removing attractants throughout the subbasin. Nearly all high risk calving areas in the subbasin have electric fences (41,000 feet of fencing have been installed) and on average, 225 livestock carcasses are removed annually from ranches in the subbasin. All ranches located in core grizzly bear habitat in the subbasin remove livestock carcasses. Ninety-five percent of all beehives in the subbasin are protected with electric fences. All road killed deer and livestock composting facilities are protected with electric fences, and plans are underway to protect two of the three transfer stations in the subbasin with electric fences. A network of 120 residents monitor both grizzly and wolf activity and the Blackfoot Challenge has dozens of trash resistant garbage cans that are loaned out to residents each year. For these reasons, the subbasin grizzly bear work group assigned presence of bear attractants a threat rank of "low." Because this threat only affects one conservation target, the overall threat rank to the subbasin is also "low."

### 3.4.5 External Threats

Threats to Blackfoot Subbasin conservation targets originate both within and outside of the subbasin. The preceding discussion of 20 key threats identified by subbasin work groups focuses on within-subbasin impacts. In this section, we note the significance of external factors that pose a threat to subbasin targets. External impacts to fish and wildlife in the Blackfoot Subbasin include climate change, fish migration barriers, habitat conditions, land use in adjacent subbasins and human population growth at a regional scale. Of the Blackfoot Subbasin conservation targets, bull trout, westslope cutthroat trout and grizzly bears are all wide-ranging species that are particularly vulnerable to threats originating outside of the subbasin.

External threats to bull trout and westslope cutthroat trout include:

- Climate change, as described in Section 3.4.4.2, has specific impacts on the life histories of both westslope cutthroat trout and bull trout.
- The removal of Milltown Dam just downstream of the mouth of the Blackfoot River, while generally considered to a positive change for migratory native fish, may have the ancillary effect of allowing the in-migration of non-native species, which could intensify competition and hybridization.
- The spread of invasive, aquatic species not yet established in the Blackfoot Subbasin (e.g., New Zealand mud snail, zebra mussel) in areas outside of the subbasin may increase the likelihood of their future import into the subbasin.

External threats to grizzlies include:

- Future coal mining north of the Canadian border in the British Columbia portion of the Flathead Subbasin could impact grizzly populations in the NCDE.
- High grizzly bear mortality in southwest Alberta could act as a ‘sink’ to grizzlies that disperse there from the NCDE, potentially reducing the NCDE population over time.
- The impacts of climate change on grizzlies is unknown, but drier and hotter conditions throughout the NCDE could pose additional threats to grizzly bears through habitat change and reduced abundance in naturally occurring bears foods.
- Large-scale wind development along the Rocky Mountain Front could impact grizzlies throughout habitat loss, displacement, and increased human-caused mortality depending on how site development, maintenance, and road access is managed.
- High-speed rail and highway improvements throughout the NCDE are potential future threats to grizzly populations in the NCDE.

Climate change is the most significant external threat affecting all conservation targets to varying degrees. In addition to conservation and restoration actions at the subbasin scale, addressing the threat of climate change will require large-scale solutions that extend beyond the subbasin boundaries.