3 — Refuge Resources and Description

This chapter describes the characteristics and resources of the refuge and how existing or past management or influences have affected these resources. It specifically addresses the physical environment, biological environment, special land designations, recreational opportunities, cultural and paleontological resources including a history of human use on the site, and the socioeconomic environment. Service data and other information, both published and unpublished, was used to quantify what is known about refuge resources. Additionally, other sources were used including data and information from other agencies or other scientific studies.

The following narrative describes those parts of the natural and human environment that could be affected by implementing the plan and is organized as follows:

- 3.1 Physical Environment
- 3.2 Biological Environment
- 3.3 Special Land Designations
- 3.4 Visitor Services
- 3.5 Human History and Cultural Resources
- 3.6 Paleontological Resources
- 3.7 Socioeconomic Environment

3.1 PHYSICAL ENVIRONMENT

The following sections discuss the physical environmental resources that could be affected by the implementation of the CCP. Physical characteristics include climate, air, visual resources, soundscapes, geography, soils, and water resources.

CLIMATE

The climate of the refuge region is typical of the high plains in North America with moderately cold winters (average January lows are near 0 °F) and occasional cold periods exceeding –20 °F. Summers are generally pleasant (averaging in the 80s during afternoon hours) with occasional hot periods exceeding 100 °F. Low humidity, high temperatures, and moderate to strong winds cause rapid loss of soil moisture. Mean annual precipitation is 12–13 inches with about 70 percent occurring from April–September. Due to the dominantly heavy-textured soils, runoff is rapid, often exceeding 50 percent of the total precipitation. The average frost-free period is about 120 days. The refuge is also subject to intense lightning storms from late July to early September, often resulting in wildfires.

USFWS

The elk-viewing area is popular, particularly during the fall months.

Climate Change

In 2001, the Secretary for the Department of the Interior issued Secretarial Order 3226 (DOI 2001) requiring Federal agencies under its direction that have land management responsibilities to consider potential climate change effects as part of long-range planning endeavors. Recently, this order was replaced by Secretarial Order 3289 (DOI 2009). It left intact many of the planning requirements of Secretarial Order 3226, reiterating the need to analyze climate change effects but made organizational changes to enable the bureaus and agencies to fulfill the planning requirements (refer to chapter 1). In 2009, President Obama signed Executive Order 13514) requiring Federal agencies to establish an integrated strategy toward sustainability in the Federal Government and to make reduction of greenhouse gas emissions a priority for Federal agencies. In 2010, the Service completed its strategic plan for managing climate change (FWS 2010c).

The U.S. Department of Energy report, "Carbon Sequestration Research and Development," concluded that ecosystem protection is important to carbon sequestration and may reduce or prevent loss of carbon currently stored in the terrestrial biosphere (U.S. Department of Energy 1999). The report defines carbon sequestration as "the capture and secure storage of carbon that would otherwise be emitted to or remain in the atmosphere."

The increase of carbon dioxide (CO_2) within the earth's atmosphere has been linked to the gradual rise in surface temperature commonly referred to as "global warming." In relation to comprehensive conservation planning for Refuge System units, carbon sequestration constitutes the primary climate-related effect to be considered in planning. Vegetated land such as what occurs on the refuge is a tremendous factor in carbon sequestration. Large, naturally occurring communities of plants and animals that occupy major habitats—grasslands, forests, wetlands, tundra, and desert—are effective both in preventing carbon emission and in acting as biological "scrubbers" of atmospheric CO_2.

Recently, the U.S. Global Change Research Program released a comprehensive report (Karl et al. 2009) synthesizing information from a wide variety of scientific assessments about what is known about the observed and projected consequences of climate change in the United States. Average temperatures in the United States have increased by more than 2 °F over the past 50 years. Global temperatures are expected to rise at least 1 °F over the life of the CCP. In the Great Plains, temperatures could increase more by 2–4 °F. Additionally, there could be increases in both evaporation and drought stressing limited water supplies. Invasive weeds will likely increasingly compete with native vegetation on rangelands (Karl et al. 2009). Precise estimates of how climate change will affect the refuge are not known.

AIR QUALITY

The UL Bend Wilderness is a class I air quality area, and receives special protections against air pollution under the Federal Clean Air Act. The refuge is a member of the Interagency Monitoring of Protected Visual Environments (IMPROVE) network, a cooperative program of Federal and State agencies whose primary purpose is to protect visibility in class I areas and to characterize regional haze. This program was established to aid in the implementation of the 1977 Clean Air Act goal of preventing future and remedying existing visibility impairment in class I areas (national parks, wilderness, and wildlife refuges). At the UL Bend Refuge, a monitoring station filters the air every third day, collecting fine particles in three modules and larger particles in one of the modules. The filters are changed on a weekly basis and sent to a laboratory in Davis California where the data is analyzed. The lab looks at visual obscurity due to particulate matter and long-term trends of 50 years or more. The laboratory was not able to provide information as to whether the UL Bend monitoring site had ever exceeded class I standards (Jose Mojica, Crocker Nuclear Laboratory; personal communication, December 2, 2009).

The Service conforms with the interim air quality policy on wildland and prescribed fires (Environmental Protection Agency 1998). The policy was prepared in an effort to integrate the public policy goals of allowing fire to function in its natural role in maintaining healthy ecosystems and protecting public health and welfare by mitigating the negative effects of air pollutant emissions on air quality and visibility. Prescribed fires are conducted under strict smoke and air regulations as established by the Montana/Idaho Airshed Group. The purpose of this group is to reduce the effect of particulate matter within specific air sheds throughout the two States. The group was formed in 1978 and all prescribed fires conducted on the refuge have met permitted requirements. The refuge is assessed a fee based on tons of particulate matter produced by prescribed fires.

Critical smoke concerns are addressed in each individual prescribed burn plan. These plans are very thorough and discuss specific smoke issues, measures to reduce negative effects, downwind receptors, and smoke vector maps. The Service obtains clearance from the Montana/Idaho Airshed Group (MIAG) before conducting any prescribed fire (MIAG 2010). An air shed coordinator and meteorologist evaluate each prescribed fire for information air shed by air shed to anticipate cumulative

smoke effects. Key factors include burn elevation, windspeed and direction, type of burn, closeness to smoke-sensitive features, anticipated impacts from nonmember burners, and any other pertinent information made available at the time of the decision. A prescribed burn is not conducted if negative effects cannot be mitigated.

VISUAL RESOURCES

The National Environmental Policy Act requires that measures be taken to "assure for all Americans … aesthetically pleasing surroundings." Visual resources are those qualities of the resource that often inspire people and contribute to their overall experience. There are several land designations found on the refuge that are intended to preserve or even capitalize on the refuge's scenic values. These include the Wild and Scenic River designation along the western boundary, the Lewis and Clark National Historic Trail along the entire Missouri River, and the designated and proposed wilderness designations. There are sweeping views of the prairie, forested coulees, deep river canyons, broad mesas, badlands, and river bottoms. Throughout its human history explorers, writers, photographers, and visitors have penned, photographed, or painted vibrant descriptions of the refuge's abundant wildlife resources and its rugged and picturesque scenery.

Three categories were used to address potential effects on visual resources: (1) facilities and structures such as roads, buildings, fencing, and developed areas; (2) management activities like livestock grazing including the use of water impoundments and use of prescribed fire or other activities; and (3) other indirect factors like wildfires, drought, and invasive species. These categories are also addressed in greater detail later in this chapter under other topics, and only the visual aspects are addressed here.

Facilities, Structures, and Developed Areas

Roads, buildings, and developed camping areas provide access and amenities, but potentially affect the visual resources.

Roads. The refuge covers a vast remote area with about 670 miles of road that crisscross the refuge and provide vehicle access that is otherwise only accessible by foot or horseback (refer to "Access" under visitor services in section 3.4 below). A road borders several of the proposed wilderness units as boundaries were often drawn around roads. Most of the refuge's roads are primitive, nongraveled roads that are inaccessible during wet periods; nonetheless, refuge roads are highly visible in some areas, particularly from bluffs, ridges, and other viewpoints as the aerial photo below shows. In places, roads have become heavily rutted and braided, which potentially degrade scenic and resource values.

In 2009, the Wilderness Society conducted a spatial analysis (The Wilderness Society 2009) assessing the visibility of roads on the refuge from various distances ranging from 0.25 mile to 10 miles. Using GIS software, points were plotted along refuge roads to assess how visible a road could be from any location on the refuge. Figures 7 and 8 show the potential visibility of roads from a distance of 1 mile and 3 miles. Although this was a modeling exercise and may not represent the actual visibility from all locations, the analysis is instructive in showing where road density

Roads often follow ridges, bottomlands, and drainages.

is lowest with fewer visible roads versus where road density is highest and roads are more visible. The aerial photo on the facing page gives an overview of the area marked as "A" in figure 7 below, which has some of the least road density on the refuge. Several proposed wilderness units are located next to this area.

Roads are likely more visible from further away than close in to the resource (for examples, ridges and viewpoints). Figure 9 summarizes the number of road segments that are likely to be visible from various sight distances across the refuge including non-wilderness and wilderness.

Other Facilities and Structures. Fencing is used across the refuge to fence livestock pastures including common pastures with BLM, riparian areas, and for delineating the refuge boundary (refer to "Uplands" in section 3.2 below). In addition, there are a few ungulate exclosures for monitoring purposes. Refuge fences are typically a three-strand wire with a t-post and commonly found throughout the west. The ungulate exclosures are wire fences approximately 8 feet high. Although refuge fencing is generally unobtrusive and not visible from any great distance, in places, it could potentially affect view

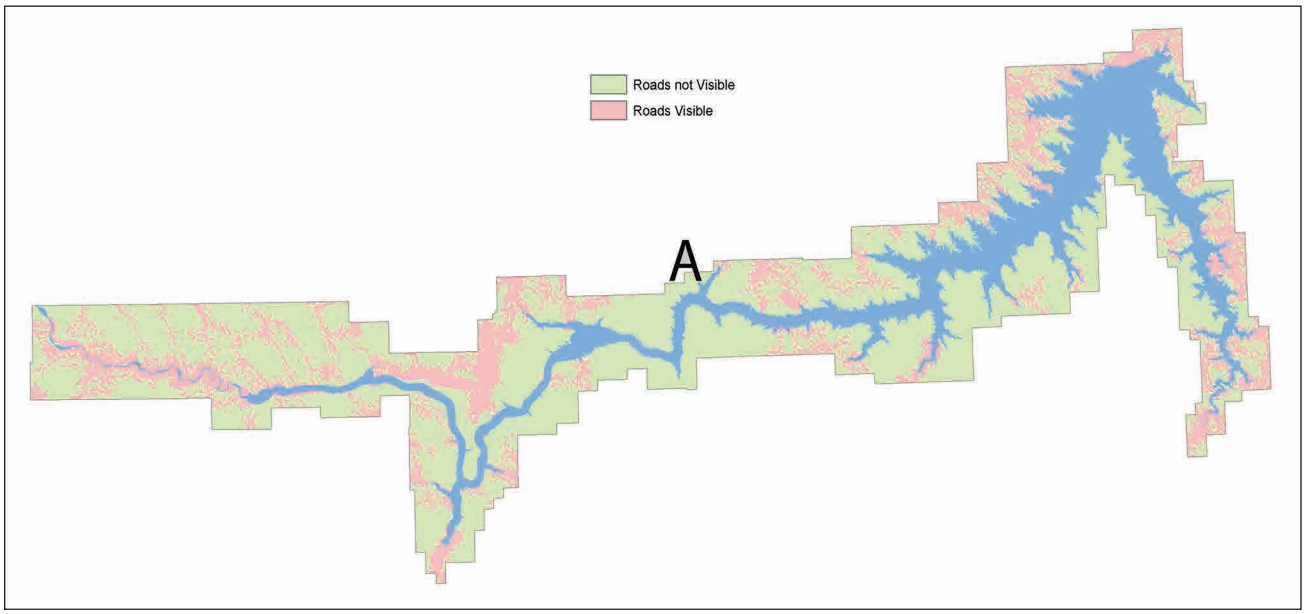


Figure 7. Map of potential visibility of roads at 1 mile along the Charles M. Russell and UL Bend Refuges, Montana. (Pink indicates that roads are likely to be visible and green indicates roads are less likely to be visible.)

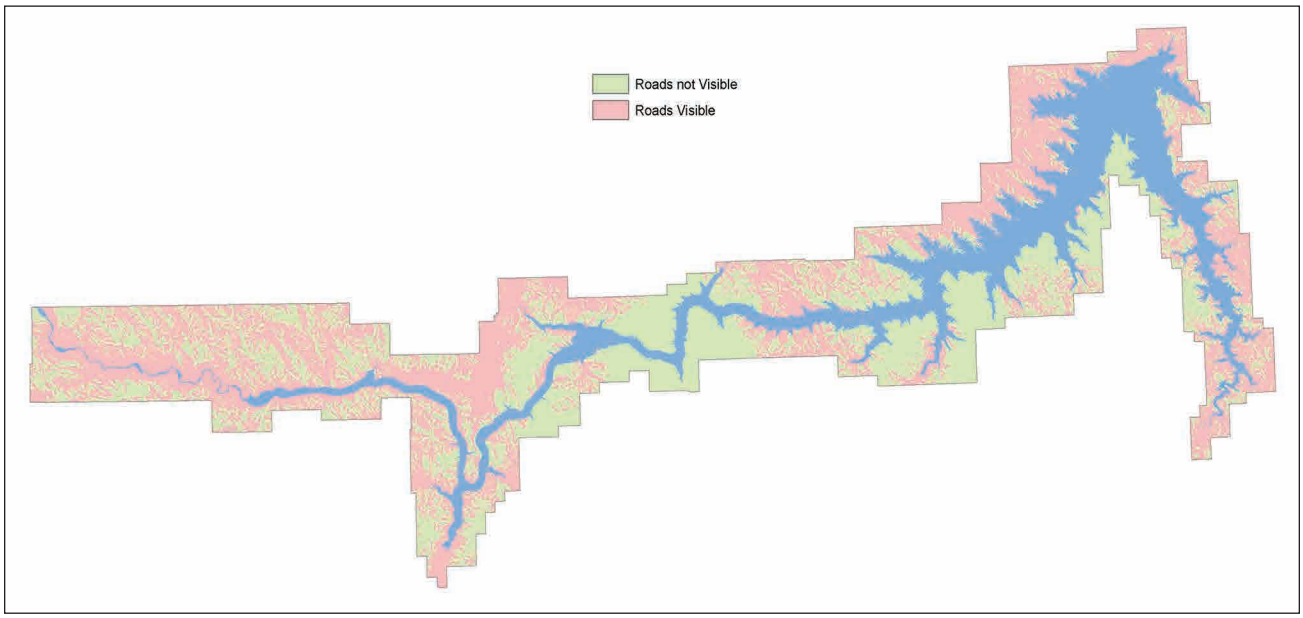
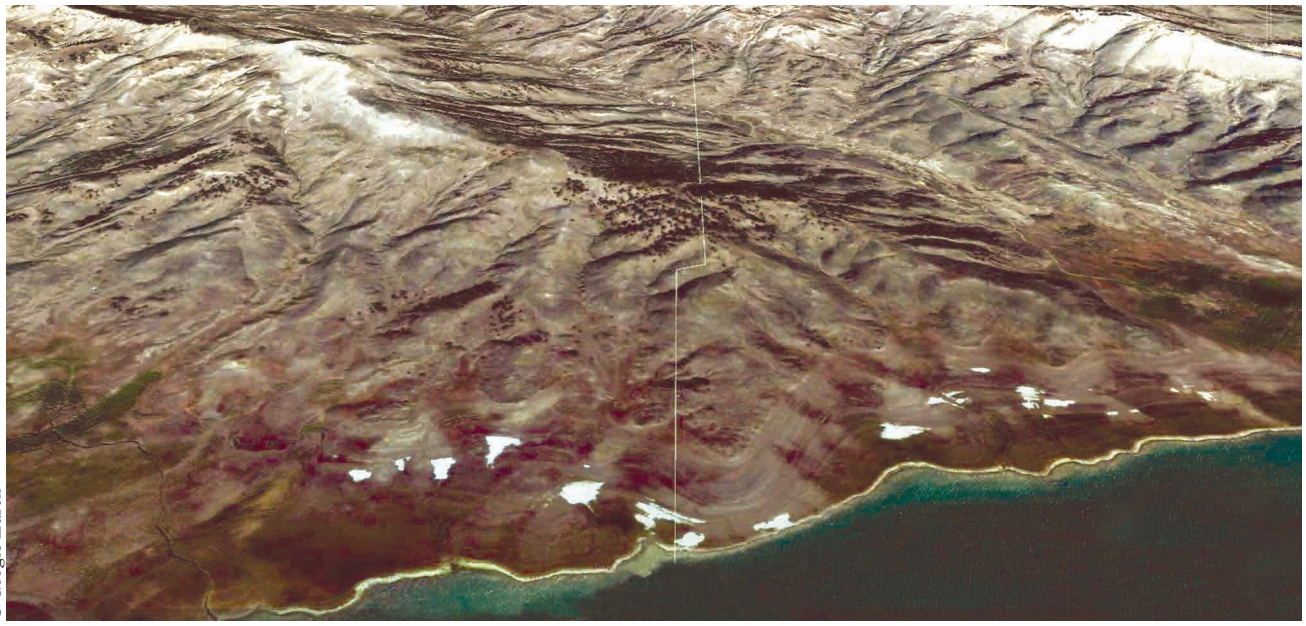


Figure 8. Map of potential visibility of roads at 3 miles along the Charles M. Russell and UL Bend Refuges, Montana. (From further away, roads could be more visible.)



An aerial photograph shows the low density of roads in a wilderness unit (near the same area marked as "A" in figure 7.)

in the foreground (for example, a photographer who was photographing wildlife could have a fence visible in the picture in some locations, whereas in a landscape photograph, a fence would be less visible).

The developed areas (both USACE and Service) are generally found along the Missouri River and Fort Peck Reservoir and are associated with boat ramps, roads, and campsites. Some are visible from ridges and other viewpoints, but generally, they are small with few facilities and are scattered along 134 miles of river. The east end is more developed. A few of the existing proposed wilderness units directly border or are near one of USACE's developed recreation areas (for example, Crooked Forchette, and Hell Creeks). The Service does not have primary jurisdiction over USACE's developed areas, and these are not analyzed further. The camping areas that the Service manages are primitive, consisting of camping area and a vault toilet (see figure 10). Additionally, there are several historic homesteads found

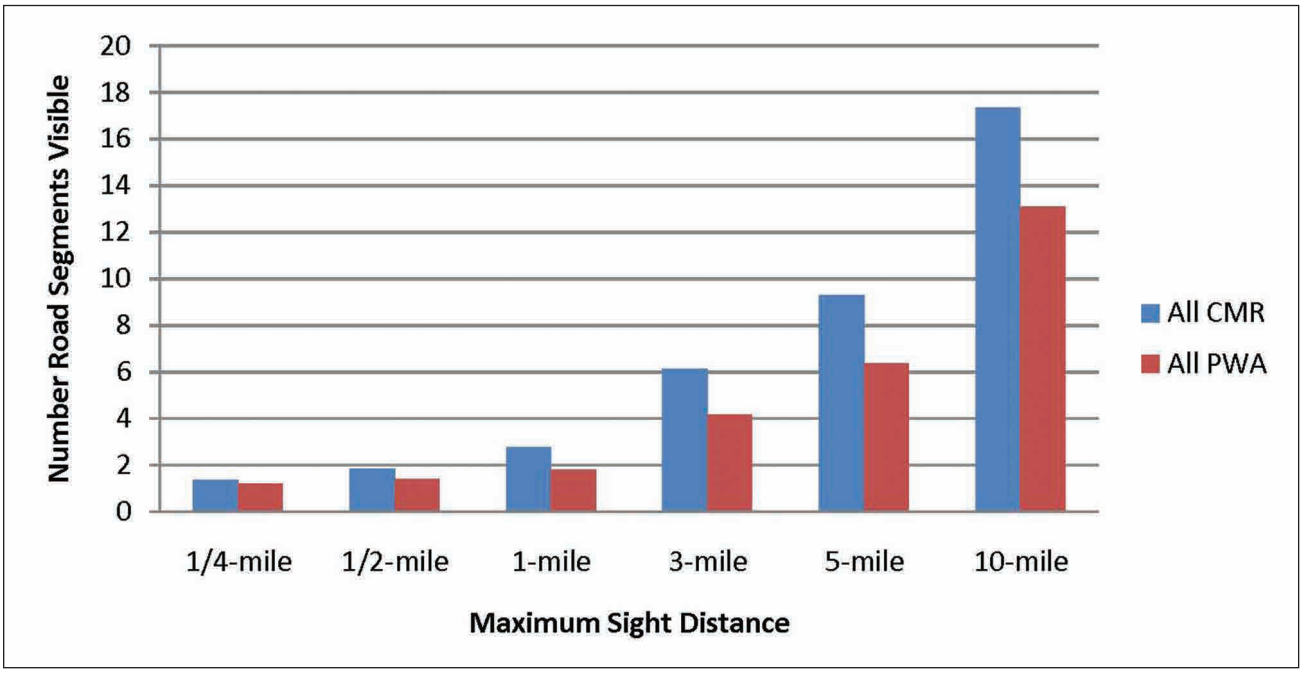


Figure 9. Chart of the number of road segments visible across the Charles M. Russell and UL Bend Refuges in Montana and from proposed wilderness units and wilderness study areas.

across the refuge; these are unobtrusive and are slowly fading into the landscape or even adding to the view. There are several areas with Service buildings across the refuge including Sand Creek Field Station, UL Bend Refuge, and Fort Peck Field Station, making up a small footprint.

Management Activities

Habitat and wildlife management practices or other public use activities can also affect visual resources. Sanderson et al. (1986) looked at the effect that intensive management activities on public lands have on scenic beauty and recreational activities. They found some recreationists placed a great emphasis on the visual qualities while others did not. They also found that dispersed recreationists do perceive differences in visual resources. In addition, perception about visual qualities differs among subgroups of recreationists.

Livestock Grazing on Wilderness and Nonwilderness Lands. Livestock grazing occurs across much of the refuge, but due to changes in ranch ownership, or because there were never AUMs allocated, some areas are not currently grazed (for example, most of UL Bend Refuge). Grazing occurs in some but not all of the proposed wilderness units. Some areas are grazed more heavily than others (see figure 11). Artificial water impoundments are also scattered across the refuge. Livestock are fenced out of some riparian areas along the Missouri and Musselshell Rivers, but in other riparian areas it is difficult to keep cattle out (for example, Big Dry Arm). Livestock congregate along water resources on the refuge, and monitoring has shown many of these areas to be degraded both in the biological and physical sense (refer to "Riparian Areas and Wetlands" in section 3.2 below).

Several studies have looked at visitor perceptions about livestock grazing on public lands, specifically how grazing relates to visitor experiences. Johnson et al. (1997) surveyed more than 1,000 visitors from different backgrounds to five wildernesses in Colorado and Utah. The proportion of visitors who accepted livestock grazing in wilderness and on public lands (43 percent) was similar to the proportion to those who considered grazing unacceptable (40 percent). However, most of the visitors surveyed reported that direct encounters and negative livestock effects detracted from their wilderness experience. Wilderness visitors were more tolerant of grazing on nonwilderness public lands if properly managed to protect ecosystems like riparian areas. Many visitors made their judgments on issues related to what they observed. Mitchell et al. (1996) found varying attitudes from users in the Uncompahgre National Forest in Colorado. They concluded that as long as livestock are kept out of developed campgrounds and adjacent riparian areas used for fishing and dispersed camping, visitors to those locations are likely to be less offended by livestock grazing. Brunson and Gilbert (2003) found differences in the type of visitor seeking recreational experiences along with demographic characteristics. Hikers were more likely than hunters to have negative opinions about livestock management in a protected area, but hunters were more likely to report seeing moderate to heavy vegetation impacts as they were more likely to venture off trails. Sanderson et al. (1986) examined the effect of grazing intensity on scenic quality and found that anglers were the most vocal in responding to management activities that had a negative effect on riparian habitat. Similar to the study by Brunson and Gilbert (2003), they also found that the visual effects of livestock grazing did not bother hunters as long as it did not affect their chances for success.

Prescribed Fire. Very little prescribed fire currently occurs on the refuge (refer to fire under "Disturbance Factors Affecting Major Ecological Processes" in section 3.2 below). Fire management is a significant issue in this planning process and one that could affect visual resources. Prescribed fire is described in detail under vegetation.

Following Service policy (FWS 2000b), the Service uses prescribed fire in accordance with fire management plans and have the proper approvals. Smoke management is always a concern in using prescribed fire, and planning for prescribed fires requires notification to local and State agencies (refer to air quality above). Substantial planning occurs in advance of a prescribed fire to limit the effects to visual resources (FWS 2000b) and to notify local agency officials. Prescribed fire is used to reduce vegetative litter and improve the vigor and health of plants, thus improving scenic values.

Airplanes and Motorboats

Although the visual sight of airplanes and motor boats could negatively affect some users, information about the aircraft and motorboat use is described under soundscapes below and under "Access" in section 3.4 later in this chapter.

Other Conditions Affecting Visual Resources

Invasive species, severe drought conditions, and wildfires are other factors that potentially affect the refuge's scenic values. Saltcedar infestations along the shoreline of the large rivers are pervasive. USACE conducts treatment below the high-watermark, but infestations move into the upland areas. Some former agricultural areas (river bottoms) have been heavily infested with invasive plants (refer to the discussion under vegetation).

Figures 10 and 11 follow (three foldout pages)

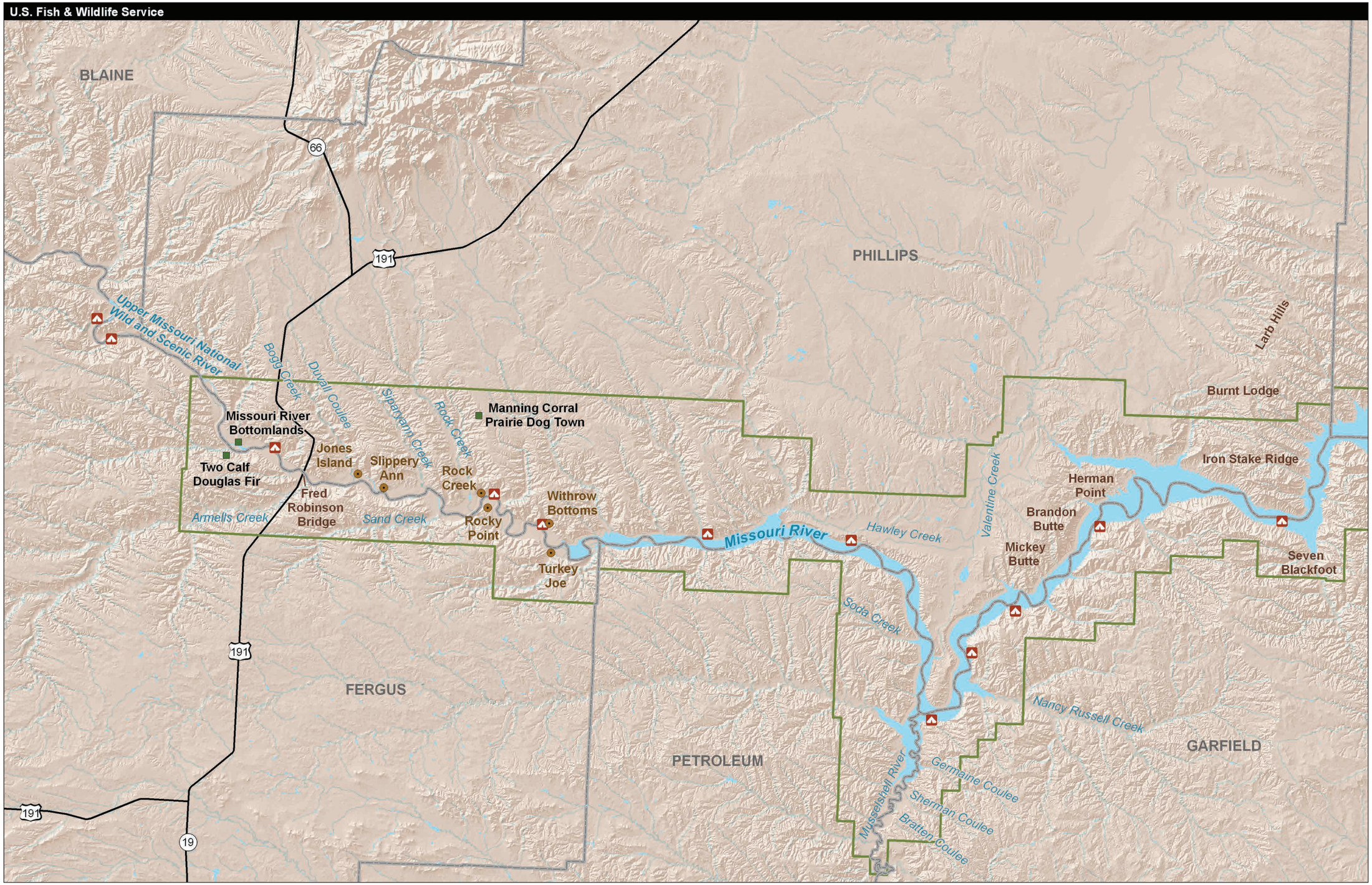


Figure 10. Map of water and geographic features in the Charles M. Russell and UL Bend Refuges, Montana.

Figure 10 (water and geographic map, west)

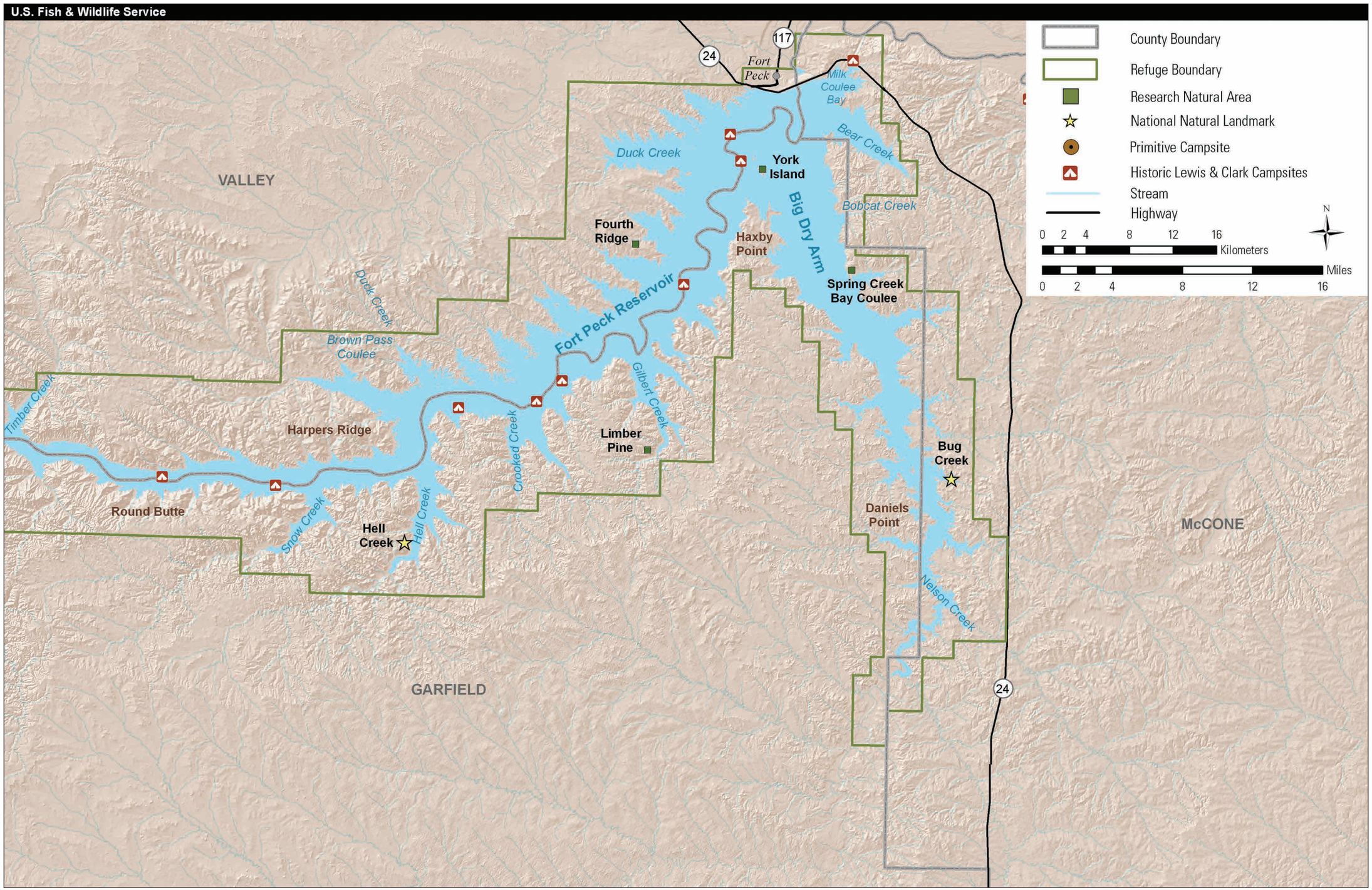


Figure 10 (water and geographic map, east)

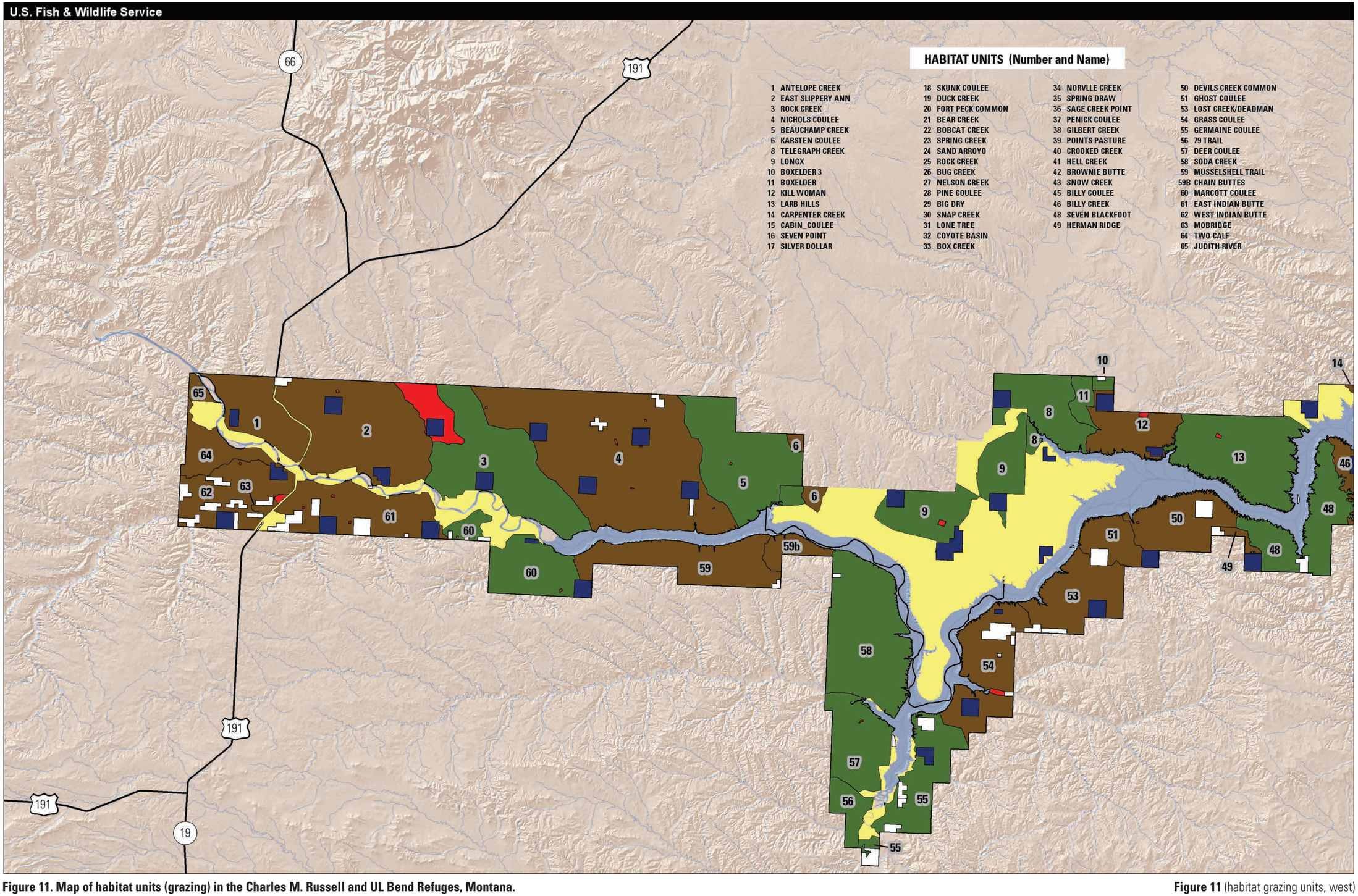


Figure 11. Map of habitat units (grazing) in the Charles M. Russell and UL Bend Refuges, Montana.

Figure 11 (habitat grazing units, west)

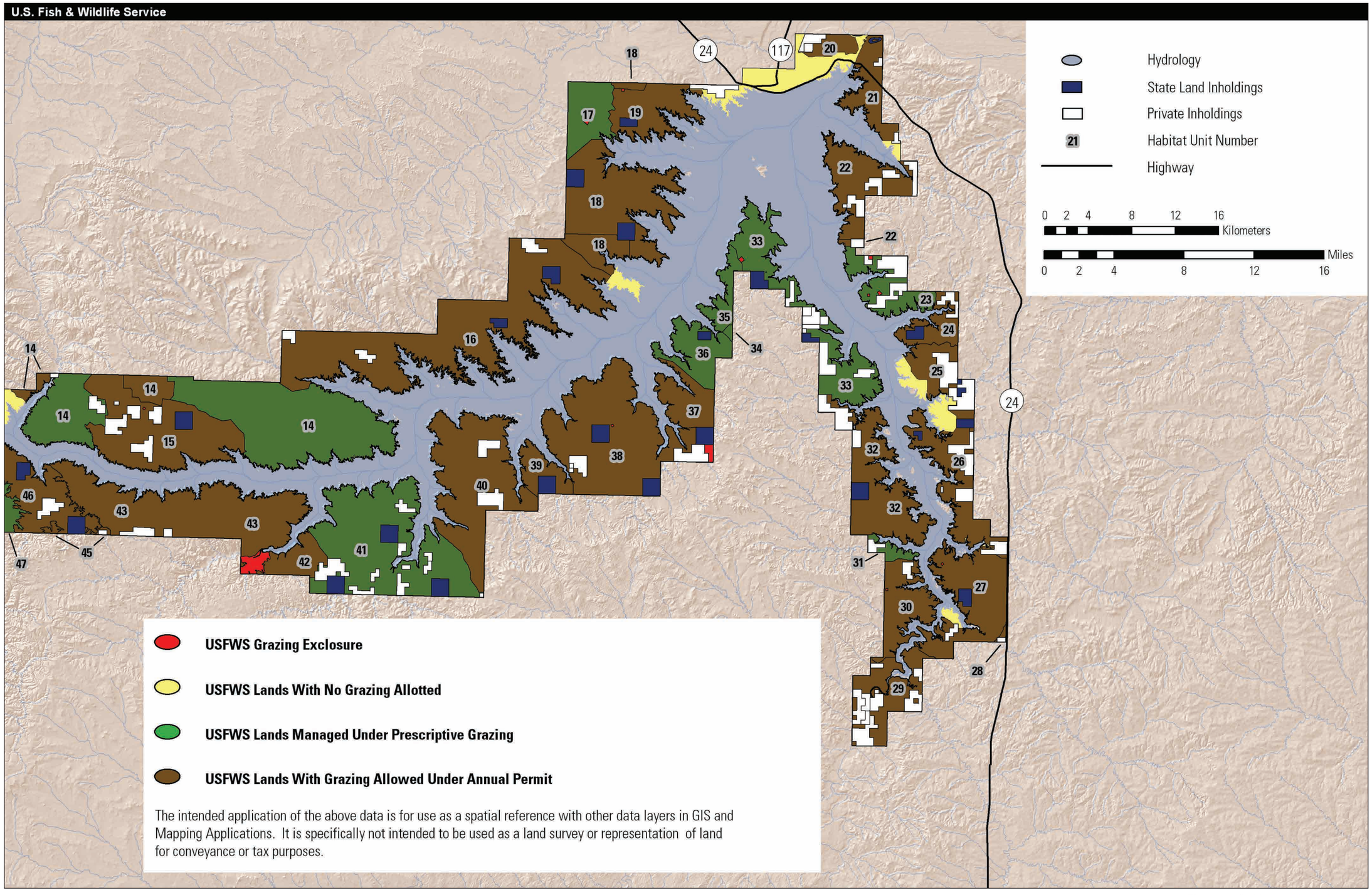


Figure 11 (habitat grazing units, east)

Wildfires, generally lightning-caused, occur frequently across the refuge during the summer months (refer to wildfires under "Uplands" in section 3.2 below). At times, there has been significant visible smoke during large wildfires, most recently during the large fires in 2003 and 2006.

SOUNDSCAPES

A soundscape refers to the natural acoustic environment consisting of sounds such as wildlife vocalizations and weather events. The disruption of natural sounds can affect visitors and wildlife. An important quality of the refuge as identified by the public and staff is the opportunity to experience a remote recreational setting not available in other places (refer to chapter 2). A tangible and intangible aspect of wilderness is maintaining soundscapes, whereby solitude is enhanced by the absence of distractions such as unnatural noise (FWS 2008c). Although the refuge is considered remote, there are several sources of noises found on the refuge that could affect a visitor's experience:

- motor vehicles including four-wheel-drive vehicles, all-terrain vehicles (ATVs), quadricycles, and snowmobiles
- management activities associated with developed areas such as camping areas, restoration projects, and equipment
- motorboat activity on Fort Peck Reservoir and the Missouri River
- airplanes
- military overflights (This issue is outside the scope of the CCP and is not discussed further.)

Motor Vehicles

Most vehicle access occurs during the summer and fall months with most activity occurring during the hunting season. Snowmobiles are allowed on the frozen surface of Fort Peck Reservoir during the winter. All vehicles must be licensed to travel on refuge roads, and under Montana law noise emissions cannot exceed 96 decibels for all off-highway vehicles including snowmobiles.

Management Activities and Developed Recreation Areas

Activities associated from management activities and other recreation include equipment (such as generators), tractors, chainsaws, and other machinery. Few of the proposed wilderness units are near developed areas or bottomland restoration areas.

Motorboats

From the refuge's western boundary to the Fred Robinson Bridge, the Missouri River is designated as a unit of the Upper Missouri National Wild and Scenic River. Travel is limited upstream of the bridge from June 15 through September 15. Downstream travel is restricted to idle speeds only with no wake from Thursday through Saturday, and no motorized boats can travel downstream to the bridge on Mondays and Tuesdays.

As with motor vehicles, Montana law limits noise emissions for motor boats (less than 86 decibels).

Within the next few years, the Service will be initiating a study to assess the amount of boat use that occurs along the Missouri River, particularly during hunting season. The Service believes that more hunters are accessing the refuge from the river, but there is not enough information to assess the effects, if any, on wildlife populations.

Airplanes

Aircraft can only land in designated landing zones in accordance with USACE and the refuge's seaplane landing plan (USACE 1995). There are no landing zones or landing areas west of Crooked Creek, but some landing zones and areas border or are near edges of proposed wilderness units (for example, Crooked Creek, Forchette, and Bone Trail). Landing zones are located near USACE developed recreation areas. In addition, there are several other landing areas on Fort Peck Reservoir. The number of aircraft flying over the refuge on an annual basis is unknown.

Hunting

Every year, more than 100,000 hunters come to the refuge to hunt big game, small game, and migratory birds. Gunshots could potentially be heard. The distance that any weaponry could be heard varies greatly with the terrain and other factors.

Restrictions are in place on motorboats to limit the effects on soundscapes along the wild and scenic river part of the refuge.

LAND FEATURES, SOILS, and GEOLOGY

Many of the topographical and water sources in this section are identified on figure 10. The Missouri and Musselshell Rivers flow through deep valleys with narrow floodplains lying 500 to 1,000 feet below the average elevation of surrounding uplands. Elevations vary from slightly more than 2,000 feet above mean sea level near Fort Peck Dam to more than 3,200 feet in the Seven Blackfoot area (see figure 10). Three main landforms—uplands, breaks and floodplains—dominate the refuge and surrounding area.

Uplands are level to rolling prairies dissected by intermittent streams flowing toward the Missouri River in a generally eastward direction. These are the sagebrush–grassland plains typical of eastern Montana.

The breaks lying along the Missouri River are typified by rough terrain often culminating in spectacular badlands. Badlands are arid, eroded land "breaks" of uplands that are dissected into steep slopes and grassy floodplains. This topography along the Missouri River varies from low, barren hills of the Big Dry area south of Fort Peck to severely eroded coulees of the scenic Seven Blackfoot and Burnt Lodge areas and the juniper, pine, and grassland ridges on the western half of refuge. Approximately 40–50 percent of lands within refuge consist of steep ridges and eroded coulees.

Floodplains occur along the Missouri and Musselshell Rivers at upper extremities of Fort Peck Reservoir and along some of the larger drainages. These developed from preglacial river and stream alluvium and are characterized by heavy clay soils, deciduous trees, sagebrush, and grassland. These floodplains are comparatively flat and vary in width from 25 yards to 2 miles.

The Judith River formation outcrops west of Rock Creek in Phillips County in major stream valleys. It comprises several hundred feet of interbedded shale, siltstone, and sandstone with scattered beds of lignite and bentonite. This formation has good stability, but its outcrop area is limited to steep slopes.

Bearpaw shale underlies more of refuge than any other formation. The breaks west of UL Bend Refuge are almost entirely composed of this shale as are lower slopes east of UL Bend, except in the central and southern parts of Big Dry Arm. Bearpaw shale is almost entirely composed of dark gray, clayey shale and includes thin beds of bentonite. The predominant particle size of this formation is clay, and the predominant clay mineral found in Bearpaw shale is montmorillonite. As a result, this unit swells when exposed in steep slopes and erodes rapidly at many locations.

Fox Hills sandstone comprises yellowish gray sandy shale, claystone, siltstone, and very fine-grain sandstone and grades upward into relatively thick beds of resistant fine and medium-grain yellowish brown sandstone. This formation is generally found in areas of high relief along Fort Peck Reservoir such as Larb Hills, Harper Ridge, and much of Garfield County. Along Big Dry Arm, Fox Hills sandstone is found south to Rock Creek (east).

The Hell Creek formation is generally found above 2,500 feet in elevation in the central and eastern parts of refuge. It comprises unconsolidated fine sediments such as claystone, shale, siltstone, and sandstone. Some of the clay and silt-rich zones of the formation tend to shrink and swell during excavation or when exposed to water. The Fort Union formation is found in Garfield and McCone Counties, east and west of Big Dry Arm and south of Rock Creek (east). It is also found in the highest parts of Larb Hills. Tullock member, most widely found subunit of the Fort Union formation of refuge, is light gray to dark gray shale alternating with sandy shale and gray to buff sandstones. Lignite beds are also found in association with this member. This formation responds similarly to the Hell Creek formation to most development activities.

Glacial till is found at scattered locations, particularly between Rock Creek (west), Phillips County, and Valentine Creek. This is dense, clay-like material with characteristics similar to Bearpaw shale. Outwash and related deposits are found west of UL Bend on low benches and in the Missouri River Valley, in the lee of bedrock ridges. These latter deposits are porous and stable.

Exposed rock found on the refuge dates to almost 80 million years B.P. (before present, present=1950) or Late Cretaceous. Sedimentation dominated the area until about 58 million years B.P. For the next 55 million years, sediments were successively eroded away as the plains and surrounding areas were sporadically uplifted. In the past 3 million years, glaciers advanced over the area, the most recent retreating northward about 20,000 years B.P.

Ice jams caused the highest levels of flooding on major streams such as the Missouri River, Big Dry Creek, and Musselshell River. Snowmelt runoff causes the greatest flood flow volumes on these same streams. High flows can occur on these streams any time from January to August. Rainstorms cause major flooding on smaller drainages.

All stream channels flowing through unconsolidated material meander over time. The Missouri River upstream of Fort Peck Reservoir has shifted as much as 2,000 feet over about 65 years, at average rates up to 30 feet per year. The Fort Peck Reservoir delta is the area of greatest channel change and sedimentation; other areas of channel change and bank erosion are found on most upstream parts of most stream bottoms.

Areas of current and past landslide activity cover about one-third of the surface area of the refuge.

Steeply sloping areas in the western Bearpaw breaks, Garfield County, Larb Hills, and Harper Ridge have the most significant number of landslides. Landslides are of several types; slump-earth flows are the most common. Rapidly moving debris flows also occur, especially in the western Bearpaw breaks. Piping is an important erosional process in the Hell Creek formation and in landslide deposits. Pipes may collapse or create general ground instability.

Mineral Development

There are no known gravel deposits on the refuge. Gravel used for road improvements in the Hell Creek area was hauled a considerable distance, making transportation costs a significant issue for future road improvements. Results of a mineral report (USGS, U.S. Bureau of Mines 1979) show that parts of the area have a low to moderate bentonite potential and low diatreme gem potential. These located minerals have no economical mineral potential. The mineral estate was withdrawn in 1993 (Public Land Order 6997) for 20 years on the Charles M. Russell Refuge and was permanently withdrawn on the UL Bend Refuge in 1970 (Public Land Order 4826). There is no oil or gas development occurring on the refuge. The Service is currently seeking an extension of the 20-year mineral withdrawal for locatable minerals on Charles M. Russell National Wildlife Refuge.

WATER RESOURCES

Water resources on the refuge include large rivers like the Missouri River, Musselshell River, and many smaller streams and tributaries, many of which are intermittent (see figure 10). In addition, there are livestock ponds scattered across the refuge.

Hydrology

The watershed of the Missouri River defines the Charles M. Russell and UL Bend Refuges. The river and its tributaries create a series of badlands or "breaks" consisting of rolling uplands, steep bluffs, and grassy floodplains. The river flows easterly through the refuge, with an average mean daily discharge of 8,915 cubic feet per second (cfs) at the entrance of the refuge above the Fort Peck Dam (USGS station Missouri River near Landusky, Montana, number 06115200). Peaks at this site since 1934 have ranged from 8,460 cfs (2000) to 137,000 cfs (1953). The Missouri River leaves the refuge below Fort Peck Dam with an average mean daily discharge of 9,284 cfs. Peaks since 1934 have ranged from 7,200 cfs (2009) to 51,000 cfs (1946). The river itself flows about 300–500 feet below the refuge's uplands.

Upland areas on the refuge are drained by perennial (flows generally 90 percent of the time), intermittent (flows during wet months, generally only 50 percent of the time), and ephemeral (flow only in response to storms) streams. The channels are deeply entrenched with floodplains being 15–20 feet above the water during low-water dry periods, and exhibit steep gradients in many areas. Clay from the Bearpaw and Lance shale erodes easily from the stream action: breaking, collapsing, and rolling into flows creates turbid waters and dynamic channels. Stressed riparian areas erode rapidly, with active gullying and active headcutting present in many watersheds. In 1995, the riparian area health of 113 reaches on 75 separate streams was assessed (refer to "Riparian Areas and Wetlands" under section 3.2 for more information). All of the reaches assessed on 50 of the 75 streams were found to be "nonfunctional." Only six streams had all parts of the riparian zone at proper functioning condition. The water statistics in table 3 are from streams on or near the refuge.

The Musselshell River flows northerly through the refuge into the Missouri at Fort Peck Reservoir. USGS's station at Mosby, just upstream the refuge, has an average mean daily flow of 253 cfs. Peak flows during 1929–2010 range from 90 to 18,000 cfs. Being a snowmelt-fed stream, the Musselshell River floods in the spring until mid-June, when flow begins to decrease. The low discharges in late summer and fall are dependent on ground water base flow and releases from reservoir storage. Occasional summer peaks appear in response to thunderstorms. MFWP lists 40 miles of the river from Mosby to its confluence with the Missouri as chronically dewatered each year. Water quality can also be an issue, as irrigation return flows bring salts flushed out of the irrigated fields.

Due to the vastness and remoteness of most of the refuge watersheds, studies have been done to obtain better estimates of stream discharge and hydrograph behavior. USGS published several studies describing surface-water statistics for gauged and ungauged basins in and around the refuge. Parrett et al. (1983) used regional gauging station data to develop regression equations that describe mean annual streamflow for ungauged basins. Parrett and Johnson (2004) developed regression equations to estimate peak flows having recurrence intervals of 2, 5, 10, 25, 50, 100, 200, and 500 years for ungauged sites for all of Montana. Sando et al. (2009) used data more specific to the refuge and published, "Estimation of Streamflow Characteristics for Charles M. Russell National Wildlife Refuge, Northeastern Montana." By using data from five gauging stations on the refuge, as well as long-term gauging stations near the refuge, the publication provides methods of estimating the long-term median streamflow, 2.33-year peak flow thought to be bankfull or "channel-

Table 3. Average daily discharge and peak flows for six U.S. Geological Survey water stations on or near the Charles M. Russell and UL Bend Refuges, Montana.

Name and location	*USGS station number*	*Average daily discharge (cubic feet per second [cfs])*	*Lowest peak on record (cfs)*	*Highest peak on record (cfs)*	*Period of record (cfs)*
Armells Creek near Landusky, Montana	06115270	8.5	192	2910	2001–04
Duval Creek near Landusky, Montana	06115300	0.09	0	640	2001–04 (mean daily) 1963–2007 (peaks)
Rock Creek near Landusky, Montana	06115350	2.36	12	1660	2001–04
Hell Creek near Jordan, Montana	06130650	2.23	120	1700	2001–04
Nelson Creek near Van Norman, Montana	06131200	1.5	5	1750	1976–2008
Big Dry Creek near Van Norman, Montana	06131000	47.9	47	24600	1940–2006

forming," and maintenance flows, as well as monthly and annual 90-, 80-, 50-, and 20-percent exceedence streamflows. (An exceedence flow means there is an "×" percent chance the actual flow will exceed the given value. For instance, an 80-percent exceedence monthly flow for July is low in value and represents a "dry" year, because there is an 80-percent chance the actual July value will be higher.) In addition, the study provided monthly and annual mean streamflows for ungauged watersheds.

Higher streamflows typically occur from February through August, and lower flows occur September through January. The highest mean monthly volumes generally occur in March and April, due to snowmelt runoff. April and May flows decrease as snowmelt amounts diminish. Late spring and summer rainstorms create fast rising and diminishing flood peaks in June and July. Flows in August and autumn are low or zero, and frequently are only a result of ground-water base flow.

Ground water occurs at shallow depths in the Hell Creek–Fox Hills Sandstone Strata. The hydrostratagraphic sandstone intervals yield small quantities of water suitable for livestock and wildlife. These strata occur north of Fort Peck Reservoir and in the southeast part of Phillips County. At lower depths, ground water occurs in the Judith River Formation. Water-bearing sandstone strata can yield fair amounts of ground water; however, quality can be an issue due to salinity levels. Artesian pressure created by the thick layer of impervious Bearpaw Shale overlying the formation allows wildlife and stock wells to flow without the aid of pumps.

Water Rights

The United States holds Federal reserved water rights appurtenant to land withdrawn pursuant to Executive Order 7509, dated December 11, 1936, which established the refuge. The reserved right has the priority of the 1936 withdrawal.

The United States also holds Federal reserved water rights appurtenant to land withdrawn pursuant to Public Land Order 4588, dated March 25, 1969, which established UL Bend National Wildlife Refuge. This order removed some reserved lands from the refuge and included them within the UL Bend Refuge, and also withdrew additional lands from the public domain for the new refuge. The reserved right has the priority of the 1969 withdrawal.

The United States is in the process of quantifying these reserved rights with the Montana Reserved Water Rights Compact Commission. The Commis-

sion was created by the Montana Legislature in 1979 to "conclude compacts for the equitable division and apportionment of waters between the State and its people and the several Native American tribes claiming reserved water rights within the State (MCA 85–2–701), and between the State and its people and the Federal Government claiming non-Indian reserved waters within the State (MCA 85–2–703)."

The United States has already successfully achieved compacts for the Black Coulee, Benton Lake, and Red Rocks Lakes National Wildlife Refuges. The United States anticipates the compact for the refuge including UL Bend National Wildlife Refuge will be modeled in a similar manner, with protection of existing private rights, protection of enough water to carry out the primary purpose of the refuge, and dovetailing in refuge water protection with operations of the Service's sister agency, and largest landholder upgradient of the refuge, BLM. The Service's 1936 Federal reserved water right is senior to most BLM water rights. The United States has until July 1, 2013 to complete the compact.

In addition to Federal reserved water rights, the United States also holds State-based water rights. Before July 1, 1982, and in accordance with the Montana Water Use Act, the Service filed Statements of Claim to water rights appurtenant to the refuge and with priority dates earlier than July 1, 1973. Claims were filed for water rights vested on acquired land as well as land reserved from public domain. Since 1982, the State of Montana has proceeded with examining and adjudicating many of these claims. The basins the refuge covers and each basin's adjudication status are as follows:

- 40EJ, Missouri River between Musselshell River and Fort Peck Dam; claims are being examined
- 40E, Missouri River, between Musselshell River and Fort Peck Dam; temporary decree
- 40O, Milk River, below Whitewater including Porcupine Creek; preliminary decree
- 40S, Missouri River, below Fort Peck Dam; preliminary decree
- 40C, Missouri River, Musselshell River, below Roundup; temporary decree
- 40D, Dry Creek; preliminary decree
- 41S, Judith River; temporary decree

Temporary (decrees for areas that have Federal or tribal reserved water rights but where the rights have been left out until they are affirmed) and preliminary decrees (decrees for areas that do not have Federal or tribal reserved water rights) are issued to allow for interested parties to file objections if they disagree on the merits of a claim. Objections to Statements of Claim are resolved by the Montana Water Court, which then issues a final decree. Entry of the final decree begins the appeal-filing period where appeals are decided by the Montana Supreme Court. Some very small areas of the refuge are in basins with preliminary decrees but the United States has not waived its Federal reserved rights in those basins. The following are the number of claims filed by the United States:

Charles M. Russell National Wildlife Refuge

Basin 40C: 10 claims
Basin 40D: 4 claims
Basin 40E: 142 claims
Basin 40EJ: 128 claims
Basin 40O: 4 claims
Basin 40S: 4 claims
Basin 41S: 2 claims

UL Bend National Wildlife Refuge

Basin 40E: 36 claims
Basin 40EJ: 14 claims

Most of the claims were for small, water storage impoundments used for wildlife and stock watering. Two hundred forty-eight claims were filed for ponds, which hold 2,138 acre-feet of water. Ninety-eight claims were filed for other pre-1973 water diversions such as wells, springs, dikes, instream flow, and stream and lake pumps.

Private individuals also filed claims to pre-1973 stock water rights on refuge lands. The United States filed objections against all of these claims, asserting prior case law and statutes precluded and preempted the establishment of such rights. In June 2005, in Case No. 40E–A, the Montana Water Court ruled private State-based stock water rights could exist on Federal land. Since this ruling, the United States has reviewed the validity of each claim and is in the process of settling. Prior court decisions have affirmed the United States' position that ownership of these stock water rights appurtenant to Federal land does not grant grazing access to Federal land, nor does being refused grazing privileges constitute a taking of the private property water right.

In addition to claims for pre-1973 water rights and Federal reserved water rights, the refuge also holds permits or certificates to post-1973 water rights. In addition, the refuge filed late claims on some pre-1973 developments. The number of pre- and post-1973 ponds only on the refuge is 265; these ponds hold 2,207 acre-feet of water.

Water Quality Monitoring

Water quality on the lower Musselshell River exceeds State Water Quality Standards for total dissolved solids including sodium and alkalinity (Musselshell River Basin Water Management Study; U.S. Bureau of Reclamation 1998). This study was established to monitor changes in water quality, quantity, and aquatic habitat as they relate to management.

Best management practices were carried out on a watershed-wide basis along the Lower Musselshell River: offsite stock water tanks, riparian area fencing, rotational grazing, and improved irrigation efficiencies including land smoothing and installation of gated pipe and sprinkler systems.

Long-term monitoring sites were established along the 72 miles of river from 8 miles south of Mosby, Montana to the refuge at Fort Peck Reservoir (Hollow et al. 2001). Nine water quality sites were established and samples were taken three times per year for 2 years. Of the 71 miles of river, 20 miles were inventoried. The Musselshell River was listed by the Montana Department of Environmental Equality 303(d) list a "moderate" priority waterbody in need of total daily maximum loads development for the 1998–2000 biennium. The Lower Musselshell River was listed as a "high" priority waterbody under the 2000–02 biennium 303(d). It was listed as impaired for chronic dewatering and riparian habitat alteration and in need of total daily maximum loads development. DNRC has found that the Musselshell River meets the criteria for designation as a chronically dewatered watercourse. Lower part of the Musselshell River is a fourth order, perennially flowing waterbody. Flow peaks in spring after snowmelt and diminishes by late summer.

The Montana Department of Environmental Quality has also listed several other surface waters besides the Musselshell River that run through the refuge as water quality-impaired under section 303(d) of the Clean Water Act. Segments of Rock Creek and Nelson Creek, as well as the Missouri River and Fort Peck Reservoir, are listed as water quality impaired by Montana Department of Environmental Quality and require an assessment of the total maximum daily load (commonly called TMDL) of a pollutant a waterbody can receive and still meet water quality standards (Montana Department of Environmental Quality 2011).

The Missouri River within the refuge boundary is listed as water quality impaired. Likely causes of impairment are arsenic and copper, probably from abandoned mine sites, none of which are located on refuge lands. Alteration in streamside or littoral vegetation cover is also listed as a potential cause of poor water quality. Of the 49 miles of the Missouri River within the refuge boundary, approximately 95 percent of the stretch of river has been excluded from livestock grazing since 1995. This management action has improved riparian habitat on the Missouri, particularly on the refuge. The Missouri River riparian area corridor on the refuge, above Fort Peck Lake, is one of the few areas where the riparian habitat is functioning to its fullest potential.

Rock Creek in Phillips County is also listed as water quality impaired with lead, mercury, selenium, zinc, cadmium, copper and pH as probable causes (likely from abandoned mine lands.) Fecal coliform is also listed as a probable cause of water quality impairment, likely from grazing in riparian zones. Rock Creek drainage is approximately 39 miles long, with the lower 7 miles inside the refuge boundary. The riparian zones on the refuge's 7-mile stretch of Rock Creek are fenced to eliminate livestock grazing to protect the riparian area and water quality. There has been tremendous improvement to the riparian area health on the refuge on the lower 7 miles of Rock Creek drainage. Where it has jurisdiction, the Service will continue to manage to improve riparian area health on these streams and rivers.

Nelson Creek in McCone County is listed as water quality impaired with sulfates, nitrates, copper, and cadmium and the altered streamside or littoral vegetative cover listed as probable causes. The heavy metals source is unknown, while the nitrates, sulfates and streamside or littoral vegetative cover alteration are likely caused from grazing in riparian zones. Nelson Creek runs 37 miles, 2 miles of which are on refuge lands and fenced to exclude livestock grazing.

Fort Peck Lake is listed as water quality impaired with lead and mercury from various sources listed as causes. Native aquatic plants from agriculture are also listed as a probable cause of water quality impairment. Fort Peck Lake is surrounded by the refuge lands, but drains an immense area and inherits water quality problems from contributing rivers and streams.

Riparian health on a national wildlife refuge is of utmost importance because of the high value to wildlife. Many of the water quality impairments originate upstream of the refuge.

In 1999–2000, the refuge contracted with the University of Montana's Riparian and Wetland Research Program and Dr. Paul Hanson to conduct water quality analyses for nutrients, fecal coliform, total dissolved solids, total suspended solids, and flow on the refuge. Conductivity, pH, and temperature were also measured at each of nine established water quality sites. Macroinvertebrate sampling and periphyton sampling were performed. The analyses of periphyton populations showed no impairment and full support of aquatic life uses. In particular, the siltation index showed that sediment was not a cause of impairment. Periphyton is considered a good indicator of water quality because of the naturally high number of species and their ability to respond rapidly to both exposure and recovery from pollution events. The siltation index evaluates the percentage of diatoms that are mobile. Their abundance is thought to reflect the amount and frequency of siltation. The Lower Musselshell River had a siltation index of 32.84–49.26. The causes of pollution in the

Lower Musselshell River are attributed to flow alteration and riparian area degradation. The Water Quality Restoration Plan includes voluntary implementation for irrigators and landowners to use best management practices by land smoothing, converting flood systems to sprinklers, improving irrigation ditches, and installing gated pipe, upgrading management of irrigation water and installing flow measuring devices, and using soil moisture monitoring methods. Grazing operations' and landowners' recommendations include implementing best management practices by installing cross fencing, stock water pipeline with offsite water facilities and developing grazing plans on rangelands.

On the refuge, the Riparian and Wetland Research Program's Lotic Inventory form was used to evaluate and characterize the function and present condition of selected reaches of the Musselshell River within the riparian area corridor. Health scores range from 77 percent (functional at risk) to 44 percent (not functioning). The Riparian and Wetland Research Program's Lotic Health Assessment for Large River Systems was used to evaluate the general functioning condition of 20 miles of the river. Ninety-two percent of reaches inventoried showed a range of ratings from 60–80 percent (functioning at risk), and 8 percent scored less than 60 percent (not functioning). Reasons for low health score included low cover of woody species, presence of invasive plants, lack of native graminoids, and dewatering. Some positive findings included lack of human-caused bare ground, few exotic woody species, high shrub regeneration and high cottonwood regeneration as well as high densities of dead or decadent woody species.

Healthy riparian systems enhance water quality by filtering out organic and chemical pollutants (Ehrhart and Hansen 1997). Water quality is closely related to soil erosion and sedimentation. These can be associated with vegetation cover, concentration of livestock grazing, and geologic erosion. High concentrations of sediment loads, and fecal coliforms can have a major effect in altering an existing stream ecosystem or even creating an entirely new ecosystem (Kauffman and Krueger 1984).

Larry Allain / USDA–NRCS PLANTS Database

Purple Prairieclover

3.2 BIOLOGICAL RESOURCES

The following sections describe the biological resources that may be affected by implementation of the CCP. Biological characteristics include vegetation communities (often referred to as habitats) and wildlife including big game, furbearers, small predators birds, American bison, other wildlife (amphibians, reptiles, fish, and small mammals), and threatened and endangered species and species of concern. Unless otherwise noted, much of the following information is from unpublished Service data located in files at the refuge office.

Habitat for wildlife is the combination of vegetation and topography that provides the water, food, and protection that is necessary for their survival. The diverse vegetation provides thousands of habitat types supporting hundreds of wildlife species (see figure 12) across the nearly 750,000–800,000 acres of land found on the refuge. Habitat needs for some species are very general, while others are very specific. This section initially discusses the distur-

bance factors that have affected the major ecological processes on the refuge. Following this, the discussion is organized into four broad categories of vegetation: uplands, river bottoms, riparian areas, and shoreline vegetation. Invasive species are discussed at the end of this section.

Vegetation types are traditionally classified into plant communities with specific characteristics and defined boundaries. While plant communities are useful for describing dominant vegetation types and constructing maps, they do not illustrate the complexity, integrity, and management needs of individual areas. For example, general plant community descriptions do not adequately represent subdominant plant species that are more sensitive to change and disturbance, are more difficult to detect yet are more important for biological integrity (refer to "Focal, Target, and Sentinel Species" under section 4.1 in chapter 4). Recognizing the complexity of vegetation and habitats and the importance of sentinel species as an indicator of environmental health, the Service strives to manage the refuge for biological integrity, diversity, and function rather than generalized plant communities. For this reason, the Service does not classify vegetation into traditional plant communities. Refer to appendix G for a list of important sentinel species.

DISTURBANCE FACTORS AFFECTING MAJOR ECOLOGICAL PROCESSES

Fire, herbivory (grazing by all ungulates), and predation (including hunting) are key factors that have affected the plant species' populations on the refuge. Other disturbance factors include invasive species, roads, and other public use activities such as hunting. The legacy of these natural and human caused disturbances has resulted in the vegetation and habitat mosaic that exists today. Understanding these factors, their history, and their influences on the landscape is a key component of the CCP and its implementation. The following discussion includes a brief history of ecological change on the refuge, followed by descriptions of the key disturbance factors.

The Great Plains have evolved over time through ecological disturbances like fire and grazing. These disturbances can be described as "pulse" and "press." A pulse occurrence occurs sporadically but still occurs; whereas a press disturbance is constant. Historically on the refuge, the interaction between fire and grazing can be viewed over the following periods (see figure 13).

- *1700–1882:* Fire and wild ungulates interacted to create constantly shifting mosaic patches of land influenced by grazing and abandonment. Predation by wolves, grizzly bears, and humans occurred yearlong. There was a decrease in predators and wild ungulates during the last years. The last large wild bison herd was destroyed in 1882 (FWS 2010d).
- *1882–1910:* This period saw the end of free-ranging wild ungulate herds and the shifting mosaic of grazing and abandonment with the beginning of fences and constant excessive grazing by cattle and sheep (no more periods of abandonment), the end of large predators, and a great reduction in fire.
- *1910–86:* This period saw a constant grazing by livestock with no abandonment, a continued low fire frequency due to suppression and lack of fuel, and an increase in wild ungulates; in later years, there were no large predators.
- *1986–present:* This period has seen a reduction in livestock grazing, an increase in wild ungulates, continued fire suppression, few large predators, an increase in fine fuel, and an increase in wildfire size and intensity after 2000.

Fire

Wildfire, historically a pulse or sporadic disturbance, occurs over much of the refuge. Depending on the site, the average frequency of occurrence of fire in pre-European settlement times ranged from every decade or less (in many sites) to once a century in a few sites (Frost 2008). As shown in the timeline above, since European settlement, the frequency of fire has been dramatically reduced because of a lack of fuel (due to livestock grazing) and fire suppression. Fire-intolerant plant species such as big sagebrush and Rocky Mountain juniper have spread from their original fire refugia (areas with longer fire-return intervals and periods of drought) and now occupy a much larger part of the landscape. Exceptions have been the recent large fires in 2003 and 2006 in the middle of the refuge. The behavior of these was largely driven by long-term drought conditions and extreme fire weather.

Prescribed fire has been used sparingly on the refuge. Only 15 burns have been ignited since 1992, treating 3,077 acres. Except for the King Island burn in 2008, all have been in the river bottoms, prairie dog towns, or on the lakeshore. The specific prescribed fire objectives were to reduce Russian knapweed infestations and enhance habitat suitability for prairie dogs or piping plover. The King Island burn was the refuge's initial treatment of a 1,000-acre unit with fire to reestablish a more natural fire regime, enhance upland habitat, and promote pyric herbivory (grazing enhanced by fire).

Herbivory

Like fire, ungulate grazing (herbivory) was originally a pulse disturbance. Before 1882, there were many years with periods of abandonment (rest) by

Figures 12 and 13 follow (three foldout pages)

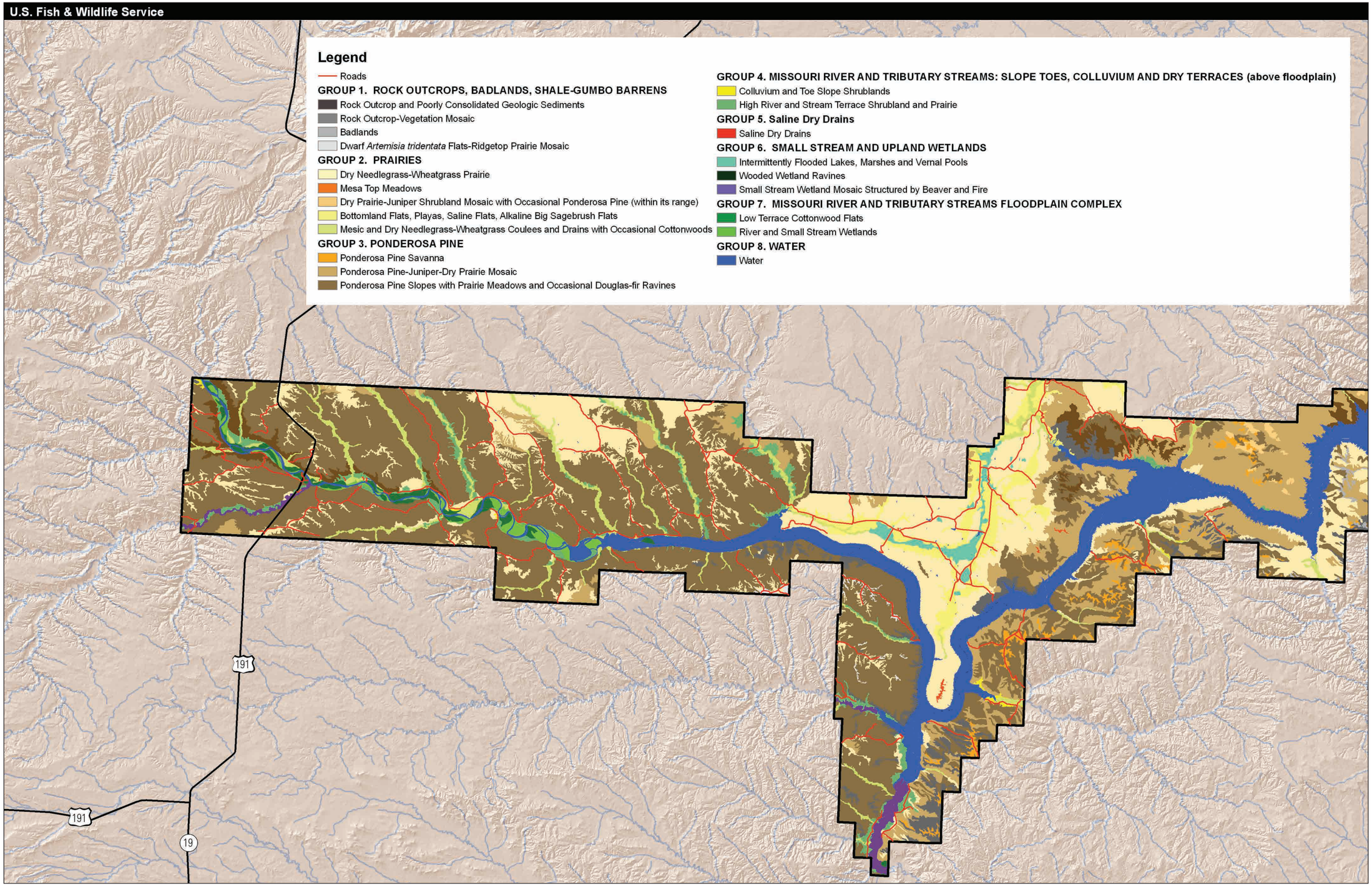


Figure 12. Map of habitat types for the Charles M. Russell and UL Bend Refuges, Montana. *Source: Cecil Frost.*

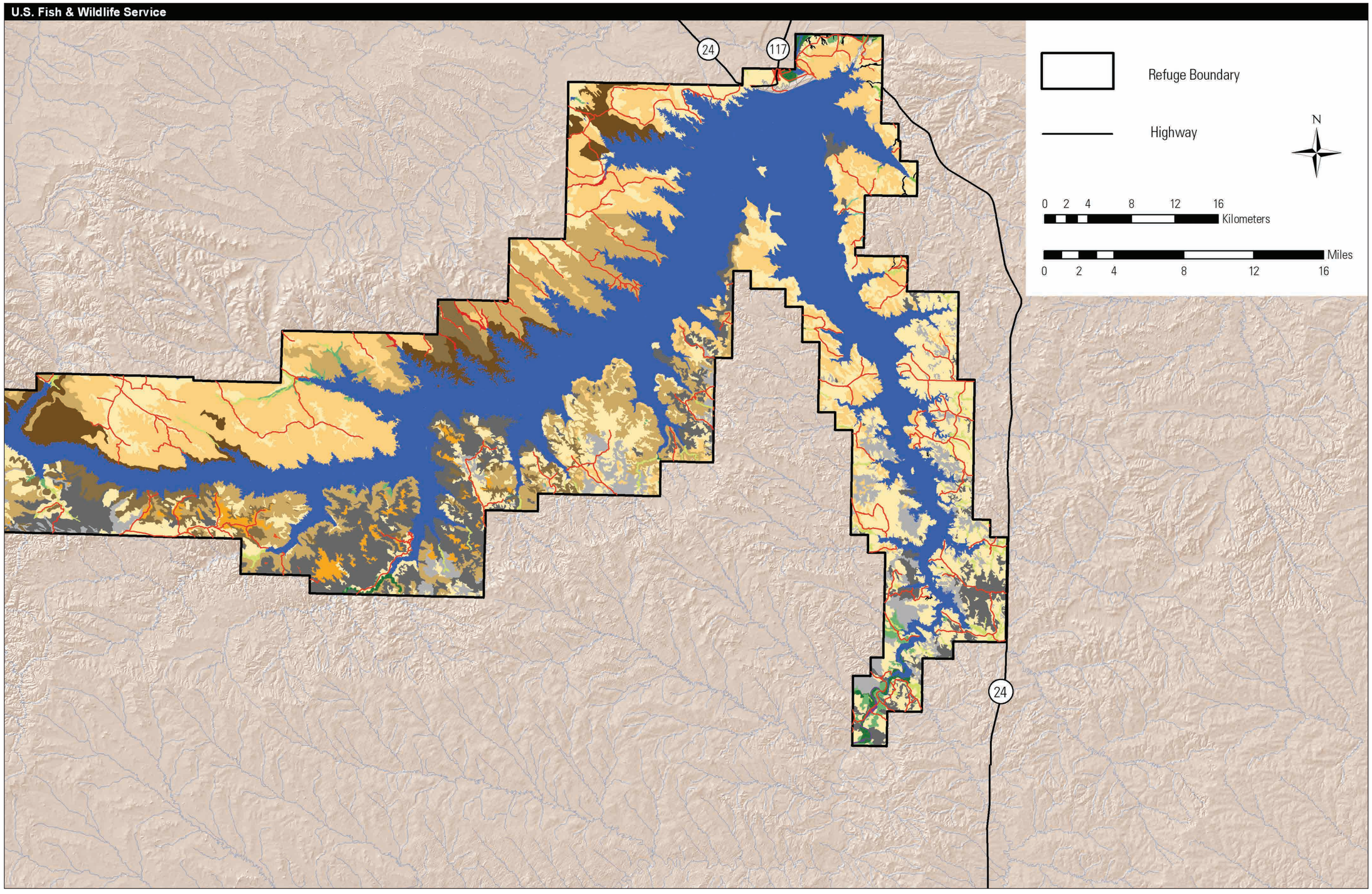


Figure 12 (habitat, east)

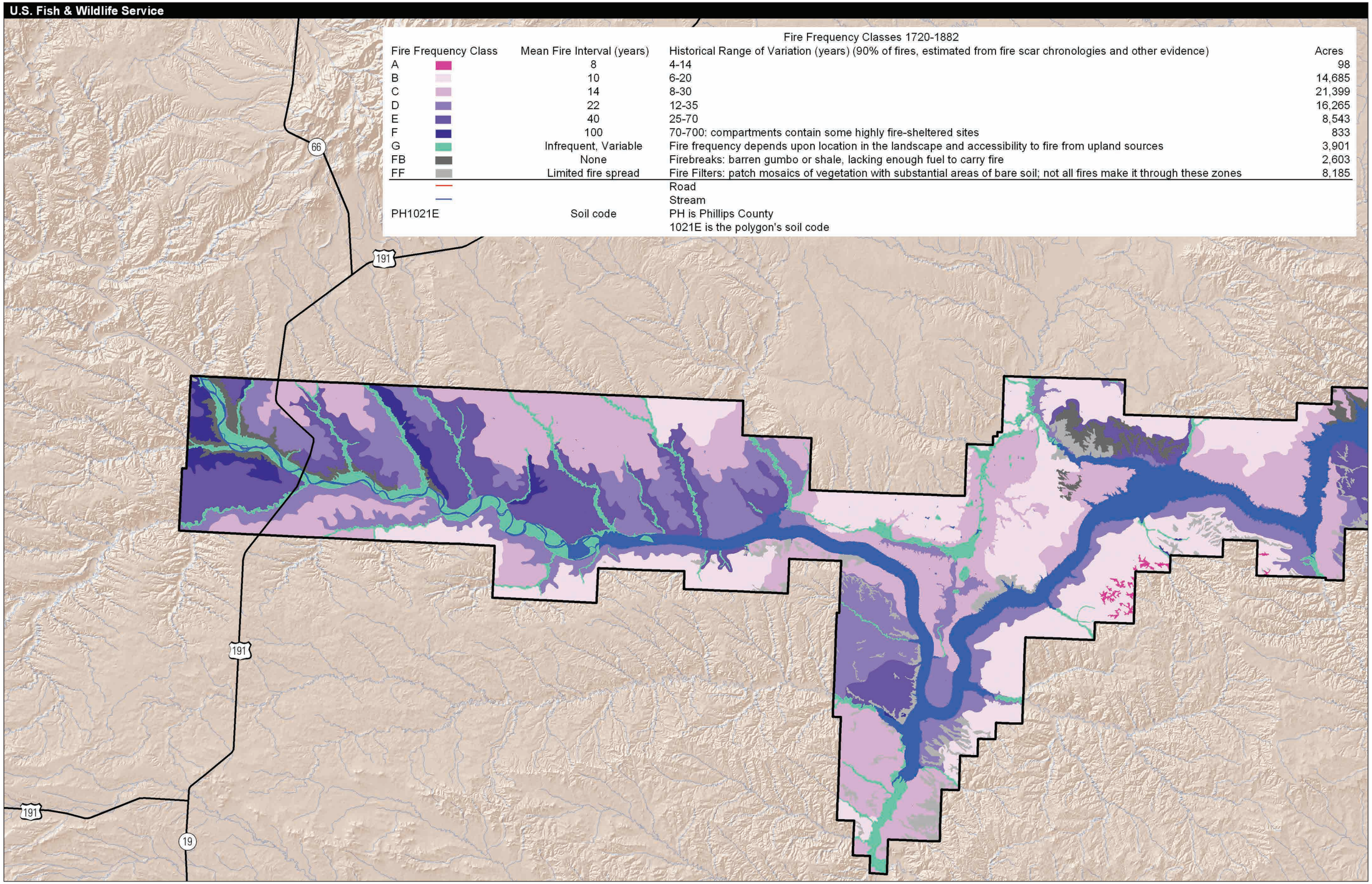


Figure 13. Map of fire frequency for the Charles M. Russell and UL Bend Refuges, Montana. *Source: Frost 2008.*

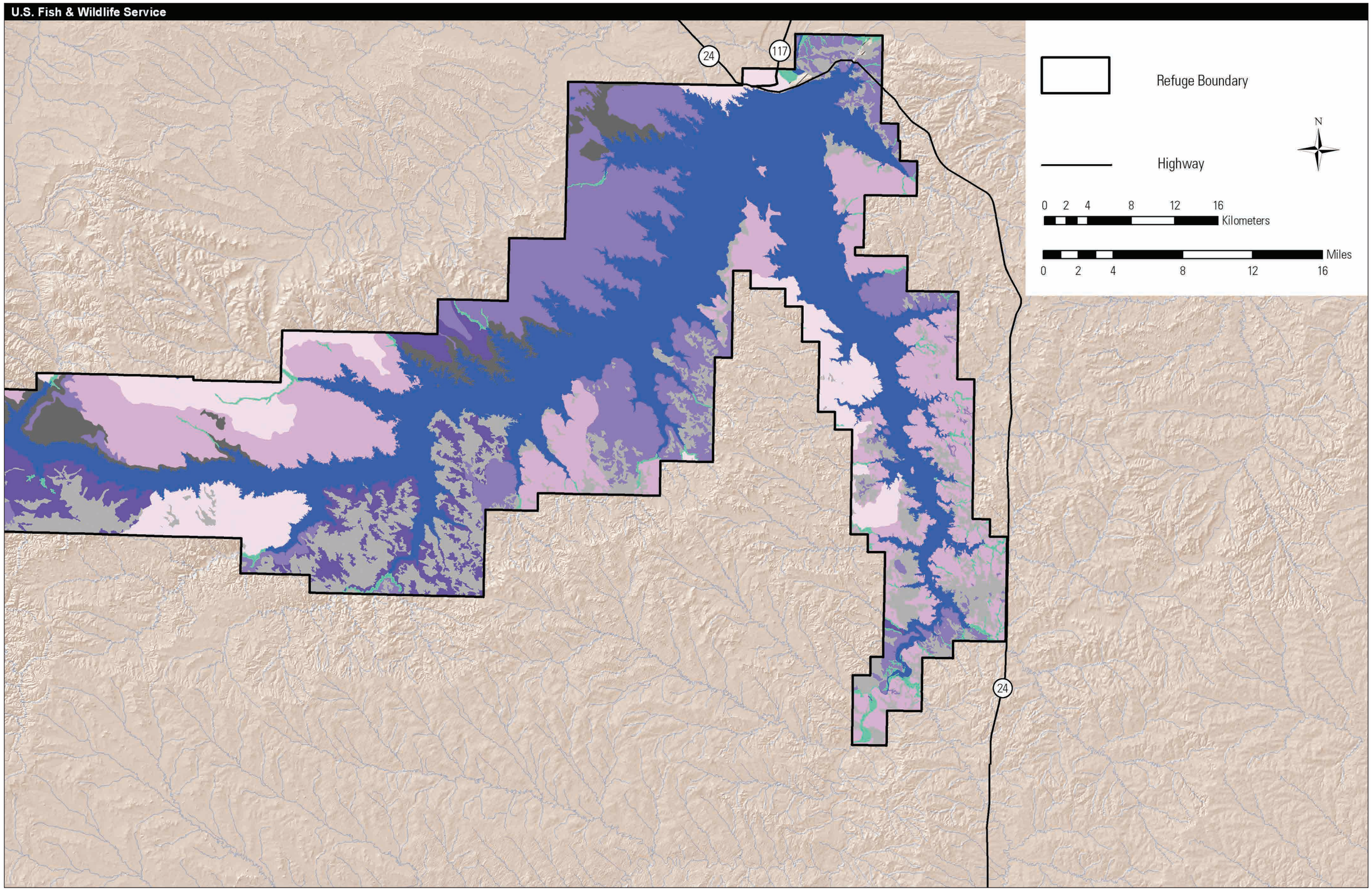


Figure 13 (fire frequency, east)

ungulates where less grazing took place due to its interaction with fire. Since 1882, it has become a constant (press) disturbance because of fences and fire control. As a result, highly palatable species (particularly shrubs and forbs such as chokecherry and white prairieclover) have dramatically declined. These species evolved with and are highly adapted to grazing when combined with several-year periods of abandonment for recovery. Palatable shrubs require several years to grow from seed to seed-bearing maturity and are alive aboveground (or vulnerable to damage from grazing) 12 months of the year. Present-day livestock grazing systems typically only rest pastures for 1 entire year or less from livestock use (with no rest from wild ungulate use).

Livestock and wild ungulate numbers have had an additive negative effect on ecological systems. Even though each herbivore species has a different diet, some plant species such as Maximilian sunflower and saltbush (sentinel species for herbivory) are eaten by all. Thus far, the management of each herbivore species on the refuge and elsewhere has been independent of the others, leading to overuse of sentinel plant species.

Predation and Hunting

When Lewis and Clark first traveled through the refuge in the early 1800s (Moulton 2002), they reported seeing grizzly bears and other predators. Historically, in the Missouri River Breaks ecosystem, wolves, grizzly bears, and Native Americans once slowed the growth rates of ungulate populations in between unfavorable climatic events, which also curtailed population numbers. This helped keep ungulate populations from destroying many plant species. Presently hunting is the only tool used to control the ungulates found on the refuge.

Fencing

As of 2009, more than 700 miles of fence have been constructed on the refuge with about 425 miles constructed since implementation of the 1986 EIS. Fencing is used to delineate the refuge boundary, fence between pastures, fence off riparian areas, or exclude wildlife and cattle for monitoring purposes. Fences have been used to exclude livestock in several riparian areas (for example, Rock Creek in Phillips County and Bobcat Creek in McCone County). Fences are generally about 42 inches high, three strands with 12 inches between wires with bottom wire about 18 inches above the ground to allow pronghorn to pass under. Most cattle exclosures are generally four-strand barbwire, with the bottom wire being 16 inches above the ground and the top wire being about 44 inches high. There are two types of total exclosures used on the refuge. One type is built with woven wire and the second type is built with modified portable stock panels. Both are about 8 feet tall and designed to keep out all ungulates. There are roughly 40–50 cattle exclosures on the refuge and about the same number of total exclosures.

Fencing is a management tool that can be used to improve the health of landscapes or harm them. It is often an unnecessary impediment to wildlife movement. Fencing, together with heavy grazing, and fire suppression effectively ended the historical fire grazing interaction. Grazing animals were no longer able to move freely to fire and abandon other locations, allowing other areas to rest for multiyear periods. On the refuge, boundary fences have improved the health of many plant species by controlling or eliminating excessive livestock influences from surrounding lands.

Water Development

Impoundments for livestock water have been developed throughout the refuge (refer to the water rights discussion under the previous "Water Resources" section). These impoundments negatively affect riparian areas and prairie stream functions by holding water that would have supplied these areas down to the rivers. These artificial water resources also concentrate livestock, which severely impact vegetation within about 1 mile of these water sources. When livestock are present plant species and thus wildlife habitats are often damaged in large areas surrounding the impoundments. Impoundments are unnecessary for wild ungulates. They can easily travel to stream water sources when they have not been destroyed. Water in streams has been reduced by these impoundments, by irrigation off the refuge, by loss of beaver foods (and beaver) due to livestock grazing, and by livestock trampling and use of riparian stream catchments. As impoundments are removed and natural riparian areas are restored, beaver-created ponds and wetland areas will replace the human-constructed ponds. Wild ungulates and other wildlife can then easily travel to natural stream water sources.

Biologists have long hypothesized that in arid areas of the country, the scarcity of free-standing water limited numbers of game animals. During the 1940s and 1950s wildlife managers in the west spent considerable time and money enhancing existing water supplies as well as developing new water sources (Rosenstock et al. 1999). These same new water sources (such as ponds, catchments, stock tanks, and dugouts) also benefited livestock. Because of human use of water, many of the new, constructed, water supplies for wildlife are actually mitigating the loss of naturally occurring water sources (Krausman et al. 2006). Wildlife water developments are currently being scrutinized as to whether their benefits outweigh the adverse effects caused by concentrating

wildlife in areas and at numbers that would not have normally been found. The use and promotion of constructed water catchments as a wildlife management tool remains controversial (Krausman et al. 2006).

Waterfowl use of stock ponds has been extensively studied (Candelaria and Wood 1981). Migratory waterfowl use constructed stock ponds; however, natural marshes and beaver-created wetlands are better in quality (Brown and Dinsmore 1986). In North Dakota, studies on the distribution of breeding ducks and wetland habitat type showed that the highest number of breeding ducks were found on natural ponds and lakes (76 percent) and the lowest on stock ponds and dugouts (5 percent) (Stewart and Kantrud 1973). The suitability of constructed ponds for waterfowl is influenced by size and characteristics of emergent and bank vegetation. The type of land use around the ponds most determines their use by waterfowl. Grassy shorelines instead of mud shorelines are a deciding factor as to whether ponds are useful for waterfowl breeding. Livestock trample shoreline vegetation, muddy the shorelines and water, which results in a decrease in the amount of aquatic vegetation and consequently wildlife food. Livestock also contaminates shorelines and water with droppings (Candelaria and Wood 1981). Studies do show that restoring wetlands on large tracts of native grassland increases duck productivity much more so than creating more water surface area such as with livestock ponds (Ball et al. 1995, Mack and Flake 1980, Shearer 1960).

Studies in Montana show that the best constructed ponds for waterfowl are larger than 1.2 acres, with irregular shorelines and more than 40 percent of their areas less than 2 feet deep (Ball et al. 1995, Lokemoen 1973). Silted ponds receive less use by all waterfowl at all times of year. When comparing constructed ponds that are fenced and unfenced, little difference in adult pairs or brood use was recorded. Stock ponds are more important to breeding waterfowl than dugouts and diked dugouts, dugouts were the least important (Lokemoen 1973). When comparing stock ponds in South Dakota, waterfowl use was highest when there were natural pond basins near the constructed ponds. Grain fields near ponds are also important for waterfowl use (Rumble and Flake 1983).

Constructed impoundments on the refuge are of little use for breeding, brooding or migratory waterfowl. Although migratory waterfowl do use constructed impoundments for resting, the refuge pond sizes are smaller than the "large size" ponds recommended in the scientific literature. Stock ponds (excluding the UL Bend) range from 140 to 800 linear feet with the majority smaller than 600 linear feet (refuge maintenance database). Pond sizes convert to approximately 0.03–1.2 acres with most smaller than 0.7 acre, which is about half the size recommended for breeding and brooding waterfowl. The natural pond basins and riparian areas needed close to constructed ponds are also deficient or missing in many areas of the refuge due to impoundments reducing natural waterflows. The refuge is also lacking the important grain fields nearby, which makes constructed ponds useful to migrating waterfowl.

Roads

Roads (also discussed under public use and visual resources) are not a natural part of landscapes and destroy the native plants that were present or could be present on the road site. Roads, because they are artificial firebreaks, have contributed to the reduction in fire frequency and loss of the fire–herbivory interaction. Most invasive plant infestations on public lands are found alongside the roads and adjacent to roads where hunters camp or associated with illegal off-road use (USFS 2003). They also result in habitat fragmentation, which has been shown to exacerbate the problem of habitat loss for grassland birds (Johnson and Igl 2001).

Invasive Plant Species

Numerous noxious or invasive plant species have affected habitats on the refuge. This topic is addressed in detail at the end of the vegetation section.

USFWS

Roads can become braided and unsightly, particularly during wet periods.

UPLANDS

Uplands make up most of the refuge. The uplands comprise grassland, shrubland, and forest. The grassland and shrubland communities compose more than 60 percent of the upland area, and forest communities cover about 30 percent of the uplands.

Common grass species include western wheatgrass, bluebunch, wheatgrass, green needlegrass, and blue grama. Western wheatgrass and blue grama have increased while the other species have declined over time. With the reduction or elimination of summer grazing, bluebunch, and green needlegrass have responded positively and are increasing. Japanese brome has invaded all grasslands, especially those in poor condition. The forbs associated with grassland and shrubland in excellent condition include white prairieclover, purple prairieclover, dotted gayfeather, purple coneflower, and stiff sunflower. These forbs continue to decline even in the best-condition grasslands and, for the most part, have been eliminated from fair-condition grasslands.

Shrubs important to wildlife include big sagebrush, silver sagebrush, juniper, chokecherry, golden currant, redosier dogwood, and silver buffaloberry. Shrubs across the refuge are not found where they once were. All shrubs—except for big sagebrush and juniper, which are in better health in areas with low herbivory (grazing)—have declined in historical distribution, density, and plant height.

Key upland trees include ponderosa pine, Douglas-fir, and some limber pine. Over time, ponderosa pine and Douglas-fir have increased across the refuge, especially in the western part; some trees are several hundred years old. A few green ash and cottonwood trees are scattered in the upland coulees (ravines), and aspen trees dot the sheltered coulees.

The refuge's total plant community contains more biomass of grasses than of other plant groups. Generally, the land can support a high biomass of large ungulates such as elk, bison, and domestic cattle based primarily on these grasses. However, sentinel shrubs and forbs, which have been affected by ungulate numbers and altered fire-return intervals, disappear long before grasses.

Sentinel Plant Species

Sentinel plant species are early warning indicators for ecosystems: they are the first species to decline or vanish in ecological systems when evolutionary natural processes such as herbivory, predation, and fire change. The Service has been monitoring the health of these important plant species on the refuge since 2003 and has found that some are beginning to diminish due to the changes to natural processes that have occurred. Different species of sentinel plants are adapted to all the temperature, moisture, and physical gradients present on the refuge and are more sensitive to changes in management or environmental conditions than general plant communities.

The concept of sentinel species monitoring is not new. In 1947, Aldo Leopold discussed diagnostic plant species that were early to respond to ungulate grazing pressure (Leopold et al. 1947). More recently, focal species are understood to be the individual

Gary A. Monroe / USDA–NRCS PLANTS Database

Golden Currant

W.L. Wagner / Smithsonian Institution

Winterfat and golden currant, both shrubs, are two of several sentinel plant species identified for refuge habitats.

wildlife species that have the most stringent limitations for area, dispersal, or resources or are limited by ecological processes (Lambeck 1997). (Refer to "Focal, Target, and Sentinel Species" under section 4.1 in chapter 4.) While animal species are clearly the best indicators of habitat area and dispersal needs, plant species (as suggested by Landsberg and Crowley (2004)) are important indicators of habitat quality and the ecological processes that sustain it. An important limiting component for many, if not most, animals is the availability of quality foods (White 1978). Even generalist herbivores prefer the highest quality plants (Mysterud 2006), which are the first to decline or disappear. Sentinel plant species include the most valuable wildlife forage, fruit, and pollen producing food plants. Sentinel species are also important indicators for monitoring biological diversity (Noss 1991, Gibson and Bosch 1996, Simberloff 1998, Rogers and Biggs 1999, Cousins and Lindborg 2004, Cushman et al. 2008), which are a critical component of wildlife conservation and a defining purpose of the Refuge System. Monitoring for sentinel plants is a key measure of success or failure of the Service's desire to promote ecological resilience by managing for natural and diverse processes (refer to "Upland Objectives" under section 4.2 in chapter 4).

Sentinel species are early to respond to adverse or beneficial changes in management or environmental conditions, while general plant communities may take decades to respond, which may be too late to understand the implications for the most sensitive plant and animal species. This is why sentinel species are important for monitoring the direct effects of current management on ecological processes and overall habitat conditions. This diagnostic approach to habitat monitoring is an important and valuable tool for the ongoing management of all wildlife habitats, especially when time and money are limited.

Grasses

Grasses are important foods for the largest herbivores, such as domestic cattle and bison. They are not a major food for pronghorn or for bird species such as greater sage-grouse, sharp-tailed grouse, or migratory songbirds. Grasses furnish protection for many species such as Baird's sparrow and upland sandpiper. Grasses are fire-adapted, returning from roots or seeds. Unlike forbs, shrubs, or trees, grasses have low growing points, making them exceedingly well adapted to herbivory. Grasses are not considered first-to-decline sentinel species.

Two of the taller and most palatable grasses are bluebunch wheatgrass and green needlegrass; these grasses dominate the better soils when grazing is light. Under the current practice of constant grazing, when these two grasses decline from overuse, in localized areas, palatable shrubs and forbs are reduced to remnants or locally eliminated. In some areas, as bluebunch wheatgrass and green needlegrass have declined, there has been an increase of low-growing grasses such as blue grama and Sandberg bluegrass that now cover much more area than what was described by NRCS for ecological site potentials. This change is probably the result of constant grazing and overuse by ungulates.

Forbs

Forbs are broad-leaved, nonwoody, flowering plants (for example, sunflowers). The leaves and seeds of forbs furnish food for many species of wildlife. Species that depend on forbs include greater sage-grouse (spring and summer food), pronghorn, and goldfinch. Forbs are perhaps the most important hosts for pollinating insects. In turn, insects are essential foods for most migratory and resident birds. Forbs are fire-adapted, meaning they return from their roots or seeds after fire. Unlike grasses, their growing points are on the tips of their stems. Several species are sentinels (among the first to decline from herbivory) and include white prairieclover, purple prairieclover, and Maximilian sunflower.

In some areas of the refuge, palatable forbs including white prairieclover and Maximilian sunflower, have been reduced to remnants or locally eliminated. The reduction in populations is likely due to constant selective grazing, fire suppression, and competition from less palatable native species or invasive species. Palatable forb populations historically benefited from fire and periods of less grazing pressure.

Shrubs and Trees

Shrubs and trees furnish protection and food for many of the refuge's wildlife species: fruit for sharp-tailed grouse and cedar waxwing, browse for mule deer and pronghorn, and nesting sites for the red-tailed hawk and Bullock's oriole.

First-to-decline, fire-intolerant species of trees and shrubs were historically confined to places that have little fuel or are difficult for fire to reach (refugia) (Frost 2008). Fire refugia are common due to the refuge's poor soils and rough topography. Fire suppression and constant herbivory pressure has benefited big sagebrush, junipers, ponderosa pine, and Douglas-fir. Ponderosa pine is usually killed by fire when it is young, but older trees have thick fire-adapted bark that often prevents death in a low-intensity fire that does not reach the crown. Wildfire, after long periods of fire suppression, can burn in these refugia areas due to crowning and spotting caused by the heavy fuel load and ladder fuel. Low-intensity prescribed fire can be used to preserve the heterogeneity that naturally resulted in the fire refugia.

Shrubs and trees that are the first to decline due to grazing and browsing by ungulates (herbivory)

are usually fire-adapted species. These species have the ability to resprout after disturbances such as fire and herbivory. Examples of sentinel shrubs and trees that are suppressed by constant herbivory include saltbush, winterfat, golden currant, green ash, and chokecherry. Furthermore, shrubs and trees are particularly sensitive indicators because they are alive aboveground 12 months of the year and, thus, vulnerable to damage. Also, unlike grasses, their growing points are on the tips of stems. Shrubs and trees are very useful for monitoring because the history of past years' growth is visible and measurable.

In the past, fire and herbivory occurred more sporadically. These natural processes benefited fire-adapted shrubs and trees such as silver sagebrush, green ash, chokecherry, golden currant, and saltbush by reducing competition and providing long periods of abandonment. In addition, historical juniper, pine, and big sagebrush populations were not as prevalent on the refuge as they are currently.

Fire Ecology of the Uplands

The Missouri River Breaks has had a long and rich history of wildfire occurrence; fire was one of the natural forces maintaining northern grasslands. It has long been suggested that treeless grasslands are a product of repeated fire, sometimes as a direct result of human activities. Research within the past few decades has confirmed that fire has been an important natural component of many grassland communities. Before European settlement, fire was the most common and widespread influence on the landscape in the Intermountain West (Gruell 1983). Natural fire replaced fire-sensitive woody species with species that were more fire-adapted (Gruell 1983).

Lightning-set fires were common in the United States and Canada; however, fires set by native peoples were the type mentioned most often in historical journals, diaries, and other accounts including the journals of Lewis and Clark (Moulton 2002, Higgins et al. 1986). The reduction in Native Americans' use of fire after 1875 (Higgins 1986), the break-up and reduction of fuel caused by the livestock grazing and cultivation that came with European settlement, and then the introduction of organized fire suppression have caused a drastic decrease in fire occurrence and size (Gruell 1983, Swetnam and Betancourt 1990).

Lightning is an integral part of climate, and the frequency and return interval of lightning-set fires undoubtedly played an important role in the species composition and ecology of the northern grassland plains. Fire-scar data collected by the refuge in the mid-1990s indicated a fire frequency of 10–20 years in the fire-prone ponderosa pine and Douglas-fir habitats before settlement by homesteaders. These data do not indicate the source of ignition; however, fire-scar evidence dropped off dramatically once the area was settled, which indicates an increased emphasis on human suppression of the numerous lightning starts that occur throughout the summer. (Bill Haglan, former wildlife biologist at Charles M. Russell National Wildlife Refuge; personal communication, fall 2009).

Fire exclusion has had the most marked effect on ecotones between two different vegetation types. With the omission of fire as a dominant ecological factor on some sites, there have been many changes in vegetation; successional changes that have occurred on some sites may not have occurred in the pre-European-settlement environment, where frequent

USFWS

Smoke billows from the Black Polaski wildfire in 2006.

fires suppressed woody vegetation (Gruell 1983). As a result, an increase in density of woody species has occurred on some sites, as well as the invasion of woody species into sites where frequent fire used to preclude their dominance.

As described before, grassland and shrubland compose most of the upland area and the areas devoted to livestock grazing. These are also the primary habitat types for use of prescribed fire. The effects of wildfires on specific species within each habitat type are well documented and can be found in the Fire Management Information System (USFS 2009). In general, the effect of fire on grasses depends on the growth form (low-growing points or stem-tip growth); in addition, the effects depend on how fire influences and is influenced by soil moisture and other environmental conditions. Many grass species are fire resistant and can produce new shoot growth even after moderate- to high-severity burns. When desirable understory plants are present within the sagebrush community, prescribed fire can release the growth of these species. Spring or fall fires are most desirable and effective, because the soils are moist and cool and fire effects are not as severe. Sprouting shrubs such as chokecherry and snowberry respond favorably, and perennial grasses also benefit. Wildland fire can be used to increase edge effect and increase plant diversity (Wright and Bailey 1982).

Shrubs are generally less tolerant of fire than grasses. However, the season and intensity of fire on shrubland also determines the effects of fire. Sagebrush is the most common category of shrubland on the refuge, with Wyoming big sage and silver sage as the dominant species. Fire history of the shrublands has not been firmly established, but fire was probably uncommon on drier sites because of sparse fuel; fire was more frequent, averaging every 32–70 years, on moister sites with more vegetation (Wright et al. 1979).

Recent Fire History

A recent fire history study of the refuge shows fire frequency intervals are extremely variable across the refuge (figure 13), ranging from 8 years to more than 200 years between fires (Frost 2008). About 30 percent of the refuge is a forested conifer community, with Douglas-fir and ponderosa pine being the dominant species. Fire records show this community type to be the most subject to wildfire occurrence. Fire exclusion in this forest type can lead to accumulation of dead woody fuel, as well as the establishment of dense understory regeneration (ladder fuel). Ladder fuel alters fire behavior dramatically, oftentimes creating high-intensity crown fires. Forest succession has been substantially altered due, in part, to fire exclusion. Exclusion of fire allows the less fire-tolerant species to replace the more fire-tolerant species. This can be seen on the refuge with the increased abundance of juniper and higher densities of Douglas-fir. Low- to moderate-intensity wildfire in this community type sets back succession, promotes establishment of mature ponderosa pine forest, and retards encroachment of juniper and Douglas-fir (Keane et al. 1990).

In the refuge's early annual narratives, staff mentioned large wildfires, but specific information about these fires is lacking. Formal fire records started in the 1960s and have documented great variety in the annual number of wildfires, from 1 fire in 1975 to 44 fires in 1988. Since 1982, when records were initially entered into a national database, about 87 percent of the wildfires have been caused by lightning and occurred from mid-May through the end of September. Fires during that period ranged in size from one-tenth of an acre to as large as 21,967 acres. In 2003 and again in 2006, several lightning-ignited wildfires occurred on and around the refuge, mainly in Garfield County. When finally extinguished, two fire complexes (Missouri River complex and Black Pulaski complex) were in excess of 130,000 acres each. These fires were the direct result of significant, dry lightning storms that ignited multiple fires, followed by cold frontal passages 1–2 days later that produced winds of 40–60 miles per hour.

Most fires are directly influenced by local and general winds and have the potential to exhibit extreme fire behavior. Generally, a large fire will make an initial run until it hits a natural barrier or burns into an area of little or no vegetation. For example, in 1994, the CK Creek fire made a run of 6 miles in one afternoon and burned more than 11,000 acres before burning into sparse vegetation.

Early in the history of the refuge, great emphasis was placed on putting out wildfires at the smallest acreage, regardless of cost, habitat management strategies, or land designation such as wilderness. Not until the Leopold Report of 1963 (Leopold et al. 1963) was the public informed that protecting plant communities from fire can lead to these negative effects: (1) catastrophic, stand-replacing wildfires; (2) decadent shrub and grass communities; (3) encroachment of shrubs and trees into grasslands; (4) increased infestations of disease and insects; (5) lack of diversity in plant and wildlife species; and (6) devastating wildfires that cannot be controlled with any amount of resources (Wright and Bailey 1982).

In the late 1970s and early 1980s, land managers at the refuge began to look at alternatives to putting all fires out at the smallest acreage. With the signing of the record of decision for the 1986 EIS, managers had the option of using modified suppression. Modified suppression is based on an evaluation of each wildfire for the resources at risk, and if the risk

does not justify the cost of full suppression, alternate suppression tactics can be used. Suppression strategies may allow a fire to burn into clay ridges, gumbo knobs, alkali flats, and the Missouri River or Fort Peck Reservoir. As a result, parts of some wildfires might burn for more than one burning period.

Based on fire records for the past 28 years, 364 wildfires have burned 180,230 acres on the refuge (data comes from the 2008 Fire Management Information System database and archived individual fire reports, DI–1202s). Fire size has increased significantly over the past decade as shown in table 4. Possible causes may be changes in land management, climate change, natural wildfire cycles, or a combination of all three.

The Mickey Butte fire burned nearly 3,200 acres of prime habitat for Rocky Mountain bighorn sheep in 2003. The fire burned close to Mickey Butte, which is the core of the home range for upwards of 50 bighorn sheep. In 2005, the Brandon Coulee, Heartland, Sheep, and Shore fires burned an additional 15,647 acres of sheep habitat on the Mickey–Brandon Butte and Iron Stake Ridges.

Livestock grazing in habitat units is restricted for 2 years following large wildfires. This occurred after the CK fire of 1994, the Missouri Breaks complex of 2003, and the Black Pulaski complex of 2006. In such situations, the Service gives permittees the option of taking nonuse of their permits or temporarily moving their livestock to habitat units that no longer have annually permitted grazing.

Prairie dog towns are effective natural barriers for wildfire during all but the most extreme fire conditions. To promote population expansion, refuge staff applied prescribed fire to 1,435 acres of prairie dog habitat during summer 2007 and 2008 in the Locke Ranch area of the UL Bend Refuge.

Table 4. Historical fire data for the Charles M. Russell and UL Bend Refuges, Montana.

Timeframe	*Number of fires*	*Acres burned*	*Average acres per fire*
1981–89	132	25,642	194
1990–99	120	35,643	207
2000–09	120	118,982	991
Peak number of fires in a single year (1988)	44	12,953	—
Peak number of acres burned in a single year (2006)	22	69,737	—

Livestock Grazing

In 1954, there were 25,673 cattle, 3,365 sheep, and 700 horses permitted on the refuge. Wildlife estimates for the same period were 140 elk, 8,000 deer, 800 pronghorn, and 54 bighorn sheep. Records report that livestock wintered on river bottoms from December to March, and they grazed in the uplands in the summer. As a result, the river bottoms were heavily impacted. Although BLM did not issue winter permits, according to a refuge report, "BLM was aware of the fact that it had been the practice for a number of large ranches to run cattle on the range during the winter months." After considerable urging by refuge staff, BLM did not stop winter grazing but added it to the permit. Since the passage of Executive Order 7509, livestock grazing has been a tool to manage habitat on the refuge. The specific application of it on the refuge is discussed below. For more information refer to section 2.1 in chapter 2 and "Upland Objectives" under section 4.2 in chapter 4.

History of AUMs on the Refuge. The first range survey of actual livestock numbers was conducted in 1953–54. Initially, there were few limits on the number of AUMs grazed on the refuge. Following the first range surveys conducted by BLM, the number of AUMs slowly decreased. However, the number of AUMs permitted were not the same number as actual AUMs. By 1962, there were 26,820 cattle, 11,481 sheep, and 950 horses. The bighorn sheep herd reported in 1954 had vanished by 1962. By this time, the Service and BLM relationship was strained. The record from a 1962 inspection of the refuge by the Service's Washington office staff stated, "The land of the Fort Peck Game Range has literally been raped and this despoiling is accelerating." Although much of this past use came from BLM-managed lands, about 150,000–200,000 AUMs were grazed annually on the refuge in the 1950s. At least part of the overuse of grazing on the refuge was a result of how the program was carried out; for example, in one BLM unit management plan that included a refuge pasture, there were 3,400 AUMs permitted, which was equivalent to the 1953–54 range survey numbers. However, BLM allowed flexibility of up to 10,000 AUMs to be permitted yearly without application. The numbers permitted on paper did not equate to what was occurring on the ground.

The 1986 record of decision established new livestock grazing levels. Of the 100,000 AUMs estimated

to be supported by available forage, about 40 percent of this forage is allocated for livestock on 62 different habitat units through 73 grazing permittees. Livestock forage allocations range from 0 to 78 percent of the available forage. These allocations were based on a 1978 range survey. All lands were stocked at the recommended stocking rate of the then-Soil Conservation Service (now the Natural Resources Conservation Service). Slope and distance-to-water deductions were applied to Service lands but not to State or private lands. This resulted in a 33-percent reduction in overall livestock AUMs on the refuge, an almost unprecedented action on western grazing lands. Generally, the livestock capacity of State and private lands increased. In pastures such as the West Indian Butte Habitat Unit (see figure 11) that includes non-Federal lands, this increase totally offsets the Federal reduction. Livestock stocking rates on the eastern part of the refuge typically are higher, reflecting the flatter terrain and nearness to Fort Peck Reservoir, as compared to the western part of the refuge that has steep, rugged coulees and where the distance to water is greater. Livestock allocations in Fergus and Petroleum Counties are the lowest (number of AUMs), McCone and Garfield Counties have the highest number of AUMs, and Valley and Phillips Counties have intermediate levels of AUMs. Garfield County is stocked at twice the level per acre as Petroleum County. There is a direct correlation between the forage allocation for livestock and conflicts with wildlife habitat.

Permitted use in 2003 was 22,304 AUMs, which was 17,000 AUMs less than the 1986 record of decision level and 36,000 less than the 1976 level. The lower AUM levels are due to a variety of reasons including higher grazing fees and not automatically transferring permits (refer to "Issues not Addressed" in section 1.9 in chapter 1). Additionally, livestock supervision and permit enforcement have ensured that actual use approaches what is permitted today. Livestock numbers on the refuge are currently lower than anytime in the past century.

Transition to Prescriptive Grazing. Since 1986, the Service has gradually been making the transition to prescriptive grazing (refer to "Upland Objectives" under section 4.2 in chapter 4). Today, there are approximately 740,030 acres of potential grazing acreage on the refuge; current livestock grazing units are shown in figure 11. About 409,849 acres are lands grazed under annual permit. Prescriptive grazing occurs on about 252,706 acres, and 77,475 acres are not grazed. Under annual grazing, a permittee can graze a set number of AUMs every year. There are some limits placed on when and where they can graze. Under prescriptive grazing, the Service determines the habitat objectives for an area, and then sets the number of livestock needed to achieve those objectives. (Refer to the prescriptive grazing explanation in section 4.2 in chapter 4.) This does not include grazing on other State or private lands (inholdings) within the refuge boundary.

About 86 percent of the forage is allocated to livestock within 0.5 mile of water on slopes of less than 10 degrees. Extensive water development has resulted in many upland sites, moist areas, and riparian areas being heavily impacted by livestock. Forage in riparian areas is almost exclusively allocated to livestock. Because of gentle terrain and available water, some habitat units along Big Dry Arm have as much as 50–78 percent of the forage allocated to livestock. In one unit, 40 percent of the livestock forage comes from 18 percent of the land—those lands within 0.25 mile of the creek. Riparian habitats reflect the livestock allocation; fieldwork conducted by the University of Montana in 1995–96 documented the poor state of riparian habitat on the refuge.

Benefits of Prescriptive Grazing. Although there have been many issues associated with livestock grazing on the refuge, when prescriptive grazing is used with careful consideration of its compatibility with habitat and wildlife and other land management goals, it can be an effective tool (FWS 2011b). For example, it can be used to control invasive species or to accomplish other restoration and conservation objectives (refer to "Upland Objectives" under section 4.2 in chapter 4). When applied correctly, it can address some of the challenges and issues of domestic grazing systems to create effective and ecologically beneficial results (FWS 2011b).

State and Private Lands

There are about 36,000 acres of State school lands within the refuge (figure 11). The CCP only directly affects lands under the management authority of the Service. However, the implementation of prescriptive grazing could have indirect negative effects on DNRC in meeting its statutory obligation of generating revenue for local schools.

Private lands make up about 41,000 acres on the refuge (figure 11), although this acreage changes when there are willing sellers and money exists to acquire more lands within the authorized boundary. Private landowners are also affected by wildlife migrations, and at times large ungulates have negatively affected private lands. In the past, the refuge has worked with MFWP who controls harvest levels as well as the community to address these issues (see table 10 under "Big Game"). As with DNRC, the continued transition toward implementing prescriptive grazing on the refuge has negative effects on landowners who are also permittees who graze on refuge lands. More information about the socioeconomic environment is in section 3.7 in chapter 3.

Vegetation Monitoring in the Uplands

The Service has been monitoring residual grass cover since 1986, and has also been increasingly emphasizing sentinel plant monitoring in recent years. As described above, sentinel plants are the first to decline in response to changes to the evolutionary pattern of ecological processes and provide an indicator of landscape-scale biological integrity and health. The combination of poor and highly erosive soils, a century of historical overuse by livestock, current livestock grazing, and current use by wild ungulates (elk and deer), has compromised the health of upland habitat on the refuge. Monitoring of residual cover and sentinel species has shown that wild ungulate populations alone are negatively affecting sentinel plant species (causing negative growth rates and low to no seed or fruit production), and residual cover objectives are not being met. Livestock use compounds the problem. Several examples of upland monitoring results that show this current condition of upland habitat are described below.

Residual Cover. Since 1986, one of the primary purposes of monitoring residual grass cover has been to ensure nesting and roosting cover for sharp-tailed grouse and other grassland obligate birds. Livestock exclosures have been developed in many of the existing 65 habitat units. The goal of habitat management on the refuge has been to provide, outside the exclosures, at least 70 percent of the grass cover that is inside the exclosures. Measurements are taken after the grazing season. A cover pole or height–density pole is observed from set distances and angles at points along transects, in and out of the exclosures, to measure the comparison.

Habitat monitoring across the refuge has varied annually. Several units were not monitored in the late 1990s to early 2000s. Since 2005, almost all units grazed by livestock have been surveyed for residual grass cover. In 2008, Service personnel conducted 27 height–density plot (HDP) surveys across the refuge: 8 for Jordan (5 failed), 10 for Fort Peck (4 failed) and 9 for Sand Creek (all 9 failed). Eighteen of the 27 units failed to meet objectives established in the 1986 record of decision). Most of the habitat units that failed in 2008 have not met objectives or improved since monitoring began. All three of the habitat units in Jordan that passed were not grazed in 2008.

Figure 14 provides an example of one habitat unit, East Indian Butte, that failed to meet objectives for residual cover in every year between 1990 and 2007. Figure 14 displays residual cover information collected from the East Indian Butte Habitat Unit (see figure 11). The monitoring data show that this unit does not meet the baseline objective of 70 percent residual cover (red line on graph). This habitat unit is grazed by livestock in common (no separating fences) with private, State, and BLM land.

Residual cover monitoring has shown that many habitat units, like the East Indian Butte example, are not meeting objectives and are showing negative effects from long-term ungulate grazing.

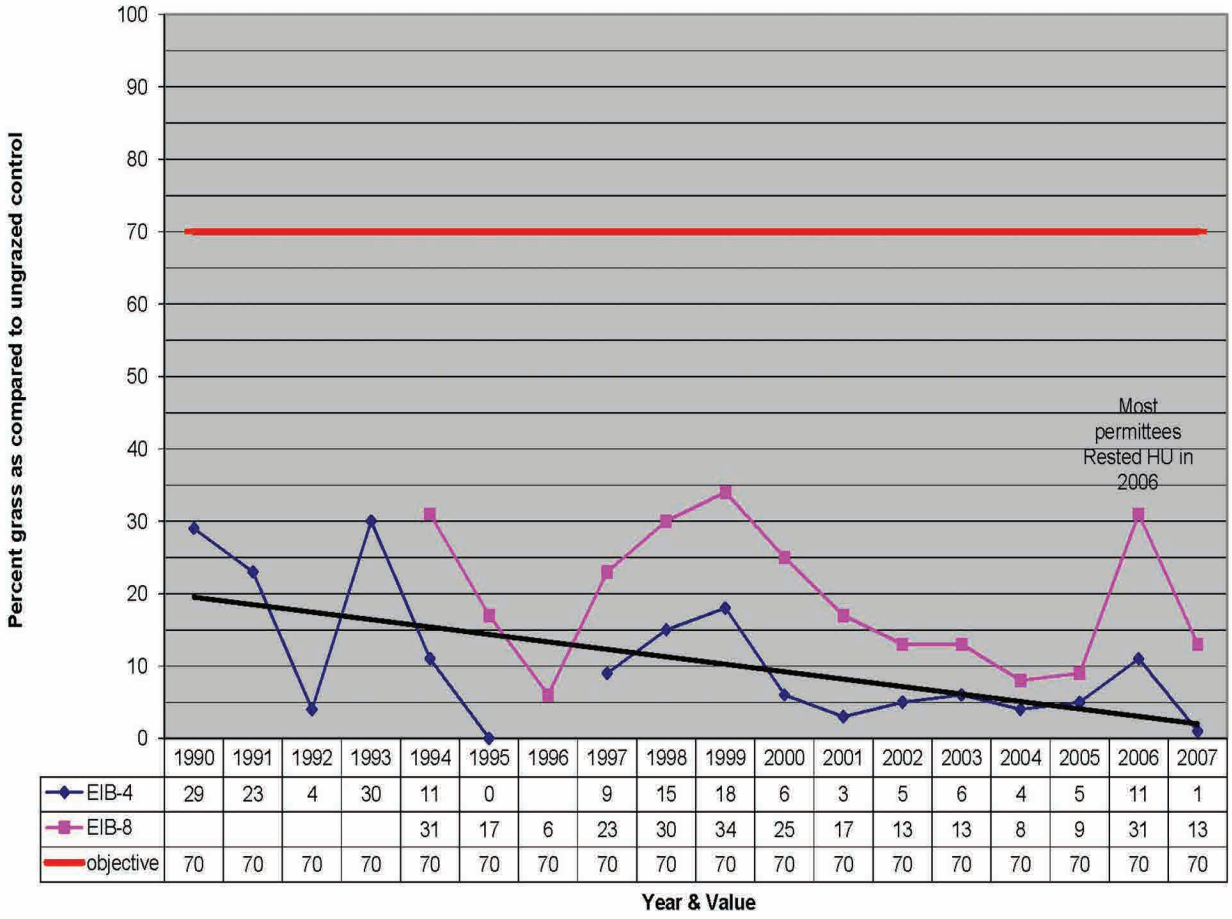
Sentinel Species. The Service is increasingly emphasizing sentinel plant monitoring as an indicator of biological integrity and health. The refuge has been monitoring sentinel plant species populations in and out of exclosures since 2003. Since 2004, biologists have been working on new survey methods to incorporate with current HDP monitoring to fully assess habitat conditions. Sentinel plants (plants that are the first to decline due to grazing pressure) will be identified and monitored across the refuge to determine overall grazing pressure on these plants. Subsequently, the refuge staff uses this information to influence planning and adaptive management of ecological processes.

Currently, the Service is working with West, Inc., and Dr. Sam Fuhlendorf from the University of Oklahoma to develop a statistically sound standard operating procedure for monitoring sentinel species' response to the adaptive management of fire and herbivory, and these are anticipated to be completed in 2010. Below are detailed descriptions of results from a chokecherry site and an aspen site, as well as brief descriptions of monitoring results for other sentinel species (silver buffaloberry, grey rubber rabbitbrush, and saltbush). All of these examples show the effect of grazing pressure on sentinel plant species on the refuge.

Chokecherry. Chokecherry is a sentinel species of riparian zones and moist, north-facing slopes across the refuge. Formerly, this species was much more common. Populations of this shrub have been reduced by herbivory (chokecherry is highly preferred by all ungulates) and by competition from juniper and pine (see figure 15).

Chokecherry fruit is important to many species of resident and migratory birds. Fruit production is perhaps more affected by herbivory than height growth; many species including chokecherry produce fruit only from stems not browsed the year before. Furthermore, fire often stimulates chokecherry growth, resulting in fruit production a few years after a fire.

In 2006, refuge staff constructed two types of exclosures to monitor chokecherry fruit production on a site that burned in 2005: (1) one type excluded both large ungulates and cattle; and (2) the second type excluded cattle but not other large ungulates. In 2009, the average chokecherry plant in the total ungulate exclosures produced 312 berries; chokecherries in the cattle exclosure averaged 103 berries;



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
EIB-4	29	23	4	30	11	0		9	15	18	6	3	5	6	4	5	11	1
EIB-8					31	17	6	23	30	34	25	17	13	13	8	9	31	13
objective	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70

The dark blue line shows information collected from height–density plot (HDP) transect EIB–4, about 1 mile from water.
The pink line shows information collected from HDP transect EIB–8, which is about 2 miles from water.
The red line shows the objective set by the 1986 record of decision for habitat units: 70-percent residual cover.
The black line is the overall trend at 1 mile from water.

Figure 14. Graph of residual cover after grazing in the East Indian Butte Habitat Unit of the Charles M. Russell Refuge, Montana (1990–2007).

and chokecherries outside of exclosures averaged 5 berries.

In addition, monitoring showed that grasses in the exclosures were mostly not grazed. Even the most palatable grasses are not first-to-decline sentinel species.

Aspen. Aspen, a sentinel species, is one of the first species affected by herbivory. Occurring in scattered relict groves, aspen is highly preferred by livestock and all species of wild ungulates. In addition, aspen is fire-adapted and dependent on fire to occasionally remove fire-intolerant conifers, which are more competitive over long periods without fire. Within the refuge, aspen is also a climate-sensitive sentinel. It only occurs in pockets of the landscape such as coulee bottoms that are moister than the landscape in general. Aspen will likely be affected first by a warming climate with less soil moisture.

In 2005, the refuge staff constructed an exclosure within an aspen site in a coulee in the Soda Creek watershed. At that time, the new growth of plants both in and out of the exclosure was similar (about 14 inches) and the plants were heavily impacted by browsing and were unable to grow taller. This site burned in a wildfire in 2006, eliminating all above-ground growth both in and out of the exclosure. In subsequent years (2007, 2008, and 2009), aspen growth within the exclosure has exceeded the growth outside of the exclosure, with averaging about 7, 34, and 52 inches, respectively, compared to about 4, 12, and 15 inches outside of the exclosure. Current browsing levels prevent the plants outside the exclosure from growing taller. Figure 16 displays these results.

It is likely that aspen will disappear from this aspen site in the future except for those in the exclo-

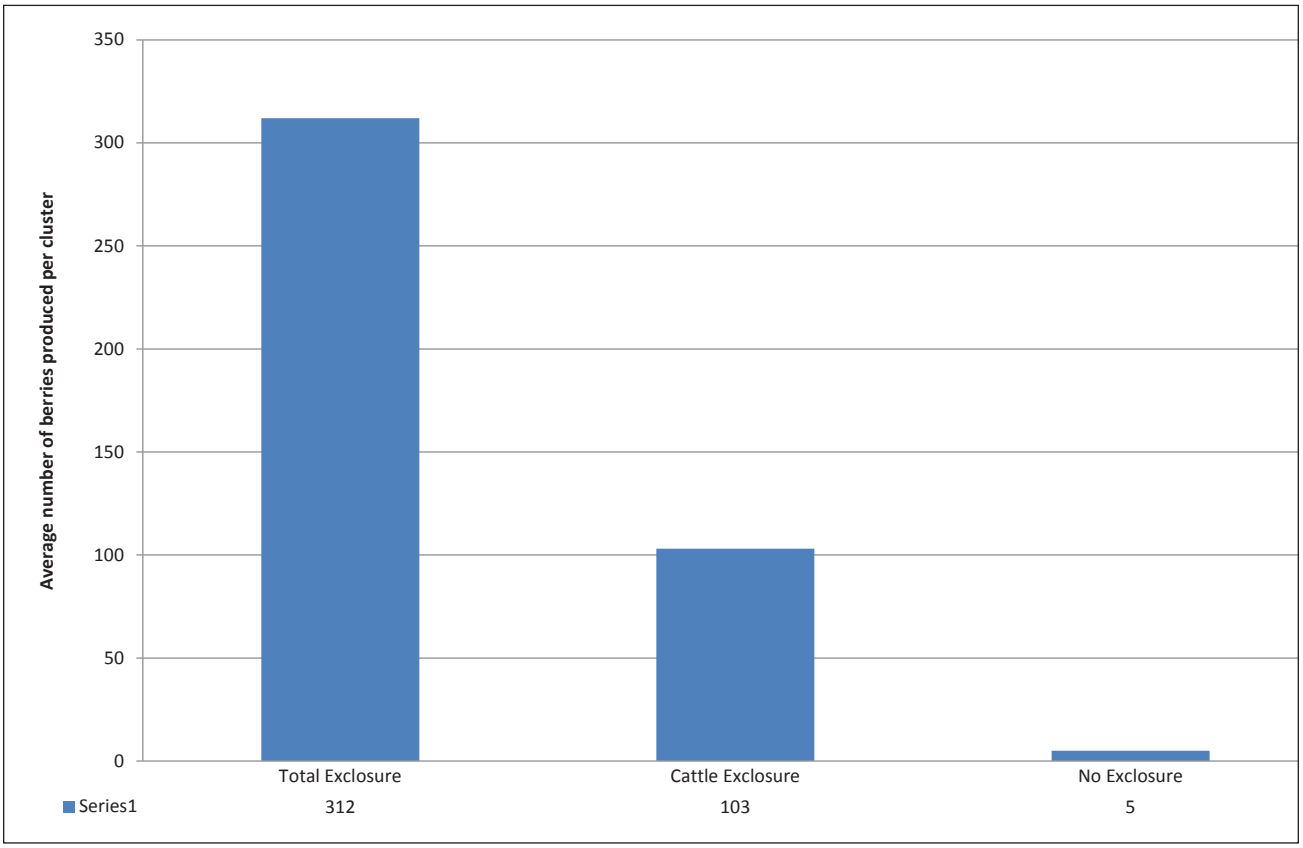


Figure 15. Bar graph of monitoring results for chokecherry fruit production 4 years after fire at the Charles M. Russell Refuge, Montana.

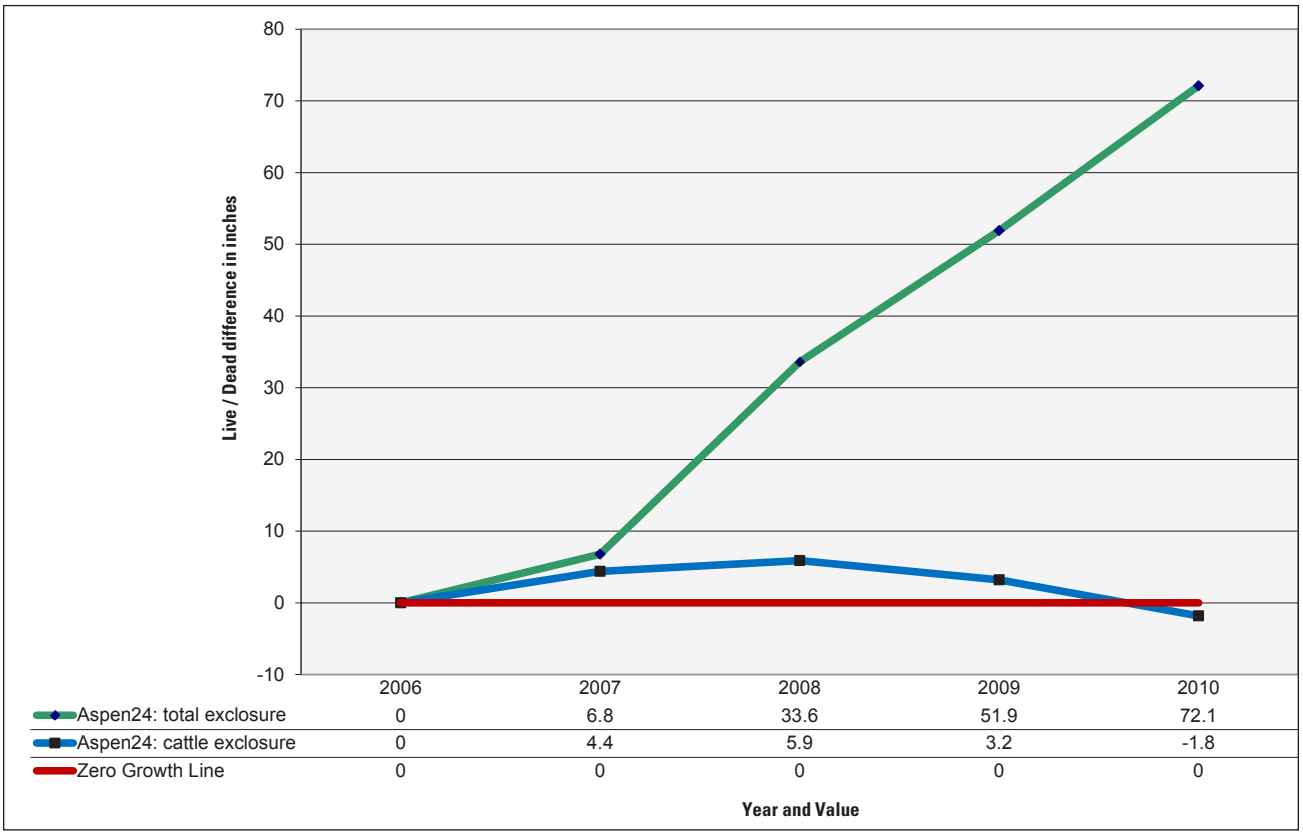


Figure 16. Graph of monitoring results for aspen growth at the Charles M. Russell Refuge, Montana (2006–10).

sure and possibly a few in highly protected locations, areas that are steep and covered with fire-killed juniper. It is likely that other relict aspen sites disappeared after constant grazing by all ungulates and a lack of fire.

Other Sentinel Species. Other examples of sentinel species monitoring include a silver buffaloberry site in the Rock Creek West Habitat Unit, a grey rubber rabbitbrush site in the East Indian But Habitat Unit, and a saltbush site in the Rock Creek East Habitat Unit. Results of monitoring the average annual plant growth (height to base of current year's growth) at these sites are summarized below.

- *Buffaloberry (2005–09):* About 9 inches within the exclosure, compared to about 6 inches with no exclosure
- *Rabbitbrush (2003–09):* About 10 inches within the exclosure, compared to about 2 inches with no exclosure
- *Saltbush (2004–09):* About 10 inches within the exclosure, compared to about 3 inches with no exclosure (figure 17)

RIVER BOTTOMS

Bottomlands or river bottoms are found in the floodplains of the Missouri River above maximum lake level. They occur only on the west end of the refuge.

There are about 16 river bottoms on the west end of the refuge (see figure 18). The total area covered by these river bottoms is estimated at between 5,000 and 7,000 acres. A diverse mixture of native trees, shrubs, forbs, and grasses characterizes the river bottom plant community. Trees and shrubs present are green ash, boxelder, redosier dogwood, silver buffaloberry, golden currant, western snowberry, Woods' rose, chokecherry, sumac, plains cottonwood, sandbar willow, peachleaf willow, and a couple of other willow species. Native forbs present include Maximilian sunflower and American licorice. Native grasses present are bluebunch wheatgrass, green needlegrass, prairie cordgrass, basin wildrye, western wheatgrass and reed canarygrass.

The most significant threat to river bottom health is from exotic species such as tamarisk (saltcedar), Russian olive, smooth brome, crested wheatgrass,

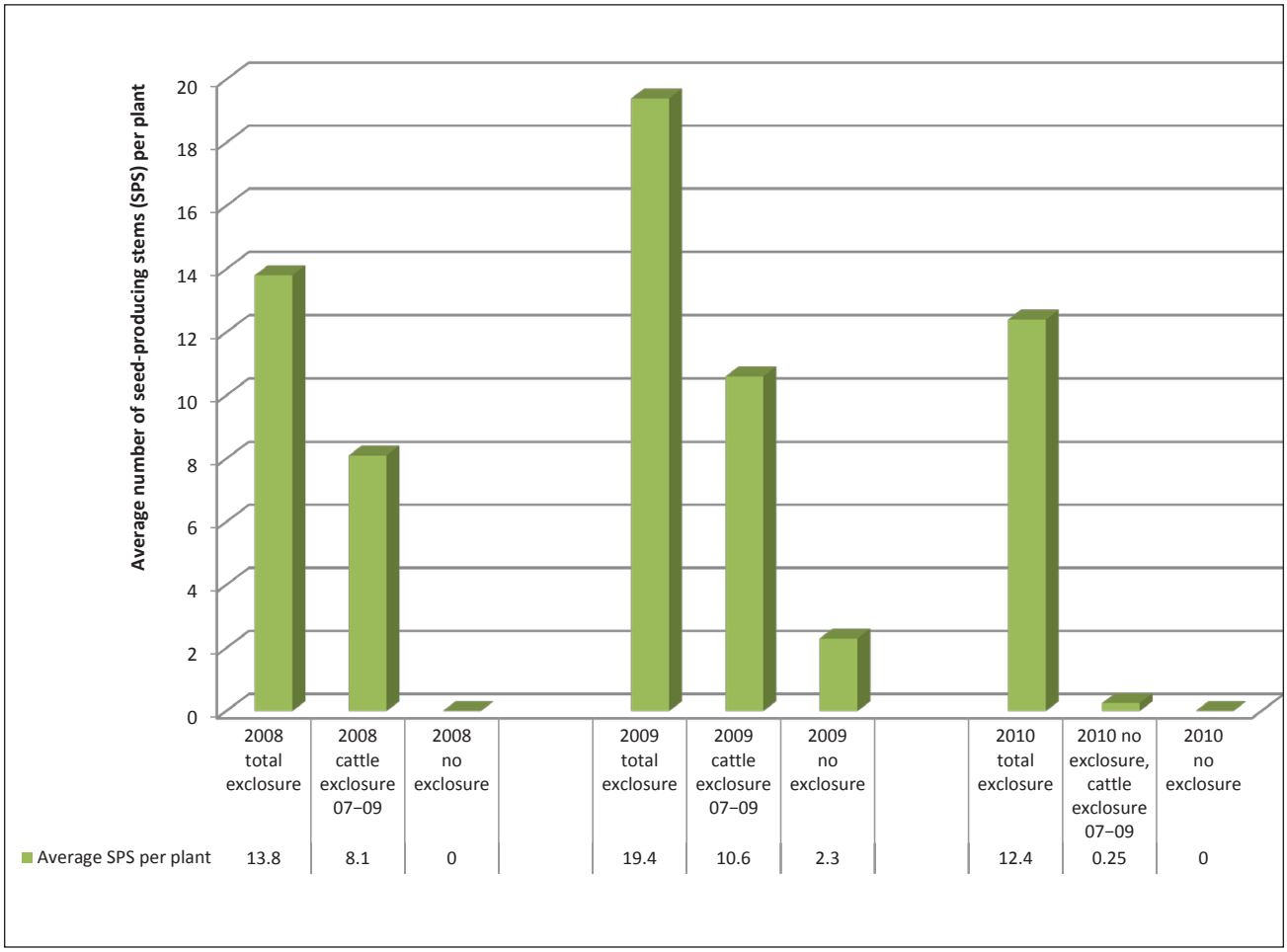


Figure 17. Bar graph of monitoring results for saltbush growth at the Charles M. Russell Refuge, Montana (2008–10).

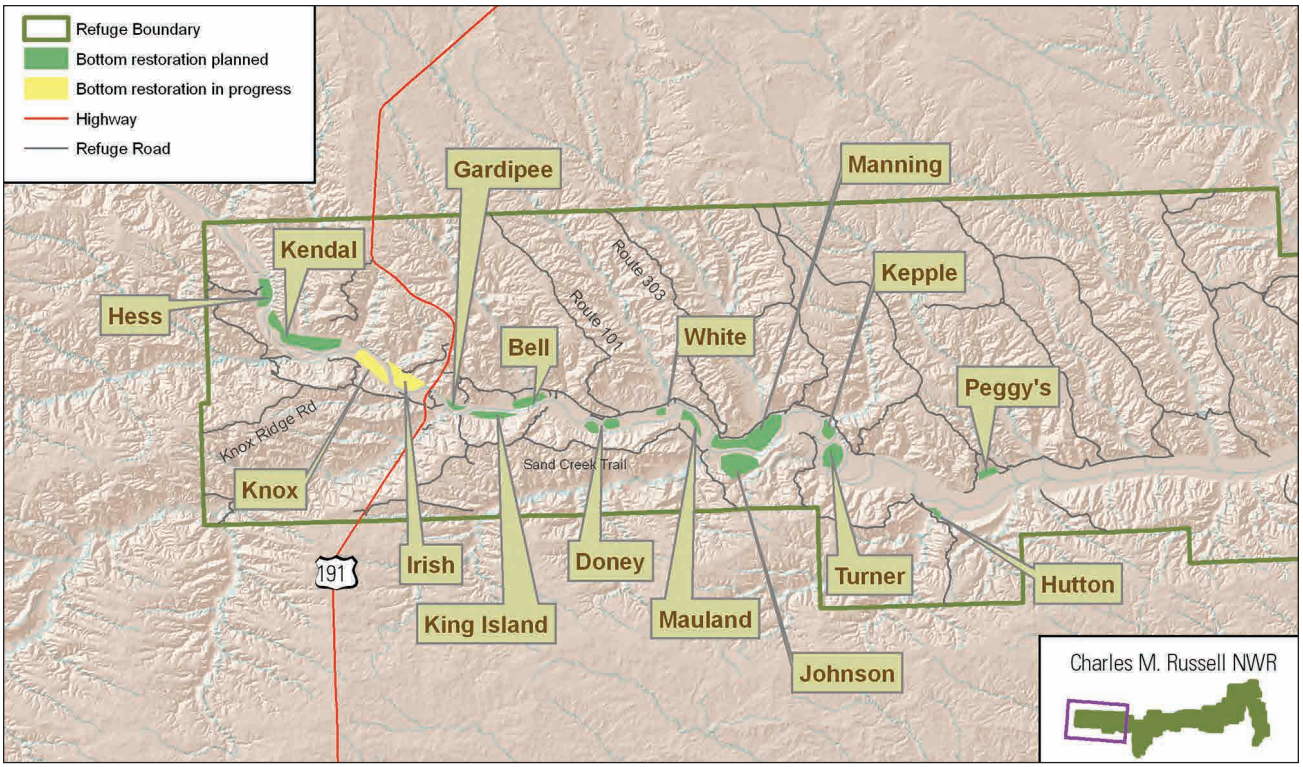


Figure 18. Map of river bottoms in need of restoration at the Charles M. Russell and UL Bend Refuges, Montana.

quackgrass, leafy spurge, Russian knapweed, and Canada thistle. Invasive species have been increasing in many areas largely because of two reasons: (1) lack of seed source to establish native plants that can compete with or outcompete the invasive weeds; and (2) extensive browsing on sentinel plants that are established.

Historically many of the river bottoms on the refuge were cleared. Native plant communities were plowed, and nonnative agricultural crops were planted because these were the most productive areas. Farming the river bottoms occurred for decades, but has now been eliminated. The last homesteader on the refuge stopped farming in 1983–84, and the last two bottoms to be planted to crops have not been farmed since 1985–86. The plant communities left existing on the river bottoms have now mostly been invaded by Russian knapweed, leafy spurge, smooth brome, and quackgrass, which have very little value to wildlife. Native plant communities that once existed on these bottoms have been unable to reestablish themselves. The Service is currently consulting with experts from NRCS and State agencies to determine the best methods to restore these bottomlands back to healthy native plant communities. Establishing and maintaining healthy native plant communities is an important way to slow or prevent reestablishment of weeds after they have been treated mechanically, chemically or with biological control. The Service has begun restoration work on two bottomland areas (Irish and Knox Bottoms already). Figure 18 shows the river bottoms in need of restoration.

Use of Prescribed Fire

Prescribed fires were used to treat Kendall Bottoms (55 acres) and Leclair Bottoms (74 acres) in 1992. In 1993, Forchette Creek (50 acres), Doney Bottoms (8 acres), Manning Dog Corral (50 acres), Hawley Creek (200 acres), Irish Bottoms (110 acres), Mauland Bottoms (30 acres), and White Bottoms (30 acres) were treated as well. The objectives were to reduce invasive plant invasion and reestablish native vegetation. Prescribed fire continues to be used as a tool to treat river bottoms and has proved to be very effective in preparing the seedbed for native planting.

RIPARIAN AREAS and WETLANDS

Riparian habitat areas include wetland and upland vegetation associated with rivers, streams, and other drainage ways. The riparian areas of the refuge occupy a relatively small part of the landscape, but wildlife and livestock use these areas disproportionately more than any other habitat type (Kaufman and Krueger 1984, Johnson et al. 1977, Ames 1977). Riparian and wetland areas provide important habitat for a wide variety of wildlife species, ranging from reptiles and amphibians that are solely dependent on streams and wetlands, to upland mammals that depend on riparian areas as a source of water,

foraging habitat, and cover. Riparian areas are also important for many bird species, providing nesting and breeding habitat for migratory songbirds, open-water habitat for waterfowl, and foraging and nesting habitat for some raptors. Besides wildlife habitat, riparian and wetland habitats also provide important functions that sustain the ecosystem including sediment filtering, streambank development, water storage, aquifer recharge, and energy dissipation from streams (Hansen et al. 1995).

Riparian systems play an important role in maintaining the ecological function of the entire refuge, from aquatic habitats to uplands. This section describes the general composition of riparian habitats, the historical influence of beaver, wildlife diversity, ongoing riparian area monitoring, the influence of livestock grazing, and water quality considerations.

Riparian Habitat Composition

Riparian vegetation and habitat has historically been found along most of the small streams and rivers on the refuge. Vegetation within the larger riparian systems (such as the Missouri and Musselshell Rivers) is dominated by mature forests of plains cottonwood with an understory of shrubs, grasses, and wetlands. Other trees and shrubs include green ash, redosier dogwood, common chokecherry, and silver sagebrush, while the riparian area understory includes grasses (redtop, inland saltgrass, western wheatgrass, and foxtail barley) and a variety of forbs, sedges, and rushes. Smaller streams and coulees with a healthy riparian area are generally similar in species composition but at a smaller scale.

Many of the cottonwood riparian areas along the Missouri River are in a degraded condition, with limited shrub understory, limited cottonwood regeneration, and an overabundance of monotypic nonnative grasses (such as smooth brome). This change in riparian area structure along the Missouri River is likely due to a combination of livestock grazing and changes in riverflows. Hansen (1989) found the overall ratio of replacement to mature trees is 54 percent, suggesting a future decline in the riparian forests and the habitat they provide.

Several studies have be done on the riparian vegetation along the Missouri River from west of the refuge boundary to Fred Robinson Bridge (Auble et al. 2005; Auble and Scott 1998; Dixon et al. 2009; Scott and Auble 2002; Scott et al. 1993, 1994, 1997). Flows in this reach of river are influenced by several dams and diversions, most importantly, Canyon Ferry and Tiber Dams. While the timing of the average high and low riverflows has not been substantially altered, their relative magnitudes have. Scott et al. (1993, 1994) found that cottonwood establishment occurred in years with a peak mean daily flow greater than 49,434 cfs (1,400 cubic meters per second) or in the 2 years following such a flow. These years include 35 out of the 111 years of record and account for establishment of 47 of 60 trees examined.

Seedlings become established most years on bare, relatively low surfaces deposited by the river. The high elevation for establishment of all trees dating to before 1978 (relative to the normal river stage elevation) indicates that only individuals established on high flood deposits are able to survive subsequent floods and ice jams. Highest flows almost always occur during the ice-free period and establishment is more likely to occur during ice-free flooding. Mortality is higher for those cottonwoods established in relatively low channel positions.

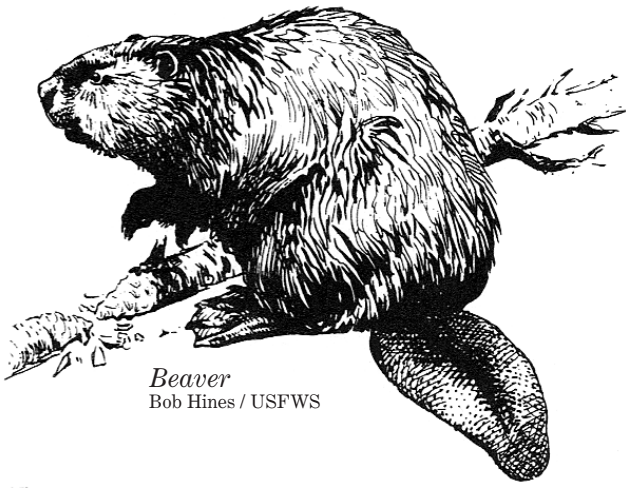
Bovee and Scott (2002) developed a flow model to reconstruct unregulated daily peak flows in the national wild and scenic reach of the Missouri River. To maximize establishment of cottonwoods, a threshold of 65,333 cfs is necessary. Floods this size lead to establishment of cottonwood seedlings above the zone of ice-drive disturbance. Cottonwood is a pioneer, disturbance-dependent species that establishes from seed on bare and moist surfaces during a brief period following seed dispersal.

Three human-caused factors have contributed to the riparian area changes on the refuge: (1) beaver have been eliminated from tributary streams; (2) cattle have been stocked at high densities in riparian areas during the growing season; and (3) upland reservoirs have altered the waterflow in major drainages (FaunaWest 1996).

Many of the smaller streams on the refuge are in a degraded condition due to the combined effects of these factors, which have, in general, resulted in narrower riparian area corridors, fewer wetlands, and less robust riparian vegetation across the refuge. In some areas, riparian vegetation has disappeared from extended reaches of stream. However, the construction of fencing to exclude livestock from several important riparian areas (such as Rock Creek and Bobcat Creek) has allowed conditions in these areas to improve.

Influence of Beaver on Riparian Areas

Historical literature suggests that beaver were a dominant feature in parts of the original bottomland landscapes of the refuge before trapping reduced them to numbers too low to support their wetland mosaic. Trapping on the refuge dates earlier than 1840 when trappers worked in the area. Hundreds of thousands of "wolf and beaver skins and pelts of the deer and elk were brought to Fort Benton by Indian and white from the far North, from the South, from the Rockies and the vast extent of plains surround-



Beaver
Bob Hines / USFWS

ing it, and were later shipped down the river to St. Louis" (Schultz 1902). Sometime between 1877 and 1882 Schultz worked at a fur trading post on the refuge at Carroll bottom (Turkey Joe) where one winter he mentions that they took in 300 beaver skins. By 1901, beaver were so scarce that trapping was illegal, but this did little to stop the continued exploitation. There are historical records of beaver system collapse after trapping. In addition to trapping, much of the water from the upper watershed of Armells Creek was used for agriculture by 1900 (Frost 2008). It is likely that they maintained a now-collapsed wetland system along at least three major streams, (1) Armells Creek with headwaters in the Judith Mountains; (2) Musselshell River with headwaters in the Crazy, Little Belt, and Judith Mountains; and (3) Big Dry, which has a much smaller watershed. Beaver also maintained wetlands in the lower ends of several minor streams on the refuge (Frost 2008).

Beaver change second- to fifth-order streams by as much as 20–40 percent by (1) changing channel geomorphology and hydrology; (2) retaining sediment and organic matter; (3) creating and maintaining wetlands; (4) changing nutrient cycling and decomposition dynamics; (5) changing plant species composition; (6) influencing the timing, rate, and volume of water and sediment movement downstream; and (7) through the creation of pools and backwaters generating new fish and wildlife habitats, which results in significant increases in biodiversity (Ohmart 1996). Currently, water quickly runs out of beaver impounded water streams like Armells Creek. The more beaver wetland created, the longer the water is held after snowmelt and rain events. As a result, these systems acted as sponges, slowly releasing water from one pond to the next below, and certain streams should have been sustained as permanent wetlands. These systems, lying in the lowest and coolest parts of the landscape, would not have been expected to dry up (Frost 2008).

Importance of Riparian Areas for Wildlife

Wildlife use riparian zones disproportionately more than any other habitat type, and fish, depend on the structure and inputs to this zone (Fitch and Adams 1998, Hubbard 1977, Ohmart 1996). In a study within the Great Basin of Southeastern Oregon, 82 percent of the terrestrial species known to occur are either directly dependent on riparian zones or use them more than other habitats (Thomas et al. 1979). There are similar findings for nesting bird species (Johnson et al. 1977, Kauffman and Krueger 1984). In a recent study on the refuge, riparian forest edge habitat accounted for the highest bat activity (Stewart 2007) and might be a limiting factor to bat distributions and abundance on prairie landscapes.

Closer to the refuge, Tewksbury et al. (2002) compared deciduous riparian areas with surrounding upland communities, and repeatedly found breeding bird diversity and density to be greater in riparian communities. The ungrazed Missouri River sites were located on the refuge and grazed survey locations were in a 25-mile stretch of river bordering the refuge to the west. In grazed locations, about 70 percent of species were less abundant, 13 species were significantly less abundant, and only one species was more abundant (Tewksbury et al. 2002). Knowles and Knowles (1994) found twice the abundance of birds in the ungrazed area of Rock Creek on the refuge compared to grazed area of Siparyann Creek. They found birds that have an affinity to grasslands do well in a grazed area, whereas those birds associated with riparian forests were more abundant in the ungrazed area. The most common bird in Rock Creek was the yellow warbler, and in Siparyann it was the mountain bluebird.

Bats serve a variety of ecological roles such as insect predators, prey, pollinators, and seed dispersers. Because of their sensitivity to pollution and habitat disturbance, they also serve as indicators of habitat health. Several species of bats use rock crevices and caves next to riparian area corridors for maternity colonies and possible year-round roosts, and use the riparian area corridor to forage (Lausen and Barclay 2002). In addition to providing important foraging habitat, cottonwood riparian zones along the Missouri River most likely provide important roosting habitat. Along the Missouri River on the refuge, Stewart (2007) detected a high intensity of use next to all riparian forest habitat types from big brown, silver-haired, and hoary bats as well as the "40 kHz group" made up of long-legged myotis, little brown myotis, small-footed myotis, and eastern red bat. Stewart (2007) also found riparian habitat and complexity were significant factors influencing bat activity. Activity and foraging attempts were highest for the entire bat community next to ripar-

ian forest edges compared with more open habitat and Russian olive stands. Overall bat activity was also high next to the center of riparian forest habitat.

Livestock Grazing and Riparian Monitoring

Historical grazing by large herds of bison and other ungulates included long periods of rest after intensive disturbance such as drought, fire, and grazing. Wild bison did not linger in riparian areas (Fuhlendorf et al. 2008, Van Vuren 1981) and did not use an area all season long. Cattle spend a disproportionate amount of time in riparian areas, 5–30 times longer (Ehrhart and Hansen 1997).

Streams and their watersheds function as units and are inseparable. Riparian area health is affected by offsite factors operating at the landscape level, including upland range conditions that affect runoff timing and sediment delivery to the channel and headwater impoundments that divert water from the channel downstream (Thompson and Hansen 1999, Belsky et al. 1999). The desired riparian-wetland habitat of a watershed should dictate the grazing management of the surrounding uplands.

The proper management of livestock grazing in riparian-wetland areas requires a recognition that (1) grazing management practices that improve or maintain upland sites may not be good management practice for riparian-wetland areas, and (2) season-long grazing is not a viable option to improve deteriorated riparian-wetland areas or to maintain a healthy riparian-wetland zone. To maintain necessary riparian function, grazing management must provide for adequate cover and height of vegetation on the streambanks and overflow zones to permit the natural stream functions to work successfully (Ehrhart and Hansen 1997). Currently, the refuge is working with cooperators above the refuge to enhance riverflow, which will potentially aid riparian area restoration.

Over the past 15 years, several studies were conducted to evaluate riparian area conditions on the refuge. These include a broad-scale stream assessment from 1995–97 with followup assessments in 2009, exclosure monitoring on Rock Creek, monitoring along the Lower Musselshell River, restoration recommendations along Telegraph Creek, a 5-year USGS study to gage streams on the refuge, and water quality sampling conducted on the refuge by the Montana Department of Environmental Quality in 2006–07 (Cook et al. 1996, Parker et al. 1996, Sando et al. 2009, Thompson et al. 1999). The findings of some of these key studies are described in detail below.

From 1995 to 1997, the Riparian Wetland and Research Program assessed 82 streams across the refuge, selecting 203 segments representing 79 river miles. Of the selected segments, 10 percent were found to be functioning as healthy riparian areas, 31 percent were functioning at risk, and 59 percent were scored not functioning or unhealthy (Thompson and Hansen 1999). The designation of "unhealthy" signified that those river segments could no longer properly filter out sediment from the water, build and retain erosion-resistant streambanks, and store adequate amounts of water throughout the summer (Thompson and Hansen 1999). In 1997, Neppl surveyed 2,000 feet of Duck Creek and Brown Pass Coulee using the Riparian and Wetland Ecological Evaluation Form (Hansen et al. 1993), and both were found to be not functioning.

Ecological Solutions Group (2009) resurveyed most of the same locations in 2009 as in 1995–97 (see figure 19). However, the Service requested more survey areas where management changes have occurred such as Armells Creek, Rock Creek (west), and Bob-

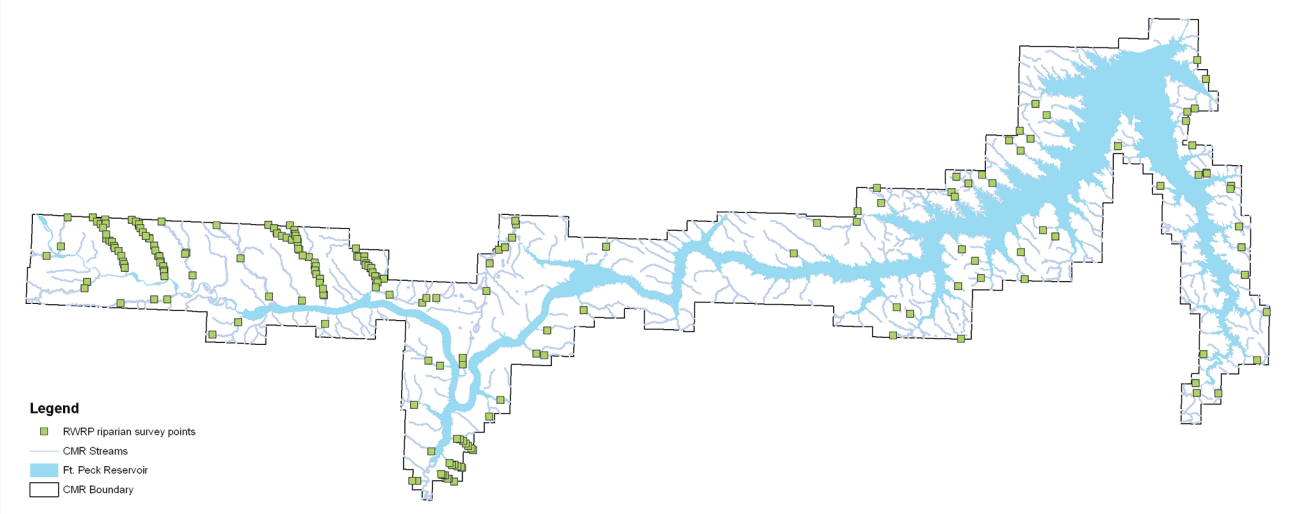


Figure 19. Map of Riparian and Wetland Research Program survey locations at the Charles M. Russell and UL Bend Refuges, Montana.

cat Creek Habitat Unit and reduced survey points in habitat units where management changes have not occurred such as CK Creek and Beauchamp Creek. Ecological Solutions Group (2009) found riparian area health has greatly improved since 1995. Most of the gains have come on physical site factors (soil and hydrology). Increased precipitation promoted vegetation growth and sediment for floodplain building. Additionally, changes in management (most notably the removal of livestock) have allowed the increased vegetation cover to remain onsite. This is due to the capture and anchoring of sediments by recently improved herbaceous vegetation on streambanks. However, much of the gain in health rating due to increased vegetation cover is offset by the negative further invasion by noxious weeds. Recruitment of woody plant species (for example, willows and taller shrubs and cottonwoods and other trees), including riparian sentinel species, has been limited over time due to the browsing effects of both wild and domestic ungulates. Therefore, woody riparian plant recruitment has not been widespread enough to affect the overall average riparian area health ratings.

While the overall average of riparian area health across the refuge has improved, not every stream or local area has shared this improvement. Woody draws located east of the Big Dry on the eastern edge of the refuge, have suffered significant decline. Streams that remain in the lower edge of "Functional At Risk" category include CK Creek and the Pines Recreational Area. Table 5 summarizes the riparian area health assessment findings and compares these to 1995–97.

A contracted firm, Riparian Resources, was hired to establish monitoring locations and collect vegetation data in three areas along Rock Creek (1996 and 2005) and two areas along Siparyann Creek (1996 only) (Miles 1996). Area 1 was on BLM land with normal livestock grazing densities, area 2 was on the refuge within a livestock exclosure built in 1991, and area 3 was on the refuge with spring-only livestock grazing. Siparyann (area 4) was located on BLM land inside and outside a limited fall-grazing pasture.

The monitoring between 1996 and 2005 documented an uneven, unexplainable distribution in cottonwoods and willows that was not tied to river geomorphology. Over the 9 years, the areas all experienced a 55-percent decrease in number of young cottonwoods (98 percent, 59 percent, and 35 percent decrease in areas 1, 2, and 3 respectively). This showed that the older plants are not being adequately replaced by young cottonwoods, due to browsing by wildlife and livestock. Timing of use is critical with winter use probably removing the most plant biomass and causing the most damage to the young cottonwoods. Average age of recruitment is 3 years suggesting that cottonwood replacement did not equal loss.

Browsing use by wildlife and livestock is high throughout the entire project area. Sixty to ninety-two percent of the second-year stems had been browsed on the young cottonwoods and willows. In area 1, this was likely to due livestock; in area 2, it was likely due to elk and possibly deer; and in area 3, it was due to both elk and livestock. These results were not expected. Studies have shown elk avoid areas with large concentrations of cattle and without security cover (Knowles and Campbell 1982, Stewart et al. 2002). Siparyann Creek (area 4) was monitored in 1996 for willows because only eight cottonwood seedlings were found along 8,000 feet of stream. The number of willows found inside the fence was 110, and 30 willows were found outside. Essentially, by excluding cattle in area 2, a highly attractive area was created, concentrating high numbers of elk. It is believed that quality riparian habitat will not be as heavily impacted if more riparian areas are improved or created by excluding cattle and keeping elk at lower numbers.

It is important to work closely with lessees to manage livestock. A few weeks of unauthorized use or overgrazing can set back years of progress in improvements of riparian-wetland systems (Duff 1983). A few head of unauthorized livestock throughout most of the hot season can negate any positive riparian-wetland habitat response (Myers 1981). According to the guide, Best Management Practices for Grazing in Montana (1999), it is the amount of time livestock spend in the riparian area that determines the amount of grazing impact. Success in maintaining or enhancing riparian area health is dependent more on the commitment and involvement of the manager (both refuge staff and livestock operator) than on what grazing system is employed (Ehrhart and Hansen 1997).

SHORELINE

The nearly 1,520 miles of shoreline is a highly dynamic area found along the lakeshore areas of the refuge. The habitat is defined as the vegetation found between current lake levels and high pool elevation (about 2,250 feet). USACE has primary jurisdiction for management of the lakeshore areas, and the Service cooperates with USACE to meet habitat needs of several threatened and endangered species (piping plover, least tern, and pallid sturgeon).

An interesting observation recently is the influence of lake levels and livestock use. When lake levels are low, livestock spend most of their time in the zone between the low-watermark and the high-watermark, thus reducing grazing pressure on refuge uplands. When lake levels return to high pool, refuge uplands will again take the brunt of the grazing pressure.

Table 5. Comparison of riparian area health of 82 streams across the Charles M. Russell and UL Bend Refuges, Montana (1995–2009).

Year	Number of polygons	Miles of stream	Riparian acres	Vegetation score* (%)	Soils and hydrology score (%)	Overall score (%)	Health category
All polygons on Charles M. Russell Refuge: assessed in 1995–97 and resampled in 2009							
1995–97	188	88	1,284	63	55	59	Nonfunctional
2009	155	81.8	1,303.5	70	86	78	Functional at risk
All one-to-one exact match polygons on Charles M. Russell Refuge: assessed in 1996 and resampled in 2009							
1995–97	114	53.6	681.2	62	52	56	Nonfunctional
2009	114	53.6	773.4	65	83	74	Functional at risk
Slippery Ann (Siparyann) habitat unit 2: assessed in 1996 and resampled in 2009							
1996	34	27	282.7	63	54	58	Nonfunctional
2009	33	27.1	329	72	89	81	Functional
Germaine Coulee habitat unit 55: assessed in 1996 and resampled in 2009							
1996	19	8.8	74.7	55	51	53	Nonfunctional
2009	19	8.8	111.6	60	83	73	Functional at risk
UL Bend Refuge: assessed in 1995 and resampled in 2009							
1995	7	1.1	24.3	65	46	55	Nonfunctional
2009	7	1.1	27.5	84	91	87	Functional
Rock Creek (northwest end of refuge): assessed in 1995 and resampled in 2009							
1995	4	0.5	13	67	61	64	Functional at risk
2009	17	13.8	228.1	84	97	91	Functional
Nichols Coulee habitat unit 4: assessed in 1995 and resampled in 2009							
1995–97	6	3.4	33.5	63	36	49	Nonfunctional
2009	6	3.4	34.3	70	72	71	Functional at risk
CK Creek: assessed in 1997 and partially resampled in 2009							
1997	18	20.7	379.5	63	55	59	Nonfunctional
2009	2	3.1	49	63	66	65	Functional at risk
Armells Creek: comparison of two small polygons assessed in 1995 with two larger polygons assessed in 2009 that contain them							
1995	2	0.3	4.1	50	31	40	Nonfunctional
2009	2	2.2	35.9	80	91	86	Functional
Armells Creek, all 15 polygons: assessed in 2009							
2009	15	9.9	187.4	74	89	82	Functional
Pines Recreation Area (South Fork of Duck Creek to Sutherland Creek): assessed in 1995 and resampled in 2009							
1995	7	0.9	18.9	68	63	65	Functional at risk
2009	7	0.9	20.3	60	63	61	Functional at risk
Woody Draws (Rock Creek area and north to Fort Peck Dam): assessed in 1995 and resampled in 2009							
1995	3	0.5	6.9	92	91	91	Functional
2009	9	3.5	74.2	59	78	69	Functional at risk

**Average scores, weighted on polygon size. Scoring values: 80–100%=Functional (healthy); 60–79%=Functional at risk (healthy, but with problems); <60%=Nonfunctional (nonhealthy).*

Fire occurrence along the Fort Peck Lake shoreline is almost nonexistent. In 1992, 35 acres of shoreline at the Fort Peck Dam were prescribed burned to provide suitable nesting habitat for piping plover. An occasional wildfire may burn into the sparsely vegetated shoreline but quickly goes out for lack of burnable fuel.

INVASIVE SPECIES

Invasive species continue to be one of the greatest challenges for managers in the Refuge System including the refuge (FWS 2007c). Service-wide, according to the Service's 2007 Refuge Annual Performance Planning database, 2.4 million acres of refuge lands are infested with invasive plants. In addition, there are 4,423 invasive animal populations on refuge lands. To combat this growing problem on refuges, Invasive Species Strike Teams were set up in several Service regions including region 6. They are mobile response units designed to rapidly respond to the detection of new infestation and eradicate them. The strike team for region 6 is based out of Benton Lake near Great Falls, Montana, and the team helps the refuge in combating invasive plants.

Although there are several types of invasive species of existing or potential concern including weed species, aquatic invasive species such as zebra mussels, and other pests that could be an issue in the future (pine beetle), weeds are the primary issue of concern for the refuge. MFWP monitors for the detection of aquatic nuisance species in Montana.

Weed Species

Figure 20 shows the areas treated from 1997 to 2008. In 2008, the strike team treated five primary weed species: Russian knapweed, saltcedar, spotted knapweed, and whitetop (hoary cress) (see table 6). Additionally, the strike team conducted several other activities centered on prevention and education efforts, inventory and monitoring, and coordination and cooperation with other agencies. For example, the team participated in the Zortman weed rodeo and conducted a weed wash of hunters' vehicles. More than 70 miles of road were surveyed. Because of the need to cover as much ground as possible, other invasive species like Canada thistle were not mapped. Other invasive plant threats found on the refuge include Russian olive, smooth brome, crested wheatgrass, and quackgrass (refer to "River Bottoms" above). In the uplands, the two common invasive species are Japanese brome and yellow sweetclover. Both species have increased as native plant species diversity has decreased in response to the press (constant) herbivory and fire suppression practices of the refuge (refer to "Disturbance Factors Affecting Major Ecological Processes" at the beginning of section 3.2). The healthier landscapes on the refuge (places where native plant species populations are diverse and viable) have less Japanese brome and yellow sweetclover.

Table 6. Acreage of treated weeds at the Charles M. Russell and UL Bend Refuges, Montana (2008).

Weed species	*Treated acres*
Leafy spurge	2.47
Russian knapweed	72.90
Saltcedar	30
Spotted knapweed	0.71
Whitetop (hoary cress)	6
Total	112.07

Invasive plant seeds are easily picked up and transported by vehicles. Because the refuge experiences much of its vehicle traffic during the hunting seasons, in 2007 the Rancher's Stewardship Alliance in Phillips County organized a hunter-vehicle weed wash. This has proven to be an excellent education program, and several hunters reported washing their vehicles before coming to the refuge in 2008.

USACE also manages for invasive species on the refuge. Generally, they concentrate their efforts on treating saltcedar below the high-watermark on Fort Peck Reservoir while the Service focuses primarily in the river bottoms and upland areas. The Service maintains close cooperation and coordination with USACE. For example, in 2008 the strike team combined contractor spray efforts in areas important to both agencies. The strike team also cooperated with BLM and Valley County to conduct an extensive invasive plant survey, recording weed infestations along 2,900 miles of road across several jurisdictions.

Several methods are currently used or could be used to combat invasive plants, including noxious weeds, on the refuge (FWS 2011b). Mechanical methods like hand pulling, power tools, and mowing and tilling are more effective for controlling annual or biennial pest plants. For perennial plants, the root system has to be destroyed, or it will continue to resprout and grow. Biological control agents involve the deliberate introduction and management of natural enemies to reduce pest populations. There are advantages and disadvantages to biological controls. Some biological control efforts have begun on the refuge. Herbicides (for example, Milestone™) are also used to treat weed-infested areas. For long-term prevention and proper maintenance of refuge habitats, restoration including revegetation with desirable (native) plants is essential (refer to "River Bottoms" above for more information).

Saltcedar or tamarisk is the most prolific invasive species along the river. Canada thistle and knapweed are also common. Saltcedar plants are spreading shrubs or small trees, 5–20 feet tall, with numerous slender branches. They are an aggressive colonizer, able to survive in a variety of habitats. Often they form monotypic stands, replacing willows, cottonwoods, and other native riparian vegetation. The stems and leaves of mature plants secrete salt that inhibit other plants and changes soil chemistry. Saltcedar is an enormous water consumer, and a single

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In collaboration with others, the Service runs a weed-wash station during hunting season.

large plant can absorb 200 gallons of water per day. Infestations can have detrimental effects on wildlife. Large infestations of saltcedar occur along the 1,520-mile-long shoreline of the reservoir. Most infestations occur along the south shore in bays and inlets where drainages enter the reservoir (Lesica and Miles 2004). Pearce and Smith (2003) estimated the presence of 24,500 plants on the Musselshell River of a river distance of 240 kilometers with concentrations at three nodes close to Roundup, Melstone, and the mouth of the river at Fort Peck Reservoir. The oldest plants on the reservoir were estimated at 21 to 33 years in 2001. It is believed that saltcedar arrived on the south shore in the mid to late 1960s and most likely dispersed from the Yellowstone River system soon after it became established in southern Montana. Many people believe that the most effective way to treat saltcedar is to inundate them by raising water levels to drown them for a substantial length of time (Lesica and Miles 2004). During the winter and spring of 2010–11, historic rain and snowpack levels resulted in lake levels returning to above record high water levels. How the elevated lake levels will affect future treatments along the shoreline is unclear. As stated in chapter 1, raising water levels is controlled by USACE and is an issue outside the scope of the planning process.

BIRDS

More than 250 species of birds have been documented on the refuge. The unique combination of native prairies, sagebrush shrublands, forested coulees, pine–juniper woodlands, riparian areas and river bottoms, and badlands makes the refuge a haven for migrant and breeding birds. The refuge is also extremely important for year-round residents such as sharp-tailed and sage-grouse. This section discusses sharp-tailed grouse (which is specifically mentioned in Executive Order 7509) in addition to other important bird species not mentioned before.

Grassland Birds

Some grassland birds found on the refuge are among the fastest and most consistently declining birds in North America due to the loss of native grasslands and the management of remaining grasslands (Cunningham and Johnson 2006, North American Bird Conservation 2009). Each grassland bird species has a unique set of habitat needs, which may include plant species present as well as plant structure and development. Some birds prefer extremely shortgrass heights (upland sandpiper) whereas others prefer tall (Baird's sparrow). Some avoid areas of woody vegetation (short-eared owl) and others do not (McCown's longspur). Needed food plants may be present but may not produce needed seed or fruits due to herbivory or timing of fire. Needed insect foods may be dependent on specific plant species that may or may not be present. Raptor prey items (rodents and small birds) may depend on individual plant species and plant structure or insects on an individual plant species. Nesting requirements may be different than brooding requirements and

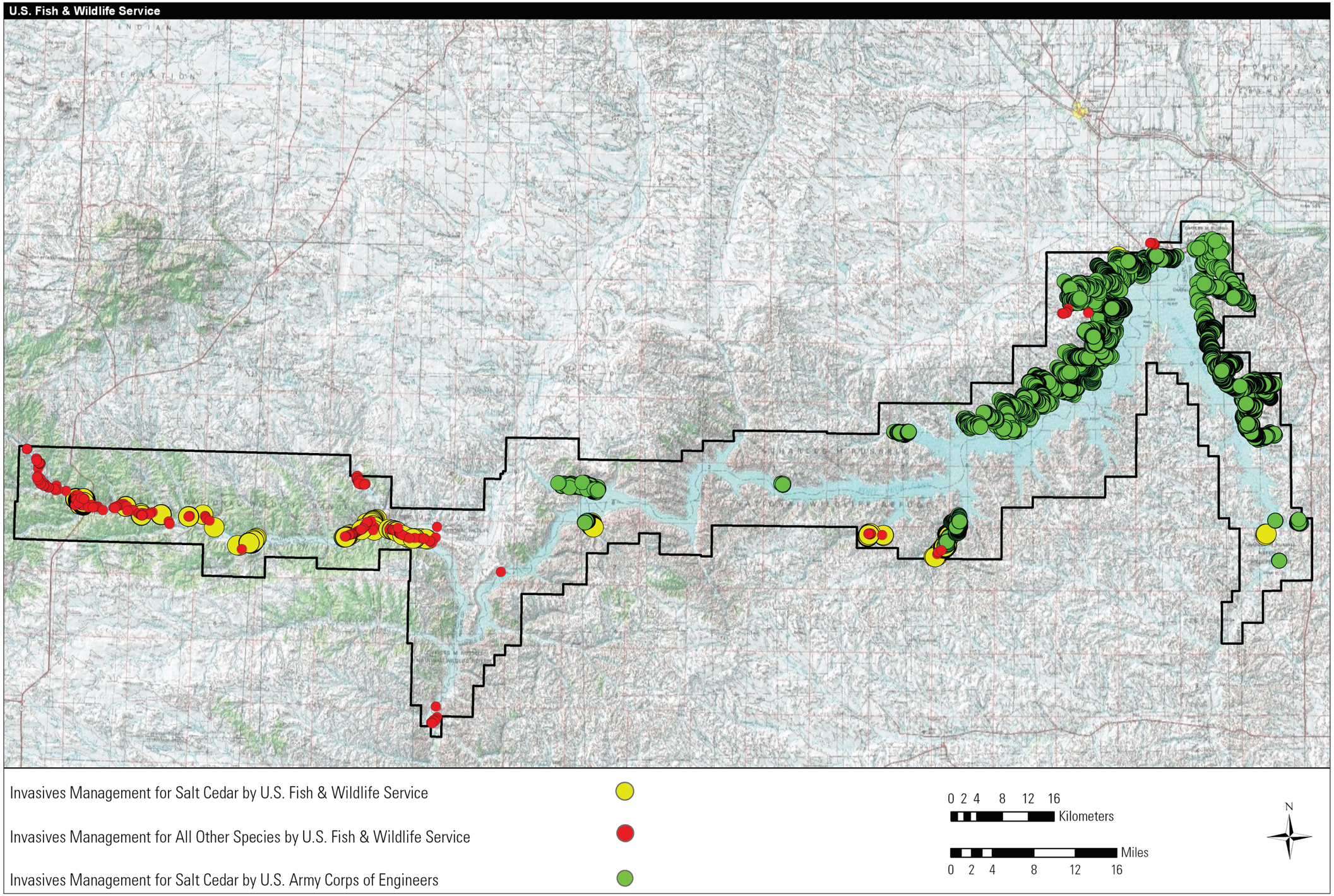

Figure 20. Map of invasive species occurrence at the Charles M. Russell and UL Bend Refuges, Montana.

both might need to be near each other. Bird species may also be dependent on unbroken blocks of grasslands of certain sizes (NRCS 1999).

According to the North American Breeding Bird Survey data from 1966 to 1993, 70 percent of 29 prairie species have experienced population declines (Fuhlendorf and Engle 2001). Resident and documented breeding refuge birds that are in trouble or showing sharp declines include western meadowlarks, short-eared owls, mountain plover, Sprague's pipit, lark bunting, Baird's sparrow, chestnut-collared and McCown's longspurs, and greater sage and sharp-tailed grouse (North American Bird Conservation 2009). Compounding these declines are the current and future effects of global climate change on grassland birds. Global climate change has and will continue to affect ranges of grassland birds by causing changes in summer range such as exclusions (Sprague's pipit), contractions (Brewer's sparrow), expansions (Say's phoebe), or additions (scissor-tailed flycatcher). It could also alter migration behavior and habitat and could ultimately affect their survival ability (Price and Glick 2002).

Sharp-tailed Grouse. Sharp-tailed grouse are distributed throughout the refuge, but similar to other species, habitat suitability varies spatially and seasonally. Sharp-tailed grouse are considered an indicator for large grassland landscapes and other grassland birds. Although Executive Order 7509 specified that the refuge should be managed for a maximum of 400,000 sharp-tailed grouse, those numbers have not been observed on the refuge.

Since the mid-1970s, 177 sharp-tailed grouse leks have been mapped (figure 21) and some 2,100 counts of sharp-tailed grouse attending leks have been counted. Leks are specific areas where grouse gather in the spring for courtship displays and mating. There have been 15,000 sharp-tailed grouse counted on the refuge (including repeat counts of the same leks within years). Exact lek counts are difficult to obtain because sharp-tailed grouse have lower site fidelity than other species (such as sage-grouse), and multiple counts within a season are challenging due to the size of the refuge. Because of these logistical challenges, an annual listening survey was started in 1989 as an index to track regional sharp-tailed grouse population levels. Some 330 stations were established in potential sharp-tailed grouse habitat, each spaced about 1 mile apart on roads. An observer listens for sharp-tailed grouse breeding sounds early in the morning and records presence or absence at each station. When populations are high, more birds make more sounds and new satellite leks become established, all contributing to hearing birds at a higher proportion of listening stations. The opposite is true when populations are low. Figure 22 summarizes listening data collected since 1990.

Other Birds

Other bird groups found on the refuge include colonial-nesting birds, waterfowl, raptors, and owls. Early refuge narratives document the declines of colonial-nesting birds and waterfowl as water levels rose after the Fort Peck Dam was completed. Pelicans, great blue herons, and cormorants were common nesters in the large cottonwoods along the river but these birds gradually disappeared as the cottonwoods were drowned out and covered by water.

Ducks and geese were also documented as common upland nesters along the Missouri River before the lake rising. Most goose nests were located in the dense underbrush found along the river whereas duck nests were located in the grassy uplands. Nesting waterfowl numbers seem to have fluctuated early on with the rise and fall of the lake. Refuge personnel noted that the lake provided little food to waterfowl,

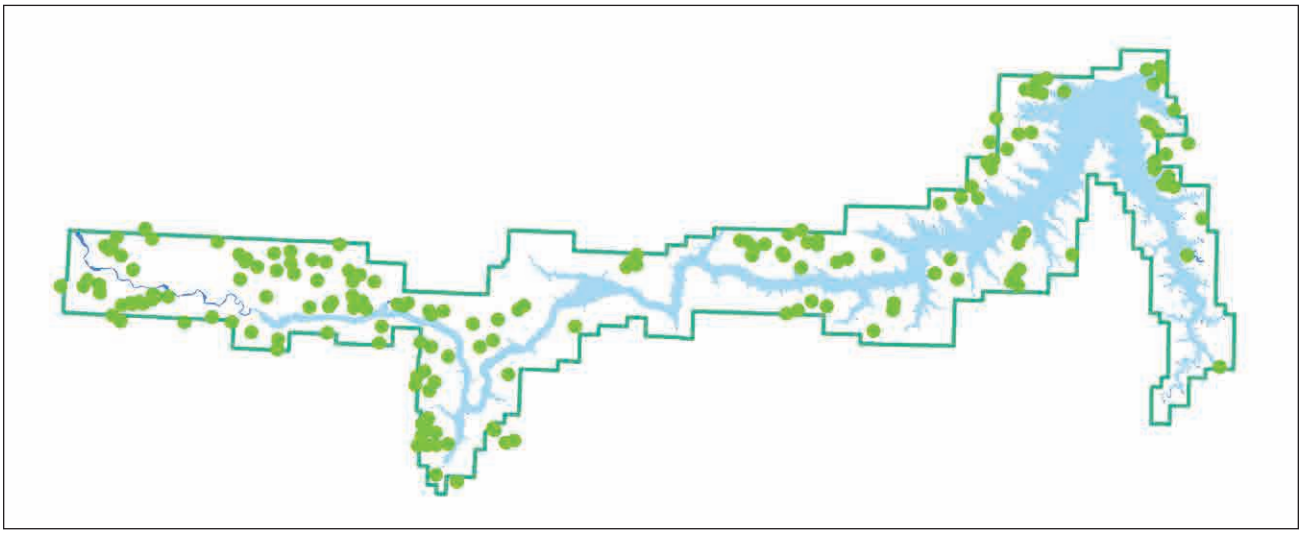

Figure 21. Map of lek locations for sharp-tailed grouse on the Charles M. Russell and UL Bend Refuges, Montana.

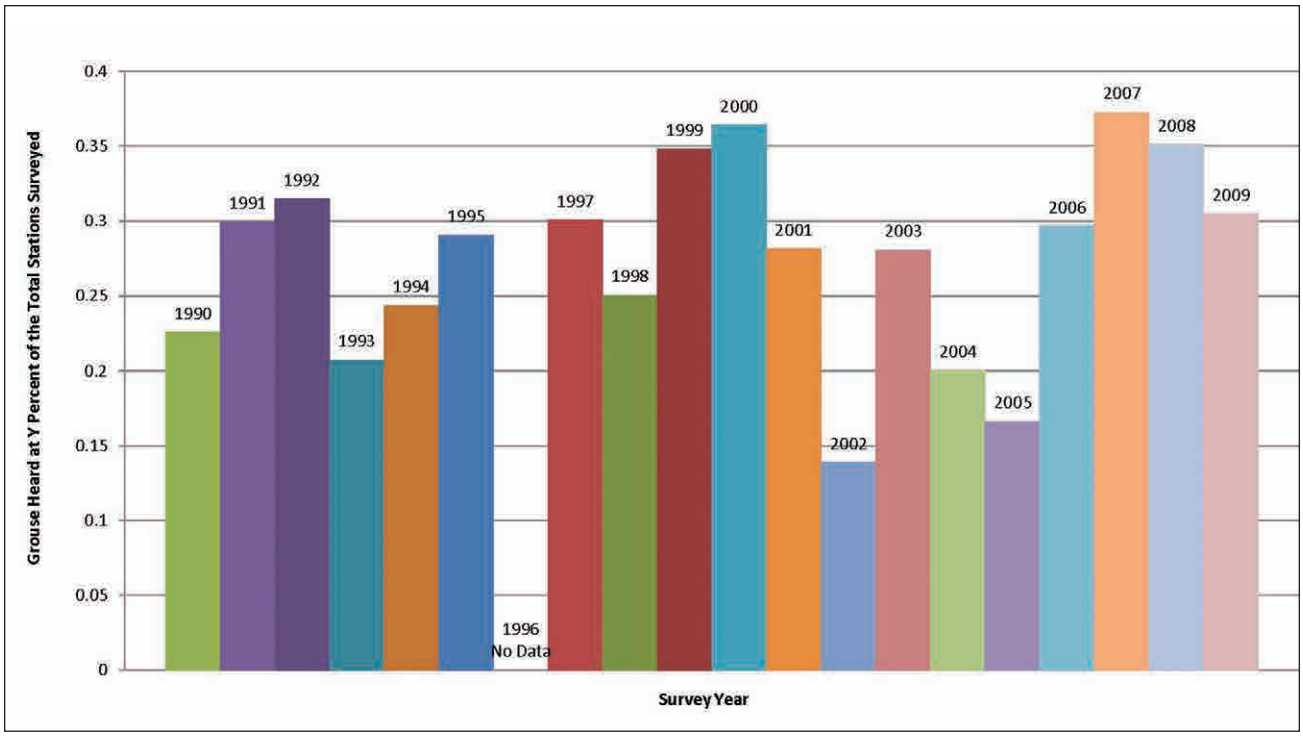

Figure 22. Chart of survey results for the listening route for sharp-tailed grouse on the Charles M. Russell and UL Bend Refuges, Montana (1990–2009).

and over time the refuge became more of a migratory loafing area than a nesting area. Winter flocks of waterfowl used the refuge during times when area farmers stockpiled cereal crops such as barley and oats for winter livestock feed. Supplemental feeding of wintering waterfowl on the refuge was also quite common during the 1940s and 1950s. Currently, waterfowl remain in the river below the Fort Peck Dam during fall and winter months.

In the mid-1950s, refuge personnel began documenting raptors and owls mainly because they counted the numbers of both that had been killed by refuge employees. It was also noted that local residents and hunters also shot these birds on sight. Both golden and bald eagles were commonly shot as well as great horned owls (crows and magpies were also shot on sight). Other raptor species documented included northern goshawk, prairie falcon, rough-legged hawk, and northern harrier ("marsh hawk"). Ospreys were first recorded along the lake in 1958. Their numbers have increased due to nesting platforms being built by refuge employees. Eagle numbers have also increased due to the elimination of strychnine poisoning and shooting.

Neotropical migratory birds use the refuge both as nesting habitat but also as a stopover area during spring and fall migrations while heading both north and south of the refuge. The millions of neotropical birds using the refuge primarily as a stopover area are also negatively affected by grazing for many of the same reasons as nesting birds. Foraging habitat (multiple layers of plant species) needs to be protected along with the food-producing plants (seed and berry producers) and food-sheltering plants (plants insects feed on) (Pool and Austin 2006).

Although riparian zones make up less than 1 percent of western landscapes, they harbor the most species-rich avifauna of all the major habitats in the western United States (Young et al. 2001). In the western United States, more species of breeding birds are found in these limited riparian zones than the far more abundant adjacent uplands. More than 60 percent of neotropical migratory birds use riparian areas as stopover areas while migrating north and south or as breeding habitat (Krueper 1993). They are also the most modified suffering a loss at greater than 95 percent. Shorebird species found on refuge wetlands, shoreline habitats and grasslands are also in decline (Brown et al. 2001).

The National Audubon Society has recognized the refuge as an Important Bird Area. The program recognizes that coupled with global warming, habitat loss and fragmentation are the most serious threats facing populations of birds across American and around the world (National Audubon Society 2009). The refuge has been recognized as a Global Important Bird Area based on three criteria: (1) the site regularly holds significant numbers of a globally threatened species or other species of global conservation concern; (2) Montana State holds species of

State Conservation Concern; and (3) Montana State has greater than 1 percent of the State's population. Of the 276 species of birds actually recorded near or on the refuge, there are several species of global or continental conservation concern. The refuge lies directly south of the Glaciated Prairie Sage-Steppe Important Bird Area for Greater Sage-Grouse and northeast of the Musselshell Important Bird Area for Greater Sage-Grouse (Montana Audubon 2008).

Focal Bird Species

The Service has identified several species as focal birds, those that serve as indicator species on the refuge. These are species that regularly nest on the refuge, species of conservation priority or concern, Service's target species, stewardship species under the North American Landbird Conservation Plan, species of concern under the North American Landbird Conservation Plan. Following are the focal birds for the major habitat types on the refuge.

- *Uplands:* long-billed curlew, Sprague's pipit, Baird's sparrow, brown creeper, sharp-tailed grouse, and greater sage-grouse
- *River bottoms:* red-eyed vireo, Brewer's blackbird, and veery
- *Riparian areas and wetlands:* ovenbird, Cordilleran flycatcher, black-billed cuckoo, and western wood pewee

For more information about focal bird species, refer to "Bird Objectives" under section 4.2 in chapter 4.

Grazing and Fire Effects

Management tools such as livestock grazing and fire can cause profound changes in the composition and abundance of plants, which in turn affects bird species composition and numbers (Bock et al. 1993, Murphy 2008, Fuhlendorf et al. 2006). Refuge narratives as early as 1942 noted the negative effects grazing was having on grouse species: "Locally, the upland game depends largely on habitat and weather, the habitat in turn depending on grazing pressure." When ungrazed and grazed streamside riparian areas were compared on the refuge, almost twice as many individual birds were found on the ungrazed areas than grazed (Knowles and Knowles 1994, FaunaWest Wildlife Consultants 1996). Bird species composition showed a higher number of grassland species (sparrows) on the grazed areas, whereas the ungrazed areas had species more commonly found in forested riparian areas such as flycatchers, warblers, and cavity nesters including kestrels.

Bock (1993) states, "the principal means by which livestock grazing affects bird populations is by altering habitat structure and food availability." Relationships between birds and grazing—whether by bison, wild ungulates, prairie dogs, or domestic livestock—are complex because there are such wide ranges in intensity, season, duration, and style of grazing. Individual bird species such as horned lark and mountain plover may respond positively to grazing, although they still require shade plants to survive summer heat (Shackford 1996). Other birds such as Baird's sparrow may respond negatively, and some birds such as grasshopper sparrow have a mixed response. These same species may respond differently in the taller grasses of the Midwest versus the response in the shorter grasses of the Great Plains. Adding seasonal changes in precipitation and possible long-term changes in climate only complicate things further.

Grassland birds can be affected by fire in several ways. Fire can eliminate trees and shrubs, which negatively affects some bird species that are adapted to nesting in prairie grasses. Although birds and nests decline immediately after a fire, within a few years they can exceed preburn levels. Short-term loss of breeding habitat is often outweighed by long-term benefits to the changes in vegetation (Murphy 2008). Using a management tool such as patch-burn grazing results in a mosaic of habitats that consistently shifts. One benefit is that it provides needed habitat for the full range of year-round resident, migratory, breeding, and nonbreeding birds (Churchwell et al. 2007). The severity of fires can also influence bird abundance and species, which suggests a need for all kinds of fires and not just the low-severity fires used most in prescribed fire plans (Smucker et al. 2005).

The short- to midgrass prairies of the Great Plains evolved with frequent disturbances including intense grazing by prairie dogs and bison. Grassland birds also changed with these grazing effects on the vegetation. Birds selected a variety of different grass heights created by the intense grazing by prairie dogs and bison. Native grazers created a natural patch ecosystem, and each patch had different site characteristics that favored the entire prairie bird fauna. When contrasted with current grazing patterns, now there is less of a patchwork of habitat because more of the grassland is the same. This change has contributed to a decline in native birds (Vickery et al. 2008). Increasing the disturbances in grasslands through patch burning and grazing can, in time, reverse this decline by increasing diversity in both food and structure (Fuhlendorf et al. 2006).

Road and Public Use Effects

Roads have the potential to fragment wildlife habitat, which can exacerbate the problem of habitat loss for grasslands birds. One of the concerns for bird species is the edge effect whereby birds that live on the edge of an area are able to invade and attack interior species. Understanding the effects of habitat fragmentation is complex and not easy to assess (Johnson 2001).

THREATENED and ENDANGERED SPECIES and SPECIES of CONCERN

There are currently four species found on the refuge that are listed on the threatened and endangered species list: black-footed ferret, least tern, piping plover, and pallid sturgeon. The grizzly bear (threatened) is found in Montana but not on the refuge. Endangered whooping cranes migrate through McCone, Phillips, and Valley Counties. These threatened and endangered species and several species of concern are discussed below.

Threatened and Endangered Species

The Service is following recovery plans for the following listed species found on the refuge: black-footed ferret, least tern, and pallid sturgeon, which are all listed as endangered, and piping plover, which is listed as threatened.

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Endangered Black-footed Ferret

Black-footed Ferret (Endangered). Black-footed ferrets, listed as endangered, were first reintroduced in Montana in 1994 on black-tailed prairie dog colonies located at UL Bend National Wildlife Refuge. The thinking at the time was that reintroduction techniques could be figured out on the refuge part (10 percent) of the experimental reintroduction area and, once refined, expand reintroductions north onto what had been about 26,000 acres of prairie dogs as mapped in 1988. There were also hopes to expand even further and try to populate with ferrets another 25,000 acres of prairie dog colonies on the Fort Belknap Indian Reservation.

Black-footed ferrets require at least a few thousand acres of healthy prairie dog colonies to provide habitat and prey because they are obligate predators of prairie dogs and they live in the tunnel systems created and maintained by prairie dogs. Many public land managers and landowners have a general intolerance for very many acres of prairie dogs and throughout the black-footed ferret's historical range, generally small and fragmented prairie dog occupied landscapes are limiting ferret recovery. In addition to limited human tolerance of prairie dogs, epizootics of sylvatic plague can eliminate thousands of acres of prairie dogs in a few weeks, thus eliminating expansive areas of black-footed ferret habitat. In addition, ferrets exposed to plague die within 3 days. Plague was first ever detected in Phillips County, Montana in 1992 when many prairie dog colonies suddenly disappeared. By 1996, nearly 80 percent of 26,000 acres of prairie dog colonies had died out. Epizootic plague (high level of mortality over a short period) was never observed at the UL Bend Refuge until 2007.

Sylvatic plague is a nonnative disease foreign to the evolutionary history of North American species. Plague was inadvertently introduced into the United States around 1900. Sylvatic plague is a bacterial infection transmitted primarily by infected fleas. It can affect the black-footed ferret directly via infection and subsequent mortality or indirectly through the disease's effects on prairie dogs and the potential for dramatic declines in the ferret's primary prey. Plague can be present in a prairie dog colony in either an enzootic state (persistent, low level of mortality) or epizootic state (high mortality). Recovery efforts for the ferrets are hampered because both ferrets and prairie dogs are extremely susceptible to plague.

Despite these obstacles, a huge amount of effort has gone into trying to establish black-footed ferrets in north-central Montana. There have been 229 captive-reared ferret kits released in three areas of the UL Bend Refuge, 95 north of the refuge on BLM lands and 167 in two areas of the Fort Belknap Indian Reservation. In addition, at least 236 wild-born kits have been observed at the UL Bend Refuge. The last confirmed sighting of a ferret on Fort Belknap was in 2003, 2006 on BLM lands and six ferrets (two male and four female) were observed at UL Bend during April 2009. The following graph (figure 23) illustrates the population history of black-footed ferrets at UL Bend National Wildlife Refuge.

During 2007 and continuing in 2008, epizootic plague eliminated about 60 percent of the prairie dog

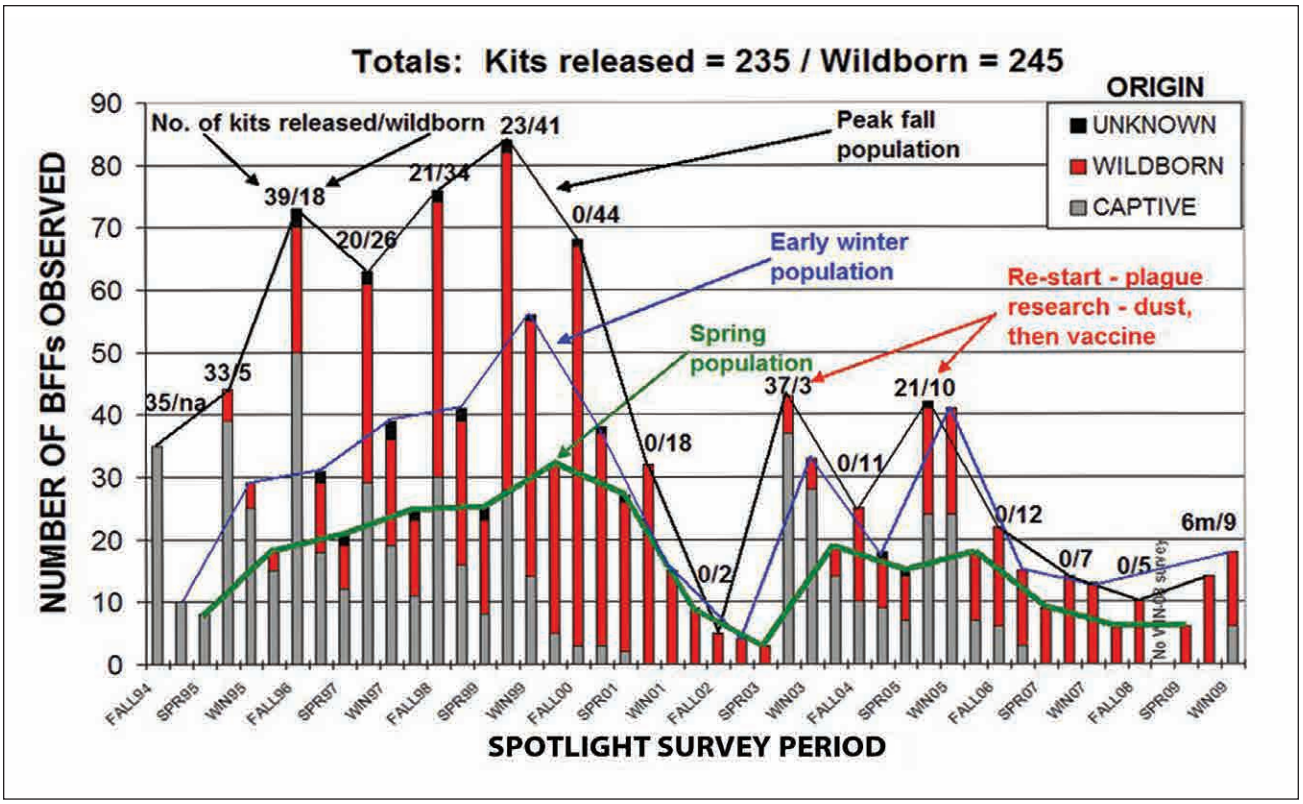


Figure 23. Graph of data for the black-footed ferret population at the UL Bend Refuge, Montana (1994–2009).

acreage where ferrets had resided at the UL Bend Refuge. Plague was also reported to be widespread north of the refuge and was eliminating a substantial number of remaining prairie dogs throughout Phillips County. To protect the remaining prairie dogs and resident ferrets (six ferrets present in April 2008—four male and two female), all remaining active parts of prairie dog populations in the Locke and Hawley area were treated with 0.05 percent deltamethrin during early summer 2008 to kill fleas (a vector for plague and shown to improve ferret and prairie dog survival in plague-prone areas (Matchett et al. 2010 and Biggins et al. 2010). More than 34,000 burrows were treated, and both prairie dog and ferret populations have persisted through fall 2009.

Despite the failure to establish a self-sustaining black-footed ferret population in Montana, the Service remains hopeful that a ferret population contributing to the rangewide recovery of the species will be established in Montana. Already, much has been learned along the way that has greatly helped national efforts for ferret recovery. For example, Matchett et al. (2010) has shown that in addition to epizootic plague affecting ferrets, enzootic plague (that is, the presence of disease-causing *Yersinia pestis* when there is no noticeable decrease in prairie dog abundance) also reduces ferret survival and that both flea control and an experimental plague vaccine for ferrets were effective.

It is likely that if an oral plague vaccine can be developed, prairie dog numbers will increase and stabilize on the refuge, and the area may be able to sustain a population of ferrets that will contribute to its recovery rangewide. If the current ferret population at UL Bend Refuge dies out before prairie dog numbers can increase, the opportunity remains to use the existing expertise and management framework to recover ferrets when more favorable conditions occur. Refuge staff will continue monitoring the remaining ferrets at the UL Bend Refuge. Several wild-born kits were observed during fall 2009, but with a total spring breeding population of only six animals during the last 2 years, the Service expects the population to die out completely in the near future.

As summarized below, MFWP has spent considerable time constructing plans for prairie dog and associated species conservation. Refuge staff and many cooperators have worked diligently for some 20 years trying to maintain and enhance complexes of prairie dogs capable of supporting a viable population of black-footed ferrets in Montana. With the multiple planning efforts and committees established by MFWP, the Service views them as the lead agency for these efforts.

In response to black-tailed prairie dogs becoming a candidate species (warranted, but precluded) for listing under the Endangered Species Act in 2000,

MFWP developed a statewide prairie dog conservation plan that was completed in 2002. They then worked hard to complete a local region 6 (northeast Montana) prairie dog plan in 2006. After completion of that local plan, MFWP established a facilitated "Implementation Committee" to attempt locating and managing for complexes of prairie dogs suitable for black-footed population establishment as called for in the previous two plans (Category I Complexes). That Implementation Committee made its recommendations to MFWP in 2008, but fell short of drawing any lines on maps.

Least Tern (Endangered). The interior population of the least tern was listed as endangered by the Service in 1985. The least tern was first documented in Montana at Fort Peck Lake in 1987. Annual surveys have been conducted since 1988 on both Fort Peck Lake and the Missouri River below the dam. The most successful breeding year for least terns on the reservoir was in 1994 and nesting has been sporadic since then (USACE 2008), as shown in table 7.

Table 7. Least tern nest success at Fort Peck Lake, Montana.

Year	*Number of nests*	*Successful nests**
1994	8	3
2004	0	0
2005	0	0
2006	2	1
2007	2	1

**Number of nests producing fledglings*
Source: USACE 2008.

Fort Peck Reservoir is at the northwestern limit of the interior least tern's breeding range resulting in the low numbers of birds in this area. In addition, the amount of available habitat changes with the lake level and affects the number of birds attracted to the reservoir in any given year. The Missouri River below the dam and the Yellowstone River attract more birds than the reservoir. Survey results show that Montana has met or exceeded the recovery goal of 50 adult birds as set forth in the 1990 Interior Least Tern Recovery Plan (Atkinson and Dood 2006a).

Pallid Sturgeon (Endangered). The upper Missouri River above Fort Peck Reservoir is one of the six recovery-priority management areas, identified as RPMA 1 in the Pallid Sturgeon Recovery Plan (Dryer and Sandvol 1993). Historically, pallid sturgeon were found along this 230-mile reach; however, losses of habitat and the migration barrier caused by the completion of Fort Peck Dam in the 1930s, and construction of Canyon Ferry and Tiber dams in the 1950s, has caused their near extinction. Additionally, the population was found to be senescent and that there had been no significant recruitment in the last 10 years (Gardner 1996). Very few wild pallids now remain in RPMA 1 (probably 10–20). The core area where most of the pallids are now primarily found is a 61-mile reach between Cow Island (river mile 1944) and Beauchamp Creek (river mile 1883).

MFWP, in cooperation with the Service, initiated pallid sturgeon recovery in RPMA 1 with the release of 733 hatchery-reared, yearling pallid sturgeon during 1998. Table 8 shows the stocking history of the Missouri River in Montana.

Table 8. History of stocking pallid sturgeon in the middle Missouri River, Montana (1997–2008).

Year (class)	*Year stocked*	*Stage*	*Number stocked*
1997	1998	yearling	733
2001	2002	yearling	2,058
	2004	age 3	189
2003	2004	yearling	3,113
2004	2005	yearling	706
2005	2005	larval	33,300
	2005	fingerling	2,480
	2006	yearling	4,737
2006	2007	yearling	4,534
2007	2007	fingerling	38,608
	2008	yearling	5,699
2008	2008	larval	62,055
	2008	fingerling	24,980
		Total	176,393

The goal for stocking is to restore the population to 1,000 adults, age 15 years or older (including about 20,000 pallids less than 15 years) by 2027. The population of 15-year-old and older adults will be maintained by stocking for one generation. The population of 1,000 adults was selected based on maintaining genetic diversity and reasonable population demographics.

The present habitat condition will be maintained in at least the present form (minimum instream flows, water quality, and riparian areas). Main stem and tributary dams in the area have had profound effects on natural flow conditions and therefore dam operation effects on pallid sturgeon habitat will be evaluated. There seems to be considerable pallid use of the transitional river and reservoir reach (river mile 1867–98) near the river delta in Fort Peck Reservoir. There may be potential for enhancing the riverine habitat here for pallid sturgeon by developing a more favorable water level management plan (Gardner 2003). Gerrity et al. (2008) found pallid sturgeon avoids reaches of river with islands and secondary channels, selecting reaches without islands and main channel habitats. Water level management can influence the amount of habitat available for pallid sturgeon. Fish are the primary prey of juvenile pallid sturgeon, because sturgeon chub and sicklefin chub composed 79 percent of the diet of sampled pallid sturgeons (Gerrity et al. 2006). These two cyprinids are on the species of concern list.

Piping Plover (Threatened). There are three breeding populations of piping plovers in North America, which were listed under the Endangered Species Act in 1985. Plovers nesting on Fort Peck Reservoir are considered part of the northern Great Plains population and are listed as threatened.

Plovers are attracted to gravel beaches on the lakeshore and islands that are exposed during periods of low lake levels. In 2002, the Service designated 77,371 acres on Fort Peck Reservoir as critical habitat (see figure 24). According to the 2006 Montana Piping Plover Management Plan, critical habitat "refers to specific geographic locations that contain features essential for conserving a species and may require special management considerations" (Atkinson and Dood 2006b).

Although plovers were observed in Montana during the 1970s and were known to breed on Fort Peck Reservoir, formal surveys did not begin until after they were listed under the Endangered Species Act. USACE conducts annual surveys of the reservoir and monitors nest success (see table 9). The amount of available habitat changes with the lake level and affects the number of birds attracted to the reservoir in any given year. However, long-term monitoring shows that most inland sites have failed to reach specified recovery levels and the northern Great Plains population as a whole is declining (Atkinson and Dood 2006b).

Table 9. Piping plover nest success at Fort Peck Lake, Montana (2004–07).

Year	*Number of plovers*	*Number of nests*	*Nesting success**
2004	9	4	4
2005	26	11	7
2006	20	7	6
2007	16	8	6

**Number of nests producing fledglings. Table taken from Fort Peck Dam/Fort Peck Lake Master Plan (2008).*

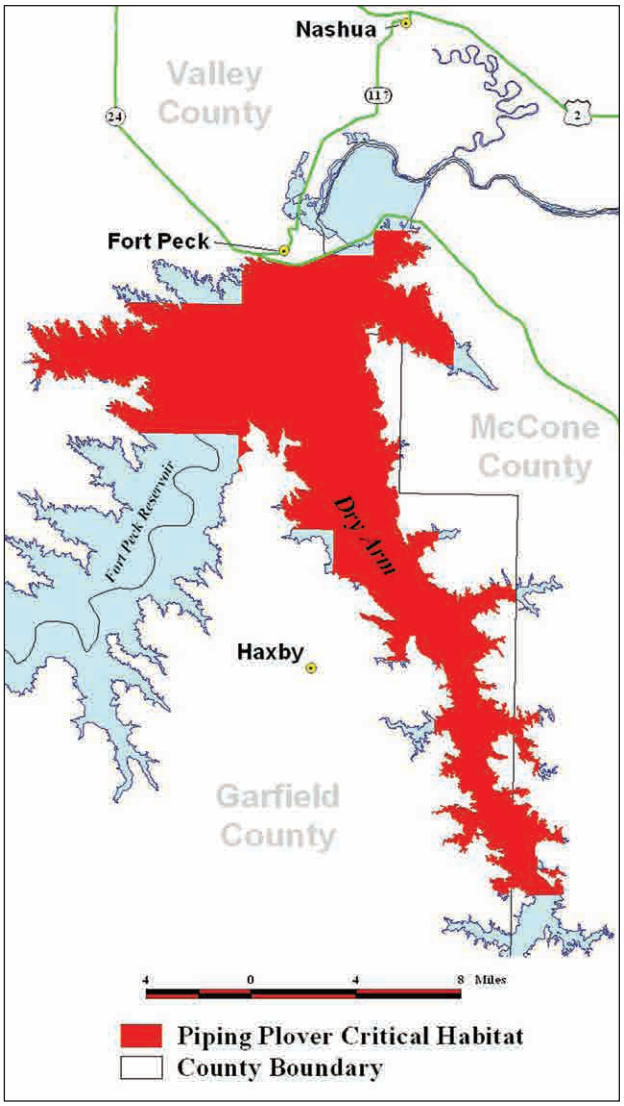


Figure 24. Map of critical habitat for piping plover at Fort Peck Reservoir, Montana.

Grizzly Bear (Threatened). Grizzly bears are generally larger and more heavily built than other bears, and can be distinguished from black bears by longer, curved claws, humped shoulders, and a face that appears to be concave. When Lewis and Clark explored the West in the early 1800s, an estimated 50,000 grizzly bears roamed between the Pacific Ocean and the Great Plains, across vast stretches of open and unpopulated land. But when pioneers moved in, bears were persecuted and their numbers and range drastically declined. As European settlement expanded over the next hundred years, habitat

for these large omnivores, along with their numbers drastically declined. Today, only a few small corners of grizzly country remain, supporting about 1,200–1,400 wild grizzly bears. Of 37 grizzly populations present in 1922, 31 were extirpated by 1975. In 1975, the Service listed the grizzly bear as a threatened species in the lower 48 States under the Endangered Species Act, placing the species under Federal protection.

On March 22, 2007, the Service announced that the Yellowstone Distinct Population Segment of grizzly bears is a recovered population no longer meeting the Endangered Species Act's definition of threatened or endangered. However, on November 11, 2011, the Fourth Circuit Court of Appeals ruled that the Greater Yellowstone Distinct Population Segment of grizzly bears should remain protected under the Endangered Species Act. On April 18, 2007, the Service announced the initiation of a 5-year review of grizzly bear (as listed in the lower 48 States). The Service conducts these reviews to ensure that a classification of each species as threatened or endangered on the List of Endangered and Threatened Wildlife and Plants is correct. A 5-year review is an assessment of the best scientific and commercial data available at the time of the review.

The Service, in cooperation with numerous partners, has purchased several conservation easements along the Rocky Mountain Front to help grizzly bears (and other wildlife species) by conserving corridors for grizzly bears to move to other large blocks of secure habitat. Over the past 2 years, juvenile grizzly bears from the Rocky Mountain Front have ventured toward the Missouri River Corridor. As grizzly bear populations grow and more habitat is conserved, the probability of grizzlies traveling from the Front to the Missouri River and subsequently onto the refuge increases. As a result, the CCP addresses the Service's response if grizzly bears naturally migrate down the river onto the refuge.

Whooping Crane (Endangered). Endangered whooping cranes migrate through three of the six counties (McCone, Phillips, and Valley Counties). The cranes may pass over the refuge during spring or fall migrations and stop briefly to feed, but there are no resident or breeding populations on the refuge.

Species of Concern

There are several species of concern found on the refuge. They generally rank no greater than G3 or S3 from Montana Natural Heritage Program (2008), or are currently being considered for listing under the Endangered Species Act.

Black-tailed Prairie Dog. Black-tailed prairie dog colonies on the refuge are most abundant in the Phillips County part of the refuge and near the southern end of the Big Dry Arm of Fort Peck Reservoir, along with a single colony of about 1,000 acres in Valley County. The perimeters of prairie dog colonies have been mapped through the years and figure 25 shows the maximum extent of where prairie dogs have been recorded from 1979 through 2007 and totals 15,700 acres. The last time all colonies on the refuge were mapped was in 2003 and totaled 7,300 acres. Epizootic plague was widespread in Phillips County during 2007 and reduced prairie dog acreage there by 50 percent from 5,200 acres mapped in 2004 to 2,600 mapped in 2007.

The vast majority of the refuge is not suitable habitat for prairie dogs and much of the refuge is on the fringe of suitable habitat. Many existing colonies have limited expansion potential because of topography, hydrology and shrub or tree cover limitations.

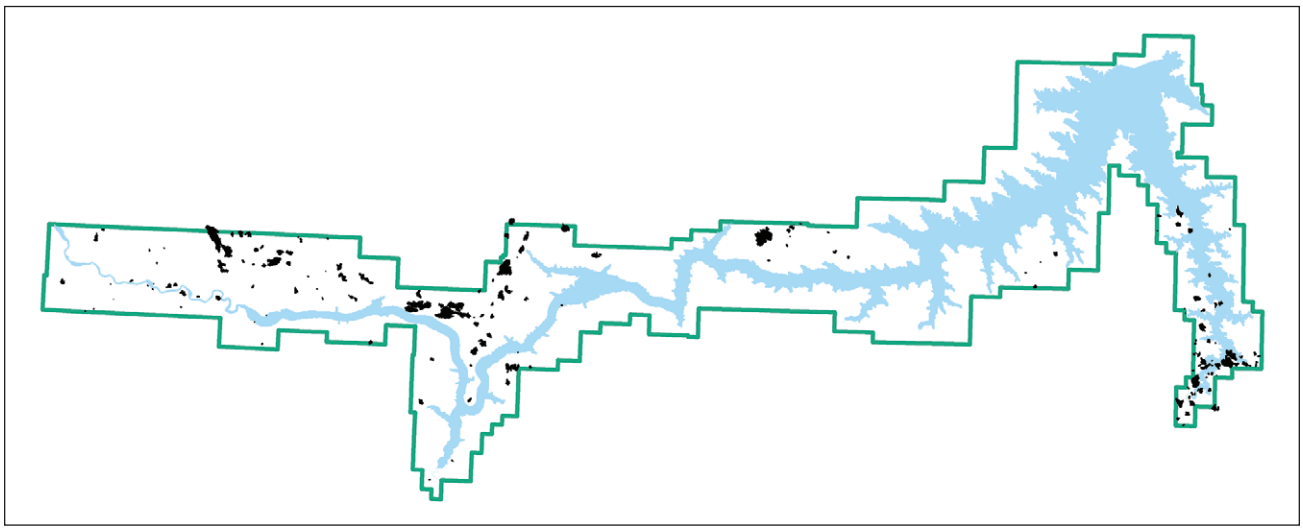


Figure 25. Map of the maximum extent of black-tailed prairie dogs at the Charles M. Russell and UL Bend Refuges, Montana (1979–2007).

Watchful prairie dogs atop their mound.

Sylvatic plague was first documented in Phillips County in 1992 after thousands of acres of prairie dogs suddenly disappeared throughout the county. The Manning Corral prairie dog colony on the refuge in southern Phillips County was nearly 1,400 acres in size before being affected by plague in 1992 when it was reduced to 16 acres in about a month. Plague epizootics continued in varying degrees through 1996 and prairie dog populations have slowly recovered since, until 2007 when plague once again eliminated many colonies over a wide area. More discussion about prairie dogs and plague is located under the black-footed ferret section.

Prairie dog range in the early 1900s reached from southern Saskatchewan southward across the Great Plains to northern Mexico. Although prairie dog colonies covered up to 98 million acres (Knowles and Knowles 1994), current estimates place the area occupied at 1–2 percent of historical levels (Miller et al. 1990, Marsh 1994). Prairie dogs have lived on the Great Plains for thousands of years, providing food or habitat for numerous species. The endangered black-footed ferret, for example, depends solely on prairie dogs for food, and on prairie dog burrows for shelter.

Prairie dogs are a keystone species for the Great Plans (Kotliar 2000). Prairie dogs are prey for other species, dig burrows used as nest sites and shelter for invertebrates and vertebrates, and alter nutrient cycling, plant species composition, and plant structure. Sensitive species closely associated with prairie dogs include the mountain plover and burrowing owl. Predator species include black-footed ferrets, raptors, badgers, bobcats, mountain lions, coyotes, and western rattlesnakes. Nine of the 208 species listed in the literature as observed on or near prairie dog colonies have quantitative evidence of dependence on prairie dogs (Kotliar 2000).

In 1998 the prairie dog was petitioned for listing under the Endangered Species Act. In 2000, the Service found that listing was "warranted but precluded" meaning that listing was warranted but other species had higher priority. In 2004, the Service issued a "not warranted" finding on a resubmitted petition removing it as a candidate species. In 2007, the prairie dog was petitioned again for listing and on December 2, 2008, the Service issued a positive 90-day finding for the prairie dog. Most recently, the Service completed a status review and found that it does not warrant protection under the Endangered Species Act at this time.

Section 87–5–103(1), Montana Code Annotated states that nongame wildlife species should be "perpetuated as members of ecosystems." The prairie dog itself is listed on the Natural Heritage Program and MFWP "Species of Concern" list (Montana Natural Heritage Program and MFWP 2009), as well as BLM's "Special Status Species" list in Montana. Several species associated with prairie dogs also are listed by the State and BLM as species of management concern. BLM has a heightened responsibility for species that it designates as "sensitive," in that it should afford them special protection to ensure that their populations and habitat are conserved.

The refuge has been an active member of the Montana Prairie Dog Working Group that produced MFWP's "Conservation Plan for Black-tailed and White-tailed Prairie Dogs in Montana" (MFWP 2002b, 2006b). Refuge staff continue to work with

MFWP and other partners to establish and maintain a complex of prairie dog colonies capable of supporting a viable black-footed ferret population as called for in the plan, but little progress has been made. Prairie dogs remain a controversial species, considered a pest in need of control by agricultural interests, the focus of recreational shooters (not on the refuge), and plague continues to be problematic. All these factors make it difficult to grow and maintain adequate prairie dog acreage to support ferrets. Experience with black-footed ferret reintroductions over the last 19 years across the Nation clearly shows that larger complexes of prairie dog colonies close together have better success establishing ferret populations than areas with small and scattered colonies.

Swift Fox. Swift fox were common throughout central and eastern Montana prairies before poisoning efforts directed at coyotes and wolves in the early 1900s (Foresman 2001). After the large poisoning efforts on the prairies and 50 years without documented observations, Hoffmann et al. (1969) suggested the swift fox was extinct in Montana. Since 1969, sporadic observations have been documented throughout eastern Montana. Reintroduction efforts on the Blackfoot Indian Reservation in northwestern Montana in 1998 and southern Saskatchewan and Alberta from 1983 to 1991 are thought to be the source population of many of these sightings (Foresman 2001). These populations continue to expand to the south and east in Montana, and recent surveys have documented swift fox in many of the counties bordering Canada in north-central Montana (Moehrenschlager and Moehrenschlager 2001). Trapping is not currently allowed in Montana.

Swift fox are not known to regularly occur on the refuge, but there were two reported sightings in the UL Bend area during the late 1990s and one along Bone Trail in southern Valley County during July 2006 along with a couple older sightings along Highway 191 north of the refuge.

Not unlike prairie dog habitat, much of the refuge is topographically too rough for swift fox that generally prefer wide-open areas with gentle topography and generally sparse vegetation. The World Wildlife Fund is planning a camera trapping survey of 16 townships in Phillips County beginning in September 2009 and will include two townships on the refuge. Results of that survey should provide better picture of swift fox abundance in southern Phillips County.

There are no current plans for any swift fox reintroductions into suitable habitat on the refuge, but they have been considered in the past, and could be again. In 2001, the Service found that swift fox should be listed as a threatened species under the Endangered Species Act.

Greater Sage-Grouse. Parts of the refuge provide quality sage-grouse habitat, but similar to other prairie species, much of the refuge is on the fringe of more expansive areas of prime sage-grouse habitat (Doherty et al. 2010). However, recent research by Rebecca Smith, M.S. candidate, University of Montana (FWS 2011f) has shown the refuge provided critical habitat for survival of about 300 sage-grouse that migrated nearly 100 miles from southern Saskatchewan and northern Montana during the harsh winter of 2010–11, which saw record snowfall. The extent of the use and the importance of the refuge to the survival of this international population are just beginning to be better understood, and ongoing research will better quantify the importance of the refuge for sage-grouse. Sage-grouse populations are monitored primarily with counts of birds on breeding leks in the spring (figure 26). Overall population levels fluctuate annually for a variety of reasons. Long-term population levels and trends appear to be stable on the refuge. An important threat to sage-grouse is the effect of West Nile virus, an exotic disease first introduced to sage-grouse in Montana during 2003.

The refuge staff monitored more than 100 radio-marked adult female sage-grouse during late summer and fall 2003 and measured a 16-percent mortality rate in about a month (Moynahan et al. 2006b). During the two summers before this West Nile virus outbreak, mortality among radio-marked hens averaged 1 percent. It is very difficult to confirm West Nile virus as the cause of death as carcasses degrade rapidly in the summer heat, but West Nile virus was confirmed as the cause of death in four birds. Subsequent monitoring of radio-marked sage-grouse through 2006 also detected West Nile virus–caused deaths, but mortality rates were lower.

In March 2010, the Service found the greater sage-grouse was "warranted, but precluded" for listing under the Endangered Species Act. Greater sage-grouse are now considered a candidate species and will be managed on the refuge as if they were listed as threatened. The refuge has been an integral part of several graduate research studies on sage-grouse in recent years (Battazzo 2007; Moynahan 2004, Moynahan et al. 2006a, 2006b; Sauls 2006). In addition, refuge staff has collaborated with many others throughout the West on sage-grouse conservation and the effects of West Nile virus (Naugle et al. 2004, 2005).

The Service has found that public harvest of sage-grouse can continue provided that habitat remains in good condition and populations are healthy. In areas where populations have declined, it may be prudent to close the season. Conditions could vary across national wildlife refuges. On the refuge, sage-grouse populations are generally robust and healthy. Har-

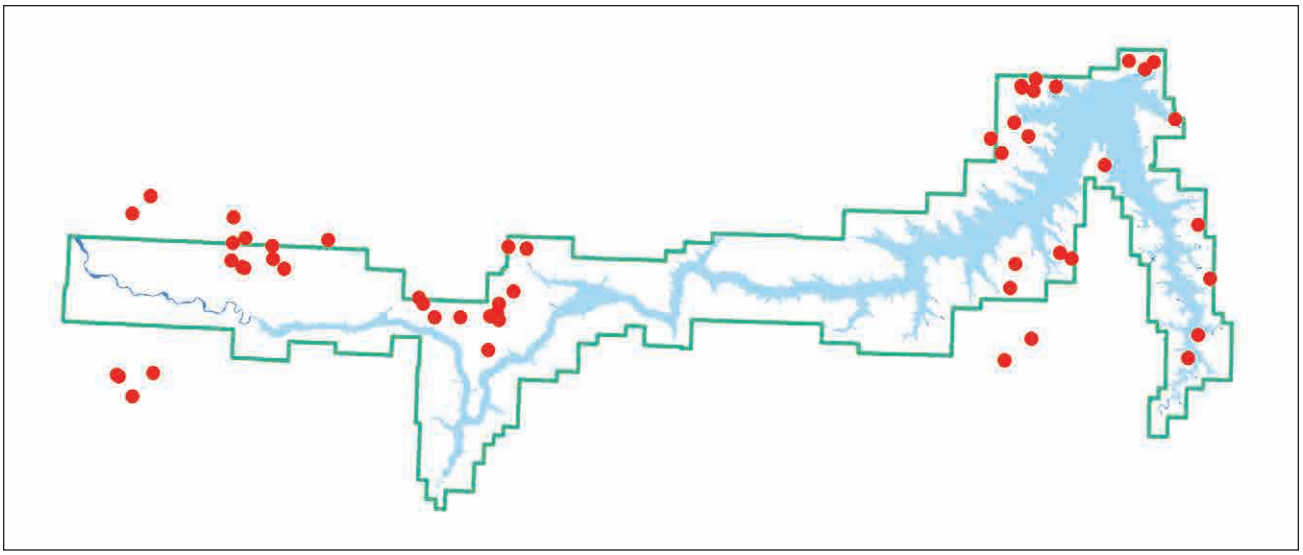


Figure 26. Map of lek locations for greater sage-grouse on and near the Charles M. Russell and UL Bend Refuges, Montana.

vest levels likely have limited, if any, influence on population dynamics. In the absence of new information, the Service has adopted State-recommended harvest management strategies for sage-grouse.

Mountain Plover. In May 2011, the Service found that the mountain plover does not warrant protection under the Endangered Species Act. Loss or degradation of mountain plover habitat has generally been identified as the greatest potential threat to the species. Black-tailed prairie dogs create favorable breeding habitat for the mountain plover in several States including Montana. Efforts to maintain prairie dog colonies and the prairie ecosystem will, in turn, benefit mountain plover. Mountain plover occurrence on the refuge is primarily associated with nesting habitats located on prairie dog colonies. Many prairie dog colonies on the refuge are not selected by mountain plovers for nesting (for example, most of the prairie dog colonies on the UL Bend Refuge), but others, primarily located on upland ridges and often with glacial till and desert pavement substrates, are prime nesting areas. Researchers have conducted long-term mountain plover monitoring efforts, primarily in Phillips County. Mountain plover populations and nesting success closely parallel black-tailed prairie dog abundance and like prairie dogs, are greatly influenced by the effects of sylvatic plague. Once plague effectively eliminates a prairie dog colony, within a year, that colony is no longer suitable for mountain plover nesting habitat as vegetation heights become too high without prairie dog activity.

Sicklefin Chub, Sturgeon Chub, and Blue Sucker. Sicklefin chub and sturgeon chub were proposed for listing as an endangered species in 1994, and in 2001, the Service found they do not warrant listing as threatened or endangered. Sicklefin chub is currently a Category 1 species (Grisak 1998), and is ranked S1 on the Montana species of concern list. MFWP conducted a population survey on the Missouri River starting in 1996. Distribution around the refuge includes the middle Missouri River from Cow Island downstream to the headwaters of Fort Peck Reservoir. The sicklefin chub lives to 4 years of age and becomes sexually mature at 2 years old. Spawning occurs in main channel areas of large turbid rivers during the summer. Early life history is unknown. They prefer deeper water and sandy substrate. The major threat is habitat alteration by dams and irrigation development. Further reductions in streamflows associated with irrigations could degrade existing habitat.

Sturgeon chub is common in eastern Montana but is listed as a Montana species of concern (S2S3). Recently, surveys have found it to be more widely distributed than previously thought. It is indigenous to the Missouri–Mississippi river basins. The sturgeon chub spawns from June to July, reached sexual maturity at 2 years, and few live to 4 years old (Gould 1998). They are adapted to turbid water, associated with moderate currents and depths and prefer sand or rock substrates. They require riffles and runs in turbid shallow waters or deeper running waters. The major threat is habitat alteration by dams and irrigation development. Further reductions in streamflows associated with irrigations could degrade existing habitat (Gould 1998).

Blue sucker (S2S3) populations are healthy in Montana, but it is listed as a species of concern. It is adapted for life in swift currents of large rivers, migrating in spring upriver and congregating in fast rocky areas to spawn. They can live 17 years but seem to have very low reproductive success. The species is considered an indicator species for ecosystem health because of its habitat-specific requirements. Habitat

protection includes establishment of more natural seasonal flows on rivers (Williams et al. 1989).

Northern Leopard Frog. Northern leopard frogs were proposed for listing as threatened under the Endangered Species Act in 2009. A positive 90-day finding was published in the Federal Register on July 1, 2009, and a 12-month status review of the species was completed in October 2011. The Service found that the leopard frog does not warrant Federal protection as a listed species. While the species has experienced reductions in its historical range, particularly in the western United States and western Canada, the species is still considered to be widespread and relatively common in the eastern United States and eastern Canada. It is considered uncommon throughout western States including Montana. They breed in a variety of habitats including slow-moving or still water along streams and rivers, wetlands, permanent or temporary pools, beaver ponds, and stock tanks (Rorabaugh 2005). These areas do not contain predaceous fish or other predators and contain emergent vegetation for breeding and tadpole habitat (Smith 2003). Subadults migrate to feeding sites along the borders of larger, more permanent bodies of water (Merrell 1970). Adults require stream, pond, lake, and river habitats for overwintering and upland habitats next to these areas for summer feeding. In summer, adults and juveniles commonly feed in open or semi-open wet meadows and fields with shorter vegetation, usually near the margins of waterbodies, and seek escape cover underwater. During winter, leopard frogs are found inactive underwater on the bottom of deeper streams or waters that do not freeze to the bottom and are well-oxygenated (Stewart et al. 2004) Males call in shallow water during breeding season. Eggs are laid in breeding habitat and are attached to the vegetation, just below the water surface. Larvae develop in shallow, still water exposed to sunlight. Tadpoles are generalist herbivores, eating attached and free-floating algae (Hoff et al. 1999). Adult and subadult frogs are generalist insectivores (Merrell 1977, Smith 2003). During spring and fall migrations and juvenile dispersals, leopard frogs have been tracked 5 miles from original locations (Werner et al. 2004).

Incidental observations of northern leopard frogs on the refuge have been recorded in early narratives. Sightings of between one and three individuals are common but on two occasions, two areas on the refuge have had more than 50 individuals recorded. In 2009 at the UL Bend Refuge, 50 individuals were found south of Dry Lake; in Valley County, more than 100 leopard frogs were found in ponds by Duck Creek (see figure 27).

Sprague's Pipit. In September 2010, the Service reviewed the conservation status of the Sprague's pipit to determine whether the species warrants protection under the Endangered Species Act. The status review found that listing Sprague's pipit as threatened or endangered is warranted, but listing is precluded by the need to complete listing actions of a higher priority. Sprague's pipit has been documented on the refuge, and it has been identified as a focal bird species of the uplands (refer to chapter 4, "Bird Objectives" in section 4.2 and "Threatened and Endangered Species and Species of Concern Objectives" in section 4.3).

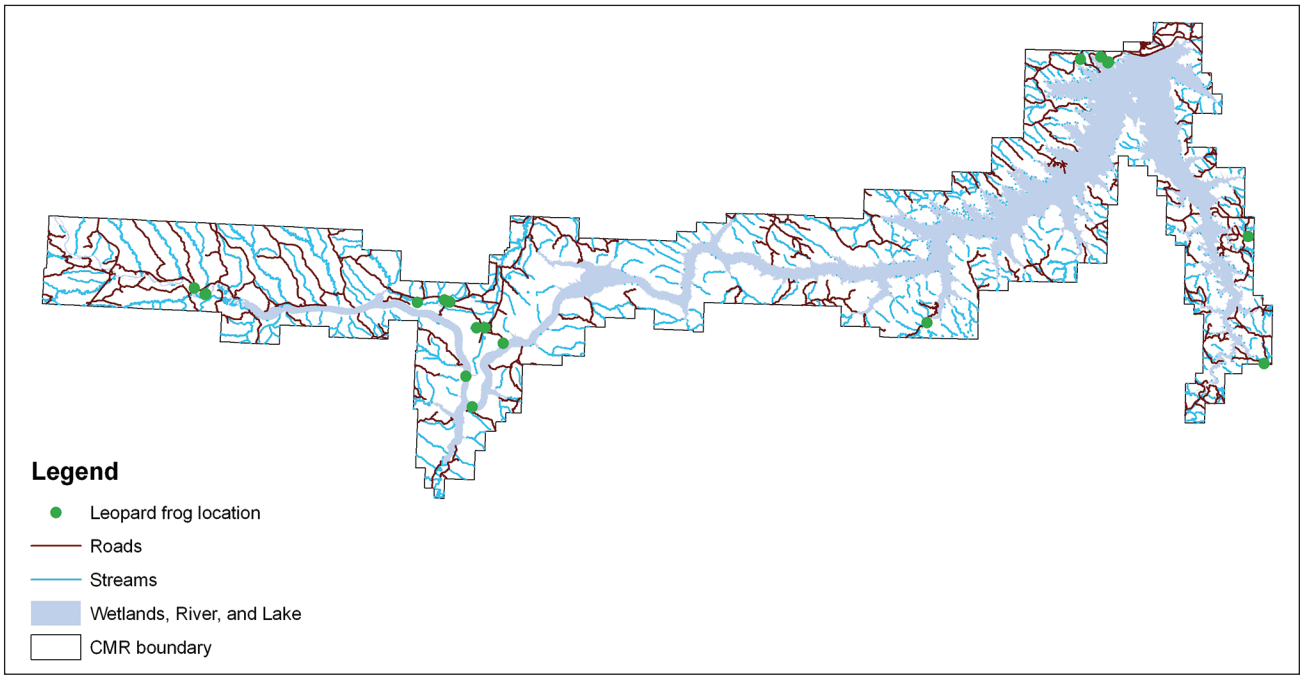


Figure 27. Map of leopard frog locations on the Charles M. Russell and UL Bend Refuges, Montana (1996–2009).

FURBEARERS and SMALL PREDATORS

Little is known about the populations of furbearing species on the refuge. There have been few studies or inventories conducted on the refuge on the abundance or ecology of furbearer species regulated by MFWP (muskrat, beaver, mink, and swift fox [discussed under Species of Concern], bobcat, and river otter) or unregulated by MFWP (least weasel, long-tailed weasel, short-tailed weasel, striped skunk, badger, raccoon, red fox, and coyote). Beaver and bobcats are the only two furbearers that have been studied or inventoried on the refuge. Beaver and muskrat sightings on the refuge are numerous enough to suggest well-established populations on the Missouri River and Fort Peck Lake. However, occurrence of these species on associated tributaries within the refuge is relatively unknown except for anecdotal observations. Expanding suitable riparian habitats will provide the basis for increased populations of muskrat, beaver, river otter, and mink. Current population numbers of the remaining furbearer species is unknown, most have undocumented observations by staff and other visitors; however, continued restrictions will be beneficial to maintaining viable populations.

A research project on bobcats conducted in 1979–80 indicated illegal hunting to be the largest mortality factor among radio-collared bobcats on the refuge (Knowles 1981). Current population numbers on the refuge remain relatively unknown; however, continued restrictions will help support a viable bobcat population in the Missouri River Breaks as areas around the refuge continue to be trapped.

The market for beaver fur in the 19th century played a major role in the exploration of western North America (Wilson and Ruff 1999). Throughout North America and Europe, beaver populations were trapped to near extinction by 1900; however, the response by game management agencies in the last century prevented total elimination (Foresman 2001). Beaver populations have since recovered and even considered a nuisance in some areas due to their gnawing of trees and dam construction. Beginning in 1949, but more consecutively 1960–87, refuge staff inventoried beaver caches along the Missouri River within the refuge boundary. Total beaver caches varied from 18 to 115 with an average of 55 per year. The last inventory was completed in 1992, with 64 caches from the west boundary of the refuge to the Musselshell River bottom. Although observations of beaver are quite common along the Missouri and Musselshell Rivers, current population numbers on the refuge remain relatively unknown.

AMERICAN BISON

Wild bison (Adams and Dood 2011) have been eliminated from the Missouri River Breaks for more than 100 years. One permittee in the Grass Coulee Habitat Unit has grazed bison as a form of livestock in recent years. The American Prairie Reserve now has about 200 bison that came from Wind Cave National Park and are currently classified as domestic livestock. Those animals graze primarily on private and BLM land next to the refuge, although some grazing does occur on the refuge in an exchange of use for AUMs that the American Prairie Reserve holds on State leases within the refuge.

Currently, there is no proposal to reintroduce wild bison on the refuge, but there has been considerable discussion about the possibility of the refuge participating in a restoration effort. Should such a proposal be developed, there will be multiple agencies, partners, and cooperators involved and a public process for consideration and evaluation of any bison restoration proposal (Adams and Dood 2011). The Service is willing to participate with others if such an effort develops and emphasizes the need for cooperation, coordination, and public input (refer to "American Bison Restoration Objectives" under section 4.2 in chapter 4).

NORTHERN GRAY WOLF

There have not been any confirmed sightings of wolves on the refuge since they were extirpated in the late 1800s or early 1900s, although refuge staff have received a few unconfirmed sightings in recent years. There was a hybrid wolf killed in northern Garfield County after several livestock depredations in 2007. Scattered reports of wolves on the refuge have been received for the past couple of years, but neither the Service nor MFWP staff has documented any packs on the refuge.

Wolf reintroductions into Montana and Wyoming occurred in 1995 in Yellowstone National Park. Populations increased rapidly and spread to surrounding lands in both States and Idaho. In recent years, populations have declined slightly as packs and prey densities become more established. There have been wolves observed in eastern Montana during the last 20 years, but they have all been transients and no packs have been established.

In May 2011, the Service published a final rule reinstating the terms of the 2009 rule that removed part of the Northern Rocky Mountain Distinct Population Segment of gray wolves from the endangered species list. This included gray wolves found in western Montana. The Service has also delisted the biologically recovered gray wolf population in the Western Great Lakes. There are no plans to reintroduce wolves on the refuge but, given their dispersal capacity and the established population in western Montana, eventually wolves could immigrate to the refuge (refer to "Northern Gray Wolf Objectives" under section 4.2 in chapter 4).

BIG GAME

The primary big game species found on the refuge include Rocky Mountain elk, mule deer, white-tailed deer, pronghorn, Rocky Mountain bighorn sheep, and mountain lion.

When the Fort Peck Game Range was established in 1936, elk, bighorn sheep and mountain lions were absent, mule deer populations were depressed and pronghorn were quite scarce. Conservation of wildlife was in its infancy at the time and setting aside a large block of land, specifically for game, was a bold and novel move. Through the years, reduced big game harvest, reintroductions and management with a wildlife emphasis has resulted in the relatively abundant big game resources present today. The emphasis to manage primarily for wildlife was reaffirmed when the Game Range became a National Wildlife Refuge in 1976 and was strengthened even further with the 1997 passage of the National Wildlife Refuge System Improvement Act (refer to chapter 1 for more details on refuge establishment and the purposes of the refuge).

Rocky Mountain Elk

Considered abundant in 1805 when Lewis and Clark traveled through what is now the refuge, elk were extirpated from the Missouri River Breaks 100 years later. Some 50 years after that, elk were reintroduced on the refuge during winter of 1951–52 with the transplant of 161 animals from Yellowstone National Park. A refuge report (unpublished report on file at refuge headquarters) from December 1964 described the game counts on the south side of the Missouri River on the refuge:

> "The primary purpose of this portion of the survey was to census and locate elk in the area prior to a State-opened permit hunt. The area from Highway 191 east to Crooked Creek [the refuge portion of hunting district 410] was transected at 2-mile intervals north and south. A total of 39 elk were sighted in an area approximately 300 square miles; 117 elk could be projected providing that the elk were distributed throughout the entire area. [equates to 0.39 elk per square mile] On the basis of these surveys, it is estimated that elk number not less than 64 or more than 76 in the area between Highway 191 and the Musselshell River."

In comparison, some 40 years later, 712 elk were counted during aerial surveys of 79 square miles in five sample blocks of the refuge in this same area during December 2005 (observed 9 elk per square mile). Total harvest of elk in the Missouri River Breaks was estimated to be 291 during 1987 and peaked in 2006 with 2,235 elk harvested. The current population of elk in the Missouri River Breaks is thought to be substantially above objective levels that MFWP established in its 2004 Elk Management Plan (MFWP 2004). Therefore, elk permit quotas and seasons have been relatively liberal in the Missouri River Breaks during the last several years. More than 9,000 elk were harvested in Missouri River Breaks hunting districts from 2004 through 2008, averaging 1,850 annually (MFWP 2009b). The refuge has a relatively small and variable proportion of administrative hunting district boundaries as established by MFWP. Those hunting districts contain continuous wildlife habitat on and next to the refuge.

Table 10 lists MFWP's elk objectives by hunting district, their most recent population estimate, and the degree of population reduction needed to achieve the upper end of their population objective range.

Mule Deer

Mule deer populations across the refuge fluctuate for a variety of reasons and densities are highly variable (figure 28). One of the oldest and continuously monitored mule deer study areas in Montana is located on and adjacent to the refuge and is known as the Sand Creek study area on the southwestern part of the refuge. Mule deer investigations and monitoring began there in 1960 and continues today. In addition, refuge staff has conducted a variety of aerial mule

Table 10. Montana Department of Fish, Wildlife and Park's elk population objectives, estimates, and needed herd-size reductions for hunting districts covering the Charles M. Russell and UL Bend Refuges, Montana.

Hunting district	*County*	*MFWP maximum objective in 2004 elk plan*	*Most recent MFWP population estimate*	*% Reduction needed to meet MFWP objective*
410	Fergus, Petroleum	2,300	2,300	0
417	Fergus	400	600	33
620, 621, 622	Phillips	1,650	2,868	42
630, 631, 632	Valley	350	650	46
700	Garfield	1,100	1,676	34
	Total	5,800	8,094	28

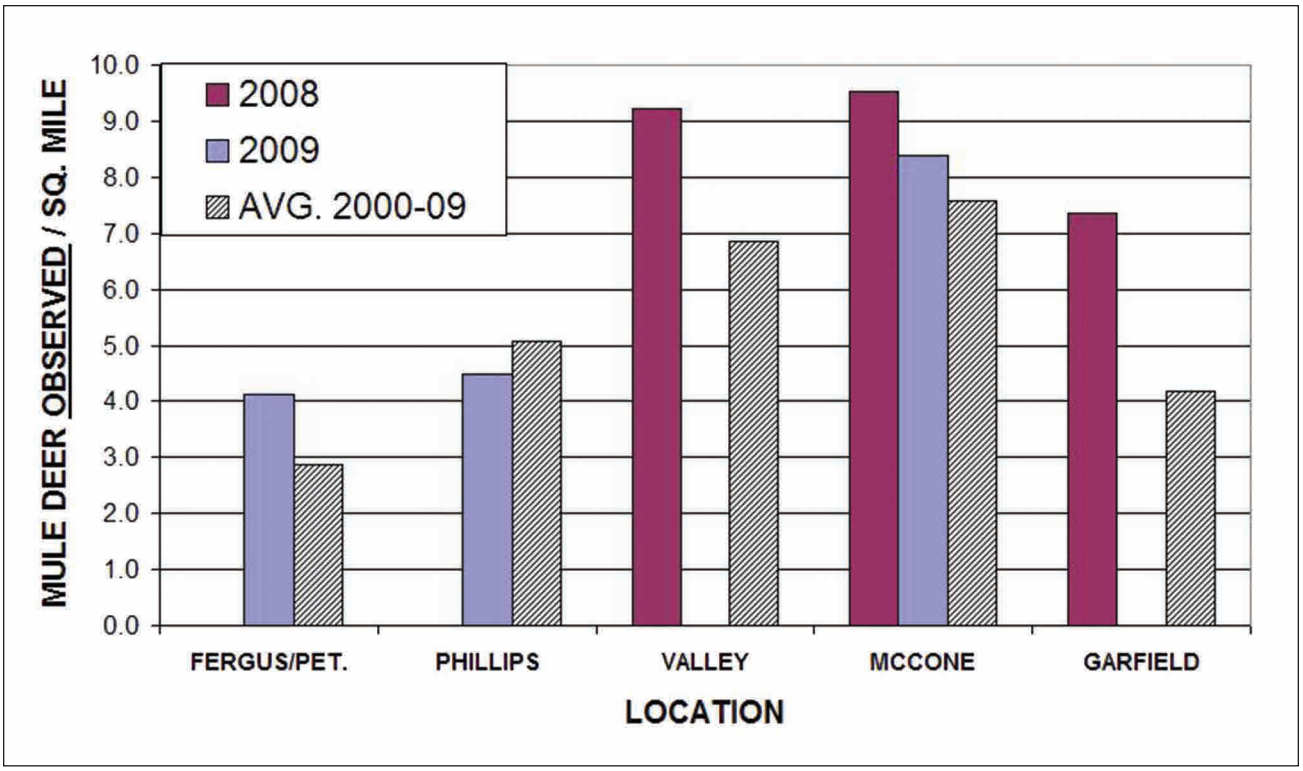


Figure 28. Chart of mule deer densities within six counties covering the Charles M. Russell and UL Bend Refuges, Montana (2000–09).

deer surveys over the years. A standardized sampling design (figure 29) for aerial surveys covering 430 square miles was implemented in 2000 and has been conducted annually after the hunting season since then. Observations from survey blocks of like colors are combined to produce mule deer density and ratio estimates for county areas.

The total number of mule deer estimated on the refuge has varied from around 7,000 to more than 14,000 over the last 10 years. Mule deer are a highly sought game animal in northeastern Montana. The refuge has managed the population so that older aged bucks are well represented in the posthunting season population (figure 30). The Service feels it is appropriate to have the older-aged bucks as an indicator for achieving naturally functioning ecological systems and for providing quality recreation experiences for the public on a national wildlife refuge (refer to "Visitor Services" in section 3.4 below for more information about quality wildlife-dependent uses).

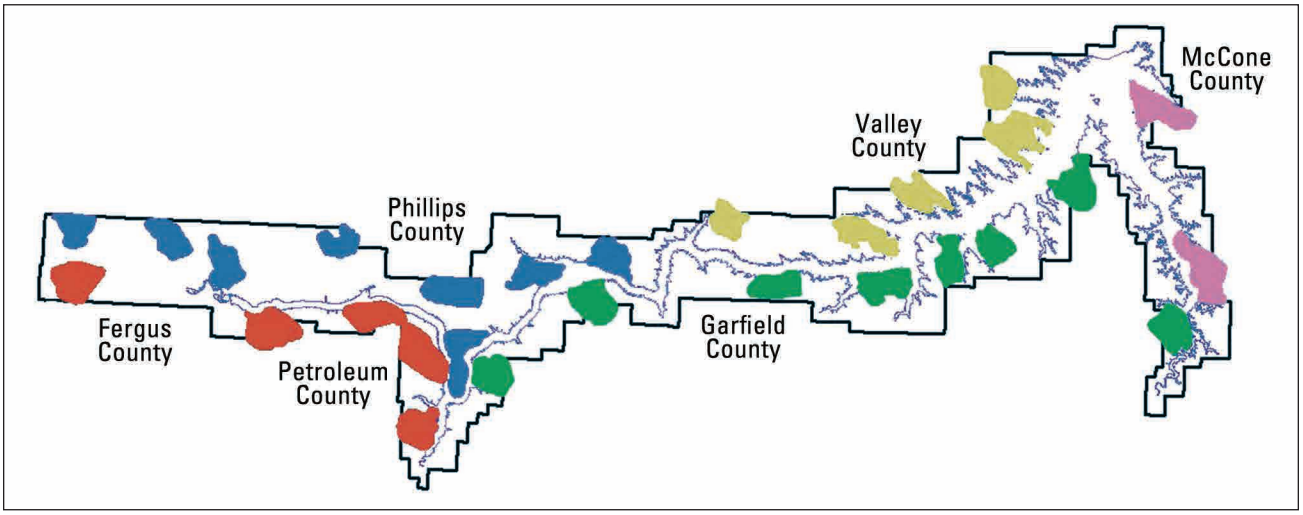


Figure 29. Map of the aerial survey blocks for mule deer and elk at the Charles M. Russell and UL Bend Refuges, Montana.

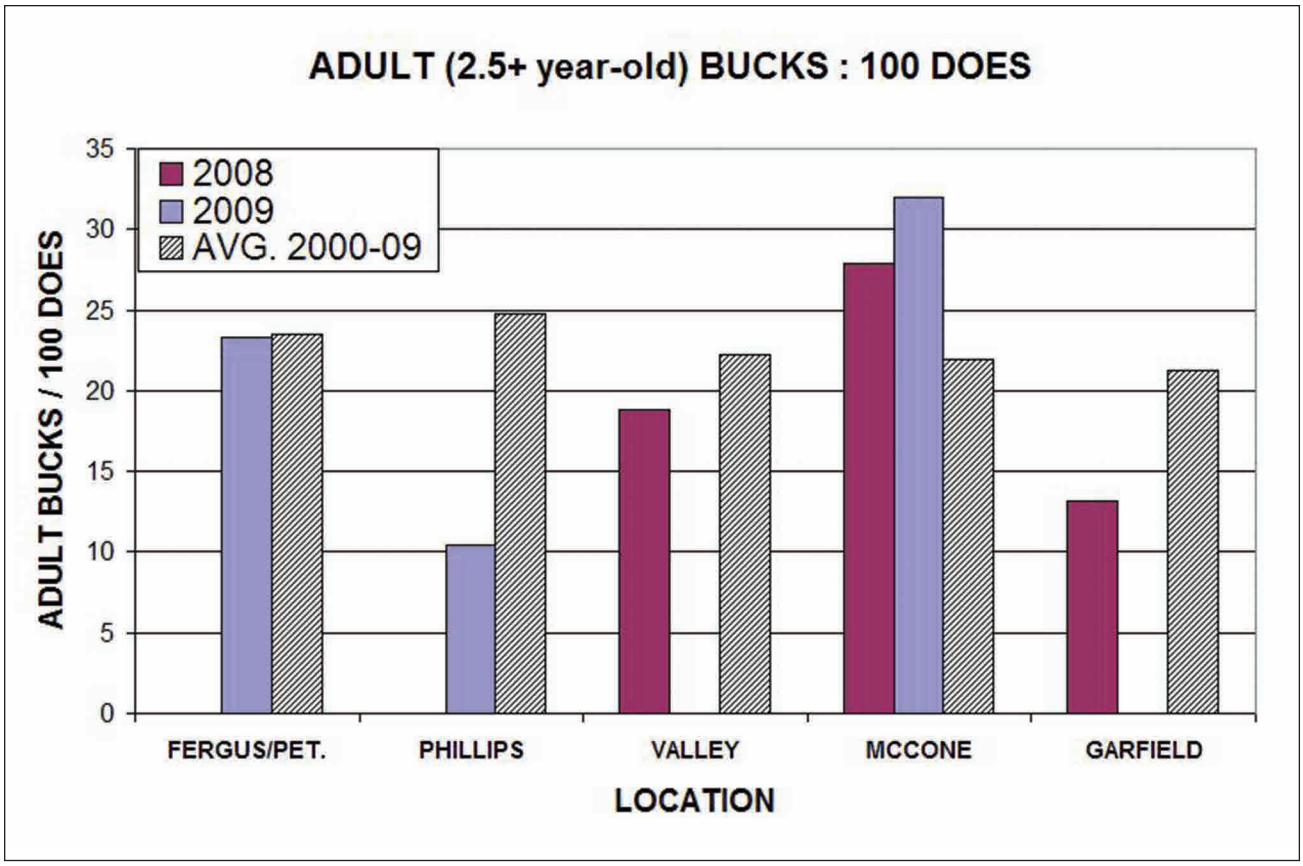


Figure 30. Chart of the ratios of adult mule deer bucks to does within the six counties covering the Charles M. Russell and UL Bend Refuges, Montana (2000–09).

Overall, the public has supported the Service's approach for mule deer because of the variety of hunting opportunities. For example, in one hunting district on the refuge (652), mule deer hunting is by permit only and in 2008, nearly 900 people applied for the 100 permits. In other areas, the refuge has established regulations that shorten the hunting season to the first 3 weeks of the standard 5-week season in most of the rest of Montana. The logic for the shortened season is to allow more mature bucks to survive the hunting season by limiting hunting pressure during the rut, when bucks are more vulnerable to harvest, generally during the last 2 weeks of the hunting season. In another hunting district (700), refuge regulations permit mule deer hunting for the full 5-week season authorized by MFWP.

There are no mule deer harvest estimates specifically for the refuge, but MFWP does produce estimates for each hunting district in the State. More than 6,000 mule deer were harvested in those hunting districts that encompass the refuge in 1995 and mule deer population levels were near all-time highs. That level dropped to less than 3,000 during the following several years and populations were near all-time lows. Slowly, populations have rebounded, but they still fluctuate, and harvest from 2006 through 2008 was around 5,000 mule deer annually (figure 31).

White-tailed Deer

White-tailed deer are much less abundant than mule deer and are found primarily along the Missouri and Musselshell Rivers and major tributaries. They are also seen often on parts of UL Bend National Wildlife Refuge and occasionally in other upland sites. No monitoring specifically geared toward white-tailed deer has been done and hunting seasons on the refuge have been the same either-sex, 5-week season as adjacent areas. In addition to a deer A–tag valid on the refuge for either deer species and either sex in most areas, MFWP also offers a B–tag for an antlerless white-tailed deer that can be used throughout eastern Montana and those tags are valid on the refuge. There are a few hunters who concentrate on hunting for big bucks in the river bottoms of the refuge, but the hunting pressure for white-tailed deer is far less than for elk and mule deer.

There are no white-tailed deer harvest estimates specifically for the refuge, but MFWP does produce estimates for each hunting district in the State. About 1,000 white-tailed deer were harvested in those hunting districts that encompass the refuge in 2000 and then dropped to an average of 500 for all eight hunting districts for the next 4 years. The estimate for 2008 was a harvest of about 1,100 white-tailed deer.

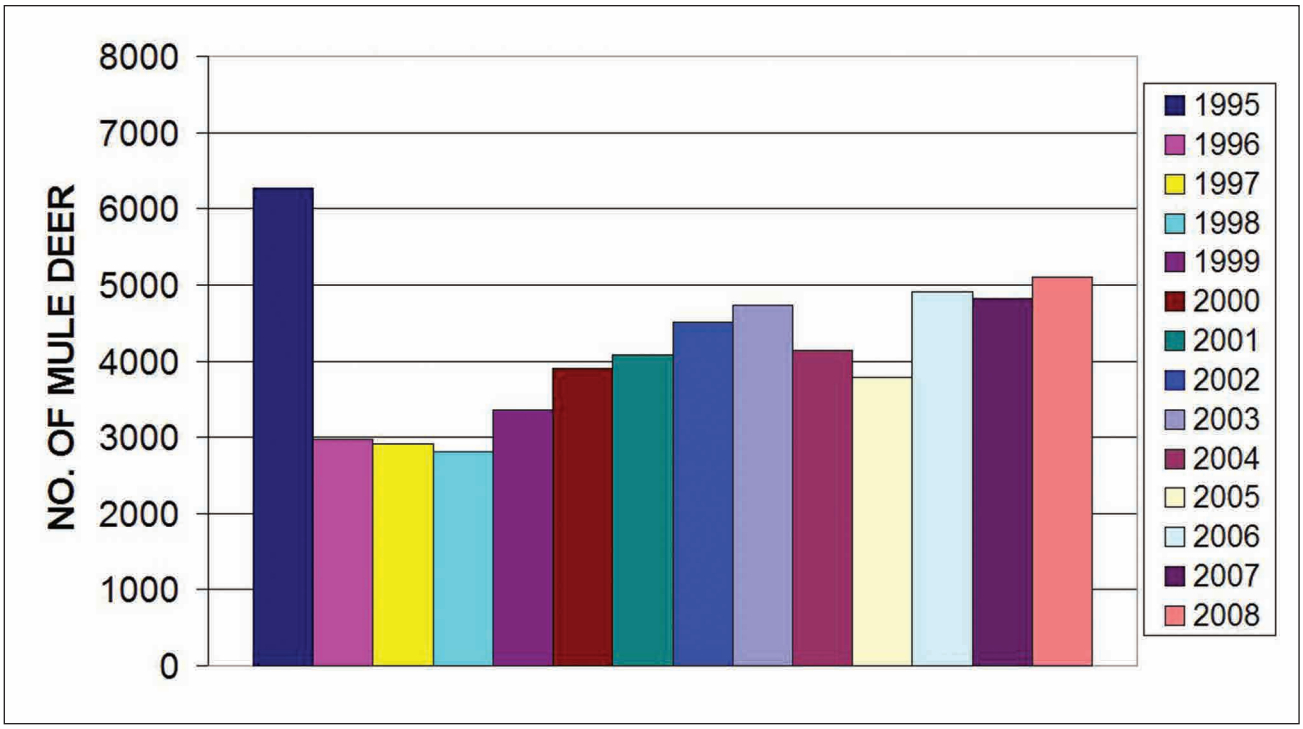


Figure 31. Chart of the number of mule deer harvested in hunting districts on and next to the Charles M. Russell and UL Bend Refuges, Montana (1995–2008).

Pronghorn

The 1936 Executive Order 7509 establishing the Fort Peck Game Range specifically identified the need to protect and manage for pronghorn (refer to chapter 2). Pronghorn are a highly mobile species and recent research using Global Positioning System (GPS) collars has documented migrations of more than 300 miles from animals collared near the Montana–Canada border north into Alberta and Saskatchewan. The collar from a pronghorn doe marked north of Malta during January 2008 was retrieved 1 year later some 70 miles south, within 1 mile of the refuge boundary. With deep snow and bitterly cold, subzero temperatures during December 2008 and January 2009, many hundreds of pronghorn were observed migrating south from Canada and northern Montana and likely crossed the refuge and the Missouri River and wintered farther south. During the spring, pronghorn have been observed crossing the Missouri River headed north, or attempting to head north, but stranded on the south side of Fort Peck Reservoir. They have been observed pacing the south shoreline of Fort Peck Reservoir during spring and sometimes attempting to swim across to the north, having migrated south across the ice during the previous winter.

Despite the mandatory focus on pronghorn in the Executive order, very little survey work has been done on pronghorn and no research studies have ever been conducted. Much of the refuge is not considered pronghorn habitat as the topography is too rough or is covered with trees and juniper. However, pronghorn are regularly observed using many areas on the refuge, but the role the refuge lands play in a larger landscape and pronghorn ecology are unknown. Studies designed to better understand pronghorn ecology using GPS collars have been proposed, but have not yet materialized.

Rocky Mountain Bighorn Sheep

Quoting from the refuge's 1980 annual narrative report:

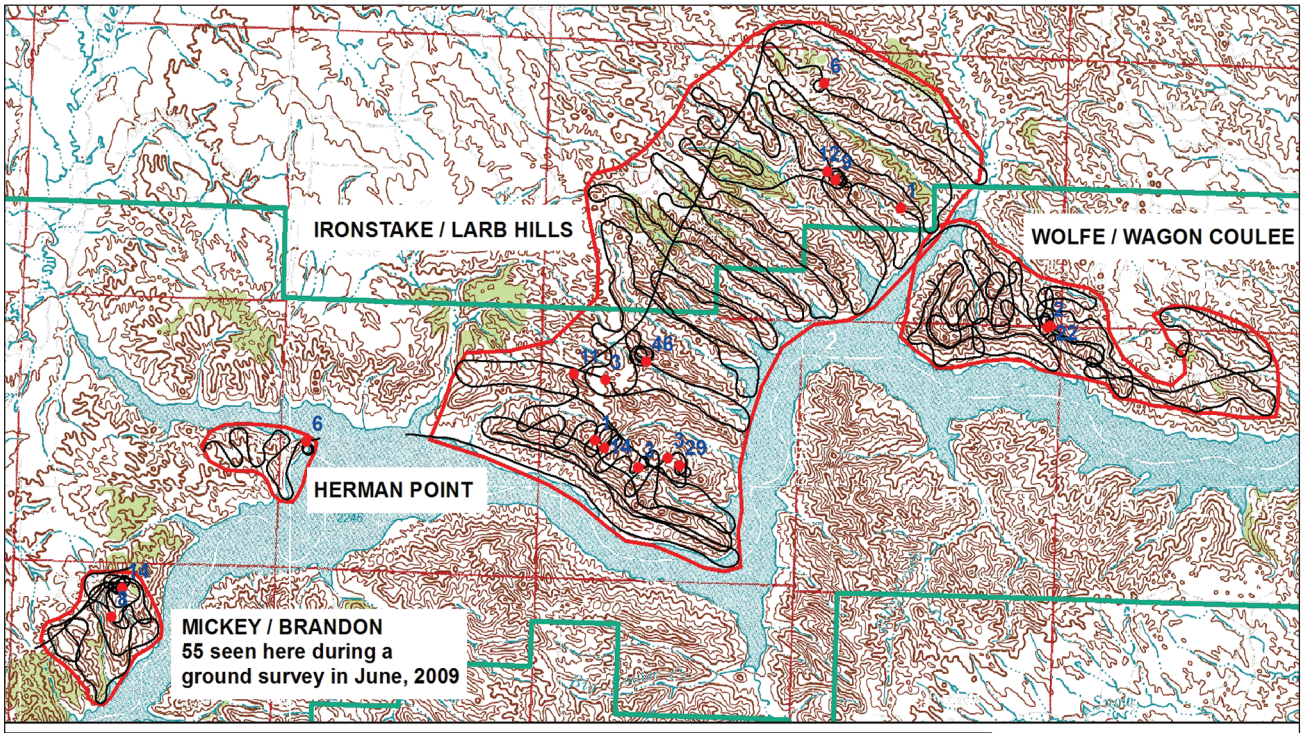
> "The future of the remnant Two Calf transplant herd was sealed this fall when the last remaining ram was poached. FWS special agents have not been able to develop enough evidence to make an arrest.
>
> The ram was poached at the beginning of the rut and it is doubtful any breeding occurred. The number of surviving lambs is unknown but probably less than five. There are no yearling rams and poor survival in the past has resulted in some very old ewes. A BLM transplant occurred some 25 miles upriver and possible dispersal might replace some animals.
>
> On March 8, 1980, 27 bighorn sheep from the Sun River herd were released near Mickey–Brandon Buttes. The majority of the ewes and two small rams stayed on the buttes. The older rams wandered to the north throughout the summer and at least 4 returned to the

buttes area for the rut. Another small group of ewes was reported by hunters to be on Iron Stake Ridge, 15 miles northeast of the main herd group. A December aerial count showed 4 rams, 11 ewes and 3 lambs."

Bighorn sheep are occasionally observed in the Two Calf Creek and Heller Bottom area on the very southwestern part of the refuge. It is thought these animals are part of a larger sheep population that extends upstream from the refuge. In the Mickey/Brandon Buttes and Ironstake Ridge/Larb Hills area, an average of 94 bighorn sheep (range of 74–128) were counted annually from a combination of ground and aerial surveys from 1986 through 1997. Counts during December ground surveys from 1998 through 2004 increased steadily from a low of 96 to a high of 174 in 2004. MFWP personnel counted bighorns in hunting district 622, west of Timber Creek, while conducting helicopter elk surveys in 2006 and 2007 and observed close to 200 sheep each year. The refuge staff conducted an aerial bighorn sheep survey in July 2009 (see figure 32). This was the first time such a comprehensive summer survey of all potentially occupied sheep habitat was attempted. Results were reported as follows:

"An aerial bighorn sheep survey was completed on July 16–17, 2009 in HD 622. Of special note was seeing 24 sheep, including at least 6 lambs, east of Timber Creek. This is the first time we've tried a summer aerial survey and although we counted 190 sheep, I'm sure we missed seeing rams."

For many years the refuge proposed moving bighorn sheep into suitable habitat east of Timber Creek. During the last several years, there have been anecdotal reports of sheep in this area. It appears they have begun colonizing this area on their own. MFWP released its Draft Bighorn Sheep Conservation Strategy in August 2009 (MFWP 2009a) for public comment. Their population objective for Hunting District 622 bighorn sheep is 175–200 observed sheep, but does not include the approximately 20 square miles of habitat now occupied by sheep east of Timber Creek. With the recent expansion of hunting district boundary 622, this could be revised in the future. Two either-sex bighorn sheep tags were issued in 1987 for Hunting District 622. From two to seven either-sex permits have been issued annually since then along with a few permits for ewes. Ninety-eight rams and 10 ewes have been harvested from 1987 through 2008



LOCATION	DATE	AREA (SQ.MI.)	SURVEY TIME	TOTAL	EWES	LAMBS	RAMS	<1/2	1/2 - 3/4	> 3/4	UNCLASS.
IRONSTAKE / LARB HILLS	7/16/2009	72.9	2:56	138	68	29	11	3	7	1	30
WOLFE / WAGON COULEE	7/17/2009	17.4	1:04	24	12	6	1	1			5
HERMAN POINT	7/17/2009	2.8	0:10	6			6	2	3	1	
MICKEY / BRANDON	7/17/2009	4.9	0:37	22	8	2	8	2	5	1	4
TOTAL		98.0	4:47	190	88	37	26	8	15	3	39

SUPER CUB PILOTED BY DOUG POWELL WITH RANDY MATCHETT AS THE OBSERVER

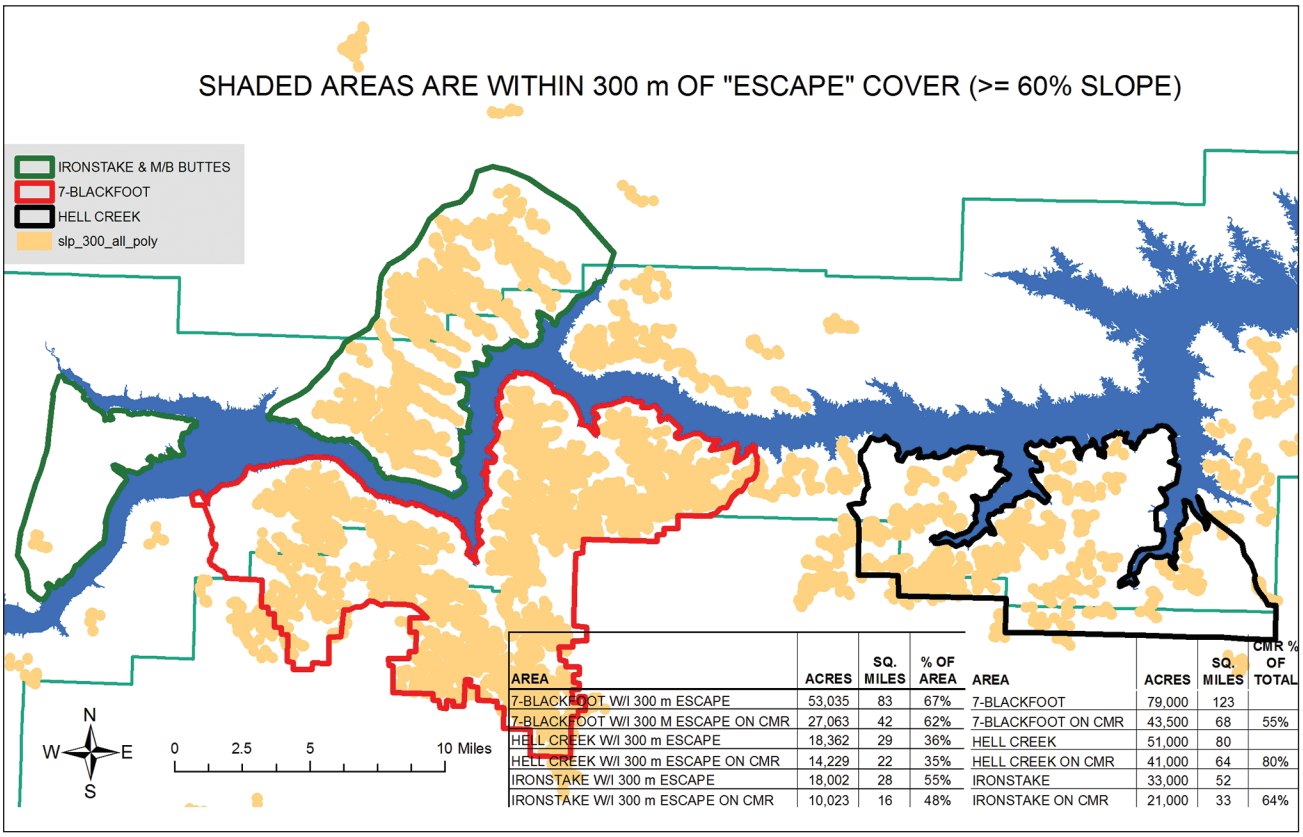
JULY, 2009

0 1.25 2.5 5 Mile

Figure 32. Map of the aerial bighorn sheep survey at the Charles M. Russell Refuge, Montana (2009).

and the long-term average ram age was 6.7 years old (range of 4.9–7.8). Almost two-thirds of the total harvest has come from the Mickey/Brandon Buttes area.

There is about 200 square miles of bighorn sheep habitat in northern Garfield County, of which more than 90 percent is on public land (figure 33). Refuge staff are in the early phases of working with landowners, MFWP, and other partners to see if bighorn restoration into this area is possible. For comparison, there is about 110 square miles of habitat where about 200 bighorn sheep currently live in the Mickey/Brandon Buttes and Ironstake Ridge areas.



AREA	ACRES	SQ. MILES	% OF AREA	AREA	ACRES	SQ. MILES	CMR % OF TOTAL
7-BLACKFOOT W/I 300 m ESCAPE	53,035	83	67%	7-BLACKFOOT	79,000	123	
7-BLACKFOOT W/I 300 M ESCAPE ON CMR	27,063	42	62%	7-BLACKFOOT ON CMR	43,500	68	55%
HELL CREEK W/I 300 m ESCAPE	18,362	29	36%	HELL CREEK	51,000	80	
HELL CREEK W/I 300 m ESCAPE ON CMR	14,229	22	35%	HELL CREEK ON CMR	41,000	64	80%
IRONSTAKE W/I 300 m ESCAPE	18,002	28	55%	IRONSTAKE	33,000	52	
IRONSTAKE W/I 300 m ESCAPE ON CMR	10,023	16	48%	IRONSTAKE ON CMR	21,000	33	64%

Figure 33. Map of areas within 328 yards (300 meters) of escape cover for bighorn sheep at and around the Charles M. Russell and UL Bend Refuges, Montana.

Mountain Lion

Hunting for mountain lion is not currently allowed on the refuge. Mountain lion sightings, encounters with hunters and poaching on the refuge have been numerous enough in recent years to suggest a well-established population. The abundance of elk and deer, especially on the western half of the refuge, will provide an adequate prey base to support mountain lions. No studies on mountain lion abundance or ecology have been conducted in the Missouri River Breaks, so little information is known.

More than a dozen mountain lions have been fitted with GPS collars in recent years in the nearby Bears Paw Mountains and Little Rocky Mountains. Data from marked animals there and other observations showed very high mortality rates, primarily from human harvest in these mountain ranges. This study was expanded to the refuge during winter 2010–11, and five of eight independent lions detected on the western part of the refuge, north of the Missouri River, were fitted with GPS collars by refuge staff. In addition, 3 litters with at least 6 kittens were also seen. Refuge staff is continuing to capture and track lions. The objectives of this study are to:

- characterize movements of mountain lion within the refuge and possible dispersal between the Missouri River Breaks, Bears Paw Mountains, and Little Rocky Mountains;
- describe habitat use and selection;
- estimate cause specific mortality rates;
- determine the proportion of mountain lion home ranges within the refuge (to what degree are mountains lions available for potential harvest outside the refuge);
- use data in support of the statewide population estimation project that will include estimates of area-specific densities within the Missouri River Breaks, Bears Paw Mountains, and Little Rocky Mountains.

Western Painted Turtle

OTHER WILDLIFE

This section discusses the smaller animals found on the refuge including amphibians, reptiles, fish, and small mammals.

Amphibians and Reptiles

Nineteen amphibian and reptile species are present on the refuge. Incidental observations from 1974 to present, as well as systematic surveys conducted in 1998–99 (Hendricks 1999), have documented nine species of herpetofauna listed as a Montana species of concern with either a ranking of S2 (milksnake, western hognose snake, and Great Plains toad) or a S3 (greater short-horned lizard, plains spadefoot toad, common sagebrush lizard, painted turtle, spiny softshell, and snapping turtle). The northern leopard frog was proposed for Federal listing, but on October 4, 2011, the Service concluded that listing under the Endangered Species Act was not warranted. The tiger salamander, boreal chorus frog, Woodhouse's toad, gopher snake, eastern yellow-bellied racer, common, terrestrial and plains garter snakes and western rattlesnake also occur on the refuge.

Amphibians and reptiles require a mosaic of habitats suitable for breeding or nesting, foraging, protection, and overwintering. Habitat linkages are required to meet all the life stages, allowing animals to migrate seasonally between different areas to feed, overwinter, and reproduce. The permeable nature of amphibian skin makes these animals extremely vulnerable to contaminants in the environment (Pilliod and Wind 2008).

Tiger salamanders often live in rodent burrows during much of the year and migrate to shallow ponds to breed in the spring. Some may keep larval characteristics including external gills and larval body form and reach sexual maturity in a process called paedomorphosis or neoteny. These are strictly aquatic and may exist with individuals that metamorphose. Most amphibians use upland forests, shrublands, and grasslands for foraging, overwintering, or dispersal. Many reptiles are adapted to be less dependent on waterbodies (Werner et al. 2004). Boreal chorus frogs breed in glacial potholes and reservoirs and feed in moist areas around ponds, or move into terrestrial settings to feed on ants and spiders. Adults forage 0.5 mile or more from breeding sites. They overwinter in underground rodent burrows or crevices.

Great Plains toads are found up drainages and on the prairie where they are seen around glacial potholes, stock reservoirs, irrigation ditches, and smaller coulees. They require clean water so heavily used stock ponds may not be conducive to breeding. They spend time underground sometimes in prairie dog burrows. They will forage 1 mile from breeding sites. Woodhouse's toads are common along rivers, large lakes and reservoirs. They overwinter below the frost line in rodent burrows, crevices or among tree roots. Breeding occurs in river backwaters, stock reservoirs, larger ponds, or lakes.

Plains spadefoot toads are found in more arid environments close to water. They spend much of their time underground, but will, depending on temperature and moisture, throughout the day, emerge from and retreat to burrows dug with the spur on the back of their feet. They burrow below the frost line during winter and occasionally use rodent burrows.

Greater short-horned lizard occupy sagebrush and shortgrass prairie, especially south-facing slopes, rocky rims of coulees, and shale outcrops. Common sagebrush lizard is associated with sagebrush habitat, but also live in ponderosa pine and juniper along the Missouri River and in shortgrass prairies. The lizards seek refuge under rocks, in crevices at the base of trees, or in rodent burrows.

Painted turtles live in ponds and wetlands, and spiny softshell turtles and snapping turtles live in the Missouri and Musselshell Rivers. They lay their eggs on land, often spending winter months buried and inactive in soft mud. Spiny softshells dehydrate much faster than hardshell turtles, and they are rarely found far from water. Nesting occurs in sand or gravel, usually 100 yards or less from water. Snapping turtles are omnivores that live in large rivers,

lakes, ponds, and marshes. They dehydrate more rapidly than most freshwater turtles, so are vulnerable to high temperatures and low humidity. They overwinter under cutbanks, submerged logjams, or in the bottom mud of larger rivers or marshes (Werner et al. 2004).

Western hognose snake and prairie rattlesnake use burrows, dens, and tunnels dug by prairie dogs and pocket gophers for cover and as places to search for food. Rock outcrops in grassland areas provide important cover and basking sites. Western hognosed snakes like well-drained, sandy soils, so are often seen along exposed riverbanks, sandstone outcroppings, and old riverbeds. Eastern yellow-bellied racers use open habitats such as prairie, sagebrush, and badlands. They overwinter in mammal burrows, rock crevices, and sandbanks, alongside garter snakes, rattlesnakes, or gopher snakes. Milksnakes inhabit grasslands and spend most of the day in burrows around sandstone outcroppings, riparian zones, cedar–juniper hillsides, and margins of agricultural lands (Werner et al. 2004).

Fish

Numerous fish species are found in both the large and small streams on the refuge. Bramblett et al. (1999) performed a literature review for fish on the refuge. He found MFWP unpublished reports (Needham 1978, Needham and Gilge 1980) summarized fish sampling on the refuge. In 1977, MFWP sampled larval fish and benthic macroinvertebrates in Timber, Nelson, Big Dry, Sand, and McGuire Creeks. Larval cyprinids and catostomids and benthic macroinvertebrates (*Diptera* spp., *Coleoptera* spp., *Neuroptera* spp., *Ephemeroptera* spp., *Trichoptera* spp., *Odonata* spp., *Hemiptera* spp., *Annelida* spp., and *Amphipoda* spp.).

In Big Dry, Little Dry, Timber, Nelson, and McGuire Creeks, in 1979 and 1981 MFWP sampled 17 taxa in Big Dry Creek including goldeye, common carp, fathead minnow, flathead chub, *Hybognathus* spp., lake chub, longnose dace, sand shiner, river carpsucker, shorthead redhorse, white sucker, black bullhead, channel catfish, walleye, yellow perch, and freshwater drum (Needham and Gilge 1980). The Montana Rivers Information System lists 17 species in Big Dry Creek. These include some of the list above with the following additions bigmouth buffalo, plains minnow, smallmouth buffalo, and western silvery minnow but not other *Hybognathus* spp., freshwater drum, or shorthead redhorse.

The 15 taxa in Little Dry Creek included common carp, fathead minnow, flathead chub, *Hybognathus* spp., lake chub, longnose dace, pearl dace, sand shiner, river carpsucker, shorthead redhorse, white sucker, black bullhead, channel catfish, walleye, and yellow perch. Nine taxa in Timber Creek included common carp, fathead minnow, *Hybognathus* spp., lake chub, longnose dace, pearl dace, sand shiner, buffalo, and white sucker. The 12 taxa in Nelson Creek include common carp, fathead minnow, flathead chub, *Hybognathus* spp., lake chub, longnose dace, sand shiner, buffalo, white sucker, plains killifish, brook stickleback, and yellow perch. Two museum specimens from Nelson Creek were a lake chub and a fathead minnow. Five species in McGuire Creek were common carp, fathead minnow, lake chub, sand shiner, and white sucker.

The Montana Rivers Information System database lists the following: (1) fathead minnow as the only species in Flat Creek; (2) four species in Squaw Creek—fathead minnow, lake chub, longnose dace, and western silvery and plains minnow; (3) four species in Timber Creek (north side)—fathead minnow, longnose dace, northern redbelly dace, and white sucker; (4) six species in Timber Creek (Big Dry Arm)—fathead minnow, lake chub, northern pike, northern redbelly dace, western silvery and plains minnow, white sucker; and (5) four species in Woody Creek—fathead minnow, lake chub, longnose dace, and western silvery and plains minnow.

Wagner (1996) sampled Rock Creek and found three species in the upper section (white sucker, longnose dace, and northern redbelly dace), six species in the middle section (white sucker, longnose sucker, carp, longnose dace, fathead minnow, and flathead chub), and no fish in the lower section because it was completely dry.

MFWP, which is responsible for monitoring and managing fish species in the Missouri and Musselshell Rivers, sampled fish in the Lower Musselshell River in August 2000. Sauger is probably not still common in the Lower Musselshell. McMahon and Gardner 2001 comments on Musselshell River habitat, "No data are currently available on the status of sauger … Chronic dewatering limits its suitability as sauger habitat." They estimate that sauger populations may have declined by 50 percent in the Lower Musselshell. The Montana Rivers Information System lists the following 24 species in the Musselshell River: black bullhead, blue sucker, channel catfish, common carp, emerald shiner, flathead chub, firewater drum, goldeye, lake chub, longnose dace, northern pike, northern redbelly dace, plains minnow, river carpsucker, sand shiner, sauger, shorthead redhorse, smallmouth bass, smallmouth buffalo, stonecat, walleye, western silvery minnow, white sucker, and yellow perch.

MFWP (Gardner 2003) evaluated the fisheries conditions in the middle Missouri River, which includes parts of the refuge. Methods used included electrofishing, trammel net drifting (deeper areas), seining (shallow areas), trawling, and creel surveys. Shorthead redhorse, goldeye, longnose sucker, emer-

ald shiner, and sauger were most abundant species found during electrofishing. Flathead chub, *Hybognathus* spp., shorthead redhorse, and emerald shiner were most abundant in the seine sampling. Channel catfish, sicklefin chub, and sturgeon chub made up 75 percent of the fish sampled by trawling and goldeye and channel catfish were the most common fish caught according to creel census surveys. Sauger catch rates were 13.8 fish per hour in the Fred Robinson Bridge section (Robinson section) giving a density 126 sauger per mile.

In 2005–06, electrofishing samples found shorthead redhorse, goldeye, emerald shiner, *Hybognathus* spp., and flathead chub to be the most abundant species. Emerald shiner and *Hybognathus* spp. were the most abundant species captured by seining. The exceptionally abundant representation of emerald shiner was one of the most noticeable changes compared to past years with catch rates nearly three times greater than the trend. The most abundant species captured by trawling were the shorthead redhorse, longnose dace, channel catfish, sturgeon chub, and sicklefin chub. Catch rates for sauger in the Robinson section were 12.3 fish per hour.

In addition to the above-listed common species, the following species were also found in the Missouri River (Gardner 2003): bigmouth buffalo, burbot, carp, rainbow trout, flathead chub, freshwater drum, longnose dace, river carpsucker, shovelnose sturgeon, smallmouth buffalo, smallmouth bass, stonecat, walleye, and white sucker. All six State species of special concern were sampled: pallid sturgeon, blue sucker, paddlefish, sauger, sicklefin chub, and sturgeon chub.

Small Mammals

Minimal information has been collected on the distribution and occurrence of small mammal species on the refuge. Although there have been cooperative efforts with the Montana Natural Heritage Program, Montana Tech University, the University of Montana, and the University of Denver that have targeted specific questions about small mammals, few have identified the current composition of small mammal communities that exist on the refuge. Half of the studies identified the presence of specific diseases (plague and Hantavirus) in terrestrial small mammals (Douglass and Hughes 2003, Holmes et al. 2006) while others have attempted to identify the composition of small mammal communities in and surrounding the refuge (Hendricks et al. 2007, Stewart 2007).

The Montana Natural Heritage Program has an ongoing study aimed at filling in the distribution gaps for small mammals in Montana and included several sites within or surrounding (within 10 miles) the refuge boundary. Terrestrial small mammal species were captured using a combination of Sherman live traps, snap-traps, and pitfall arrays. Although research in 2006 extended ranges of several terrestrial small mammals, no new species were captured outside known occupied counties (Hendricks et al. 2007). Time and personnel limited the trapping effort and many terrestrial species of low abundance or relatively rare were not captured. Further research is needed to quantify the occurrence and abundance of these rarer species.

Research targeting bat species identified range expansions and filled distribution gaps for several species found in central Montana. Bat species were documented using recorded vocalizations during survey periods in 2003–04 by University of Denver and again in 2006 by the Montana Natural Heritage Program. Results from these studies showed new locations within counties for several species (Hendricks et al. 2007, Stewart 2007), signifying the lack of information available for many species' distributions.

Moose

Moose have occasionally been observed on the refuge, often young dispersing bulls from central Montana mountain ranges or southern Canada. Although there are substantial willow communities in the Missouri River floodplain, the area is generally not considered suitable moose habitat. Nonetheless, in recent years moose appear to be expanding their range in parts of eastern Montana and in many places in the North Dakota prairies, and could potentially extend their range onto the refuge, but currently they are not a common species on the refuge.

Black Bear

A few black bear sightings have been reported on the refuge over the years, but none have become established residents and the Missouri River Breaks are not considered suitable black bear habitat.

3.3 SPECIAL MANAGEMENT AREAS

The Charles M. Russell and UL Bend Refuges have other special land designations being reviewed as part of the CCP and EIS. The Service has several types of jurisdiction across the refuge.

- *Service Primary:* Lands that were withdrawn or acquired for the sole purpose of managing as part of the refuge.
- *Service Secondary:* Lands that are withdrawn or acquired that have a secondary purpose subject to the primary purpose.
- *Withdrawn Lands:* Lands that were withdrawn from public domain and reserved for a specific

purpose such as a national wildlife refuge or USACE project. Public domain lands include lands that were never homesteaded or Bankhead–Jones lands that came back to the public domain when the original homesteader defaulted.

- *Acquired Lands:* Lands that were purchased in fee title by USACE for the Fort Peck Project or purchased by the Service for the management of the refuge.

The Service works closely with USACE, BLM, and the National Park Service in managing lands within the refuge that have other Federal-jurisdiction land designations.

WILDERNESS

In 1976, Congress designated about 20,890 acres as the UL Bend Wilderness. This acreage was later modified to its current size of about 20,819 acres. Within UL Bend Wilderness, visitors can expect to experience undeveloped land that has kept its primeval character providing an opportunity for solitude and unconfined recreation. For further information on the specific boundaries of each tract reviewed for its wilderness character, refer to appendix F.

As guided by the Service's Wilderness Stewardship Policy, which provides an overview and foundation for implementing the Wilderness Act, and as part of the development of the draft CCP and EIS, a wilderness review has been conducted updating the existing lands within the refuge and their current wilderness potential. Proposed wilderness units are those areas that have previously been reviewed by the Service and approved by the Secretary of the Interior as a parcel of land that meets the wilderness character found within the Wilderness Act of 1964. The refuge currently maintains 15 areas of about 155,288 acres as proposed wilderness units. All 15 units are spread across the 1.1 million-acre refuge. Because Congress has not officially designated these 15 areas as wilderness, they are managed as proposed wilderness units in which Service policy (FWS 2008c) requires them to keep their wilderness character in the event they are designated as wilderness. In 2002, roads were closed in several proposed wilderness units in compliance with Service policy.

Several of the existing proposed wilderness units are grazed prescriptively or have no Federal grazing allotment. Some of the proposed wilderness units are currently annually grazed: units 8 and 14 and part of units 1, 5, 7, and 11 (see figure 11 in this chapter and figure 41 in chapter 4). Refer to "Upland Objectives" under section 4.2 in chapter 4 for more information on livestock grazing in the uplands.

Appendix F has more information on the specific boundaries of each tract reviewed for its wilderness character.

LEWIS and CLARK NATIONAL HISTORIC TRAIL

In 1978, Congress amended the National Trails System Act to include national historic trails and designated the Lewis and Clark Trail as one of four national historic trails. It commemorates the events that form the trail's central theme through historic interpretation, preservation, and public use. The trail is approximately 3,700 miles and follows the Missouri and Columbia Rivers including the section that flows through the entire refuge. The official headquarters for the trail system is located in Omaha, Nebraska and is administered by the National Park Service. The Lewis and Clark expedition camped at 19 sites on the refuge, which are shown in figure 10.

HELL CREEK and BUG CREEK NATIONAL NATURAL LANDMARKS

The primary goals of the National Natural Landmarks Program, which was established by the Secretary of the Interior in 1962, are to recognize landmark resources and support their conservation. On the refuge, there are two of these areas: the Hell Creek Fossil Area and the Bug Creek Fossil Area. Both areas were designated because of their paleontological resources. The program is administered by the National Park Service and involves an annual inspection. A plaque has been installed at each site designating the area. Future refuge management involving prescribed fire, grazing, and scientific research should consider this designation when making management decisions (see figure 10). There are several sites on adjacent BLM land including Ash Creek Divide, Hell Creek, Bug Creek, and Sand Arroyo.

RESEARCH NATURAL AREAS

"Research natural areas" are part of a national network of reserved areas under various ownerships where natural processes are allowed to predominate and that are preserved for the primary purpose of research and education. Currently, there are 210 research natural areas on national wildlife refuges. They exist to fulfill three objectives, delineated by the Service's Refuge Manual as follows: (1) to participate in the national effort to preserve adequate examples of all major ecosystem types or other outstanding physical or biological phenomena; (2) to provide research and educational opportunities for scientists and others in the observation, study, and monitoring of the environment; and (3) to contribute to the national effort to preserve a full range of genetic and behavioral diversity for native plants and animals including endangered or threatened species. Research natural areas are areas where nat-

ural processes are allowed to predominate without human intervention. The Service's Refuge Manual states that a research natural area "must be reasonably protected from any influence that could alter or disrupt the characteristic phenomena for which the area was established." Future management decisions must be evaluated to ensure the characteristics for which these areas are recognized and protected for their ecological values. There are eleven research natural areas listed for the refuge on the Service's Web site: Dillon Island, Fourth Ridge, Grand Island, Limber Pine, Manning Corral Prairie Dog Town, Missouri River Bottomlands, Prairie Dog Island, Spring Creek Bay Coulee, Two Calf Douglas-fir Community, Two Calf Island, and York Island. Several of these areas are actually part of the same natural area, resulting in seven research natural areas that the refuge recognizes (see figure 10).

UPPER MISSOURI BREAKS WILD and SCENIC RIVER

In 1968, Congress passed the Wild and Scenic River Act, and in 1976 the Upper Missouri Breaks Wild and Scenic River was established, which includes the western most 10 miles of the Missouri River on the refuge. This designation recognizes the wildness and scenic values that exist along that part of the river. Management decisions should ensure that those values are protected for the American public. Such activities as livestock grazing on the river and vehicle traffic on refuge roads 209, 307, 308, 874, 845, and 853 should be evaluated to ensure these activities do not detract from the wild and scenic values.

MISSOURI BREAKS BACK COUNTRY BYWAY

The National Scenic Byways Program is part of the U.S. Department of Transportation, Federal Highway Administration. The program is a grassroots collaborative effort established to help recognize, preserve, and enhance selected roads throughout the United States. In addition to the national designation, many agencies promote their own sets of scenic roads and byways. BLM has identified several "backcountry byways" including the Missouri Breaks Back Country Byway, designated on July 21, 1989, which passes through BLM lands and through several refuge roads along the western boundary including the Knox Ridge Road to U.S. Highway 191. This byway is not officially recognized under any Service designation.

LANDS where USACE has PRIMARY JURISDICTION

These are lands within the refuge that have been withdrawn or acquired and are subject to the purposes and operation of the Fort Peck Project. Most lands where USACE has primary jurisdiction have either been outgranted to the Service, or by agreement, allow the Service to manage those lands as part of the refuge for the purposes of wildlife and wildlife habitat. Some USACE primary lands within the refuge have been kept by USACE. These include the developed recreation sites and administrative sites such as the dam and power plant.

USACE has 16 designated recreation sites on the refuge. The sites are managed by a multitude of agencies and governments including counties, BLM, MFWP, and the Service. The level of recreation development is defined in the Fort Peck master plan (USACE 2008). Agencies responsible for management of individual recreation sites changes depending on funding levels. The Service participated in the development of the master plan.

UPPER MISSOURI RIVER BREAKS NATIONAL MONUMENT

On January 17, 2001, President Clinton created by proclamation The Upper Missouri River Breaks National Monument. The monument abuts the refuge to the west, and the stretch of the wild and scenic river on the refuge is managed as if were part of the monument. Specifically, this pertains to river travel only. At the terminus of the wild and scenic river is Kipp Recreation Area near the Fred Robinson Bridge (figure 10), which is a designated USACE recreation site. USACE permits BLM to run the Kipp site. The recreation site is located where USACE has primary jurisdiction and the Service has secondary jurisdiction. At times, this has created management challenges, particularly when development of the recreation facilities involves habitat loss or degradation on the refuge. In the past, the Service and BLM have coordinated development activities to minimize habitat loss or manipulation. Ideally, this should be continued and formalized with the three agencies involved to ensure conflicts over future use of the area does not affect each agency's purposes.

3.4 VISITOR SERVICES

The nearly 250,000 visitors to the refuge enjoy a variety of recreational activities related to the six wildlife-dependent recreational uses that are identified in Improvement Act as the priority uses (hunting, fishing, wildlife observation, photography, interpretation, and environmental education). Due to the refuge's immense size and remote location, there are several other activities such as camping and boating that are allowed on the refuge, and these enable the Service to facilitate providing for the priority public uses on the refuge. Service policy guides the

management of wildlife-dependent recreational uses (FWS 2006c).

The refuge's estimates of current visitation figures come from a variety of sources including traffic counters; physical counts of visitors who come through the headquarters, field stations, and the Fort Peck Visitor Center; paddlefishing data; and hunter permits. While the Service uses traffic counters across an estimated 40 roads across the refuge, there are neither enough counters nor personnel to count every visitor on the numerous roads found across the refuge and estimates are used.

This section discusses the priority public uses, access, and other activities that the Service is involved with in managing the refuge. Recreational areas that USACE manages are mentioned briefly, but because the Service does not manage these areas, these are not analyzed further.

HUNTING

Hunting has been an important traditional public use of the refuge throughout its history. For many visitors, the refuge is synonymous with big game hunting. Long known for its ability to offer outstanding opportunities to hunt for Rocky Mountain elk, mule deer and white-tailed deer, as well as Rocky Mountain bighorn sheep, the refuge offers multiple opportunities for outdoor recreation. Hunters currently are able to take part in a variety of hunting opportunities from areas with significant road access to areas with relatively no roads as provided for through wilderness and proposed wilderness units. Each year, about 103,900 hunters come to the refuge. Of these, there are about 90,000 big game visits, 2,900 waterfowl and migratory bird visits, and 10,000 upland game visits reported annually (refer to section 3.7 below).

The Theodore Roosevelt Conservation Partnership conducted a poll of hunters and sporting groups (figure 34). The results showed that the Missouri River Breaks, including the refuge, ranks among the most highly valued recreation areas in Montana (Dickson 2008).

Hunting for upland birds and waterfowl is currently permitted and some visitors take part in this activity, although not at the level of big game hunting. In recent years, the refuge has instituted several special hunting opportunities including hunts open only to young people with a refuge-sponsored orientation day at the refuge and an accessible hunting blind to provide wheelchair-bound hunters a quality opportunity to hunt elk and deer.

The refuge takes in parts of eight hunting districts within three administrative regions managed

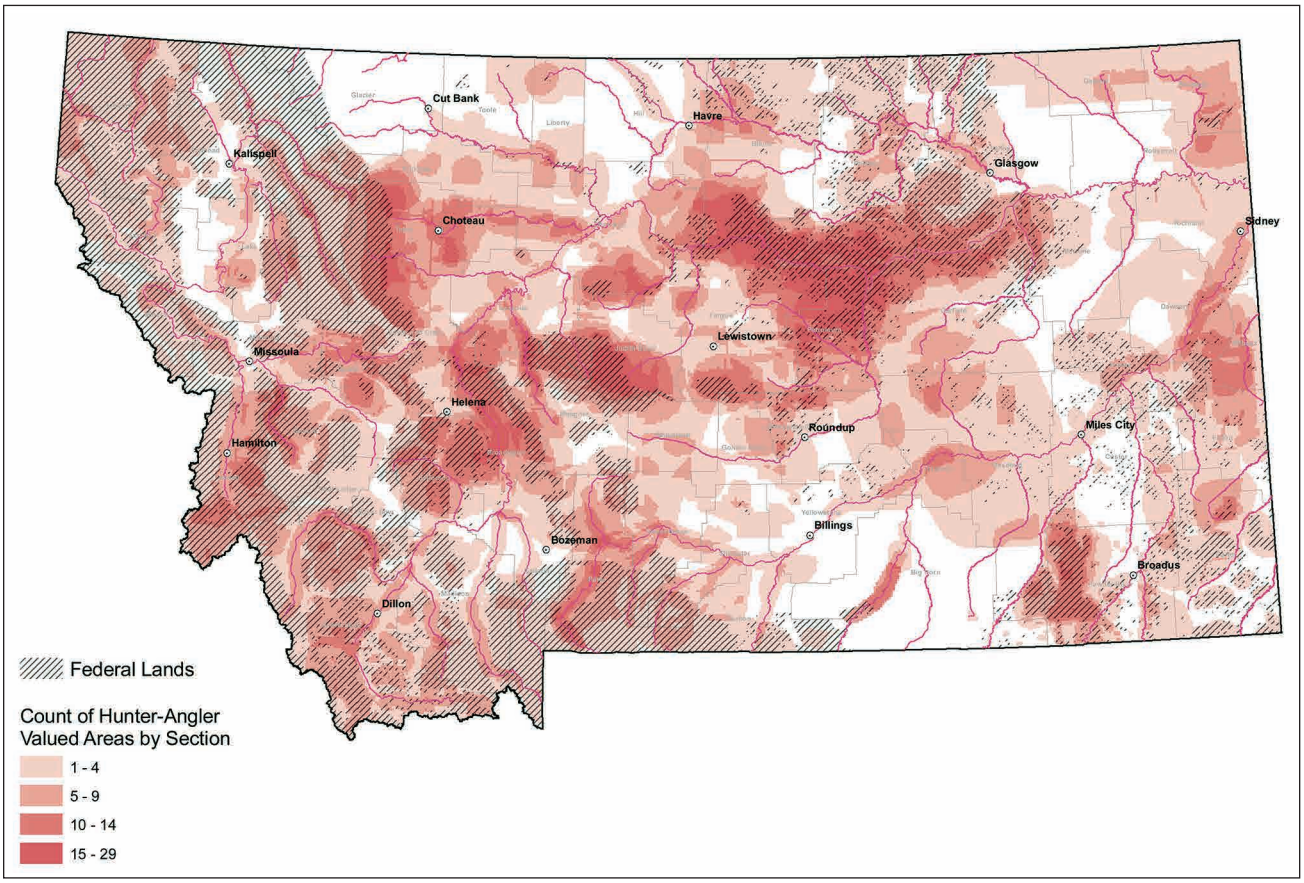


Figure 34. Map of areas in Montana that are valued by hunters and anglers. *Source: Dickson 2008.*

by MFWP. Season-setting and permit allocations are primarily done through a process administered through MFWP. The refuge is an active partner in this process and refuge wildlife objectives are considered in the refuge's management recommendations in these efforts. At times, the refuge has promulgated more restrictive regulations to address wildlife objectives within the refuge. For example, there is a current, 3-week, mule deer, rifle season in place for parts of the refuge where mature buck ratios are below the set objective, which differs from the State-regulated, 5-week, mule deer, rifle season.

Commercial outfitting for hunting is also allowed on the refuge. Currently, there are about 11 permits issued annually (refer to commercial recreation below).

FISHING

About 60,000 fishing visits are attributed to the refuge throughout the year as anglers participate in several fishing opportunities including bank fishing, fishing from boats, and also ice fishing on the surface of Fort Peck Reservoir and the Missouri River. This does not include the number of fishing visits attributed to USACE recreation areas or the lake, which is about 160,000 fishing visits (USACE 2009c).

The State of Montana (MFWP) has primary responsibility for all fisheries management within the refuge, which is consistent with the Service's policy on fishing (FWS 2006e). This includes regulating harvest, egg collecting efforts, and stocking activities (MFWP 2008a).

One of the more popular fishing opportunities is the spring paddlefish run, which brings some of the greatest angler concentrations to the banks of the Missouri River seen throughout the year. Anglers also pursue walleye, sauger, northern pike, channel catfish, and shovel nose sturgeon. Additionally, lake trout and salmon are found in Fort Peck Reservoir and provide for great open-water-fishing opportunities.

Anglers are able to access the river and reservoir on the refuge through the numbered road system, which provides for several roads leading to the water's edge, some with primitive or improved boat ramps. Recreation sites administered by USACE are located throughout the Fort Peck Reservoir and provide anglers with camping and boat launching facilities.

Sport fishing on Fort Peck Reservoir and upstream sections of the Missouri River has always been a popular activity with locals and nonresident anglers alike. The main game species present include walleye, northern pike, chinook salmon, lake trout, smallmouth bass, and paddlefish. With the exception of paddlefish, lake trout, and smallmouth bass, all of these are stocked to varying degrees in the reservoir, because natural reproduction is not sufficient to meet the needs of anglers. The State of Montana runs a warm-water fish hatchery in Fort Peck and this hatchery supplies most of the fish that are stocked in any given year. Supplemental fish releases also occur from fish reared at the hatchery in Miles City, Montana.

Walleye tournaments are popular on the reservoir, with a varying number of them occurring each year. The most popular and well-known of these is the Governor's Cup Tournament, which is held in July and can have as many as 200 teams participating. In addition, the Jordan chapter of Walleyes Unlimited annually sponsors a Kid's Fishing Day at Hell Creek Recreation Area, and the refuge always collaborates on this event. These tournaments are regulated by USACE, with enforcement activities being provided primarily by MFWP. In recent years, the number of participants in these local tournaments has declined.

Another popular time of year for fishing use on the refuge is in May and June when large numbers of paddlefish move upriver from the reservoir to spawn upstream of the refuge in the upper Missouri River Breaks National Monument. Fishing pressure is most prevalent from Rock Creek Boat Ramp to the Fred Robinson Bridge and can attract large crowds when fish numbers and weather conditions are favorable. The State of Montana regulates the harvest and typically sets a quota number that only allows for catch and release fishing after that number of permitted fish has been reached.

Paddlefish are among the largest freshwater fish. Remarkably adapted to its environment, the paddlefish is a classic example of millions of years of ecological fine-tuning and could be the oldest big game animal surviving in North America (MFWP 2009c). In Montana, the Slippery Ann area is one of a few important paddlefishing areas along the Missouri River. Historically, paddlefishing was open to all, and hundreds of anglers would pack into accessible areas from Kipp Recreation Area to the Rock Creek boat ramp along the Missouri River to try their luck in the spring. Law enforcement officers remained busy keeping order and preventing resource damage from camping and bank fishing. In recent times, MFWP has placed limits on days open for paddlefishing, the number of permits issued and number of paddlefish harvested.

Throughout the refuge depending on the lake elevation, there are about 16 boat ramps available to the public for launching boats, although most of these are managed and maintained by USACE. In general, overall fishing use of the reservoir and river is highly variable and depends on reservoir levels and boat access along with how good fishing success is in any given year.

WILDLIFE OBSERVATION and PHOTOGRAPHY

The refuge provides outstanding wildlife-viewing opportunities due to the abundance of elk, mule deer, bighorn sheep, eagles, burrowing owls, sage and sharp-tailed grouse and other grassland birds. Consistent with the opportunities to view wildlife, many visitors also take the opportunity to photograph these critters and their associated habitats. These photographers take advantage of early mornings and late evenings to make breathtaking photographs. The refuge receives approximately 20,300 photography visits a year. The auto tour route and elk-viewing area receives approximately 4,000 visitors during the elk rut. Other visitors take advantage of photographing prairie dogs and burrowing owls, sage-grouse and sharp-tailed grouse on leks, and bald eagles around Fort Peck Dam in the winter. Numerous professional photographers have photographed the scenery and diversity of wildlife for numerous book projects and magazine articles. Videographers with National Geographic and other television programs come to the refuge to capture provocative images of the Missouri River Breaks. Over the years, numerous volunteers and neighbors have obtained some extraordinary photographs of refuge wildlife and scenery. These people have graciously shared their photographs with the refuge and they have become invaluable in the development of brochures and publications.

Commercial photography occurs sporadically with a few requests annually from still photographers and videographers. Most of these requests are from professionals that are writing books on the area or preparing an informational video associated with other work in the area such as American Prairie Reserve and the World Wildlife Foundation. Temporary blinds are allowed but they must be removed at the end of the filming periods. All permit holders are required to provide the Service copies of their work for use by the Service for public use programs, brochures, and other needs. A nominal fee is charged. Additionally, the Service collaborates with other local photographers to obtain refuge media for brochures or other needs.

INTERPRETATION

Interpretation is closely tied to the other priority public uses. The guiding principles are to promote visitor understanding and appreciation for America's natural and cultural and conservation history. The communication process should forge emotional and intellectual connections between the audience and the resource (FWS 2006g). Interpretation provides opportunities for visitors to make their own connections to the resource. Examples of interpretive resources found on the refuge include interpretive programs, exhibits, signage, facilities, and special events.

Each of the refuge's four field stations—Lewistown (headquarters), Sand Creek, Jordan, and Fort Peck—provide a visitor contact area; however, the attractiveness and accessibility vary between the stations. In 2007, region 6 conducted a visitor service review, and the reviewers recommended sprucing up these areas with wildlife mounts and displays. There are also kiosks with interpretive panels at each office and at several other places on the refuge. Several kiosks need to be moved to more suitable locations and almost all of the panels need to be updated. Most of the refuge brochures and other printed materials comply with Service's graphic standards.

The Fort Peck Dam and Interpretive Center is a cooperative effort between USACE, the Service, and Fort Peck Paleontology Incorporated. One-third of the facility is dedicated to interpreting the fish, wildlife, and habitat of the refuge. There is a memorandum of understanding in place that requires a Service staff presence at the center but this position has been vacant since 2007. Two seasonal employees are hired during the summer to help USACE with running the facility.

There is a 20-mile auto tour route near the Sand Creek Field Station with a graveled road and updated interpretive panels. Based on traffic counters set up at different access points, an estimated 10,000 vehicles use the tour route each year. Several hiking trails are located at Sand Creek Field Station, which provide access to wilderness and there are paved accessible walking trails near the Fort Peck Interpretive Center on the east side of the refuge.

The Slippery Ann Elk Viewing Area on the west side of the refuge is very popular with the public, particularly during the fall. From September to early October, visitors can watch as many as 300 elk in the bottomlands near the Missouri River. During peak times, on weekend evenings as many as 175 vehicles have been counted entering the viewing area. In 2009 on one peak day (September 26), 161 vehicles entered the viewing area with 585 visitors counted. From September 5–October 18, there were an average of 35 vehicles a day and about 107 visitors a day. Out of 56 counties in Montana, visitors from 40 counties (75 percent) visited the viewing area. Additionally, there were visitors from 32 States (65 percent), two Canadian provinces and several international visitors. Some of the main issues have been how to handle the increasing interest in the viewing area. Public safety and effects on refuge resources are of concern. Dust from vehicles, inadequate and appropriate parking along the route, and visitors not adhering to refuge regulations all need to be addressed.

The refuge offers bus tours several times during the fall and has produced a brochure with information on the viewing area and elk biology.

A 30-minute video about the refuge and refuge management is being produced by the Service's National Conservation Training Center. In the future, the video will be shown at the Fort Peck Interpretive Center, on bus tours to the elk-viewing area and will be on a continuous loop at the Lewistown headquarters.

ENVIRONMENTAL EDUCATION

Environmental education is a process designed to teach visitors and citizens the history and importance of conservation and biological and scientific knowledge of the Nation's natural resources. Within the Refuge System, it incorporates onsite, offsite, and distance learning, activities, programs, and products that address the audience's course of study (FWS 2006d).

Often environmental education is associated with teaching children (kindergarten through high school) through the local schools using the State standards for the curriculum that is taught. Most of the schools in the six counties surrounding the refuge are located far from the refuge, which makes field trips difficult due to time constraints and school transportation budgets. There has been no formal environmental education program since 2007 when the outdoor recreation planner stationed at Fort Peck Field Station left the Service but refuge staff give classroom presentations when requested. There is no refuge-specific curriculum. Staffs at Fort Peck and Jordan Field Stations take part in annual environmental camps in cooperation with other agencies. Seasonal employees at the Fort Peck Interpretive Center give presentations throughout the summer and there are educational trunks available for loan through the Fort Peck Interpretive Center.

USFWS

The refuge offers limited programs in environmental education.

OUTREACH

Currently, key outreach tools for the refuge are public presentations, news releases, weed tours, county commissioner meetings, the Ranchers Stewardship Alliance, and Missouri River Conservation Districts. The refuge Web site is currently being expanded and updated to increase its usefulness and appeal. As of August 2009, the Web site attracted an average of almost 3,000 visitors a month.

ACCESS

The refuge staff and the public access the refuge by a variety of modes or means including vehicle, boat, aircraft, foot (including snowshoes or cross country skis), bicycle, or horseback. ATVs are allowed on the refuge only on numbered routes that are open to all other vehicles. All ATVs using the refuge are required to be street-legal and display a metal license plate. Snowmobiles are not allowed any part of the refuge other than the ice of Fort Peck Lake. Snowmobiles may be offloaded at any point that a numbered route reaches that lake ice, but are restricted from any other travel within the refuge.

Access is an important consideration particularly for outdoor recreationists, the primary user of the refuge. Other needs for access include staff access in the performance of duty, permittee access, and access for fire suppression.

Current information about access is in the Service's guide map and information brochure (last updated in 2009). In 2002, several roads in proposed wilderness areas were closed in accordance with Service policy for managing wilderness.

Roads

Currently, there are approximately 670 miles of refuge roads. These include several paved highways that traverse the refuge, gravelled roads, and dirt or two-track roads. All refuge routes have a three-digit number from 101 to 899. Typically, the lower the number, the more frequently traveled and maintained the road will be.

U.S. Highway 191 traverses the refuge on the west end near the Sand Creek Wildlife Station. It is an asphalt two-lane road, crosses the refuge for about 9 miles, and crosses the Missouri at the Fred

Robinson Bridge. State Highway 24 passes through or immediately adjacent to about 11 miles of the refuge near the Big Dry Arm and the Fort Peck Field Station. Both highways are maintained by Montana Department of Transportation.

There is at least one graveled, all-weather access road leading to the refuge from each of the six adjacent counties with 60 miles of all-weather access within the refuge boundary. Most of the refuge's roads are small two-track dirt trails that require a high-clearance four-wheel-drive vehicle. All open routes on the refuge are uniquely numbered. The nature of the soil types found within the refuge make road conditions impassible in wet conditions unless significant improvements have been made such as gravelling or pavement. An all-weather road does not equate to all-season access.

The refuge grades approximately 137 miles on an annual basis. Most of the work is done on the west half of the refuge. Some years, depending on weather conditions, certain parts of roads will be maintained up to three times during the frost-free season. In addition, about 2 miles of road are worked on each year with other refuge equipment to repair washouts and culverts. In Garfield County, about 56 miles of road are maintained by the county under a special use permit. In McCone County, about 25 miles of road are maintained under a special use permit. Valley County also maintains about 8 miles of refuge road leading to the Pines and Bone Trail Recreation Areas.

Money for road improvements primarily comes from the Service's refuge roads program, which was created under the 1998 Transportation Equity Act for the 21st Century (TEA–21) and subsequently revised by passage of the Safe, Accountable, Flexible, Efficient Transportation Equity Act. It is administered under the Federal Land Highways program. Any money that is obtained can only be used for refuge roads, and money must be used for maintenance and improvement.

On the refuge, roads have been created by county commission resolution or by petition. In addition, attempts have been made to establish roads by grant (easement), but at times this has met with local landowner opposition.

County Commission Resolution. The Crooked Creek Road (refuge road #103) was designated a public road by a Petroleum County Commission resolution in the 1990s. After the refuge graveled about 5 miles of the road with TEA–21 money, the county established it as a public road and, in effect, agreed to maintain the road. The road leads to the Crooked Creek Recreation Area where Petroleum County has a USACE permit to manage the site.

Petitioned Roads. There are an unknown number of petitioned roads on the refuge within the six counties. Some counties' road books and files will have complete sets of petitioned road records for individual roads. Some will have part of the legal requirements for a legally petitioned road. Usually the only time the necessary research is done to determine if a road is truly a petitioned road is when a private landowner or land management agency proposes to close a road. On the refuge, road 343/606 that leads to the Musselshell Bottom in Garfield County was closed at the refuge boundary by a new landowner. Because this was a major access point to a large part of the refuge, the Service and the county challenged the closure. Information presented at a public commission meeting showed that the refuge had periodically maintained the road, and historically the road led to an old post office. The county commissioner's decision was based on historical information provided by the Service and neighboring landowners. The road remains open today and is considered a public road. In the early 1990s, a fire destroyed the Garfield County courthouse that housed all the county road records. In Garfield County, it will be difficult to establish public roads without having the historical records. In several areas, access to the refuge has been blocked because roads cross private land that has been closed. Through land acquisition and buying rights-of-way, vehicle access to the refuge for the public will need to be improved. In addition, Garfield County may be willing to establish roads by easement if landowners and agencies can identify a public and private benefit.

Each of the six counties has a variety of complete or incomplete road records. Some records parallel and overlap nicely the current refuge road system. In some instances, county records show petitioned roads that may never have been built or have never been shown on refuge maps. As stated in chapter 1, determining the legal validity of petitioned roads is outside the scope of the CCP. This document will not affect the counties' or a private landowner's legal ability to contest the existence or nonexistence of a road on the refuge that may or may not be open to the public.

Where possible the counties and the Service may agree on which roads on the refuge are open to vehicle travel. In some situations, it will be beneficial to identify roads as being refuge roads to allow the expenditure of Service's refuge roads program money to improve all-weather access. In some situations, it may be best to recognize a road as a legal county road to facilitate maintenance. Over the past 18 years, approximately 45.5 miles of refuge roads have been graveled on the refuge with the use of refuge road dollars. If a road is designated a county road, such as the Crooked Creek Road, money from the refuge roads program cannot be used to improve or maintain the road in the future. This must be con-

sidered before declaring a "county road" versus leaving a road a "refuge public road."

Other Public Access Issues

Most of the open refuge roads are publicly accessible. Roads that lead to the refuge are designated for public use and allow legal access to the existing and open refuge roads. However, some refuge roads currently remain open, yet are not open to the public. This situation primarily occurs in the Garfield County area where several roads that access open refuge roads cross private land bordering the refuge. These roads that cross private lands are not open to the public and subject to the private landowner's permission. In Garfield County, this situation occurs on 21 individually numbered routes and has created an exclusive use situation.

Boats. Numerous types and sizes of boats are used to access the Fort Peck Lake and the Missouri River. Montana boating laws and regulations apply to refuge waters. The Service has little data on the total number of boaters using the Fort Peck Reservoir or Missouri River but informal observations by staff suggest that more boats could be accessing the refuge from the river or lake during hunting season than in the past.

Restrictions are in place from June 15 to September 15 for the wild and scenic river part of the refuge along the western boundary (refer to soundscapes in section 3.1 above). In reporting on visitor and boat use through the Upper Missouri Wild and Scenic River, about 22 percent of boaters use the stretch from Judith Landing to the James Kipp Recreation Area located on western edge of the refuge (BLM 2008c). The latest information for 2008 on boat use for the Upper Missouri River shows there were about 4,495 registered users (personal correspondence with Vicki Marquis, Missouri River Districts Council, November 2009), so it is estimated that nearly 990 boats take out at Kipp during the summer season. Since 1976, the highest number of registered users occurred in 2002 with 6,034 registered users with 1,272 using a commercial operator.

Water levels on the Missouri River fluctuate considerably and dictate what types of boats may be suitable for use. Boat access to the water varies from improved USACE concrete boat ramps located at developed recreation areas that allow larger craft to launch to areas where vehicle access leads to the water edge but only small watercraft (such as canoes) can be used. Access to those boat launch areas vary as well from paved highway and graveled and improved all-weather roads to unimproved two-track roads that are impassible when wet.

Access by Foot, Horse, or Bicycle. There are no restrictions for access by hiking or walking on the refuge other than the elk-viewing area and Sand Creek Administrative Area on the west end of the refuge. Additionally, there are no designated or improved hiking trails on the refuge (an established hiking trail is located at Hell Creek State Park within the refuge). Similarly, there are no restrictions to horseback riding on the refuge other than the previously mentioned areas closed to foot traffic. As with foot travel, there are no designated trails or paths for horse travel, and some parts of the refuge are unsuitable or unsafe for horse use. Certified weed-free hay is required when keeping horses on the refuge. Bicycles are allowed on numbered roads only including seasonally closed roads.

Universal Access. There are several hundred miles of open refuge roads that are available for hunters of all abilities to hunt from with the proper Montana State license. Additionally, an accessible blind is available to hunters needing wheelchair access along the Missouri River.

Use of Game Carts. Game carts were originally designed for retrieving big game in areas where road access was limited. They often consist of a small cart with two wheels that a hunter pushes or pulls. On much of the refuge, it is not feasible to use one because of the rugged, steep terrain, and hunters have to carry an animal out to where they can use a game cart. Game carts are not allowed in UL Bend Wilderness. However, the use of a game cart is approved for the proposed wilderness units. A minimum requirement analysis is being completed as part of the wilderness review (refer to appendix F).

RECREATION SITES

USACE recreation areas include Crooked Creek, Forchette Bay, Devils Creek, Hell Creek, McGuire Creek, Nelson Creek, Rock Creek, Fort Peck, and The Pines. Because the Service does not have primary jurisdiction over these areas, they are not analyzed further.

The Service managed several primitive camping areas that have vault toilets including Slippery Ann, Rock Creek, Turkey Joe, Withrow Bottoms, Jones Island, and Rocky Point (figure 10). A few other areas that were outgranted to the Service in the Enhancement Act of 2000 have no facilities (Bear Creek and Bobcat).

Except where designated as closed, camping (other than backpacking) must take place within 100 yards of the Missouri River and Fort Peck Reservoir or within 100 yards of numbered and open roads. Camping is limited to 2 weeks within any 30-day period. The use of dead and down wood is allowed for making a campfire. Camping is not permitted on the islands.

COMMERCIAL RECREATION

There are several commercial recreation activities that occur on the refuge including hunting and outfitting, fishing, and photography. Any commercial activity requires a special use permit. Currently, the Service has provided little to no oversight for the commercial harvest of fish or mussels in the past because most of it falls within the primary jurisdiction of USACE. This topic is discussed in detail under "Fishing Objectives" in section 4.6 in chapter 4. Commercial outfitting also occurs on the refuge but is limited to 11 special use permits annually.

REFUGE HEADQUARTERS and FIELD STATIONS

The headquarters for the refuge is located along Airport Road in Lewistown, Montana. It consists primarily of a headquarters building, a maintenance shop, and a few other buildings. Additionally, there are three field stations located at Sand Creek, Jordan, and Fort Peck and a small research facility at the UL Bend Refuge. Each field station consists of a few buildings that provide office space, a fire cache, some maintenance capability and storage, and residences or bunkhouses.

USFWS

A small wind turbine at refuge headquarters is used to offset energy costs.

3.5 HUMAN HISTORY and CULTURAL RESOURCES

From prehistoric times to the present day, the refuge has a rich human history that has shaped the landscape.

PREHISTORIC HISTORY

As a river corridor, the refuge was an important land feature for aboriginal people due to the variable resources provided by a major waterway in relatively dry country and unique hunting opportunities provided by the Missouri River Breaks. Most of the prehistoric people of the plains depended on animal products for subsistence. Areas along the Missouri River Breaks probably tended to concentrate large ungulates along the breaks, funneling animals into narrow passages to cross the river during winter migrations. These natural game funnels would have made likely ambush points for prehistoric hunters. An area of the refuge near UL Bend is known as an important migrational area for large ungulates and it is obvious that aboriginal cultures exploited this knowledge based on the presence of prehistoric sites documented in the area. Documentation of the use of the refuge by native people is known mostly through surface remains. Some archaeologists believe that the actively eroding nature of the soils along the refuge have erased the remains of many of the earlier sites, but recent archaeological work has shown that some earlier prehistoric sites could be deeply buried (Loflin 2008). Formal archaeological investigations have been sporadic and were associated primarily with Federal projects. Planning documents and some large-scale fieldwork has been produced by BLM on their lands surrounding the refuge (Davy 1992, Ruebelmann 1982). Known prehistoric site types suggests that the early inhabitants of the river were highly mobile and did not create permanent villages as is seen further east in the Missouri River floodplain. This is consistent with the use of the area by groups of people exploiting the area for hunting bison. To date, little archaeological excavation has taken place on the refuge, but archaeological testing was conducted on a few sites in 2008 and more testing is scheduled for 2009 (Boughton and Peteson 2007).

Paleo-Indian Period (9500 B.C.–6500 B.C.)

Although no Paleo-Indian sites are known on the refuge, in the 1960s, one Folsom point was reported at the UL Bend Refuge by a nonprofessional (Reubelmann 1982). More recently, Davy reports that a Folsom and a Hell Gap point have been recovered on the surface and in a buried context by professionals

(1992). Investigation into the buried artifact showed that there was no site associated with it.

Middle Prehistoric Period (6500 B.C.–200 A.D.)

Depending on location, it appears that these people were largely focused on exploiting bison, but the tool kit expanded from Paleo-Indian times suggesting dependence on a broader spectrum of plant and animal resources in more varied habitats. Climatologically, it was becoming dryer and Plains Archaic populations tended to inhabit areas with protected water sources. Sites typically occur in basin and foothill regions, river valleys and in open prairie. During the Altithermal, some of the Great Plains became dry enough to cause the formation of dune fields, which pushed the bison and native people to other areas. There is a wide variation of projectile point (spear or atlatl) types associated with the Middle Prehistoric, no doubt due to the varied species, environments and hunting techniques used to obtain game in this fluctuating climatic regime. The spear thrower was introduced allowing greater range than spear throwing and necessitating smaller projectile points. Communal hunting continued, but researchers have suggested that smaller hunting groups were used at various times of the year. There is also more evidence of processing of vegetal resources suggesting reliance on a broader spectrum of resources. There are very few excavations of Middle Prehistoric sites near the refuge, although surface finds prove that these people were present.

Late Prehistoric Period (A.D. 200–1750)

During this phase, prehistoric people moved out onto the prairies and new technologies were introduced including the bow, arrow, and pottery. Complexes included in this tradition include Besant, Avalonea, Benson's, Butte/Beehive, and Old Women's. The Besant complex represents the earliest adoption of pottery and bow and arrow use in this area of the northern Great Plains. In the Dakotas, it has been documented that sites of this phase have burial mounds along the Missouri River although none have been reported in Montana. In areas of the lower Missouri, village-dwelling, semi-agricultural, aboriginal people lived in earthen lodges, making forays at certain times of year to other areas to secure resources. Although none of these village sites is known from the refuge, a nonprofessional reported that an earthen lodge existed on the river before it was flooded to create Fort Peck Reservoir (Reubelmann 1982).

Although the horse was in use in the southern plains earlier, in the northern plains they were not in widespread use until A.D. 1725–50. Bison continued to be the primary resource exploited by Protohistoric groups, but the addition of the horse to hunting techniques drastically affected social organization, settlement patterns, and effectiveness of bison hunting. Protohistoric people were able to react more quickly to the movements of the bison herds, were able to hunt further away from base camps and began to leave women and children in camps while hunting.

Although many of the prehistoric sites on the refuge do not have datable artifacts, it has been suggested that most of the known prehistoric sites are attributed to this period. This may be because most of the sites are known from surface finds, and it is logical that the latest materials are on the surface. It is also likely that aboriginal populations were much higher during this period as more groups were pushed into the plains with the advancement of Anglos and the effect trade goods were having on tribal politics.

HISTORICAL PERIOD

During this period, trade goods and interaction between Anglos and tribal people began to directly affect aboriginal lifeways. This process started well before Anglos reached the area around the refuge. Trade goods and the desire for them changed Native American lifeways by shifting hunting activities for household consumption to a means to obtain trade goods. As more of the aboriginal people were being pushed into the area, conflict between tribes in search of bison became more frequent. Taking control of territories for hunting grounds and high mobility became increasingly important. Furthermore, during the 19th century, the area around the refuge was the stage for many conflicts between Anglos and tribal people due the increasing use of this section of the river to move goods to and from western Montana to support the fur trade, bison robes trade, and gold mining.

One well-documented, aboriginal historic site from this period is located south of UL Bend on the opposite side of the river (Park 1998). The site consisted of a bison kill located in a series of coulees. Artifacts observed in the surface included a projectile point (arrowhead), stone butchering tools, a piece of iron, and a potsherd. The site consists of three activity areas where butchering was conducted each having evidence of buried deposits including evidence of hearths. This site is planned for archaeological testing to demonstrate its eligibility for the National Register.

Native American Tribes

Archaeologists and linguists debate the origin of aboriginal groups in eastern Montana before 1500. In eastern Montana, by the 1600s, it is generally accepted that the River Crow were situated on the Missouri River and the Mountain Crow along the Yellowstone River. The Blackfoot were situated northwest of the River Crow into Canada and the

Assiniboine to the northeast of the River Crow into Canada. Before the introduction of trade goods, the Sioux lived in Minnesota. At that time, they were at war with the Chippewa, who had been armed through trade with Anglos, and began moving westward and south. Firearms gave the Chippewa an advantage in warfare, which destabilized the traditional relationships between the groups.

The Sioux left their aboriginal homelands in Minnesota and began to disperse west and south following major river drainages. This process was relatively rapid beginning in Michigan, Iowa, and South Dakota. No doubt, the mobile lifestyle required by bison hunting made the process faster. Early Anglo explorers wrote that they had seen some horses among the Sioux in Minnesota during the first Anglo contact in the 1600s. Many of the eastern Sioux have certain culture traits that are more woodland oriented while the western tribes have aspects of their culture that are similar to other plains groups. In the east, early accounts of the Sioux document at least some level of agriculture or intensive plant exploitation along with hunting as the basis of the economy. As the Sioux moved west onto the plains, their economy was directly linked to bison as their major resource. With this orientation toward hunting bison, shifts in their material culture and mobility patterns were required to stay in close association with the bison herds. For instance, the use of tipis for shelter was necessary for mobility and the use of horses, increased the effectiveness of hunting bison. Access to guns and other trade items also made bison hunting more effective. To acquire trade goods, the Sioux became involved in the bison robe trade.

The Assiniboine split from the Sioux and began to move north and westward onto the Canadian plains to hunt bison. By the late 17th and early 18th centuries, they were trading with the Hudson's Bay Company in Saskatchewan, Canada allowing them access to guns and trade goods. In the fur trade, the Assiniboine acted as intermediaries between the company and other plains tribes. Eventually the Assiniboine expanded their control from Lake Superior to northeast Montana.

In the late 18th century, increased movement of Anglos in the northern plains caused the first outbreaks of smallpox among the native people (Fandrich and Peterson 2005). By 1781, reports in Saskatchewan Canada relate that 30–60 percent of the native population was lost. Diseases introduced by Anglos greatly affected tribal politics and warfare, because the loss of population numbers forced certain tribes to create partnerships that allowed them to defend themselves against native enemies. Anglo contacts grew more frequent with ongoing movement of riverboats associated with the fur trade and discovery of gold in western Montana. This increased opportunities for diseases to spread through the native populations. With the introduction of the steam-powered riverboats using the Missouri River to ship supplies, diseases were able to move faster across the region. The Gros Ventre, Sioux, and Plains Cree did not experience radical population losses from the outbreak. The companies with which they had been trading vaccinated the Sioux and Cree to prevent population losses. The Mandan and Hidatsa, who lived in dense village populations, were devastated by the outbreak and never played a major role in the region's native political arena. Interruptions in hunting caused by the Sioux, who had moved further up the Missouri to take advantage of the territory that opened up with the movement of the Mandan, Hidatsa, and Arikara, kept these groups from sustaining themselves by hunting bison. This forced the Mandan, Hidatsa, and Arikara to become dependent on the Federal Government for support. The Assiniboine also lost two-thirds of their population and became vulnerable to attacks from the Crow, Blackfoot, Gros Ventre, Hidatsa, and Sioux. They were never again able to regain their former political power.

In the late 1860s, the Sioux were becoming a major political force in the area. In 1868, 1,000 Sioux of the Cuthead Band of the Yanktonai and two Bands of the Sissetons arrived at Fort Buford. They agreed to make peace with the Federal Government and made an alliance with the Lower Assiniboine. These Sioux were able to sustain themselves in the first year with annuities shared by the Assiniboine. Yellowstone Kelly noted that Medicine Bear of the Sioux moved up the Missouri River displacing the other groups, which opened the eastern mountains up to hunting for the Sioux. Sioux conflicts with the Assiniboine resulted in the recommendation from Indian Agent Sully that the Assiniboine go north to the Milk River Agency and join the Gros Ventre. Some Assiniboine agreed, while others did not, which split the group into the Upper Assiniboine allied with Long Hair and Whirl Wind and the Lower Assiniboine of the Canoe Paddler Band allied with the Yankton, Yanktonai, and Santee Sioux. They resided near the mouth of the Popular River. The San Arcs and Tetons controlled the area west of Big Muddy Creek to the Musselshell River.

During the 1880s, the climate and conditions for native people in northeastern Montana were at their worst. The bison were now gone from the area and a series of harsh winters left most tribal populations without adequate food. Government supplies were not sufficient to feed the tribal populations and without bison hunting for supplemental nutrition, starvation ensued. At the Wolf Point subagency, 300 Assiniboine starved as well as tribal members at other locations.

Lewis and Clark Expedition

In 1802, Thomas Jefferson organized the Corps of Discovery after the Louisiana Purchase from the French ended any European claim to the land. At the time, this part of the western United States was largely undocumented. Jefferson realized the need to survey the area in preparation for settlement and was also in search of a Northwest Passage to the Orient. At that time, there was no navigable route that connected Eastern and Western North America, requiring ships to sail around South America and Africa. Ultimately, this goal of the Corps was not realized because the route was difficult to navigate and required several portages making movement of large watercraft unpractical. When the Corps of Discovery returned to Saint Louis they brought with them field maps documenting the locations of waterways and resources they had encountered. The Corps found large numbers of wild furs and wildlife that inhabited the region, which would later spur the fur trade. Although the Lewis and Clark Expeditions of the region are generally thought of the as the first Anglo visitors to the refuge, they were predated by trappers who traveled the area in the 18th century. Some of these trappers were of French Canadian origin working with the Hudson's Bay Company.

Fur Trade

With the rise of beaverpelt prices, in the 19th century, more whites came to the Upper Missouri to trap. Once the beaver were trapped out of the area near the refuge, the fur trade shifted to the bison robe trade. Several small forts were established along the refuge part of the river for two reasons: (1) forts allowed the tribes easy access to traders for their furs; and (2) the river boats coming from Saint Louis often could not get further up river from the refuge because the river become shallower upstream. The shallower parts of the river were not navigable by riverboats when the water was low and the shallower sections froze up earlier in the year. Much of the river cargo was destined for Fort Benton near modern day Great Falls. Fort Benton served as a hub of transport for supplies and people because a road network leading to mining and other resource areas in the region connected the town.

By the 1820s, the American Fur Company began to sponsor forts along the river to secure a share of the trade in animal products from native and white trappers. In 1829, the American Fur Company established Fort Union near the mouth of the Yellowstone River creating the first substantial settlement of Anglos in the region (Brumley 2006). Fort Williams and Fort Jackson were established upstream of Fort Union to expand company control of trading. Several other forts were established to compete with the American Fur Company, but most failed due to the fierce competition with American Fur Company or frequent attacks by native people. One reason so many forts, trading posts and riverboat landings were constructed within the refuge was due to the difficulty with getting up river from this point. The stretch of river from Cow Island to Fort Benton was known as "Rocky River" marking the point where elevation increased approximately 2 feet per mile as one went upstream (Davy 1992). From the refuge, riverboats could be unloaded and freight put on wagons to be hauled to Helena, Great Falls, or the Judith Mountains. Typically, the forts did not stay in business very long because conditions of the river and animal populations themselves affected their success. Fort Carroll is an excellent example. In the early 1880s, it was located within 150 miles of the remaining bison herds. It did brisk business with the riverboats in 1874 and 1875 because the river was low, and freight was unloaded at the town to be hauled by wagon to Great Falls (FWS 1996). Afterwards, when the river was elevated, riverboats were able to get up river to Fort Benton without help and the town's prosperity dwindled. By 1881, about 2,130 bison robes were traded at Carroll, down from earlier years of 4,000 robes. Soon after, the bison robe trade ended.

Thirty-one trading posts were built on the Missouri River between the North Dakota boundary to Fort Benton between 1828 and 1885 (Davy 1992). Those located in the refuge boundary are Fort Peck (1867), Fort Pouchette (1870), Fort Musselshell (1869), Kerchival City (1866), Fort Sheridan (1870), Fort Andrews (1862), Carroll (1874), Fort Hawley (1866), Wilders Landing (1875), Rocky Point (1875), Little Belt Mountain City (1875). Forts with a military function were Fort Peck, Rocky Point, Fort Carroll, and Fort Reeve (1867). In addition to forts, there were riverboat landings along the Missouri River, because riverboats could not get up the river to Fort Benton during icy and low water conditions. Cargo had to be unloaded and moved by wagon to the forts up river. Fieldwork in the 1970s showed that remains of these landings as well as sunken riverboats can still be found (Wood 1977).

Throughout the 19th century, the fur trade in eastern Montana was dependent on riverboats to move the goods to the region. Originally, the trade consisted of beaverpelts, but in the 1840s the animals had been overexploited and fur prices dropped, changing the focus of trade to bison robes. Growth of this industry was rapid as 2,600 bison robes were sent east annually in the early 1800s, whereas approximately 90,000 or more were shipped annually from St. Louis by the 1850s. By 1850, the tribes were dependent on trade goods, which they obtained through the bison robe trade.

With the discovery of gold in western Montana in the 1860s and the development of the fur trade,

steamboat travel was a vital supply line to towns such as Fort Benton and Helena that had few other options for travel because of the lack of well-established roads or railways to supply these towns. Food, supplies, and trade goods required for miners and trappers were hauled up from St. Louis. Goods including furs, bison robes, and gold were sent downstream to the markets. Steamboat traffic was common on the river from 1859 until 1888 and averaged about 20 boats a year.

Railroads

During the 1880s, railroads were established, linking eastern Montana to large cities and markets for the natural resources that were available for exploitation at the time. With the establishment of the railways, movement of goods was faster, more predictable, and cheaper than riverboat travel along the Missouri. The grasslands left vacant by the removal of bison and the placement of native people on reservations made the area particularly suitable to livestock grazing. With the addition of the railroad to the State's transportation system, the reliable movement of cattle to large markets in the east was ensured. The industry flourished, and high stocking rates were common due to unmanaged grazing on free land. This early success was tainted in the winter of 1886–87 when severe snow and cold froze many cattle that walked with the wind into coulees and fences and became trapped. Some estimates of losses of cattle in the region are as high as 50–90 percent. Of the State's 220 cattle operations in business before that winter, 120 financially survived.

By 1900, a homestead boom began that would last until 1918. Initial settlement of the region was in river bottoms that were readily cultivated. It was spurred by the cheap transportation by railways, profitable shipment of grain to market and advertisement campaigns by the railroad companies for free land. The Federal Government had given the railways land along tracks to pay them for the construction costs. When an area was settled, the railroads were not only able to sell the land but also created more traffic for freight as the settlers needed to move their products to market. The homestead boom was so intense that Montana had more homestead entries than any other State. The boom continued successfully as high moisture during the period of 1909–16 made dry farming of cereal grains successful. The combination of shipping grain by rail made moving the grain to large eastern markets financially profitable and reliable. Once conditions became dryer, the farming boom ended as farmers began to understand the lack of predictable moisture in the eastern part of the State limited dryland farming. This, in combination with the Great Depression, caused a mass exodus from Montana in which half of Montana farmers lost their farms between 1921 and 1925. This process has continued in to modern times as illustrated by Garfield County, which in 1919 had 30 settlements with post offices. By 1968, five remained (Davy 1992). Creating predictable water for farming in eastern Montana was not resolved until large-scale Government irrigation brought predictable water to the agricultural fields.

Roosevelt Era

In response to the Great Depression and the drought of the 1930s, President Franklin D. Roosevelt created a series of Government programs to provide jobs and income for impoverished families. Most of these programs were construction projects including dams, roads, and public works. The largest of these projects in Montana was Fort Peck Dam, which is situated on the eastern end of the refuge. The project was authorized by Roosevelt in 1933 and constructed under management of USACE. This work was completed from 1933 to 1940. The dam originally

Brett Billings / USFWS

Old homesteads dot the landscape.

had two purposes: providing jobs to Montanans who were jobless and creating flood control for the Missouri River. In 1938, the dam was altered to generate electricity in preparation for the United States involvement in the Second World War. It is the largest earth-filled dam in the world. Inside the clay core of the structure are 17,000 tons of steel sheet pilings that span the river. The project was so large that several towns were established to house workers. Some of the names of the towns include New Deal, Square Deal, and Roosevelt Heights showing their direct relationship with the project. During the construction period in the mid-1930s, the city of Fort Peck unofficially had a population of 30,000. Fort Peck is distinguished as being the first planned community, other than military post and religious communities, in the United States (Davy 1992). It was designed by USACE in 1933. At its peak, the project employed 10,546 people.

Homesteads and Ranching

Ranching in Montana began as small operations providing beef to miners primarily in the western part of the State to support the mining operations. In 1866, the first cattle drive from Texas took place and started the first open-range ranching in the grasslands that were vacant after the destruction of the bison herds. (Malone et al. 1976).

By the late 1870s, the large cattle raising operations west of the Continental Divide were searching for more range lands. By the mid-1870s, ranchers had brought medium-sized herds into central Montana. The rapid expansion of the cattle industry on the northern Great Plains ended suddenly in the late 1880s south of the Missouri River and in 1906–07 north of the river. Ranchers failed to take action to ensure the range was not overstocked and during the brutal winter of 1886–87 and again in 1906–07, approximately 50–75 percent of stock in central and eastern Montana was lost. The winter of 1886–87 ended open-range ranching south of the Missouri River and started the ranch cattle operation. Open-rangeland ranching continued north of the river until the winter of 1906–07 when again another severe winter killed thousands of stock.

The Homestead Act had little effect in central Montana until 1909 when the Enlarged Homestead Act was passed. This act allowed a person to receive 320 acres instead of the original 160 and one-eighth of the land had to be cultivated continuously. The countryside became dotted with homestead shacks, and trails became roads as more and more traveled their course. "The homestead rush began slowly, but in less than 20 years an immense grassland in Central and Eastern Montana, over 500 miles long and 300 miles wide, was overrun, divided up into 320-acre tracts, plowed up and was producing some of the lushest crops ever seen." These homesteaders were mostly farmers, whereas those that preceded them were cattle and sheep men (Willmore 1990).

The beginning of the end of the boom years was 1919. It was the driest year ever recorded in central Montana, and there were no crops. More dry years followed until the Great Depression of the 1930s. Wheat harvests averaged only 2.4 bushels on land that had previously averaged 50 bushels and prices tumbled. Hordes of grasshoppers and cutworms, intense heat, and winds all added to the homesteader's misery. Families were starving and the exodus from the area accelerated. More than half of the farmers lost their land through bankruptcy and abandonment or sold to the Government under the Bankhead–Jones Farm Tenancy Act of 1937. The ranches that survived these times had diversified their operations to include a combination of stock and crops. Many of the area's farmers and ranchers of today are the children, grandchildren, and even great grandchildren of the men and women who made it through the difficult, sometimes impossible, days (Willmore 1990).

Historic Artists

Artists beginning in the early 19th century have portrayed the refuge. In 1833, Prince Maxmillian from Germany visited the refuge documenting its natural wonders. Maxmillian brought with professionally trained Swiss artist Karl Bodmer who painted the first scenes from the area by a classically trained artist. As an scientist, Maxmillian's observation along with Bodmer's illustrations provide a valuable source of scientific information about the natural features and native people inhabiting the area at that time. Maxmillian's expedition was from Fort Union to Fort McKenzie, which is just downstream of Fort Benton.

Charles M. Russell, the namesake of the refuge, was an artist and cowboy who was born in 1864 and came to live in the Judith Basin in 1880. His primary artistic subjects were the cowboys of eastern Montana. Russell worked as a cowboy for 11 years beginning in 1882. These experiences left him with scenes of cowboy life from the late 19th century from which to draw on as an artist. Russell disagreed with the practice of dryland farming in the eastern Montana prairie, because he realized that the crops would fail in dry periods causing soil destruction. Known for his early conservation ethic, Russell was given the honor of having the refuge named after him.

KNOWN CULTURAL RESOURCES

The refuge has 363 known archaeological sites. Approximately 275 of the known archaeological sites are either National Register–eligible or have not been evaluated and therefore have to be treated as eligible. Very few of the archaeological sites on the

In 2010, a bow hunter discovered the fossilized bones of a sea creature. This is a rare find for the refuge, because very few prehistoric marine reptiles have been found in this area.

refuge have been visited by a professional archaeologist. Many of the aboriginal sites that have been reported by refuge staff are stone circles or what are commonly called tipi rings or are historic farmsteads. Most of the known archaeological sites have been reported to the Montana State Historic Preservation Office; however, the information recorded was not done by current professional standards, making management of the resource difficult. Overall, less than 1 percent of refuge lands have been formally surveyed for archaeological sites.

REFUGE RESOURCES IMPORTANT to TRIBES

In 2005, USACE completed a study of the traditional cultural properties near the refuge. During this study, the Assiniboine, Blackfoot, Chippewa–Cree, Crow, and Sioux Tribes were interviewed about traditional use of the area. Many of the 16 traditional cultural properties are found on refuge land and include burial locations, plant-gathering areas, and ceremonial locations. Some areas were inundated by Fort Peck Lake.

Modern tribes still collect and use plants or other resources for ceremonial and traditional purposes. Consultation with the Fort Peck and Fort Belknap tribal council in 2009 revealed that collecting sweat rocks, willows, and other materials are very important cultural traditions. Tribes that are interested in collecting small quantities of plants or other natural resources need to contact the refuge manager and obtain a special use permit before collecting materials for ceremonial purposes. Although bison are not managed as a species on the refuge, many tribes still consider them as central to their culture. Other wildlife species currently found on the refuge that are important include elk, deer, and other species; however, the State of Montana regulates the harvest of huntable populations of wildlife through State licensing. Many tribes also use eagle feathers and parts today for ceremonial purposes. The Service provides eagles to tribal members through the National Eagle Repository located in Colorado. Tribes reported having a deep spiritual connection to the refuge, and many of the scenic areas are considered focal spiritual areas, although information about any specific site on the refuge is not known.

3.6 PALEONTOLOGICAL RESOURCES

The refuge offers various exposures of geologic and paleontological interest, and the refuge has 465 known paleontological sites. Several of these sites have been designated as "national natural landmarks" for paleontological resources (refer to "Special Management Areas" under section 3.3 above).

The western part of the refuge is shortgrass prairie with sparse pine forest in the uplands and cot-

tonwoods in the dissected drainages and floodplain areas. On the eastern side of the refuge, the vegetation is shortgrass prairie with juniper in deeply eroded drainages. Areas of the eastern part of the refuge have scant vegetation and are commonly known as badlands. In general, the central part of the refuge contains earlier fossils of Pleistocene mammals, while the downcutting of the river on the eastern part of the refuge has exposed the Hell Creek Formation (Cretaceous Era), which is tens of millions years earlier. The Hell Creek Formation is known for its dinosaur fossils. In certain areas, exposures of marine fossils are observable.

Of the paleontological deposits on the refuge, the dinosaur fossils have become famous and have been displayed in museums around the world. Although the refuge has been visited by paleontologists since the late 19th century, the first scientifically documented *Tyrannosaurus rex* fossil was excavated near Jordan, Montana, in 1902 (Graetz and Graetz 2003). Among the most recognizable dinosaur fossil finds to come from the refuge are *T. rex*, *Triceratops*, *Albertosaurus*, *Mosasaurus*, and duck-billed dinosaurs. The quality of the fossils is such that recently one of the most complete (*T. rex*) fossils excavated was found at the refuge and a group of several associated *T. rex* fossils were identified on the refuge. Many of these fossils can be seen at the Museum of the Rockies in Bozeman. The interpretive center at Fort Peck Field Station has many complete dinosaurs on exhibit.

In 2009, the Paleontological Resources Protection Act became law and requires the protection of these resources using scientific principles and expertise. Agencies are to develop plans for inventory, monitoring, and scientific and educational use of these resources in accordance with agency policies. Casual collecting or recreational digging is not allowed on the refuge. Special use permits are issued to institutions such as the Museum of the Rockies. Many of the paleontological sites known to refuge staff have not been formally reported to the Montana State Historical Preservation Office because the refuge has a problem with paleontological looters and wants to keep this knowledge as safe as possible to prevent attracting more looters. The refuge's law enforcement personnel regularly write citations for looting and try to monitor as many of these resources as possible.

3.7 SOCIOECONOMICS

Information on socioeconomic conditions was obtained with the help of USGS through the Policy and Science Assistance Branch of the Biological Resources Division, in Fort Collins, Colorado (Koontz et al. 2010).

For CCP planning, an economic analysis provides a means of estimating how planned management activities affect the local economy. The report for the refuge provides a description of the local community and economy near the refuge. Next, the methods used to conduct a regional economic impact analysis are described. An analysis of the CCP management strategies that could affect interested groups, residents, the public, and the local economy is then presented. The refuge management activities of economic concern in this analysis follow:

- refuge purchases of goods and services within the local community
- refuge personnel salary spending
- grazing operations
- spending in the local community by refuge visitors
- revenues generated from refuge revenue sharing

REGIONAL ECONOMIC SETTING

For the purposes of an economic impact analysis, a region (and its economy) is typically defined as all counties within a 30- to 60-mile radius of the impact area. Only spending that takes place within this regional area is included as stimulating changes in economic activity. The size of the region influences both the amount of spending captured and the multiplier effects. The six-county area is large (15.3 million acres) and remote with much of the regional economic activity confined within the six-county area. The 1.1 million-acre refuge boundary accounts for 1 percent of the land and water within the six-county area: 11.6 percent of Garfield County; 8.7 percent of Phillips County; 6.6 percent of Valley County; 5.3 percent of Petroleum County; 5.1 percent of McCone County; and 2 percent of Fergus County. Based on the relative self-containment in terms of retail trade, the surrounding six counties make up the local economic region for this analysis.

During the last century, ranching, farming, mining, natural gas development, and the railroad have all been important factors in the social and economic history of the area. More recently, outdoor recreation and tourism have been increasingly important contributors to the local economies. The next sections describe the socioeconomic characteristics and trends in the six-county area.

POPULATION and DEMOGRAPHICS

This section describes the characteristics of the population for Montana and the six counties surrounding the refuge. This includes population projections, employment, income, and refuge activities that affect the local economy.

Population and Density

Table 11 summarizes the population estimates and trends for Montana and the six counties surrounding

the refuge. In 2008, there were 25,278 residents in the local six-county area, comprising approximately 2.6 percent of the State's population while covering 16 percent of the State's land area. In 2008, Fergus County had the largest population in the six-county area with 11,195 residents, while Petroleum County had the least populated county with 436 residents. While Montana's population grew by more than 7 percent from 2000 to 2008, all six counties experienced a declining population during that time ranging from a 5.9-percent decline in Fergus County to a 15.2-percent decline in McCone County.

As shown in table 11, all six counties have substantially lower densities (0.3–2.6 persons per square mile) compared to that of Montana (6.6 persons per square mile). Nearly half of the residents in Fergus County live in the city of Lewistown, creating a local density of 3,055 persons per square mile. Similarly, more than 40 percent of Valley County's residents live in the city of Glasgow, resulting in a local population density of 2,075 persons per square mile. The higher local densities in these major communities indicate that rural areas outside of these communities are more sparsely populated than the county densities shown in table 11.

Communities near the Refuge. Lewistown, the county seat of Fergus County, is the largest city in the six-county area, with 5,954 residents in 2008 (U.S. Census Bureau 2008). Located in the geographic center of Montana, Lewistown has historically been an important regional trade center for the surrounding farms and ranches (Destination Lewistown 2009). Recently, there has been a great deal of growth and diversification in the local economy including recreation, tourism, and a wide variety of businesses in the small manufacturing and service sector (Destination Lewistown 2009).

Established as a railroad town in the 1880s, Glasgow, the county seat of Valley County, is the second largest city (2,921 residents in 2008) near the refuge. The construction of Fort Peck Dam (approximately 18 miles southeast of Glasgow) and the establishment and subsequent closure of Glasgow Air Force Base have been important historical events for the Glasgow economy.

Other communities near the refuge include the agricultural community of Malta (1,801 residents in 2008 and the Phillips County seat), which is also a notable stop on the Montana Dinosaur Trail. The terrain between the towns of Jordan (336 residents and the Garfield County seat) and Circle (542 residents and the McCone County seat) offers numerous recreational opportunities and is well known among paleontologists for its fossil beds (Travel Montana 2009). The agricultural town of Winnett (163 residents in 2008 and the Petroleum County seat) was formerly an oil-boom town with more than 2,000 residents in the 1920s (Travel Montana 2009).

Population Projections. As shown in table 11, Montana's population is projected to increase by 34 percent from 2000 to 2030. Based on recent trends, most of the increase in statewide population can be expected to come from the in-migration of new residents who are aged 30–49 and have children or who are older than 50 and retired, and those who are attracted to the wilderness and mountains (Kemmimck 2002, Young and Martin 2003). However, most of the increase in population is expected to occur in western Montana. In contrast, the six-county area surrounding the refuge is expected to continue to lose population in the next 20 years. Much of the loss in eastern Montana is expected to come from the emigration of people aged 20–29 leaving the region for better opportunities (Young and Martin 2003). By 2030,

Table 11. Population estimates for the Nation and the counties surrounding the Charles M. Russell and UL Bend Refuges, Montana.

Area	*2008 population*[1]	*Percent change from 2000*[1]	*Persons per square mile*[1]	*Expected population percent growth (2000–30)*[2]
United States	304,059,724	8	80.1	—
Montana	967,440	7.2	6.6	34.2
Fergus County	11,195	–5.9	2.6	–1.6
Garfield County	1,184	–7.4	0.2	–14.8
McCone County	1,676	–15.2	0.6	–23.6
Petroleum County	436	–11.6	0.3	–20.9
Phillips County	3,904	–15.1	0.7	–21.5
Valley County	6,892	–10.2	1.4	–23
Six-county Area	25,287	–9.4	1.1	–13.3

[1]*Source: U.S. Census Bureau 2008; Population Estimates, GCT–T1 and DP–1.*

[2]*Source: NPA Data Services, Inc. 2007; U.S. Census Bureau 2008.*

the counties of McCone, Petroleum, Phillips, and Valley are expected to lose more than 20 percent of their populations compared to 2000 (table 11). Garfield County is expected to lose 15 percent by 2030. Fergus County is expected to lose 4 percent by 2010 but is expected to regain some of its population, for an overall loss of approximately 2 percent by 2030. Overall, the six-county area surrounding the refuge is expected to lose approximately 13 percent between 2000 and 2030, with most of the loss occurring by 2020 (NPA Data Services 2007).

Age and Racial Composition. The six-county area surrounding the refuge has an aging population beyond that of the State of Montana as a whole. Whereas the median age of Montana in 2007 was 37.5 years, the six adjacent counties had a median age ranging 40.8–42.4 years (U.S. Census 2009). In addition, the six-county area had substantially higher proportions of residents between the ages of 65 and 84 (14.9–17.7 percent) compared with the entire State (11.7 percent) and substantially lower proportions of residents between the ages of 25 and 40 (26.8–28 percent) compared with the State (33.7 percent). The aging trend in the six-county area is likely driven by the trend of the young generation (particularly between the ages of 20 and 29) emigrating out of eastern Montana (Young and Martin 2003) in addition to the aging baby-boomer generation. The impact of retirement-age people on a community can be complex, but can include bringing in other sources of income and the desire for different types of recreation or amenities. For example, as the older recreation user groups increase, more hunters may request increased vehicle access to retrieve game and may rely on off-highway vehicles or motorboats as means to access otherwise remote hunting areas.

In 2000, the proportion of white persons not of Hispanic or Latino origin in Phillips County (89.4 percent) and Valley County (88.1 percent) was close to than the State average (90.6 percent) while the averages in Fergus County (97.1 percent), Garfield County (99.1 percent), McCone County (97 percent), and Petroleum County (99.2 percent) were greater than the State (U.S. Census Bureau 2007). The percentage of residents identifying themselves as American Indian or Native Alaskan was 6.2 percent for the State while the Phillips and Valley Counties were higher than the State average, 7.6 percent and 9.4 percent respectively, due to the presence of Indian reservations (U.S. Census Bureau 2007). The percentage of residents identifying themselves as American Indian or Native Alaskan was significantly lower than the State average for the remaining counties, ranging from 0.2 percent for Petroleum County to 1.2 percent for Fergus County.

EMPLOYMENT and INCOME

The following narrative contains information about employment trends, types of employment, current employment, and related income for Montana and the six-county area of the refuge.

Employment Trends

Employment trends in the six-county area from 1975 to 2006 are shown in figure 35 (U.S. Department of Commerce 2008). During the 30-year period, the State as a whole experienced a substantial increase in total employment. Fergus County was the only county that followed the State trend with a steady increase in employment since the early 1980s. Petroleum, McCone, and Valley Counties experienced loss in total employment until around 1990 and have been experiencing a steady recovery since. Phillips County experienced an increase in employment between 1975 and 1990, but its current total employment has been declining since the 1990 peak level. Garfield County's employment has remained relatively stable compared to the other counties in the region.

Based on the long-term trend data for employment by industry (U.S. Department of Commerce 2008), several trends explain the total employment fluctuations seen in figure 35. Decline in total employment observed in most counties before 1990 is largely attributed to the decline in farm employment as well as some rapid declines in the manufacturing industry (Valley County). Phillips County's boom and bust in employment was largely attributed to the rise and fall of the mining industry, creating a sudden decline in employment in mining as well as associated services after the gold mine closures in the 1990s. Fergus County also experienced a short boom and bust in the mining industry around 1990, but the loss of employment from the mining industry did not negatively affect total employment in the county due to the presence of other stronger industries (such as retail trade, services, and construction) that experienced growth during the same period. The employment trend data suggest that counties with higher dependency on farming, (Garfield, McCone, and Petroleum Counties) may be more likely than others to be impacted by refuge management that influence surrounding counties' farming practices.

Overall, employment in all counties in the area except Phillips County has been steadily increasing since the mid-1990s. This increase is not easily explained by the area's population trend (table 11) or the trend in employed labor force (number of persons 16 years and older who are employed) (Montana Department of Labor and Industry 2009), because both population and labor force has mostly declined

in the six-county area during the same period. It is likely that the recent increase in employment in the six-county area is explained by an increase in people with multiple jobs. The increase in people with more than one job is likely attributed to small farmers and ranchers who require supplemental income, as many are unable to make enough profit from their crops or livestock (Gruenert 1999).

Table 12 shows the percentage of total employment in Montana and the six-county area for 2005 and the percent change from 1995 to 2005. Employment is broken into two categories: (1) by wage and salary employment (people who work for someone else); and (2) proprietors (self-employed including sole proprietorships, partnerships, and tax-exempt cooperatives). In 2005, all six counties surrounding the refuge had substantially higher proportions of proprietors (39–65.5 percent) compared to the State as a whole (27.1 percent; see table 12). Approximately half of all proprietors in the six-county area are farm proprietors (those who are self-employed and run a farm, producing or expected to produce at least $1,000 worth of crops and livestock in a typical year), whereas that of the entire State is substantially lower.

As shown in figure 35, five out of six counties surrounding the refuge have been experiencing increases in total employment since the mid-1990s. During that time, Montana also had an increase in total employment, with most of the increase coming from wage and salary employment (see table 12). However, in the six-county area, wage and salary employment has declined in many of the counties and much of the loss has been compensated by the increases in proprietor employment, particularly in the nonfarm sector. These data indicate that, unlike the State as a whole, the six-county area is becoming more dependent on self-employment as wage and salary employment decline. In addition, while farm proprietorships have not shown substantial growth and have decreased in some cases, they are still significant components of the economic structure in the six-county area.

Current Employment and Income

Table 13 summarizes industry output, employment, and labor income (employee compensation plus proprietor income) for the six-county area. Industry output, as used here, is the value of an industry's total production expressed as a single dollar figure. The data presented in this section were compiled by the Minnesota IMPLAN (impact analysis for planning) Group from several sources including Census Bureau economic censuses, Bureau of Economic Analysis output, and employment projections developed by the Bureau of Labor Statistics (Minnesota IMPLAN Group 2007).

Consistent with the information presented in the previous section, the six-county area has substantially higher farm and ranch employment (proprietors and salary and wage employment combined) than the State as a whole, indicating that farming is an important sector in the area in terms of employment numbers. Aside from farming and governmental employment, retail trade and the service sectors also have high employment across all six counties.

During the past 30 years, Montana and the six-county area experienced a steady increase in total personal income (U.S. Department of Commerce 2008). This increase was attributed to a steady in-

Table 12. Employment by type for Montana and the counties surrounding the Charles M. Russell and UL Bend Refuges.

Location	*Total employment*		*% Wage and salary*		*% Proprietors*		*% Nonfarm*		*% Farm*	
	2005	% Change 1995–2005	2005	% Change 1995–2005	2005	% Change 1995–2005	2005	% Change 1995–2005	2005	% Change 1995–2005
Montana	615,864	22	73	19	27	29	23	34	4	8
Fergus County	7,654	11	61	6	39	19	27	27	12	6
Garfield County	872	9	48	–1	52	20	25	44	27	4
McCone County	1,283	7	51	–1	49	15	19	30	30	8
Petroleum County	345	24	35	–3	66	45	36	151	30	–4
Phillips County	2,645	–9	58	–16	42	4	23	4	19	5
Valley County	4,706	0.1	65	–2	35	4	20	2	15	6

Source: U.S. Department of Commerce 2008; CA30.

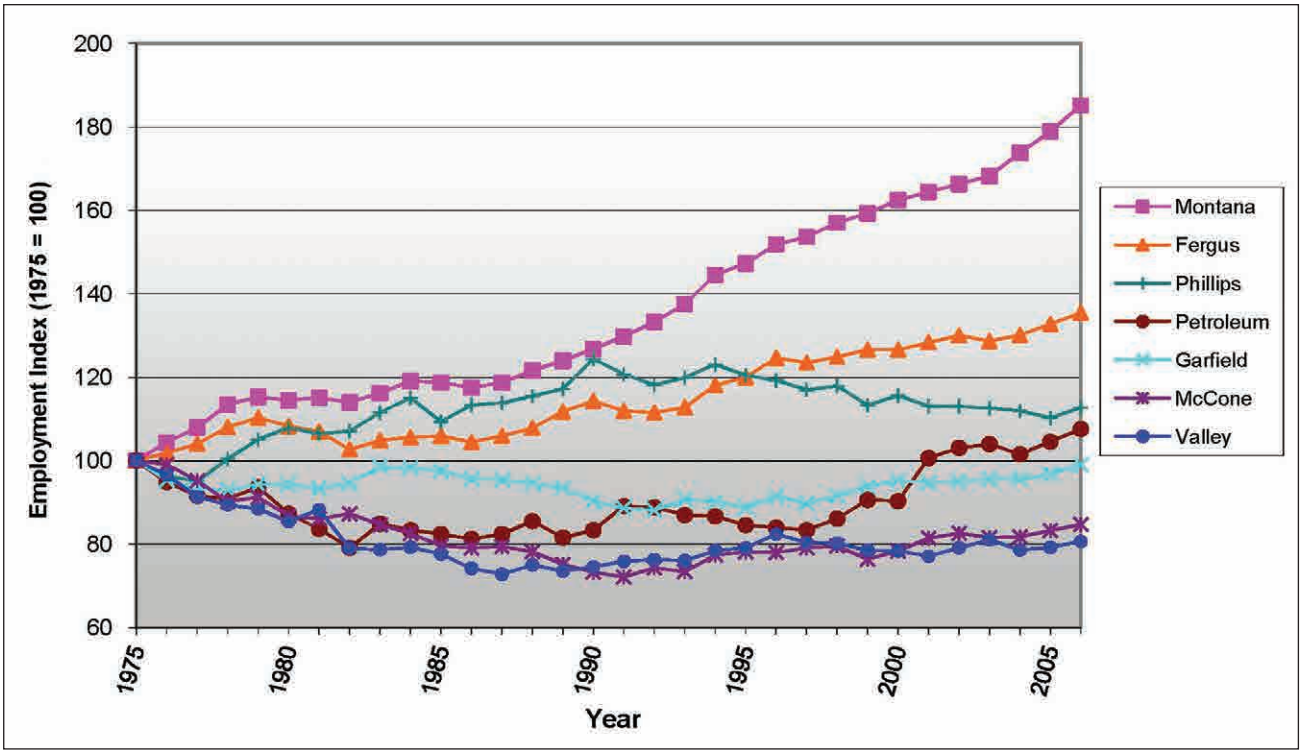


Figure 35. Graph of the total employment index for Montana and the counties surrounding the Charles M. Russell and UL Bend Refuges (1975–2006). *Source: U.S. Department of Commerce 2008; CA25.*

Note: Total employment includes all jobs filled within each area. Full-time and part-time jobs are counted at equal weight, and those holding two or more jobs are counted multiple times. The trend data for each of the counties and Montana are presented as an index, and are standardized with 1975 as the base year.

Table 13. Employment by industry for the counties surrounding the Charles M. Russell and UL Bend Refuges, Montana.

Industry	*Industry output ($millions)*	*Employment (number of full- and part-time jobs)*	*Labor income ($millions)*
Agriculture, forestry, fishing, and hunting	368.9	4,093	22.6
Mining	40.5	74	8.3
Construction	147.4	1,206	44.7
Manufacturing	184.2	618	22.8
Transportation and public utility	214.4	578	41.9
Wholesale trade	62.2	586	22.3
Retail trade	78.6	1,402	33.5
Finance, insurance, and real estate	237.3	1,129	32.1
Professional, scientific, and technical services	33.3	447	17.1
Health and social services	112.3	1,688	54.4
Arts, entertainment, and recreation	12.2	413	3.6
Accommodation and food services	45.6	1,026	12.6
Other services	119	1,887	29.2
Government (Federal, State, local, and military)	158.3	2,799	121.2
Total	1,814.2	17,945	466.4

Source: Minnesota IMPLAN Group, Inc. 2007.

Note: County level data are available for employment but are not shown because the new North American Industrial Classification System introduced in 2001 prevents disclosure of employment numbers for many industries in small communities.

crease in both labor and nonlabor-source incomes, but nonlabor-source incomes (transfer payments and dividends, interests, and rent) increased at a greater rate than that of labor source income despite decreasing populations in the area (U.S. Department of Commerce 2008). Such a trend suggests that there are greater proportions of individuals receiving transfer payments in the form of Social Security, Medicare, and Medicaid in these counties, further supporting the aging trend of the area.

Median household income, earnings per job, and unemployment data for the region, State, and Nation are displayed in table 14. Median household income and earnings per job are below the national average. The unemployment rate is the percentage of the labor force that is not working, but is actively seeking work. In general, the six counties' unemployment rate is similar to or less than the State average (U.S. Department of Labor 2008). Unemployment rates in all six counties along with Montana have followed a declining trend since 2000. In 2008, unemployment rates were lower for Montana and the six-county area than the national average. McCone and Garfield Counties have the lowest unemployment rates in the region despite having lower average earnings per job than all but one of the other counties in the region. The lower median income, earnings, and unemployment in the six-county area compared to the State average aligns with the aging population (less people actively seeking work) and the growing number of people with more than one job to supplement their income.

KEY REFUGE ACTIVITIES that AFFECT the LOCAL ECONOMY

The ability of the refuge to influence local economic activity and desired economic conditions is related to the Service's land use decisions and associated land uses. Livestock grazing, tourism, and recreation are the prominent resource-based industries with ties to the refuge, and are described in more detail in the next section.

Livestock Grazing

Farming and ranching are important cultural forces in eastern Montana including the areas surrounding the refuge. As was shown in table 13, farming is the largest employer in each of the six counties surrounding the refuge. From 2001 to 2007, agricultural employment in the six-county area has remained fairly stable, averaging 3,408 jobs, with a high of 3,487 in 2002 and a low of 3,373 in 2007 (U.S. Department of Commerce 2008). In 2007, Fergus County had the highest percentage of agricultural jobs of the six counties surrounding the refuge with 1,075 jobs, or 32 percent of total farm employment. As shown in figure 36, Valley County had the second highest farm employment with 826 jobs, or 25 percent of the total for the area. Phillips County consisted of 613 jobs (18 percent), McCone County had 444 jobs (13 percent), and Garfield County had 298 jobs (9 percent). Petroleum County had the fewest farm jobs with only 117, or 3 percent of total agricultural employment of the six-county total.

More United States farmers now hold off-farm jobs in addition to their farm operation, and off-farm income now makes up a larger proportion of the total household income of United States' farmers (Fernandez-Cornejo 2007, Gruenert 1999). This trend is clear in Montana and in the six-county area. Although the proportion of farm operators primarily employed in farming is higher in the region compared to the State, this proportion has decreased in recent years (see table 15). Garfield County has the highest proportion of farmers whose primary occupation is farming, while Valley County had the lowest.

Table 14. Income, earnings, and unemployment for the Nation, Montana, and counties surrounding the Charles M. Russell and UL Bend Refuges.

Area	*Median household income ($)*[1]	*Average earnings per job ($)*	*Unemployment rate*[2]
United States	50,740	48,900	5.8
Montana	43,000	34,433	4.5
Fergus County	37,259	28,417	4.2
Garfield County	32,694	21,053	3.3
McCone County	38,535	21,135	2.6
Petroleum County	28,254	17,851	5.3
Phillips County	33,798	22,685	4.5
Valley County	37,019	27,091	3.8
Six-county average	34,593	23,039	4

[1] *Source: U.S. Census Bureau 2007.*
[2] *Source: U.S. Census Bureau 2008.*

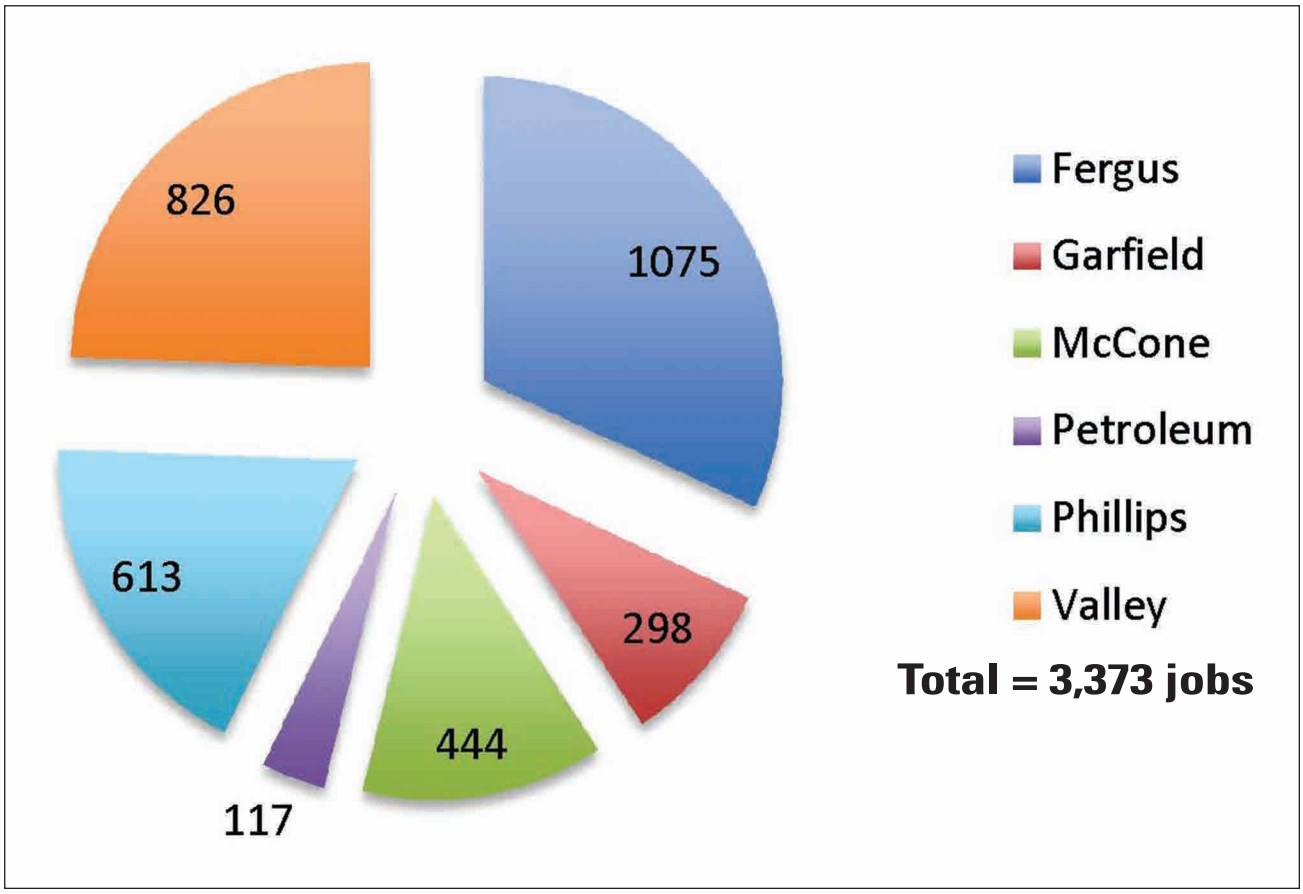


Figure 36. Chart of agriculture employment in the six counties surrounding the Charles M. Russell and UL Bend Refuges, Montana. *Source: U.S. Department of Commerce 2008.*

Table 15. Farm operators whose primary employment is farming in Montana and the counties surrounding the Charles M. Russell and UL Bend Refuges.

Year	*Montana*	*Fergus County*	*Garfield County*	*McCone County*	*Petroleum County*	*Phillips County*	*Valley County*
2007	51%	60%	77%	69%	72%	65%	58%
2002	64%	69%	84%	70%	73%	72%	73%

Source: USDA 2009, table 46.

From 2001 to 2007, agricultural earnings in the six counties surrounding the refuge were stable, with an average of $17.1 million dollars per year (U.S. Department of Commerce 2008). The highest value (just over $18 million) occurred in 2002, and the lowest (just under $16 million) occurred in 2003. In 2007, agricultural earnings totaled just under $18 million, with the largest earnings in Fergus County of $4.5 million, or 25 percent of total earnings in the six-county area. Phillips County had the second largest earnings in 2007 with $4.2 million, or 24 percent of the total. Valley County had $3.5 million (20 percent), McCone County had $2.6 million (14 percent), and Garfield County $2.3 million (13 percent). Petroleum County had the lowest agricultural earnings with only $812 thousand, or 4 percent of the total agricultural earnings in the six-county area in 2007.

Agricultural Revenues from Livestock. Gross revenues from livestock have averaged about 46 percent of total gross revenue from agricultural operations over the past 40 years (see figure 37). The lowest percentage (37 percent) of livestock revenue occurred in 1996, while the highest (62 percent) occurred back in 1971. Gross revenues from crops averaged 35 percent over this time span, with a low of 24 percent in 1971, and a high of 60 percent in 1974. Other agricultural income averaged 19 percent, with a low of 3 percent in 1974 and a high of 32 percent in 1986. Other sources of revenue for agricultural operations

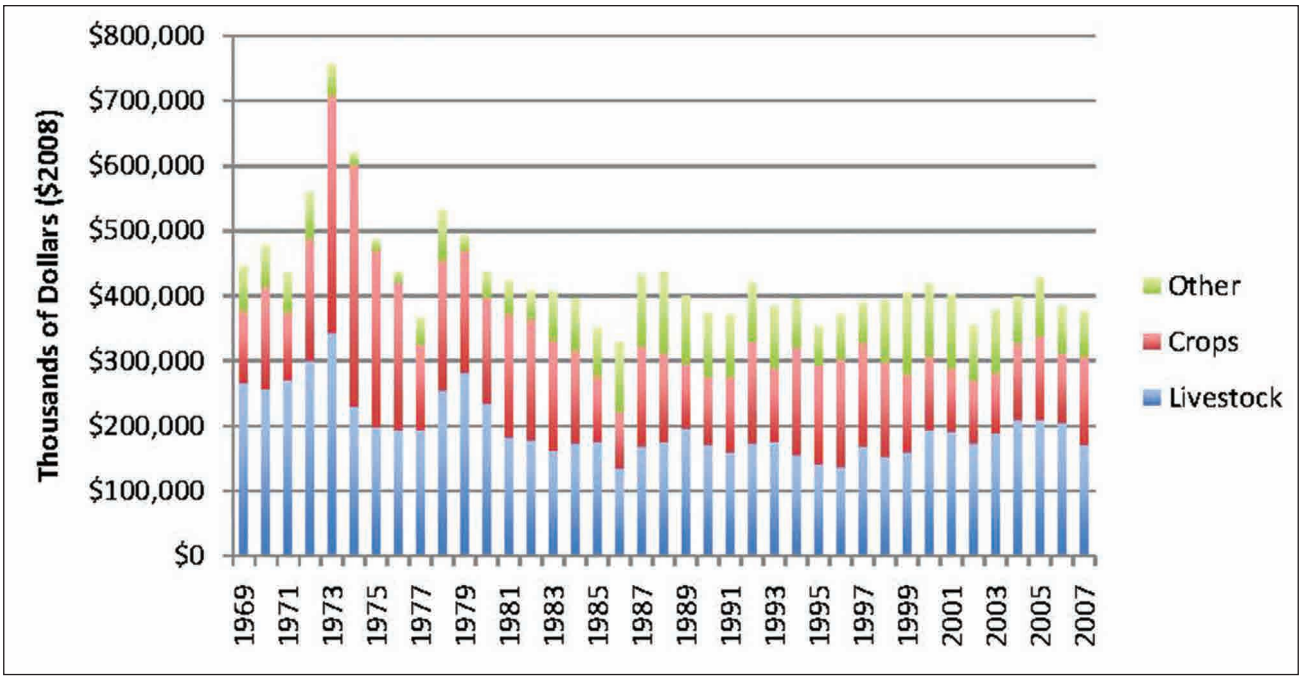


Figure 37. Chart of trends in gross revenues from agriculture in the area surrounding the Charles M. Russell and UL Bend Refuges, Montana (1969–2007). *Source: U.S. Department of Commerce 2008; other sources of revenue for agricultural operations include Government payments, value of home consumption, machine hire and custom work, rental income, and income from forest products.*

include Government payments, value of home consumption, machine hire and custom work, rental income, and income from forest products.

In 2007, gross revenue for agricultural operations in the six counties surrounding the refuge totaled $364.7 million (U.S. Department of Commerce 2008). This total consists of $164 million (45 percent) from livestock, $133 million (36.5 percent) from crops, and $67.7 million (18.5 percent) from other sources. Fergus County had the largest gross revenues from agriculture ($107.5 million), followed by Valley County ($81.2 million), Phillips County ($64.6 million), McCone County ($56.1 million), and Garfield County ($53.1 million). Petroleum County had the lowest total gross revenue from agricultural operations with $14.5 million, or 3.8 percent of the six-county total.

As shown in figure 38, livestock ranged from a low of 23 percent of total gross revenue from agricultural operations in McCone County to a high of 67 percent in Petroleum County. Valley (35 percent) and Fergus (48 percent) were the only two other counties that had less than 50 percent of total gross revenue from agricultural operations from livestock. In Phillips County, livestock accounted for 53 percent of total gross revenue from agricultural operations, while in Garfield County it account for 61 percent.

Cattle Inventories. Between 1950 and 2009, cattle inventory for the six counties surrounding the refuge has averaged 378,988 head. During this time, the cattle inventory has ranged from a low of 244,100 in 1950 to a high of 513,400 in 1975 (figure 39). As shown in figure 39, the name change to Charles M. Russell National Wildlife Refuge was initiated in 1976 when there were 474,700 head of cattle in the six-county area. When the 1986 EIS for the refuge was completed in 1986, cattle numbers in this area were 338,000 head. When the 1986 EIS was implemented in 1991, cattle numbers were 329,400 head. In 2008, there were 382,400 head of cattle in the six-county area, while the refuge supplied 18,872 AUMs. This number has steadily declined from 22,470 AUMs supplied in 2001 to 17,883 AUMs in 2007, with a slight increase to 18,872 AUMs in 2008 (+5.5 percent over 2007 levels, yet –16 percent from 2001 levels). However, over this same period, the number of cattle in the six-county area has increased from 361,400 in 2001 to 382,400 in 2008 (+2.8 percent over 2001 levels).

AUM Inventory by County. In 2008, Fergus County had the highest inventory of cattle and calves, while Garfield County had the highest inventory of sheep and lambs (table 16).

As shown in table 17, of the Federal agencies supplying AUMs in the six-county region, BLM supplied the largest proportion (21 percent) in 2008, followed by DNRC with 7 percent and the Service with just less than 1 percent. Non-Federal grazing permits or owned or leased land supplied the remaining 72 percent of AUMs in the region.

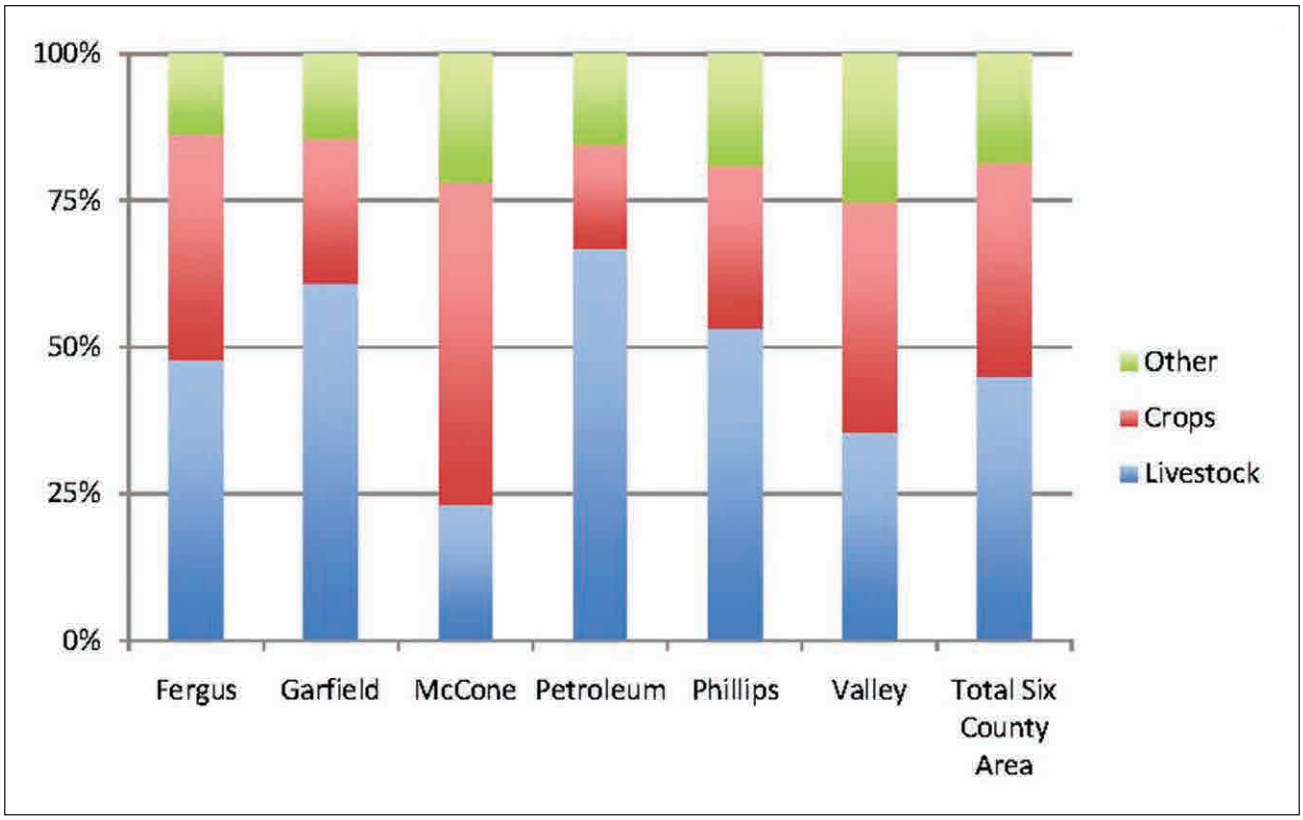


Figure 38. Chart of the breakdown of gross revenues from agriculture for the six counties surrounding the Charles M. Russell and UL Bend Refuges, Montana (2007). *Source: U.S. Department of Commerce 2008. Other sources of revenue for agricultural operations include Government payments, value of home consumption, machine hire and custom work, rental income, and income from forest products.*

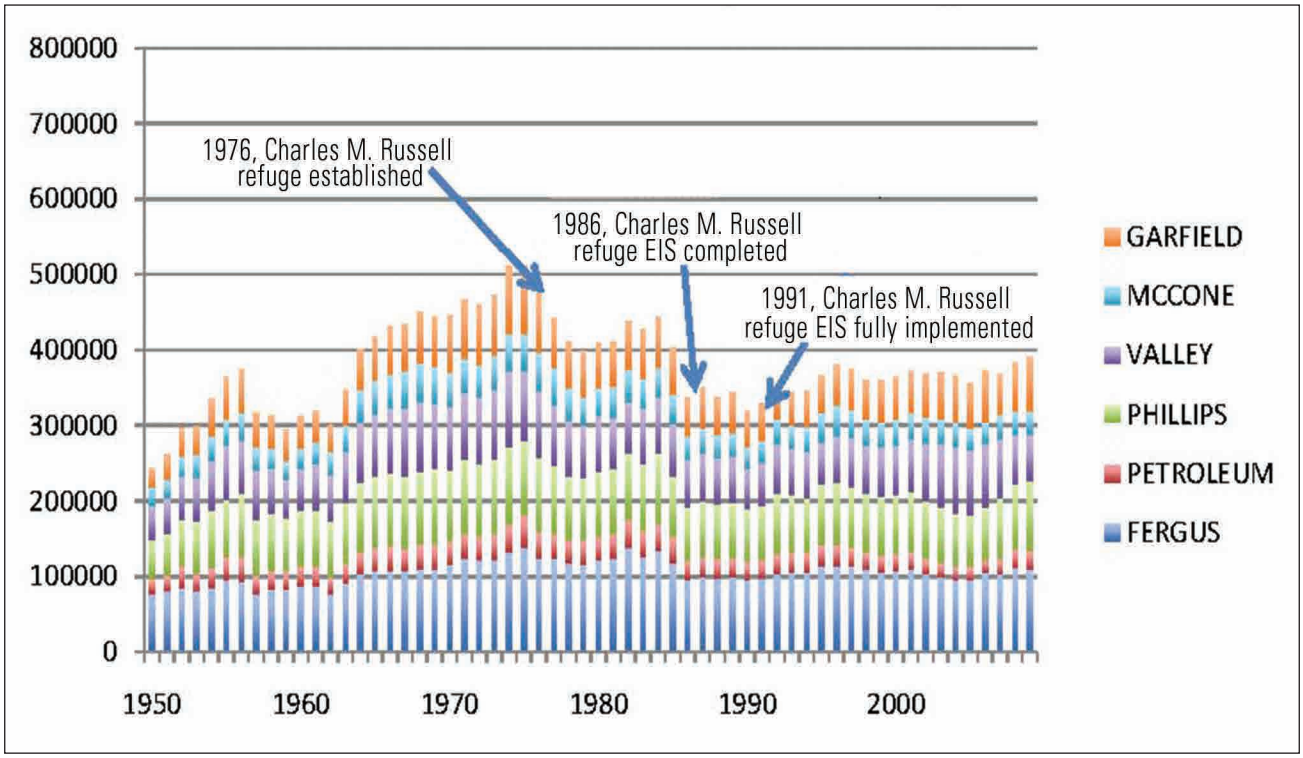


Figure 39. Chart of the cattle inventory for the six counties surrounding the Charles M. Russell and UL Bend Refuges, Montana (1950–2009). *Source: USDA 2008.*

Table 16. Animal inventory and animal-unit months (AUMs) of feed needed for the counties surrounding the Charles M. Russell and UL Bend Refuges, Montana.

County	*Cattle and calves inventory**	*Sheep and lamb inventory*	*Total AUMs of feed needed***
Fergus	116,094	6,062	711,113
Garfield	68,390	23,444	466,606
McCone	38,780	6,763	248,911
Petroleum	26,155	4,032	166,607
Phillips	80,791	10,511	509,972
Valley	71,167	2,184	432,244
Total	401,377	52,996	2,535,452

Source: USDA 2009, tables 12 and 17.

**Cows and calves are each counted as one unit. The agricultural census figure is the physical number of animals at the end of December, not the annual average, so is likely an underestimate.*

***Calculated as [(cattle and calves inventory / 2) × 12 months] + [(sheep and lamb inventory / 5) × 12 months]*

Table 17. Total animal-unit months (AUMs) for the counties surrounding the Charles M. Russell and UL Bend Refuges, Montana (2008).

County	*Total annual AUMs of feed needed* [1]	*U.S. Fish and Wildlife Service* [2]		*Bureau of Land Management* [3]		*Montana Department of Natural Resource Conservation* [4]		*Other*	
		AUMs	% of total AUMs	AUMs	% of total AUMs	AUMs	% of total AUMs	AUMs	% of total AUMs
Fergus	711,113	857	0.1	58,943	8.3	31,160	4.4	620,153	87.2
Garfield	466,606	7,088	1.5	91,961	19.7	32,784	7	334,773	71.7
McCone	248,911	2,601	1	40,135	16.1	18,951	7.6	187,224	75.2
Petroleum	166,607	501	0.3	65,302	39.2	13,017	7.8	87,787	52.7
Phillips	509,972	6,020	1.2	120,801	23.7	37,475	7.3	345,676	67.8
Valley	432,244	4,514	1	143,975	33.3	44,208	10.2	239,547	55.4
Total	2,535,452	21,581	0.9	521,117	20.6	177,595	7	1,815,159	71.6

[1] *Calculated as [(cattle and calves inventory / 2) × 12 months] + [(sheep and lamb inventory / 5) × 12 months] Dependency = agency AUMs / total AUMs of feed needed.*

[2] *U.S. Fish and Wildlife Service numbers are a 10-year annual average.*

[3] *BLM source: Rhodes, personal communication, April 2009.*

[4] *DNRC source: C. Rooney, personal communication, April 2009.*

[5] *Other = private and other non-State or non-Federal lands. This is actually an underestimate; the agriculture census is the physical number at the end of December, not the annual average.*

As shown in table 17 and figure 40, nongovernment lands supplied the most AUMs (ranging from 55 percent for Valley County to 87 percent in Fergus County) while the Service supplied the least amount (ranging from 0.1 percent for Fergus County to 1.5 percent for Garfield County). Although Valley County had the largest number of AUMs supplied by a Government agency (143,975 BLM AUMs), Petroleum County had the largest percentage of AUMs supplied by a Government agency (39.2 percent of BLM AUMs). Valley County had the largest reliance (both in absolute and percentage terms) on DNRC lands, with 44,208 AUMs (10.2 percent of total county AUMs).

Tourism and Recreation

This section describes how tourism and recreation in Montana and around the refuge affect the local economy.

Tourism and Outdoor Recreation in Montana and Counties Surrounding the Refuge. Montana residents and visitors to the State take part in a variety of outdoor recreation activities. According to the 2006 "National Survey of Fishing, Hunting, and Wildlife-Associated Recreation," approximately 950,000 residents and nonresidents took part in wildlife-associated activities in Montana (FWS 2008e). Of all participants, 31 percent fished for 2.9 million fishing days, 21 per-

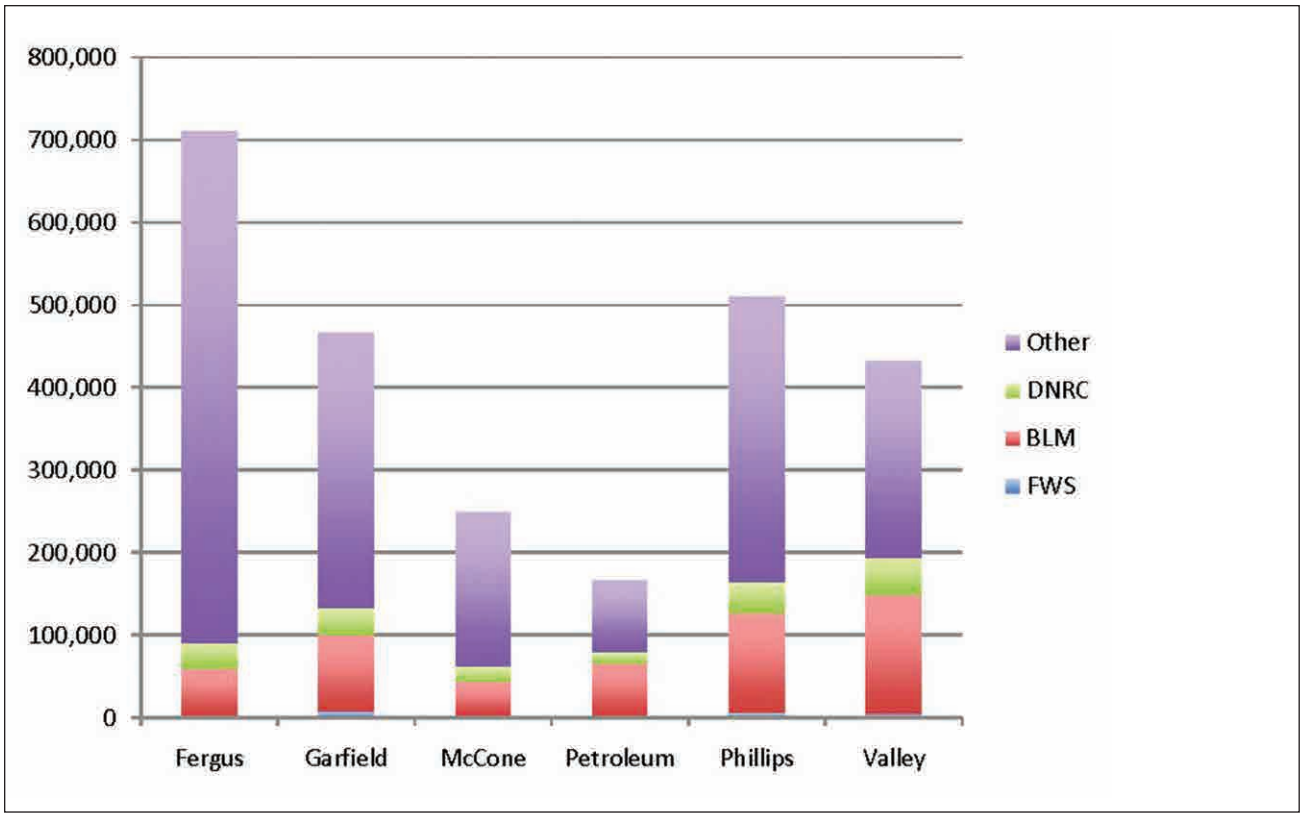


Figure 40. Chart of animal-unit months by agency for the six counties surrounding the Charles M. Russell and UL Bend Refuges, Montana (2007). *Source: USDA 2009.*

cent hunted for 2.1 million hunting days, and 79 percent participated in wildlife-watching for 3.1 million activity days. Montana residents had the highest per capita hunting participation in the country at 20 percent, and fishing participation was high at 23 percent. Most of the anglers (59 percent) and hunters (74 percent) in Montana were State residents, while most of the away-from-home, wildlife-watching participants in Montana were nonresidents (67 percent). These wildlife-associated activities in Montana generated $1.1 billion in 2006, with $231 million generated from fishing activities, $311 million from hunting activities, and $376 million from wildlife-watching activities.

Tourism and Recreation in Travel Regions Surrounding the Refuge. Montana is divided into six travel regions for similar historical, cultural, climatic, and geological features. The six-county area surrounding the refuge falls into two travel regions. Fergus and Petroleum Counties are included in the Russell Country travel region, which encompasses the north-central part of the State including Great Falls. Garfield, McCone, Valley, and Phillips Counties are included in the Missouri River Country, which encompasses most of the refuge and the northeastern part of the State.

While travel, tourism, and recreation contribute significantly to Montana's economy, most of these activities occur in the western parts of the State, bringing substantially less benefits to the Russell Country and Missouri River Country travel regions compared to the other regions. Among all of the nonresident overnight stays in Montana in 2005, only 8 percent of nights were spent in the Russell Country and 3 percent in the Missouri River Country (Rademaker and Nickerson 2006). Similarly, nonresident expenditures in Russell Country accounted for 8 percent of the State total (Oschell and Nickerson 2006b), while Missouri River Country accounted for 1 percent (Oschell and Nickerson 2006a). Lodging tax revenue growth was also lower in Russell and Missouri River Country travel regions. Both regions experienced approximately 8 percent growth from 1995 to 2005 (adjusted for inflation in 2005 dollars) while the other four travel regions experienced 19–39 percent growth during the same period (Montana Department of Commerce 2008).

Nevertheless, Russell Country received 976,140 visitors in 2005 who spent $216.8 million in the travel region for various travel-related expenses (Oschell and Nickerson 2006b). Travelers to Russell Country took part in activities similar to those visiting Missouri River Country, such as driving for pleasure (55 percent), wildlife watching (40 percent), visiting Lewis and Clark sites (31 percent), recreational shopping (29 percent), day hiking (29 percent), visit-

ing historical sites (26 percent), picnicking (26 percent), and visiting museums (26 percent). The refuge was visited by 8 percent of the Russell County visitors, and was the sixth most visited site.

Likewise, 283,013 nonresident visitors traveled to the Missouri River Country, spending $32.9 million in the area for expenses such as gas, food, shopping, and lodging (Oschell and Nickerson 2006a). Visitors to Missouri River Country took part in activities such as driving for pleasure (46 percent), wildlife watching (39 percent), visiting museums (31 percent), day hiking (29 percent), picnicking (28 percent), visiting Lewis and Clark sites (27 percent), visiting historical sites (20 percent), developed camping (20 percent), and fishing (16 percent). Fort Peck Lake, which lies within the refuge, was the second most visited site among all Missouri River Country nonresident visitors (21 percent), and the refuge was the fourth most visited site (14 percent).

LAND USE and OWNERSHIP CHANGES SURROUNDING the REFUGE

Outdoor recreational amenities are an important factor in attracting and keeping residents and small businesses in the West (Rasker and Hansen 2000, Rasker 2006). Migrants to the West have been found to select work and residences based on scenic amenities, access to recreational opportunities, and a desire to escape urban problems (Egan and Luloff 2000, Rudzitis 1999, Rudzitis and Johansen 1989, Salant et al. 1997, Vias 1999). Rapidly rising land prices in western Montana are also spurring demand, especially among recreational buyers, for large tracts of land in eastern and central parts of the State (Norman C. Wheeler and Associates 2008). The aging landowner population has further contributed to the turnover of land from production to rural residential development (Johnson 2004).

Seasonal and Recreational Housing

The number and proportion of housing units designated for seasonal or recreational use can provide insight into the types of landowners in an area, which is important for several reasons. Absentee landowners may have different opinions of how the refuge should be managed. Seasonal or part-time residents typically do not generate as much local economic activity because they make fewer purchases within the region and generate less income tax revenue. However, they will continue to pay property taxes and, because they do not require services year-round, they will typically require fewer local government services over the course of a year compared to full-time residents.

Much of the land surrounding the refuge is owned by BLM. The remaining is mostly in private ownership. As shown in table 18, the six-county area surrounding the refuge experienced an increase in seasonal housing units between 2000 and 2008, which may reflect the recent trend in private property purchases for hunting and other recreational uses in areas surrounding the refuge (Barron Crawford, project leader, Charles M. Russell National Wildlife Refuge; personal communication, fall 2009). However, the proportion of seasonal-use housing units rose only very slightly. Valley and Garfield Counties have the highest number of seasonal units, which can be partially attributed to the presence of leased cabin sites within refuge recreation areas in those counties. Garfield County has the highest proportion, by far, of seasonal housing, which is in line with its designation as a retirement destination, assuming that a significant number of those retirees are only part-time residents of the county.

Table 18. Seasonal housing in the counties surrounding the Charles M. Russell and UL Bend Refuges, Montana.

County	*Seasonal housing units*		*% of total housing units*
	2000	% Change from 1990	2000
Fergus	187	3	3.4
Garfield	293	12	30.5
McCone	107	–14	9.8
Petroleum	28	–30	9.6
Phillips	264	4	10.6
Valley	376	43	7.8
Total	1,255	3	12

Historically property sales in eastern Montana were made primarily by agricultural operators from western Montana seeking to move or expand their operations to a more affordable area. This trend is shifting more toward individuals and investors interested in the recreational amenities such as hunting and fishing. As a result, the number of seasonal units is expected to continue increasing in eastern Montana including the areas surrounding the refuge.

Most of the access roads to the refuge lands cross private lands. These mostly dirt roads are not designated as public roads or do not have rights-of-way or easements owned by local, State, or Federal governments. As a result, some roads on private lands that the public have traditionally used to access the refuge are being closed by private landowners, and the closures are reducing the number of access roads available to the public (Barron Crawford, project leader, Charles M. Russell National Wildlife Refuge; personal communication, fall 2008). These closures are seen more on lands that have recently been sold to

new owners, many of whom have bought land for private hunting access or paleontological resource use.

Changing Land Use near the Refuge

Next to the northern border of the refuge near the eastern end of the UL Bend National Wildlife Refuge in Phillips County lies the American Prairie Reserve managed by the American Prairie Reserve. As of 2011, the foundation had more than 123,000 acres in deeded and leased land acquired since 2004 for a prairie-based wildlife reserve (American Prairie Foundation 2011). Within the reserve is a 2,600-acre enclosed bison range that supports a herd of nearly 200 bison (as of spring 2010) initially translocated from Wind Cave National Park in South Dakota. The foundation plans to continue acquiring land for the preserve, as well as expand the bison herd and bison range, restore other native prairie wildlife, preserve human history, and manage the preserve for public use such as hiking, birdwatching, camping, and hunting.

A socioeconomic impacts analysis conducted for American Prairie Reserve in 2002 concluded that, under most examined scenarios, the regional economic impacts of eliminating cattle grazing on the proposed prairie reserve would be more than offset by conservation management expenditures (Duffield and Neher 2002). However, as a result of the establishment of the American Prairie Reserve, Phillips County has experienced negative economic impact from the loss of grazing as well as associated retail sales (Dunbar and Robinson, Phillips County commissioners; personal communication, fall 2008). Other residents fear that the purchases of large acreage of land by nonprofit conservation groups as well as nonresident buyers are replacing family-oriented farms with absentee owners who contribute little to local schools and businesses (Thackeray 2006).

The Nature Conservancy manages the 60,000-acre Matador Ranch located north of the refuge along Highway 191 near Zortman, Montana. The ranch is leased out to area ranchers at discounted rates, and ranchers agree to take certain conservation actions on their own grazing lands in exchange (Red Lodge Clearinghouse 2008). As part of the partnership, ranchers protect prairie dog colonies and sage-grouse leks, control invasive plants and agree not to plow their grazing lands during their leases. As a result, many of the ranchers have received the Montana State University's Undaunted Stewardship Certification. The partnership also resulted in the formation of the Ranchers Stewardship Alliance, a community-based conservation group that promotes "ecological, social and economic conditions that will sustain the biodiversity and integrity of America's northern mixed-grass prairie for present and future generations" (Ranchers Stewardship Alliance 2008).

A recent report by the World Wildlife Fund (Freese et al. 2009), highlights the expanding role of nature-based economic activities in supporting and diversifying the economic structure in northern Great Plains communities. The report suggests that "landowners, businesses, and local communities may be able to increase and diversify economic activities through three major categories of nature-based economic development: (1) natural amenities, which include those natural features of the landscape that make a place attractive for visiting (for example, ecotourism and hunting) or living; (2) ecosystem products, which include commercial products harvested from native or seminative ecosystems, such as native plant seeds and native vegetation, whether harvest directly as hay or indirectly by livestock grazing; and (3) other ecosystem services, which include many services from healthy ecosystems for which no or only quasi-markets exist, such as provisions for clean water, prevention of soil erosion, and carbon sequestration, and nonuse services such as the value people derive from knowing wildlife exists and from conserving wildlife for future generations" (Freese et al. 2009).

ATTITUDES, VALUES, and BELIEFS

As much of the data presented in this report show, eastern Montana is a changing landscape. Over the past several years, there have been changes in demographics, changes in prevailing economic sectors, and changes in land use and ownership patterns. Many of these changes are interrelated. When evaluating both historical and anticipated future change, it is important to understand public attitudes, values and beliefs toward the resources the refuge aims to protect and the effects of refuge management on the community. This information provides insight into closely held opinions about quality of life issues not as easily captured with demographic information provided in this report.

Public values toward wildlife are changing across the United States, in particular in the western United States. A study examining people's views about wildlife in 19 western States (Teel et al. 2005) identified four types of values people hold toward wildlife, called wildlife value orientations. These wildlife value orientations are related to people's support toward management actions and participation in wildlife-associated recreation. The "utilitarian" value orientation is associated with the belief that wildlife should be used and managed for human benefit, whether it is for recreational, personal, or economical purposes. On the other hand, the "mutualist" value orientation is associated with the belief that humans and wildlife are meant to coexist or live in harmony. Those who possess both utilitarian and

mutualist values are called "pluralist." The final category, "distanced," is given to those who do not have either a utilitarian or a mutualism orientation, and generally have a lack of interest in wildlife-related issues and less participation in wildlife-related activities compared to the other value orientation types.

Results from the study suggest that the western United States as a whole is gradually moving away from the more traditional utilitarian value orientation and moving more toward the less traditional mutualist value orientation (table 19). In Montana, however, nearly half of the State (47 percent) was found to hold the traditional utilitarian value orientation, while only 19 percent were categorized as mutualists. Considering that the area surrounding the refuge is considerably more rural compared to some of the western portions of Montana, it is likely that even higher proportions of residents around the refuge hold utilitarian value orientations toward wildlife, while those living in urban areas of the State hold more mutualist value orientations. This suggests that visitors to the refuge from nearby counties may be more interested in hunting and other consumptive activities on the refuge, while those coming from urban areas may be more interested in nonconsumptive activities such as wildlife watching. This may also affect the type of hunting experience visitors are seeking.

In addition to people's general perceptions about wildlife and natural resources, their attitudes toward the refuge and its management specifically form the basis of their level of support for management actions. The Service's public scoping process revealed several important qualities of the refuge that residents of the six-county area value. Some people expressed appreciation for the intrinsic values of the refuge (such as its scenic beauty, remoteness, abundance of wildlife, and unique ecosystem), while others expressed appreciation for the recreational value that the land provides (such as hunting, fishing, and wildlife watching) (FWS 2008b). In addition to these intrinsic and recreational values, local residents emphasized two other values associated with the refuge: historical value and economic value. Many residents in the area have had family ties to the land for several generations, and strive to keep unique traditions and way of life for its historical value. Local communities derive economic value from the refuge through grazing leases, as well as the money that recreational visitors spend in the region. However, some local residents believe that past management approaches in the refuge have negatively affected the local economy, while others believe that increasing visitor numbers to the refuge will require more infrastructure maintenance in local communities.

Table 19. Wildlife value orientations and proportions in the western States and Montana.

Wildlife value orientation type	*Description*	*Percent in 19 western States*	*Percent in Montana*
Utilitarian	Believe that wildlife should be used and managed for human benefit.	34	47
Mutualist	Believe that humans and wildlife are meant to coexist or live in harmony.	33	19
Pluralist	Hold both a mutualism and utilitarian value orientation toward wildlife.	20	27
Distance	Distanced from the issue of wildlife. Do not hold either a mutualism or a utilitarian orientation toward wildlife.	13	7

Source: Teel et al. 2005.