CHAPTER 3—Refuge Resources

Bob Danley/USFWS

Sagebrush buttercup is one of many plant species found on Lee Metcalf National Wildlife Refuge.

This chapter describes the characteristics and resources of the Lee Metcalf National Wildlife Refuge in Montana and is organized in the following sections:

- 3.1 Physical Environment
- 3.2 Biological Resources
- 3.3 State and Federally Listed Species
- 3.4 Cultural Resources
- 3.5 Special Management Areas
- 3.6 Visitor Services
- 3.7 Management Uses
- 3.8 Socioeconomic Environment
- 3.9 Partnerships
- 3.10 Operations

3.1 Physical Environment

The following sections describe aspects of the physical environments that may be affected by implementation of the CCP. Physical characteristics include climate and hydrology, climate change, physiography and geography, soils, topography and elevation, and air quality. Unless otherwise noted, the information in this section is from unpublished Service data or a hydrogeomorphic (HGM) report entitled "An Evaluation of Ecosystem Restoration and Management Options for Lee Metcalf National Wildlife Refuge," which was developed by Greenbrier Wetland Services (Heitmeyer et al. 2010).

Climate and Hydrology

The climate of the Bitterroot Valley is characterized by cool summers, generally light precipitation, little wind, and relatively mild winters. Annual precipitation averages about 13 inches but is variable related to position in the valley (figure 6). Precipitation increases with elevation along the valley margins and ranges from less than 13 inches in the Bitterroot Valley floor to nearly 60 inches near the Bitterroot Mountain summits on the west side of the valley. In contrast, precipitation along the crest of the Sapphire Mountains on the eastern margin of the valley is about 25–35 inches per year. The growing season in the Valley averages about 103 days; on average, the last freeze occurs May 30, and the first frost occurs September 10. Spring is the wettest period of the year, with about 25 percent of the annual precipitation falling in May and June (Heitmeyer et al. 2010). Runoff in the Bitterroot River is highest in spring, with about 55 percent of the river's discharge occurring in May and June following snowmelt and local rainfall (McMurtrey et al. 1972). Natural flows in the Bitterroot River decline from spring peaks throughout the summer and remain relatively stable through winter. On average about

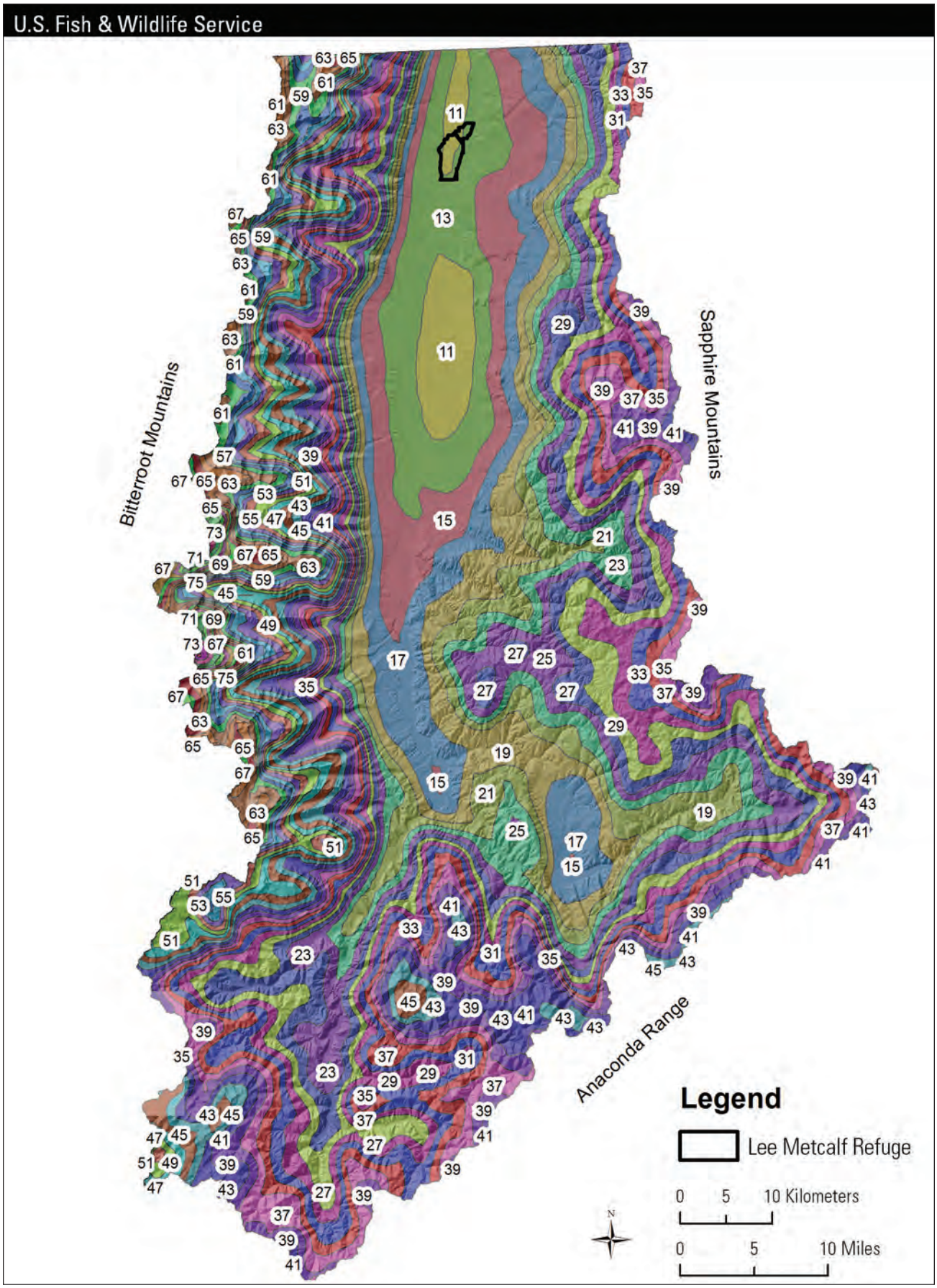

Figure 6. Ravalli County, Montana, average annual precipitation (inches) (USDA 2012).

1.772 million acre-feet of water flows into the Bitterroot basin via the Bitterroot River each year. Of this, 52 percent flows from the west, 37 percent flows from the south, and 11 percent flows from the east (Briar and Dutton 2000).

Numerous tributaries enter the Bitterroot Valley from mountain canyons. North Burnt Fork Creek and Three Mile Creek are major tributaries flowing across Lee Metcalf Refuge into Francois Slough and North Island Slough, respectively (figure 7). Other minor, within-floodplain drainages that historically crossed refuge land and ultimately emptied into the Bitterroot River included, Swamp Creek, Rogmans Creek, and the modified McPherson and Nickerson Creeks (now called Ditches). Rogmans Creek's historical channel is now covered by Ponds 2–10 and Otter Pond. Rogmans Creek was renamed "Spring Creek" on the 1967 U.S. Geological Survey topographical map. Valley-wide, about four times as many tributaries join the river from the Bitterroot Mountains on the west compared to the drier Sapphire Mountains on the east.

Records of flow and flood frequency relationships for the Bitterroot River near Florence date back to 1950. For this period of record, the river exceeded 1,050 cubic feet per second (cfs) at a 50-percent recurrence interval, or a frequency of every other year. Bank full discharge at Florence is about 13,000 cfs. This high flooding discharge causes extensive flooding throughout higher floodplain areas (figure 8) but occurs very infrequently (that is, at a greater than 50-year recurrence interval). At flows greater than 10,000 cfs, some modest backwater flooding on the refuge occurs with a greater than 7-foot stage height (USFWS 1974). This spring backwater flooding into connected floodplain sloughs and oxbows occurs regularly (that is, at a 5–10 year recurrence interval).

The Darby stream gauge station, approximately 35 miles upstream of the refuge, has the longest period of record for discharge on the Bitterroot River (beginning in 1937). Discharges on the Bitterroot River at Darby have less influence from irrigation return flow; accordingly, this gauge station represents the best location to evaluate relatively natural long-term patterns in riverflow. Records of peak discharge at Darby from the 1940s suggest some higher periodic discharge (greater than 10,000 cfs) at about 20- to 25-year intervals, with intervening years of moderate to low flows (figure 9). During the period of record, more very low flow (less than 4,000 cfs) years, about 20, occurred than did more average flow (greater than 8,000 cfs) years, about 16. In summary, river gauge data suggest the floodplain at the refuge was seldom extensively flooded historically (for example, 1974; figure 8), but that some backwater flooding into primary sloughs and tributaries occurred at a less than 50-percent recurrence interval in spring.

Many of the morphological characteristics of capillary (or secondary) channels of the Bitterroot River floodplain, including those at the refuge (such as Three Mile, Rogmans, McPherson, and Nickerson Creeks and Francois Slough), show an intimate connection with ground water discharge (Gaeuman 1997). Large upstream and downstream variations in discharge within individual channels, and observed springs along the margins of floodplain terraces reveal a substantial subsurface flow. Many of these channels are probably remnants of formerly large channels (including past abandoned channels of the Bitterroot River) that have filled incompletely. In other cases, ground water discharge may be actively excavating channels that seem to be growing by head cuts (abrupt changes in streambed elevation).

Alluvial aquifers in the Bitterroot Valley are generally unconfined and interconnected, although the configuration of water-bearing layers in the heterogeneous valley fill is highly variable (Briar and Dutton 2000). Permeability is highest in alluvium of the low Quaternary terraces and floodplain, and hydraulic conductivity of up to 75 feet per day has been calculated in low terrace alluvium. Ground water circulation is predominantly away from the valley margins toward the Bitterroot River. The basin-fill aquifers are recharged by infiltration of tributary streams into coarse terrace alluvium, subsurface inflow from bedrock, and direct infiltration of precipitation and snowmelt. High amounts of precipitation on the western side of the valley cause greater recharge in this area than on the east side of the valley. Ground water discharge occurs through seepage to springs and streams, evapotranspiration, and now by withdrawals from wells. Water in basin-fill aquifers is primarily a calcium bicarbonate type. Median specific conductance is about 250 microsiemens per centimeter at 77 °F, and median nitrate concentration is relatively low—0.63 milligrams per liter (mg/L)—within the aquifer. Nitrate concentration in surface waters may reach 6 mg/L (Briar and Dutton 2000).

Climate change

The U.S. Department of the Interior issued an order in January 2001 requiring Federal agencies under its direction with land management responsibilities to consider potential climate change effects as part of long-range planning endeavors. The U.S. Department of Energy's report, "Carbon Sequestration Research and Development" (1999), concluded that ecosystem protection is important to carbon sequestration and may reduce or prevent loss of carbon currently stored in the terrestrial biosphere. The report defines carbon sequestration as "the capture and secure storage of carbon that would otherwise be emitted to or remain in the atmosphere."

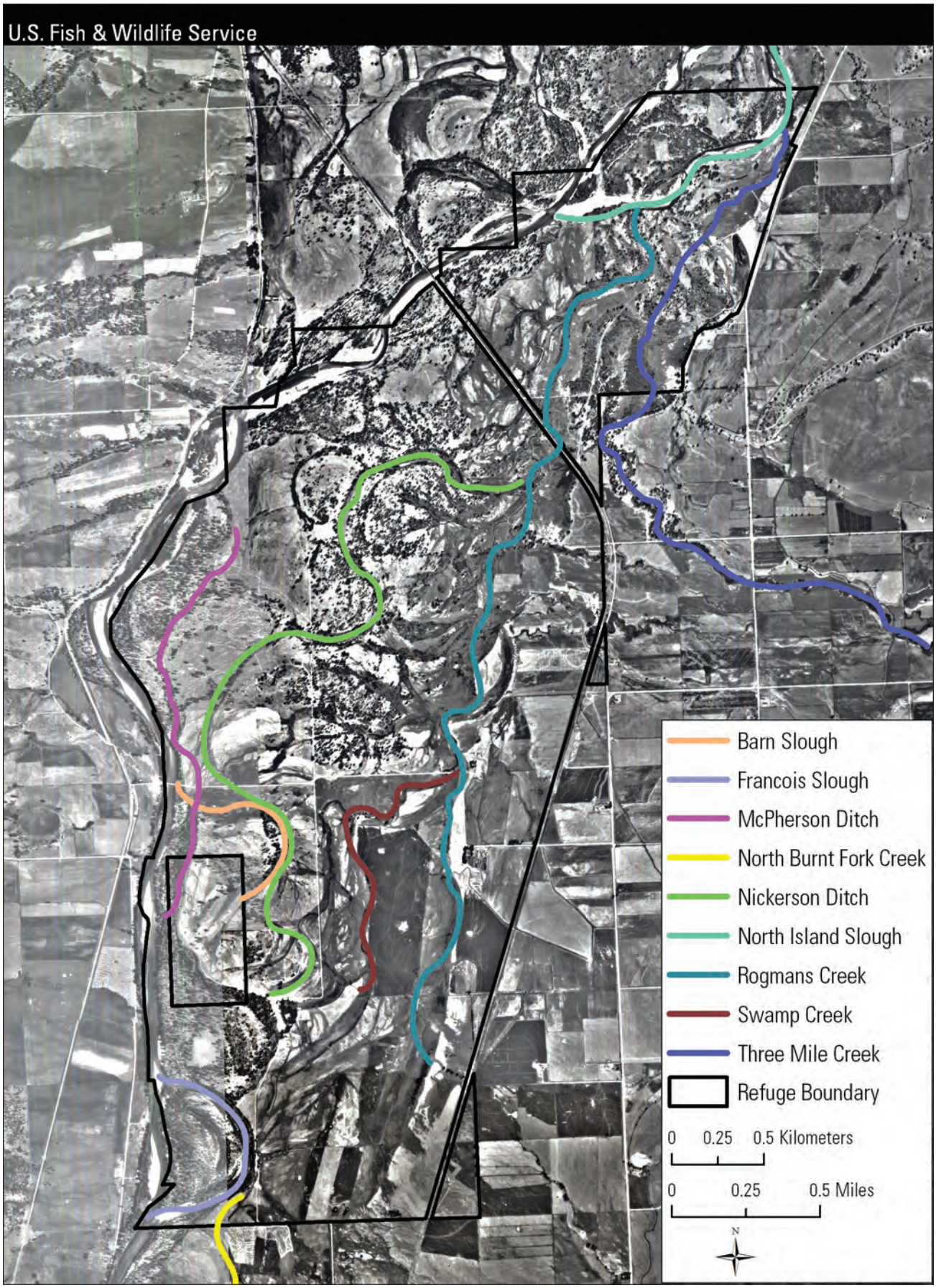

Figure 7. Primary channels and sloughs present at Lee Metcalf National Wildlife Refuge, Montana, in the 1940s.

USFWS

Figure 8. Flooding of the Bitterroot River on Lee Metcalf National Wildlife Refuge, Montana, in 1974.

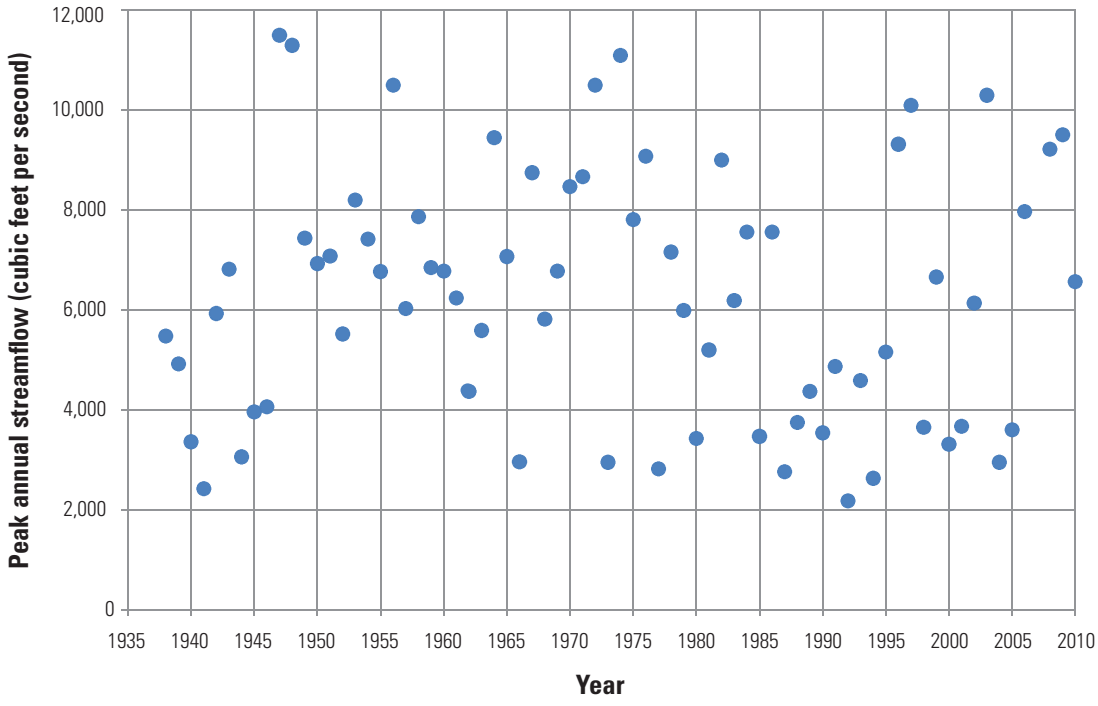

Figure 9. Bitterroot River streamflow near Darby, Montana (USGS 2011).

Bob Danley/USFWS

Although prescribed burning releases CO_2, there is no net loss of carbon because new vegetation quickly germinates or regrows to replace the burned-up biomass.

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 is a tremendous factor in carbon sequestration. Large, naturally occurring communities of plants and animals that occupy major habitats—grassland, forest, wetland, tundra, and desert—are effective both in preventing carbon emission and in acting as biological scrubbers of atmospheric CO_2.

One Service activity in particular—prescribed burning—releases CO_2 directly to the atmosphere from the biomass consumed during combustion. However, there is no net loss of carbon because new vegetation quickly germinates or regrows to replace the burned-up biomass. This vegetation sequesters an approximately equal amount of carbon as was lost to the air (Dai et al. 2006).

Climate data for Montana show a slight reduction in annual precipitation and increases in temperatures over the last 100 years (National Climatic Data Center 2011). Climate change impacts predicted in the Rocky Mountains are rising temperatures, less snow, less water in snowpacks, earlier spring snowmelts, and lower streamflows in the summer. These changes will in turn lead to increased forest ecosystem water stress, increased winter temperatures, earlier snowmelts, and longer summer drought periods. With this warming trend, the growing season will increase, but with limited water resources, forest ecosystems will be water stressed and most likely begin to release CO_2 instead of acting as net absorbers of CO_2 (Running 2010). Other impacts anticipated include increased wildfires and insect infestations. This change in climate could also alter vegetation patterns and species, possibly allowing for additional invasive species to become established. Invasive plants could spread more rapidly, the effectiveness of control methods may be altered, and certain species would likely survive the drier and milder climates, thereby outcompeting native plants.

Stronger and more frequent droughts associated with climate change could cause waterfowl and other waterbirds to lose breeding and stopover habitat. Because of the valley-floor location of this refuge, it is expected that ground water would continue to surface at least though the life of this plan. In addition, changes in the timing of migration and nesting could put some birds out of synchronization with the life cycles of their prey. Natural food sources for wildlife could be reduced or eliminated.

As surface water supplies might decrease with climate change, the refuge could depend more on subsurface water sources; this would increase management costs due to the challenges of pursuing ground water that has also been depleted by increased demand. Less ground water recharge, along with a greater demand for human consumption and irrigation, could limit water available for wildlife purposes. Increased potential exists for managed wetlands that depend on runoff and delivered water to not receive adequate amounts of water for waterbird habitat. Water impoundments might go dry more often and for possibly longer periods of time. Compatible public use activities may be affected on Service lands due to degraded habitats and less wildlife. Furthermore, climate change could displace local ranchers and farmers if they could no longer produce enough crops and livestock to maintain the viability of their businesses; this could cause an even greater change in land use as ranches and farms become further subdivided and developed.

Physiography and Geology

The Bitterroot Valley, where the Lee Metcalf Refuge is located, is a north-trending basin bounded by the Bitterroot Mountains on the west and the Sapphire Mountains on the east. These mountains and the rich montane Bitterroot Valley date to nearly 90 million years before the present (B.P.) (Hodges and Applegate 1993). The Bitterroot Valley extends about 120 miles from the confluence of the east and west forks of the Bitterroot River south of Darby to its junction with the Missoula Valley and Clark Fork River 5 miles south of Missoula. The elevation of the valley floor ranges from about 3,900 feet above mean sea level (amsl) in the south to about 3,200 feet amsl near Missoula. Summit elevations of surrounding mountains range from 6,000 to 8,000 feet amsl in the Sapphire Range and exceed 9,500 feet amsl in the Bitterroot Range.

The Bitterroot Mountains are composed of granitic rocks, metamorphic materials, and remnants of pre-Cambrian sediments of the Belt series. The Sapphire Mountains are mostly Belt rocks with localized occurrences of granitic stocks.

The unusually straight front of the Bitterroot Range is a zone of large-scale faulting (Langton 1935, Pardee 1950); however, the Bitterroot Valley shows little sign of recent tectonic activity (Hyndman et al. 1975). Undisturbed valley fill shows that tectonic movement since the early Pliocene has been slight or that the entire valley floor has moved as a single unit. The structural basin of the Bitterroot Valley has accumulated a considerable thickness of Tertiary sediments capped in most places by a layer of Quaternary materials. Surficial geology evidence suggests Tertiary fill in the Bitterroot Valley may be up to 4,000 feet thick in some locations (Lankston 1975). Sediment is coarse colluviums near the fronts of mountains with finer-grain alluvial fill deposits that interfinger with floodplain silts and clays. Channel deposits of the ancestral Bitterroot River lie beneath the valley center.

Low terrace alluvium occurs as outwash, or alluvial fans, below the mouths of tributaries on both sides of the valley (Lonn and Sears 2001). Floodplain alluvium is mostly well-rounded gravel and sand with a minor amount of silt and clay derived from the edges of the neighboring terraces and fans. Most of the refuge is mapped as Qal alluvial deposits of recently active channels and floodplains. These deposits are well-rounded, and sorted gravel and sand with a minor amount of silt and clay. Minor amounts of Qaty (younger alluvial outwash terrace and fan complex deposits from the late Pleistocene) occur next to the Bitterroot Valley alluvium on the north end of the refuge. Materials in these terraces are well-rounded and sorted gravel of predominantly granitic, gneissic, and Belt sedimentary origin (Lonn and Sears 2001). Qafy surfaces extend along the Bitterroot Valley on both sides of the refuge. These surfaces are younger (late Pleistocene) alluvial outwash terrace and fan complexes of well-rounded cobbles and boulders in a matrix of sand and gravel deposited in braided-stream environments that formed between and below the dissected remnants of older fans. These surfaces appear to have been at least partly shaped by glacial Lake Missoula, which reached an elevation of 4,200 feet and covered the Bitterroot Valley near the refuge 15,000–20,000 years B.P. during the last glacial advance (Weber 1972).

The Bitterroot River has an inherently unstable hydraulic configuration and high channel instability, particularly between the towns of Hamilton and Stevensville (Cartier 1984, Gaeuman 1997). The river reach immediately upstream from the refuge has a complex pattern that is characterized by numerous braided channels that spread over a wide area of the valley bottom. The zone of non-vegetated gravels associated with this main braided channel system has widened and straightened since 1937 (Gaeuman 1997). In addition to this widening, severe bank erosion is common, but numerous cutoff chutes counteract some lateral bend displacement. Together, active river movements and a braided river channel pattern create low riverbanks and natural levees that encourage chutes and other avenues of river overflow. A complex network of minor channels occurs in the valley floor including the floodplain lands on the refuge (figure 10). These minor channels appear to flow from ground water discharge, which promotes erosion at slope bases and headwater retreat of small channel head cuts on the floodplain. Channel fragmentation appears to be controlled by irregularities in the respective elevation gradients of the valley.

About 10–15 miles north of Stevensville, the Bitterroot River channel is more confined, compared to its highly braided form farther south. Despite limited changes in river shape north of Stevensville, the river stretch along the refuge has maintained a highly dynamic, instable channel form due to its geological, topographic, and hydraulic position. The historical floodplain at the refuge was characterized by the following: (1) multiple abandoned channels (for example, Barn and Francois Sloughs) that were connected with the main river channel during high-flow events; (2) small within-floodplain channels (for example, Rogmans and Swamp Creeks) that received water from ground water discharge and occasional overbank backwater flooding during high-flow events; (3) entry of two mountain- or terrace-derived major tributaries to the Bitterroot River (for example, North Burnt Fork Creek and Three Mile Creek); (4) slightly higher elevation inter-drainage point bars, natural levees, and terraces; and (5) alluvial fans (figure 7).

Soils

Nearly 25 soil types or groups currently identified by the U.S. Department of Agriculture Soil Survey Geographic Databases are present on or next to the Lee Metcalf Refuge. The most extensive soils are Riverrun-Curlew-Gash complex, Ambrose creek sandy loams, and Riverside-Tiechute-Curlew complexes. Current soil maps of the refuge are constrained by numerous water impoundments where no soil type is identified and each impoundment area is simply identified as water. Consequently, soil surveys conducted before major floodplain developments and impoundment construction are more useful for understanding soil types. These soil surveys can also be used to determine the historical distribution of plant communities.

The combination of soils on the refuge is complex and highly interspersed, and it reflects the numerous channel migration events across the floodplain. It also reflects the introduction of mixed-erosion sediments from surrounding Quaternary and Tertiary terraces and alluvial deposition of Bitterroot Valley parent materials. Most soils on the refuge are shallow, with thin layers of silts and clays overlying deeper sands and gravels. In many places sandy outcrops occur, especially near the Bitterroot River.

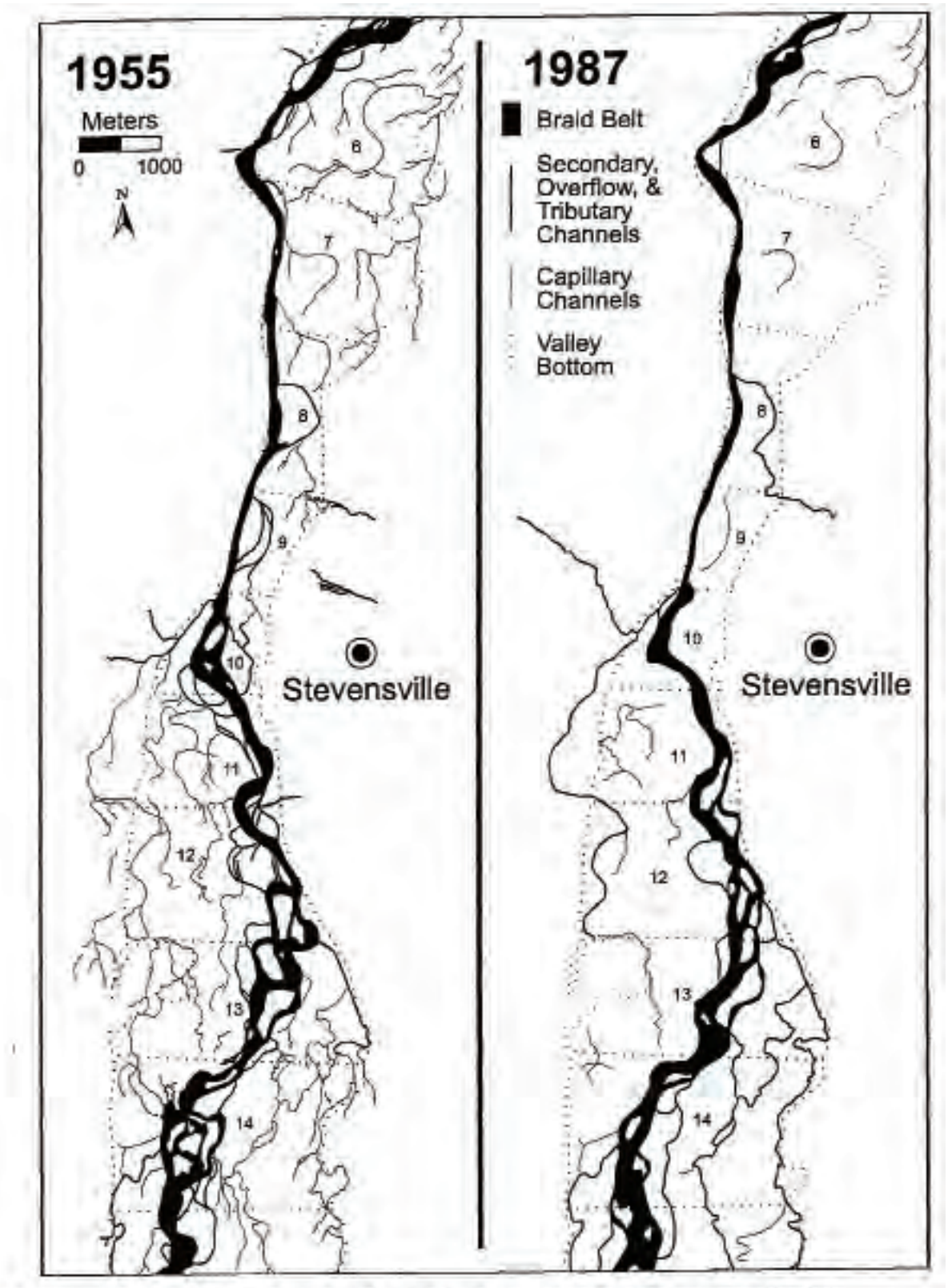

Figure 10. Network of minor channels occurring in the valley floor on Lee Metcalf National Wildlife Refuge, Montana (Heitmeyer et al. 2010).

Topography and elevation

Elevations on the Lee Metcalf Refuge range from about 3,230 feet on its north end to about 3,260 feet on its south end at the river (figure 11). The topographic variation within the refuge is related to the historical channel migrations of the Bitterroot River and its tributaries, scouring and natural levee deposition along minor floodplain channels, and alluvial deposition. A large southeast portion of the refuge contains higher, more uniform elevations while north and west portions of the refuge have lower, more diverse elevations. Alluvial fans are present in many locations along the Qafy geomorphic surfaces on the east side of the refuge. A larger tributary fan is present where North Burnt Fort Creek enters the Bitterroot River floodplain; this fan is much larger than the alluvial fans along the floodplain margin that grade into the Sapphire Mountains.

Water rights

The refuge has a complex system of irrigation ditches, springs, creeks, impoundments, and water control structures for moving water within the refuge to fill the various impoundments and to irrigate upland fields. In 1982, the refuge submitted 24 water right claims in response to State Senate Bill 76, which mandated adjudication of pre-1973 State water rights. These 24 pre-1973 claims total 31,297.88 acre-feet per year. There is also one post-1973 storage permit (300 acre-feet per year) and two domestic well permits (11.5 acre-feet per year) that increase the total refuge-owned water rights to 31,609.38 acre-feet per year (table 4). Most of these rights are supplemental, meaning the water sources are commingled to supply the refuge needs for optimum operation. In addition, the refuge receives up to 2,600 acre-feet per year (average diversion rate of 8.57 cubic feet per second) from the Supply Ditch Association to augment refuge water rights. This water flows through three lateral irrigation ditches and costs approximately $3,600 annually; however, the refuge does not receive this water at a rate of 8.57 cfs for a variety of reasons including the lack of ditch capacity and side diversions. Post-1973 claimed, permitted water rights total 34,209.38 acre-feet per year.

In 2008, the Department of Natural Resources and Conservation of the State of Montana began examining water right claims for the refuge. In this process, a claims examiner reviews various elements to determine the validity and necessity of each claim. A preliminary decree is anticipated to be issued by the water courts in the next few years. After the objection process is completed and the water court is satisfied, the claim representing prior use and a final decree will be issued.

Water is diverted on the refuge to store approximately 2,079 acre-feet of water on 795 acres of wetland impoundments. Water is also used for grassland units on approximately 205 acres. The main season of water use is from mid-March until early December. This varies with water conditions as determined by annual precipitation, snowmelt, and availability of water from the Supply Ditch. Adequate water is important to provide spring and fall migration stopover habitat for migratory birds and for irrigation of habitat restoration sites within upland fields during the summer. During the winter, most impoundments are kept full to provide water for resident species such as bass, aquatic invertebrates, and wintering waterfowl.

Hydrogeomorphic changes

The Bitterroot River stretch at the Lee Metcalf Refuge lies near the geomorphic threshold between a highly braided river channel pattern from Hamilton to Stevensville and a straight or sinuous channel pattern immediately downstream (figure 10). Consequently, the river channel pattern for the area is changing and highly sensitive to perturbation (for example, inputs of sediment, changes to shading or discharge) (Gaeuman 1997). The combination of irrigation development and land use changes, mainly in the 1900s, significantly altered hydrology and river channel morphology and movement in the Bitterroot Valley and its floodplains and facilitated degradation and loss of wetlands in this ecosystem (for example, Kudray and Schemm 2008). The extensive irrigation network of the Bitterroot Irrigation District led to construction of reservoirs, ditches, water diversion structures, and modified natural drainage routes. Stream channel networks, common in the Bitterroot Valley near the refuge, were altered by culvert and bridge crossings, railroad levees and beds, and extensive channelization of tributaries. Many stream channels, including sections of the Bitterroot River, were lined with riprap rock and car bodies to slow stream migration and in-channel bank erosion (figure 12). In addition to local physical disruptions to topography and hydraulics, the entire fluvial system of the Bitterroot River has been altered by historical land use changes (see section 3.4, "Cultural Resources"). The valleys and lower hill slopes have been grazed and farmed, while the upper valleys and mountains have been partly deforested. Overgrazing was common on many valley terraces and, when coupled with deforestation in neighboring mountains and slope areas, led to erosion and increased sediment loading in the Bitterroot River (Briar and Dutton 2000). Subsequently, extensive sedimentation has occurred in drainages and floodplain depressions on the refuge (USFWS 1988–93).

The channel morphology and discharge of the Bitterroot River has also been affected by land and water use in the valley (Gaeuman 1997). From 1936 to 1972, the Bitterroot River underwent significant adjustments in sinuosity and braided character causing a nearly 4-percent reduction in channel length between Darby

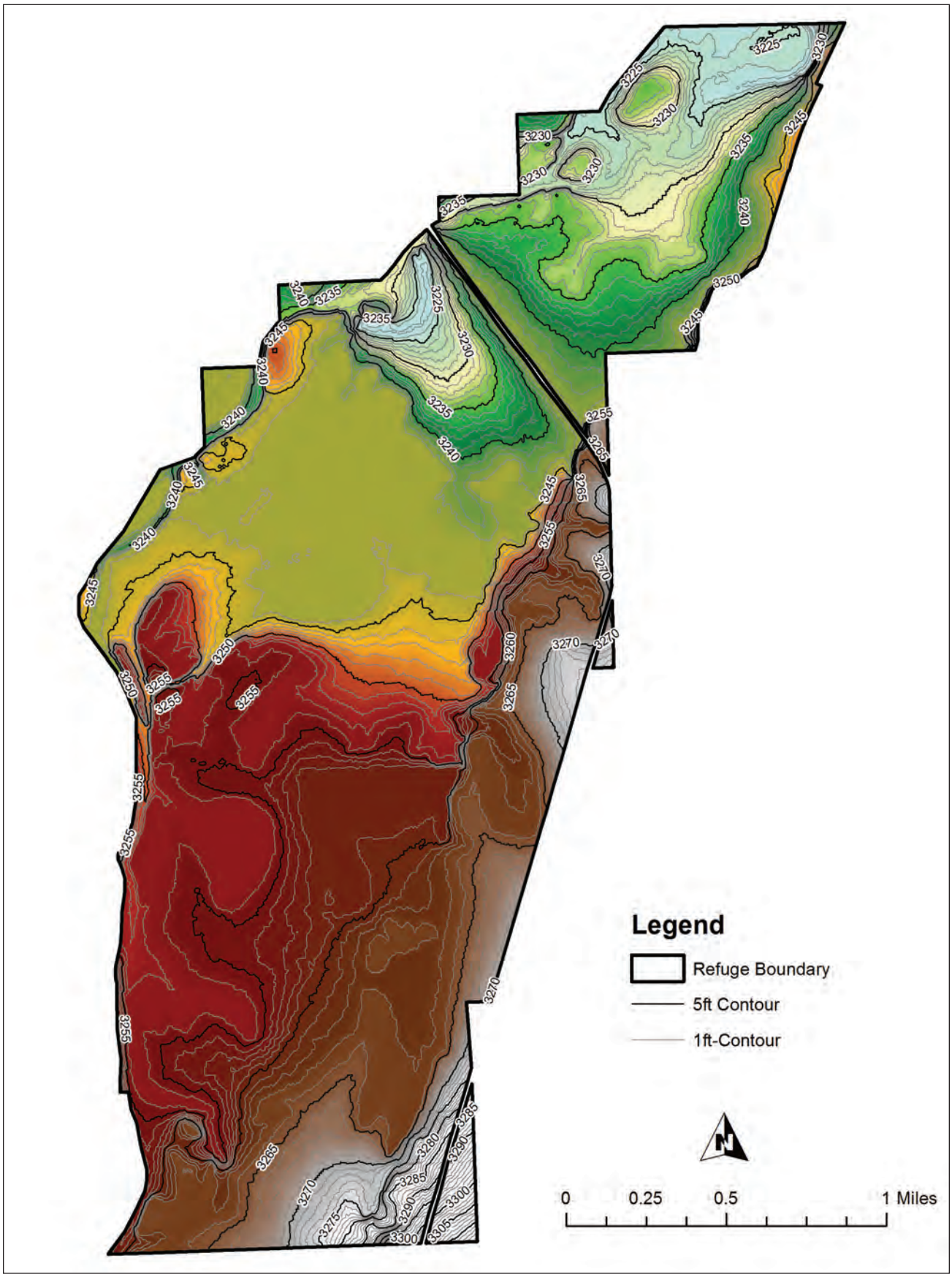

Figure 11. Map of Lee Metcalf National Wildlife Refuge, Montana, showing 1-foot contour intervals (Heitmeyer et al. 2010).

Table 4. Water rights summary for Lee Metcalf National Wildlife Refuge, Montana.

Water right number	*Priority date*	*Volume rate (cubic feet per second)*	*Volume (acre-feet per year)*	*Irrigated acres*	*Source*
76H–W–142486	04/05/1882	3.57	1,060	1,837	North Burnt Fork Creek
76H–W–188239	06/10/1882	5	560	1,929	Rogmans Creek (also known as Spring Creek)
76H–W–142487	10/01/1882	2.5	742.5	1,837	North Burnt Fork Creek
76H–W–142482	06/15/1903	10	742.6	2,188	South Drain
76H–W–188233	06/15/1905	1.86	1,344	1,536	Unnamed tributary of Bitterroot River
76H–W–142483	05/15/1930	1	49	14	Three Mile Creek
76H–W–188235	07/02/1931	1.28	470	51	Middle Drain
76H–W–188236	05/07/1938	8	3,008	1,038	Rogmans Creek
76H–W–188231	08/15/1941	10	535.5	1,866	Swamp Creek
76H–W–142493	01/29/1947	10	2,162	1,544	Bitterroot River
76H–W–188238	11/04/1950	25	980	1,929	Rogmans Creek
76H–W–142492	04/01/1952	0.9	212	1,029	Unnamed tributary of Spring Creek
76H–W–142491	05/15/1953	5	301	1,619	Unnamed tributary of Bitterroot River
76H–W–142489	11/13/1957	1.8	1,306	2,188	Unnamed tributary of Spring Creek
76H–W–142484	07/13/1960	1	49	None	Three Mile Creek
76H–W–142485	12/10/1963	2	1,120	209	Three Mile Creek
76H–W–188237	12/10/1963	20	6,317	1,929	Rogmans Creek
76H–W–188232	12/10/1963	0.25	181.5	720	Unnamed tributary of Spring Creek
76H–W–142490	12/10/1963	2	629.8	67	Drain #2 (also known as water and seepage; also known unnamed tributary of Spring Creek)
76H–W–188234	12/10/1963	1.86	1,344	1,536	Middle Drain (also known as water and seepage; also known unnamed tributary of Spring Creek)
76H–W–184100	12/10/1963	5	3,629	1,288	South Drain (also known as water and seepage; also known unnamed tributary of Spring Creek)
76H–W–142488	12/10/1963	2	1,445	1,837	Drain #1 (also known as water and seepage; also known unnamed tributary of Bitterroot River)
76H–W–188240	12/10/1963	1.25	32	1,288	Spring (unnamed tributary to Bitterroot River)
76H–W–188230	12/10/1963	5	3,078	1,866	Swamp Creek
76H–81434	02/02/1968	0.02[1]	1.5	None[2]	Ground water
76H–W–10850	12/30/1976	0.03[3]	10	None[2]	Ground water
069642–S76H	10/14/1988	25	300	None[4]	Spring Creek

[1] *Equals well pumping capacity of 12 gallons per minute.*
[2] *Domestic use.*
[3] *Equals well pumping capacity of 15 gallons per minute.*
[4] *Post-1973 permit for Otter Pond.*

Source: USFWS, Region 6 Water Resources Division 2011.

and Missoula (Cartier 1984). Other data suggest that in the last decade, increased instability, channel migration, and overall widening of the river's braided area from Hamilton to Stevensville has occurred compared to other reaches of the Bitterroot River both above and below (Gaeuman 1997). This instability has caused rapid erosion of riverbanks on the refuge (figure 13) and increased physical dynamics of sediment and waterflow that facilitate rapid lateral channel migration across the refuge floodplain. In contrast to the highly active river migration physics from Hamilton to Stevensville, substantial narrowing of the Bitterroot River occurred near Stevensville and the refuge lands after 1937 in part because of artificial control structures. Part of the river has been channelized immediately upstream of riprap bank stabilization structures near the railroad embankment on the refuge. This artificial narrowing of the Bitterroot River to control river migration and bank erosion has actually heightened river migration tendencies immediately upstream of structures and has the potential to carve new channels across the refuge floodplain.

Aerial photograph maps of a 2.5-mile stretch of the Bitterroot River on the north end of the refuge from

Bob Danley/USFWS

Figure 12. Car bodies along the Bitterroot River on Lee Metcalf National Wildlife Refuge, Montana, that were intended for erosion control before refuge establishment.

Bob Danley/USFWS

Figure 13. Bank and levee erosion along the Bitterroot River on the west side of Lee Metcalf National Wildlife Refuge, Montana (Heitmeyer et al. 2010).

1937 to 2009 show the highly unstable channel location of the river (figure 14). Three key points (labeled A, B, and C on figure 14) of river migration are apparent through the time-series of photographs, and typical movements of the outer riverbanks average about 8 feet per year. During more active periods of river channel bank migration, the rate of erosion is greater than 32 feet per year. The 1955 photograph reveals that the river migrated significantly to the south and was deemed a threat to the existing railroad bed and trestle. Subsequently, actions were taken by the railroad company to stop river migration by placing car bodies (figure 12) along the riverbank to act as riprap and cut off the river, which created an oxbow that is still present. The most active area of river migration in 2009–2010 is at point C. Between 2004 and 2009, the river migrated about 197 feet east, or about 39 feet per year. If this rate of river migration continues, then the river may reach the refuge's main road in about 15 years and effectively remove about 10.5 acres of current floodplain land.

The Bitterroot River Irrigation District's Main Supply Canal continues to transport water to most of the eastern benches in the Bitterroot Valley, including those next to the refuge. This canal facilitates a net transfer of about 75,000 acre-feet per year of water from the west side of the valley to the eastern benches and terraces. During summer, irrigation withdrawals significantly reduce flow in the Bitterroot River and some of its tributaries. Part of the diverted flow eventually drains back into the river system; this irrigation return flow is about 280,000 acre-feet per year in normal precipitation years. This includes well water and other canals used for irrigation. Average discharge of the Bitterroot River near Florence is 1,540,000 acre-feet per year, and at this point there is about a 13 percent current loss of discharge from irrigation use, other consumptive uses, and evapotranspiration. More than 10,000 wells are now in the valley, and the extraction of water from these wells, coupled with irrigation diversion, may be affecting ground water levels, recharge to floodplain wetlands, ground and surface water quality, and the connections of branches (anastomosis) of the Bitterroot River (Briar and Dutton 2000).

Air Quality

Air quality is a global concern. The U.S. Environmental Protection Agency has lead responsibility for the quality of air in the United States; through the 1990 Clean Air Act, the agency sets limits on the amount of pollutants that can be discharged into the air. More than 170 million tons of pollution are emitted annually into the air within the United States, through either stationary sources (such as industrial and power plants) or mobile sources (such as automobiles, airplanes, trucks, buses, and trains). There are also natural sources of air pollution such as fires, dust storms, volcanic activity, and other processes. The U.S. Environmental Protection Agency has identified six principal pollutants that are the focus of its national regulatory program: carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter, and sulfur dioxide.

Air quality problems in Montana are usually related to urban areas and narrow mountain river valleys that are prone to temperature inversions. These temperature inversions cause chemical and particulate matter to become trapped in the air. (Particulate matter is tiny liquid or solid particles in the air that can be breathed in through the lungs, with the smaller particulates being more detrimental than larger particles.) These air pollutants have the greatest adverse effect on Montana's air quality.

Air quality in the Bitterroot Valley and Ravalli County is classified as either "attainment" or "unclassifiable-expected attainment" with respect to the National and Montana Ambient Air Quality Standards for all regulated air pollutants. The primary pollutant of concern in the Bitterroot Valley is particulate matter less than 2.5 microns in size ($PM_{2.5}$). Ambient $PM_{2.5}$ levels have been measured at several locations in the Bitterroot Valley over the past several years and continue to be measured in the community of Hamilton, approximately 20 miles south of the refuge. Smoke from wood burning appliances (primarily residential heaters and woodstoves), forestry and agricultural prescribed burning practices, and forest fires occasionally result in elevated $PM_{2.5}$ levels in the Bitterroot Valley. The Montana Department of Environmental Quality conducts an open burning smoke management program to mitigate impacts from forestry and agricultural burning. Nevertheless, Missoula experienced 16 days of Stage I Air Alerts in 2003. The Montana Department of Environmental Quality evaluates monitored concentrations of $PM_{2.5}$ during the winter months to address elevated $PM_{2.5}$ levels primarily resulting from wood burning appliance emissions during periods of poor atmospheric dispersion (Hoby Rash, Monitoring Section Supervisor, Ambient Air Monitoring, Montana Department of Environmental Quality; email; September 27, 2010).

3.2 Biological Resources

This section describes the biological resources that may be affected by CCP implementation. It begins with a description of the refuge's historical land cover and vegetation communities, and it discusses changes to the refuge since its establishment. Following this background, the current vegetative habitat type descriptions (upland, riparian, and wetland) and the associated birds, mammals, amphibians, reptiles, and

fishes are described. The remainder of this section describes the invasive species, wildlife diseases, and contaminants found on the refuge.

Unless otherwise noted, the information in this section is from unpublished Service data; a hydrogeomorphic (HGM) report entitled "An Evaluation of Ecosystem Restoration and Management Options for Lee Metcalf National Wildlife Refuge," developed by Greenbrier Wetland Services (Heitmeyer et al. 2010); or from another habitat analysis entitled "Lee Metcalf National Wildlife Refuge 2009 Assessment of Upland Units" prepared by Aeroscene Logic (Graham 2009). These data and reports are available at the refuge headquarters.

Land Cover and Vegetation Communities

The Bitterroot Valley is composed of the intermountain and foothill grassland ecotype cut and formed by the meandering Bitterroot River that creates core riparian zones and wetland areas. This ecotype harbors more wildlife communities than any other in Montana (MFWP 2005). The relatively low precipitation in the Bitterroot Valley prohibits the establishment of expansive areas of densely wooded or herbaceous wetland vegetation communities. Consequently, the distribution of woody or wetland-type species is restricted to areas of greater soil moisture—primarily sites next to the Bitterroot River and in floodplain drainages and depressions (Heitmeyer et al. 2010).

Historically, vegetation in the Bitterroot River floodplain on the Lee Metcalf Refuge included seven distinct habitat and community types: (1) riverfront-type forest, (2) floodplain gallery-type forest, (3) persistent emergent wetland, (4) wet meadow herbaceous, (5) floodplain and terrace grassland, (6) saline grassland, and (7) grassland-sagebrush. Figure 15 is a composite model of potential historical vegetation communities present on the refuge before significant alteration and development beginning in the late 1800s; community identification was made on the basis of HGM attributes (table 5).

The Bitterroot River floodplain at the refuge historically supported a wide diversity of vertebrate and invertebrate animal species associated with the interspersed riparian woodlands, floodplain wetland, and grassland habitats (appendix G). Resources used by animal species were seasonally dynamic and also annually variable depending on long-term climate and riverflow and flooding patterns. In the refuge region, most bird species exploited seasonal resources during migration and in the summer, but a few species overwintered in the area. Many waterbirds likely stayed in the Bitterroot Valley during wet summers to breed when floodplain wetlands had more extensive and prolonged water regimes. In contrast, limited numbers of species and individuals probably bred in the valley during dry years. In the years when wet springs combined with carryover water in the fall, larger numbers of waterbirds would stopover in the valley during fall migration. In average or dry years, however, little wetland habitat would have been available in fall except in historical river channels. Cold winter temperatures freeze most wetlands in the floodplain, but the river and a few springs remain open throughout winter in most years and provided sanctuary, loafing, and some foraging resources for some species. Amphibian and reptile annual emergence and life cycle events coincided with spring thaw and flooding and the availability of key arthropod and other prey species. Larger mammals moved in and out of the floodplain

Table 5. Hydrogeomorphic matrix of historical distribution of vegetation communities and habitat types on Lee Metcalf National Wildlife Refuge, Montana.

Habitat type	*Geomorphic surface*[1]	*Soil type*	*Flood frequency*[2]
Riverfront forest	Qal, Qaty	Riverside, Riverwash, Chamokane gravelly-sand, sand, fine sand-loam	1YR–I
Gallery forest	Qal	Chamokane loam and loamy sand	2–5YR
Robust emergent–shrub or scrub	Qal	Slocum poorly drained loam	1YR–P
Wet meadow	Qal	Slocum deep loams	2–5YR
Grassland	Qal, Qafy	Corvallis, Hamilton, Grantsdale silt loam	>5YR
Grassland-saline	Qal	Corvallis saline silt loam	>5YR
Grassland-sage	Qafy	Lone Rock mixed erosional alluvial fan	>10YR

[1] *Qal = Quaternary alluvial deposits, Qafy = Quaternary younger alluvial fan and outwash terrace complex, Qaty = late Riverside and Hamilton terraces.*

[2] *1YR–I = annually flooded for intermittent periods, primarily during high water periods of the Bitterroot River; 2–5YR = surface inundation at a 2- to 5-year recurrence interval; 1YR–P = annually flooded primarily for most of the year; >5YR = surface inundation at a greater than 5-year recurrence interval; >10YR = surface inundation rare except for lower elevations during extreme flood events.*

Source: Heitmeyer et al. 2010.

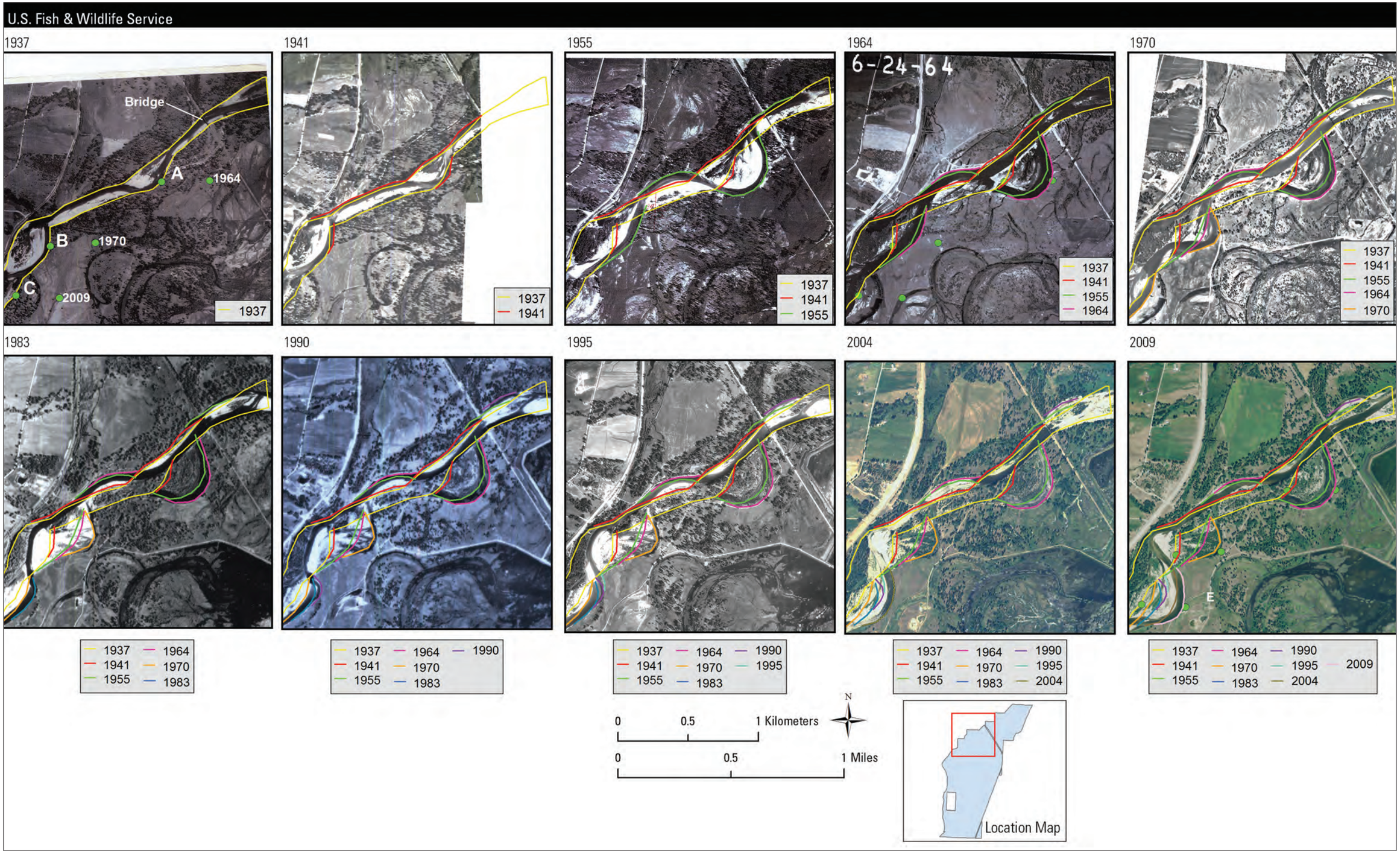

Figure 14. Maps showing the changes in the main channel of the Bitterroot River in Montana.

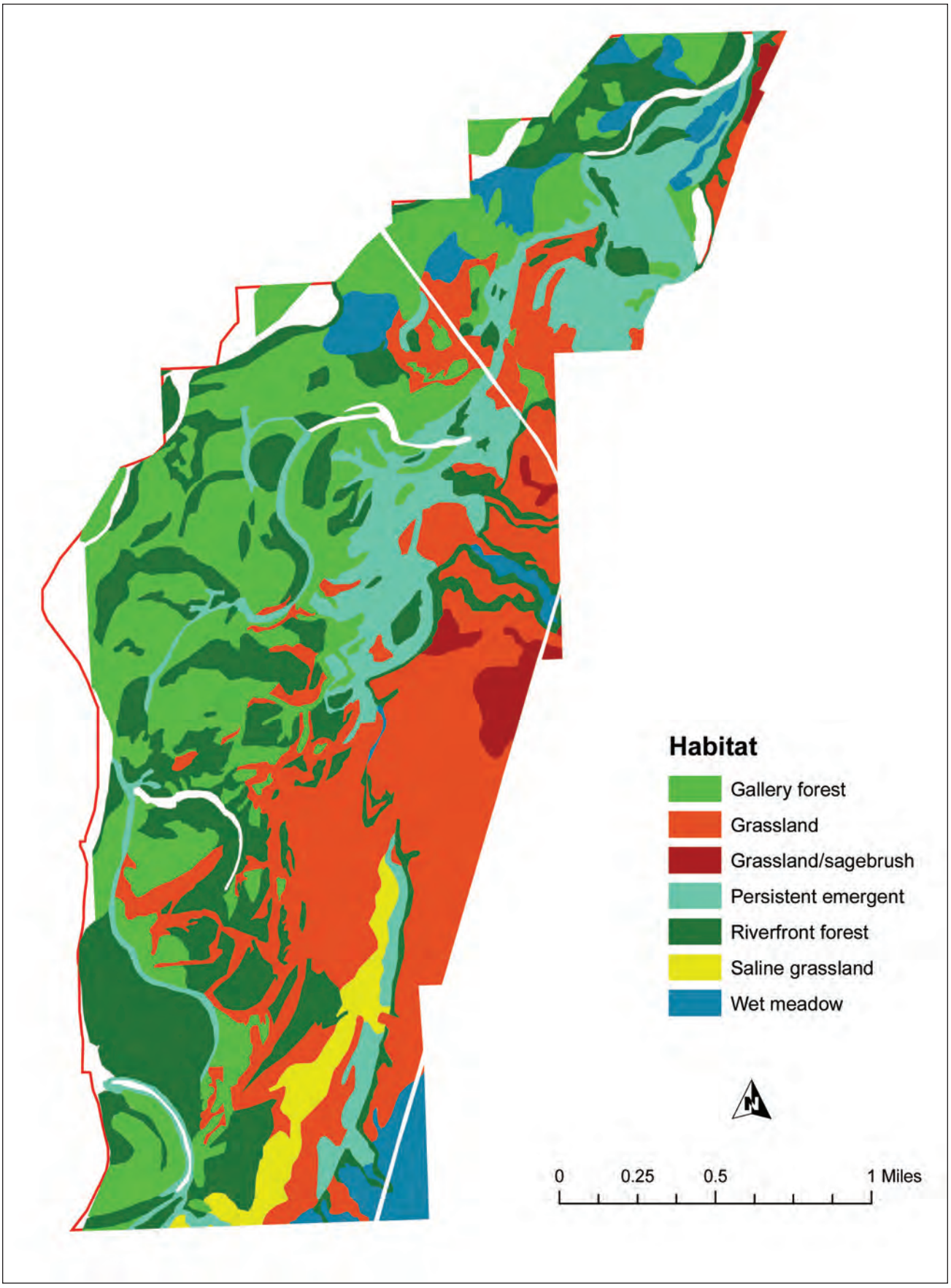

Figure 15. Hydrogeomorphic-derived map of potential vegetation communities on Lee Metcalf National Wildlife Refuge, Montana, before European settlement in the mid-1800s.

to forage and take advantage of cover during winter and in other seasons when nutritious grassland forage and prey were present.

Figure 16 shows the 2,800 acres of habitat and vegetation communities that exist today. Historical vegetation communities have changed over time due to past and present land uses, including agriculture and the creation of wetland impoundments. The existing habitat and community types present today are shown in figure 16 and described below in three different vegetation communities:

- uplands (grassland, shrubland, and a combination of both)
- riparian (river channel, woodland, and natural wetlands)
- wetland impoundments (open water and robust emergent)

Migratory birds are especially abundant on the refuge during fall and spring migration. More than 260 species of birds are present in the Bitterroot River watershed, and 242 species have been documented on the refuge (USFWS, unpublished refuge files), including grebes, bitterns, herons, egrets, waterfowl, raptors, shorebirds, flycatchers, swallows, chickadees, warblers, wrens, sparrows, and blackbirds. Additionally, many bird species nest in forest, wetland, and grassland areas; the most common species are ducks, warblers, flycatchers, swallows, blackbirds, sparrows, wading birds, and raptors.

More than 40 mammal species also are present in the refuge. Some of the more common species include white-tailed deer, yellow-bellied marmot, yellow-pine chipmunk, northern pocket gopher, meadow vole, porcupine, striped skunk, muskrat, American beaver, mink, and raccoon. At least eight species of reptiles and amphibians commonly use the refuge including three snakes, one turtle, two frogs, one toad, and one salamander. Several species of native fish historically were present in the Bitterroot River, and many moved into floodplain drainages, oxbows, and wetlands during high flow periods. Native species include mountain whitefish, northern pikeminnow, large scale sucker, longnose sucker, and redside shiner. Presently several nonnative fish are also present in refuge impoundments, including, but not limited to, largemouth bass, yellow perch, and brown and rainbow trout.

Habitat Modifications Since Establishment

Following establishment, the refuge began physical developments on floodplain lands in the mid-1960s, with the purpose of creating wetland habitat for waterfowl and other waterbirds. By the late 1980s, fourteen impoundments (or ponds) encompassing more than 1,000 acres had been created (figure 17).

The following list encompasses major wetland management and development activities on refuge lands from 1963 through the early 1990s, according to refuge annual narratives (USFWS 1988–93) and as summarized in Heitmeyer et al. (2010):

- Lee Metcalf National Wildlife Refuge was authorized by Migratory Bird Conservation Commission on December 10, 1963.
- The first parcel was purchased in February 1964.
- In the mid-1960s, evidence revealed that the west Barn Slough area, a pre-refuge diversion structure, was sending water through the McPherson and Nickerson Creeks (now Ditches).
- Ponds 1–4 were completed in the summer of 1966 (refuge files). By 1970, Pond 5 was impounded by forming the existing county road into a levee. Ponds 6, 8, and 10 were constructed between 1967 and 1970, judging from photos from this period.
- In the mid-1960s, no dikes or structures existed on Francois Slough and North Burnt Fork Creek was unimpeded on the refuge. By 1970, three water control structures were constructed on these waterways, and they remain in place today.
- Ponds 11–13 were built between 1970 and 1973, as refuge photos show the north ponds in the flood of 1974. Pond E, which was a small impoundment on Rogmans Creek near Pond 11, was likely built around the same time. Pond E was expanded by the creation of Otter Pond in 1989.
- In the early 1980s, the refuge focused on Three Mile Creek sedimentation issues. This creek flowed into Pond 11 and out through Pond 13 to the river. Two supply ditches were cleaned out in 1985. A bypass channel with three sediment ponds was constructed in 1984 to lead the creek directly to the river. These ponds filled quickly and were cleaned out in 1987.
- By July 1988, the Pair Ponds were established as part of a rehabilitation project by the Montana Power Company. Pair Ponds comprise 10 acres and are up to 3 feet deep in some areas.
- Otter Pond was built in 1989 as a solution to the sedimentation of the northern ponds from Three Mile Creek. An 18-inch diameter siphon was constructed to bring water from Pond 10 under Three Mile Creek bypass to supply water to Ponds 11, 12, and 13. This expanded the existing Pond E to about 65 surface acres.
- In the early 1990s, ditch leveling was completed in Swamp Creek and Ponds 1, 3, 4, 11, and 12.

These wetland impoundments were developed using levees to back water up drainages and depressional areas. Because of river channelization, development, and wetland loss, the refuge currently manages more than 20 percent of all palustrine wetlands present in

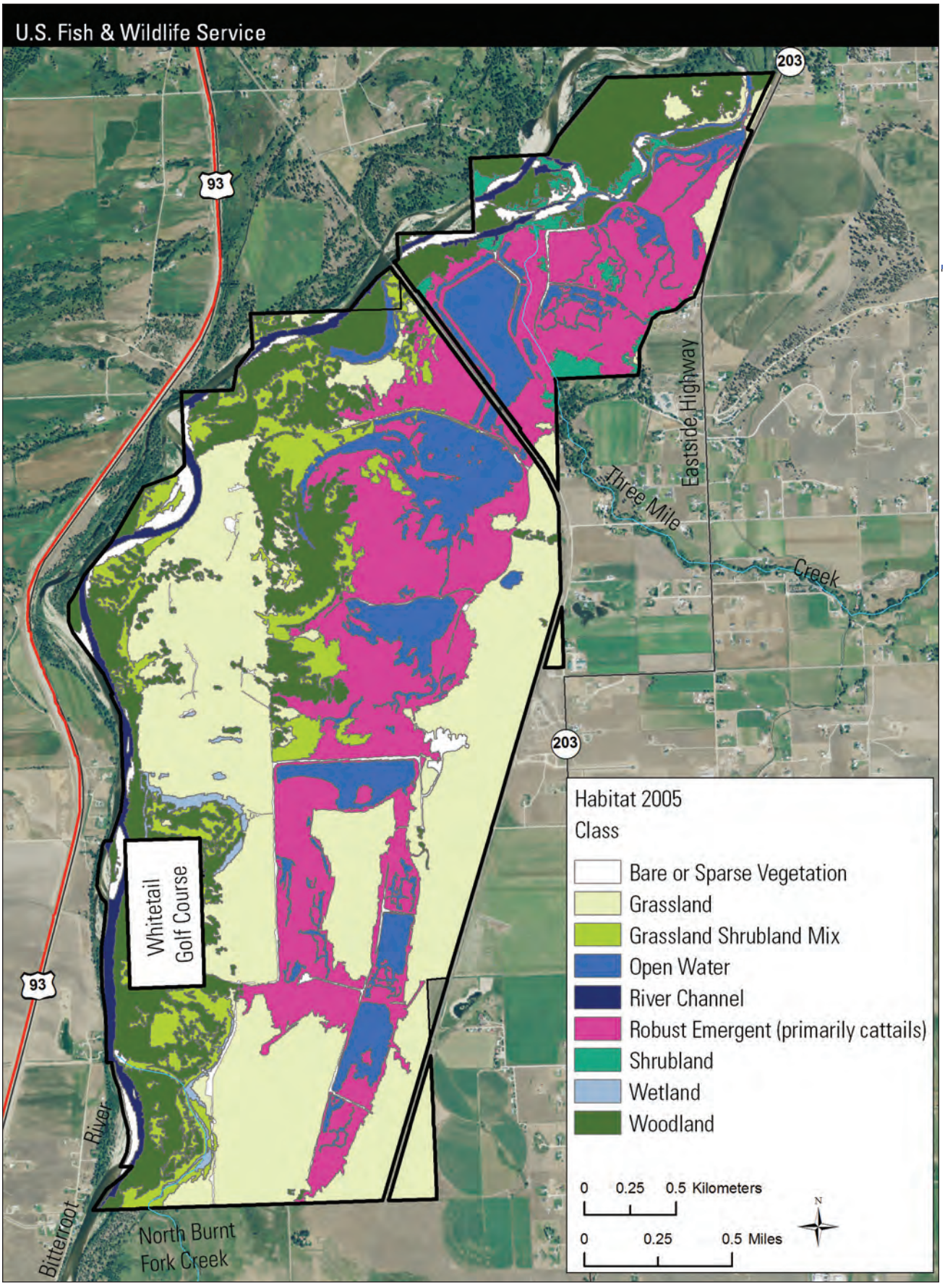

Figure 16. Existing habitat and vegetation communities on Lee Metcalf National Wildlife Refuge, Montana.

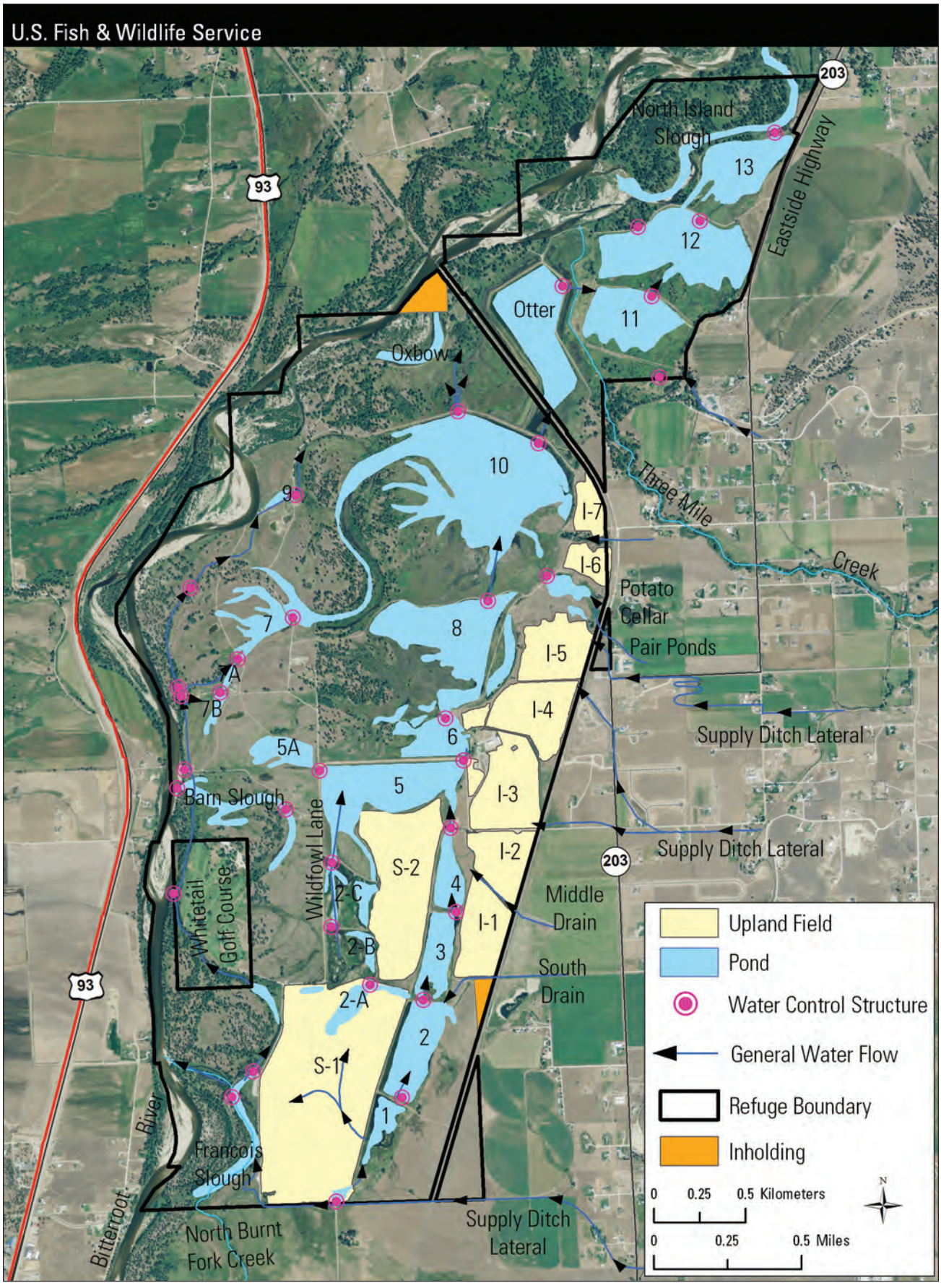

Figure 17. Ponds and upland fields in Lee Metcalf National Wildlife Refuge, Montana.

the Bitterroot Valley (Kudray and Schemm 2008). Water control structures that significantly alter the direction and amount of surface water flow in natural drainages have been constructed on Rogmans Creek, Barn Slough, and Francois Slough/North Burnt Fork Creek. Three Mile Creek used to feed Ponds 11, 12, and 13 but was re-routed because of sedimentation in ponds. Wetland impoundments have been managed by diverting irrigation and tile drain water (that is, excess water drained from agricultural subsurfaces), flows in minor channels and tributaries, springs, and Three Mile Creek water into and through the impoundments.

Water that enters or can be diverted to the refuge comes from multiple points of diversion (PODs). Certain sources, such as the South Lateral Ditch and Middle Lateral Ditch, supply private property in addition to the refuge. Tile drain water also enters the refuge from open tile drains or ditches from surrounding private lands. The refuge receives nutrient-rich water from these drains, and during summer months this water has abundant algal growth. Most water enters managed wetland impoundments from the south end of the refuge and sequentially is routed via gravity flow through Ponds 1–13. However, the variability of water sources often results in variable amounts and timing of available water for individual ponds. For example, water from the South Lateral Ditch can be moved by gravity flow into all refuge ponds, whereas water from Rogmans Creek can only be used for Ponds 2–13. The Spring Creek POD (outlet of Pond 10) flows under the railroad tracks into Otter Pond and is then siphoned under Three Mile Creek to feed Ponds 11, 12, and 13. Currently, Three Mile Creek contains high sediment loading that, when diverted into impoundments, precipitates out. Three Mile Creek is currently directed via a bypass channel to what is now North Island Slough.

Since refuge establishment, most wetland impoundments have been managed to promote waterfowl production by holding water through summer or year-round and occasionally draining areas for vegetation management using tillage, grazing, and burning (USFWS 1988–93). Otter Pond was stocked with warm-water fish in 1989 to provide both prey for nesting osprey and limited public fishing opportunities. Other wetland developments included construction of a siphon to move water from Otter Pond to Ponds 11, 12, and 13; level-ditching in Swamp Creek and Ponds 1, 3, 4, 11, and 12; pool construction near Potato Cellar Pond; and sediment removal in Three Mile Creek. Ephemeral ponds also resulted from the excavation of gravel pits.

Certain upland areas were converted to warm- or cool-season grasses for dense nesting cover for waterfowl in the early 1990s (figure 18), and two predator-exclusion fences were built around some fields and a levee. These fences were removed in 2010. From the 1960s through the early 1980s, some higher elevation fields on the refuge were used for small grain production.

In 1971, the refuge contracted the placement of riprap material along 1,250 feet of the east bank of the Bitterroot River west of McPherson Ditch (USFWS 1988–93). This riprap was subsequently eroded and moved by high riverflows; by 1984 the riprap was gone, and the bank at this location was moving eastward. Since the mid-1990s, levees built along the Bitterroot River, including the area where the riprap was placed

Bob Danley/USFWS

Figure 18. Field planted as dense nesting cover on Lee Metcalf National Wildlife Refuge, Montana.

in 1971, have eroded and been at least partly breached in places as the Bitterroot River attempts to move laterally (figure 14). Also, the Bitterroot River appears to be moving more discharge through the North Island Slough area immediately north of Otter Pond on the north side of the refuge. These river movements could potentially affect the north Otter Pond levee; cause water movement across other floodplain areas on the refuge; and affect other structures, roads, and the railroad bed.

More than 18 miles of roads are present on the refuge along with six buildings, two trails, two shelters, and an amphitheater. Eight residences and several outbuildings have been removed over time.

Changes to the Vegetation Communities

Collectively, the many landscape and hydrological changes in the Bitterroot Valley since the presettlement period have dramatically altered the physical nature, hydrology, and vegetation communities of the Lee Metcalf Refuge. Before Euro-American settlement, the relatively dry climate of the valley and the traveling nature of the Bitterroot River created a heterogeneous mix of communities: riverfront and gallery forest next to the Bitterroot River and floodplain drainages, persistent emergent wetland communities along floodplain drainages and fluvial-created depressions, wet meadow habitats, and grassland and sagebrush communities on higher elevation terraces and alluvial fans (figure 15). This community matrix was maintained by:

- periodic overbank flooding of the Bitterroot River that inundated much of the floodplain for relatively short periods in spring;
- regular backwater flooding of the Bitterroot River up tributaries and floodplain secondary channels into floodplain wetland depressions;
- annual spring discharge of water from tributaries, sheet flow across terraces and alluvial fans, and seep and spring discharge from mountain slopes and terraces;
- frequent burning of the grasslands and shrublands (primarily by Native Americans) that may have led to frequent, low-intensity fires in the adjacent ponderosa pine forest (Arno 1980) that, when combined with grazing, recycled nutrients and established germination and regeneration sites for specific plant species.

Each of these primary ecological processes at the refuge has been systemically altered:

- Water diversions, channel constriction, and river channel modification have reduced overbank flooding and restricted floodplain connectivity. Fewer extensive overbank events now occur, but lateral movement and bank erosion of the Bitterroot River have been accelerated in this river stretch.
- The above changes, some of which have occurred upstream of the refuge, have restricted backwater flow from the Bitterroot River into its floodplain and tributaries, and floodplain secondary channels have been ditched, diverted, dammed, and impounded.
- Waterflow across the floodplain has been altered by extraction and diversion of water from drainages before reaching the floodplain. Sheet flow across terraces and alluvial fans is almost completely eliminated, and ground water aquifers and discharge from seeps and springs are changed, usually by reduction from presettlement times.
- Wildfires have been eliminated or greatly reduced.

In addition to changes in the primary ecological processes of the Bitterroot Valley ecosystem on the refuge, the local and regional landforms and vegetation communities have been negatively affected by many alterations to topography, drainages, clearing, conversion to various agricultural crops or livestock forage, extensive grazing by cattle and sheep, sedimentation, expansion of nonnative plants, and recent urban expansion. Vegetation changes are documented in aerial photographs from the 1940s to the present (figures 5 and 10). Collectively, the system now has:

- reduced areas of riverfront and gallery forest;
- fewer wet meadows;
- increased areas of persistent emergent and open-water habitat;
- increased areas of herbaceous wetland vegetation;
- fewer native grassland communities;
- more agricultural and tame grass fields;
- increased presence of invasive and exotic plant species.

Invasions of sulfur cinquefoil, Dalmatian toadflax, leafy spurge, spotted knapweed, Canada and musk thistle, houndstongue, St. Johnswort, and yellow flag iris are present in many areas on the refuge (Kudray and Schemm 2008, Lee Metcalf Refuge unpublished data). Of the 32 currently considered noxious weeds in Montana, 15 species are present on the refuge. (Refer to "Invasive and Noxious Species" under section 2.6 for more detail).

Changes to Fish and Wildlife Populations

The many ecological and community changes to the Lee Metcalf Refuge ecosystem have corresponding effects on fish and wildlife populations using the area. Unfortunately, few quantitative data are available on animal use of the area during historical times, but correlations of species occurrences with specific habitat types can indicate relative abundance for at least some groups. Apparently, waterbirds and other wetland associated birds increased in number and seasonal occurrence on the refuge at least during the 1970s and

1980s after wetland impoundments were built and managed for more prolonged water regimes during summer and fall. Peak numbers of dabbling and diving ducks, shorebirds, and wading birds on the refuge collectively exceeded 20,000, especially during spring and fall migrations in some years in the 1970s and 1980s; now, they seldom exceed 5,000 (USFWS 1988–93). One contributing factor may be the conversion of grain fields surrounding the refuge to housing developments. Production of ducks on the refuge also reached 10,000 in some years during the 1970s and 1980s, but now annual production typically is less than 1,000 ducklings (unpublished refuge data). Populations of other birds associated with more permanently flooded wetlands including osprey and certain passerines also apparently increased 20–30 years after wetland impoundments were built, but now these populations are declining. For example, osprey production on the refuge reached a peak of forty young in 1988, but it has declined since (figure 19). Concerns about mercury contamination of osprey eggs and young relate to their consumption of warm-water fish present in several ponds and high mercury levels of fish in other refuge impoundments and regional waters. Methylmercury concentrations in fish (mainly largemouth bass) on the refuge average more than 0.1 milligram per kilogram wet weight for 14- to 22-inch size classes (figure 20).

Some data suggest declines in animals using riparian forest, grassland/sagebrush communities, and floodplain channels and tributaries to the Bitterroot River (Brandt 2000, USFWS unpublished refuge inventories). Reduction of riparian forest habitat has meant less foraging, nesting, loafing, and stopover habitat for many passerine birds, raptors, and native resident species. Additionally, conversion of native grassland to pasture, hayland, and agricultural crops has reduced resources for many birds, mammals, and amphibians. While the Bitterroot River and its floodplain did not historically support a large diversity of native fishes, many species were highly abundant and widely distributed, especially when overbank and backwater floods occurred. Distribution is now restricted to primary channels of the Bitterroot River and impoundments or ponds (Brandt 2000). The federally listed threatened native bull trout is now rarely found in the river (Chris Clancy, fisheries biologist, MFWP, personal communication, October 2011) but historically occurred in North Burnt Fork Creek. The bull trout is now restricted to the upper reaches of this creek on U.S. Forest Service land because of dammed and

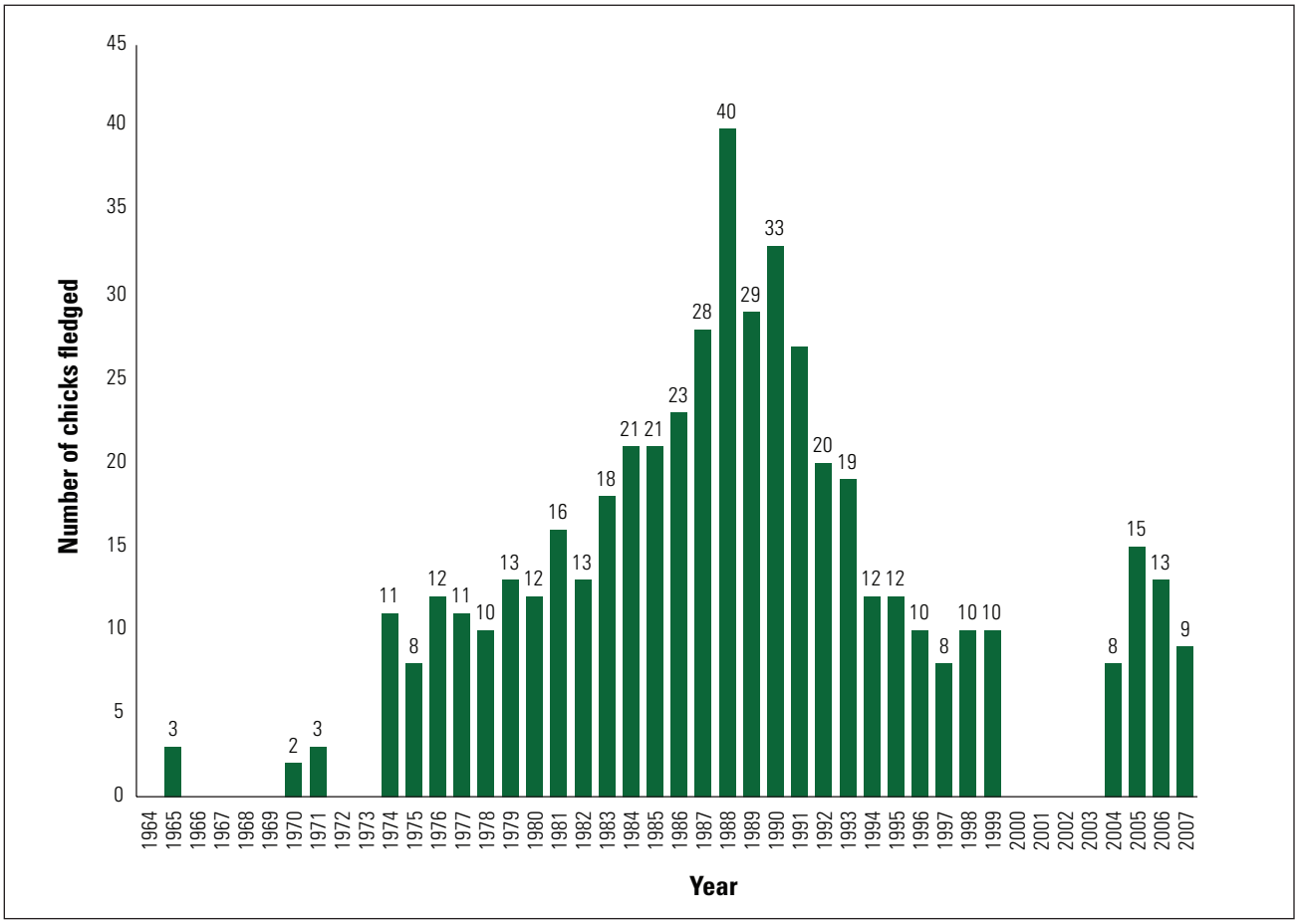

Figure 19. Osprey production on Lee Metcalf National Wildlife Refuge, Montana, 1964–2007.

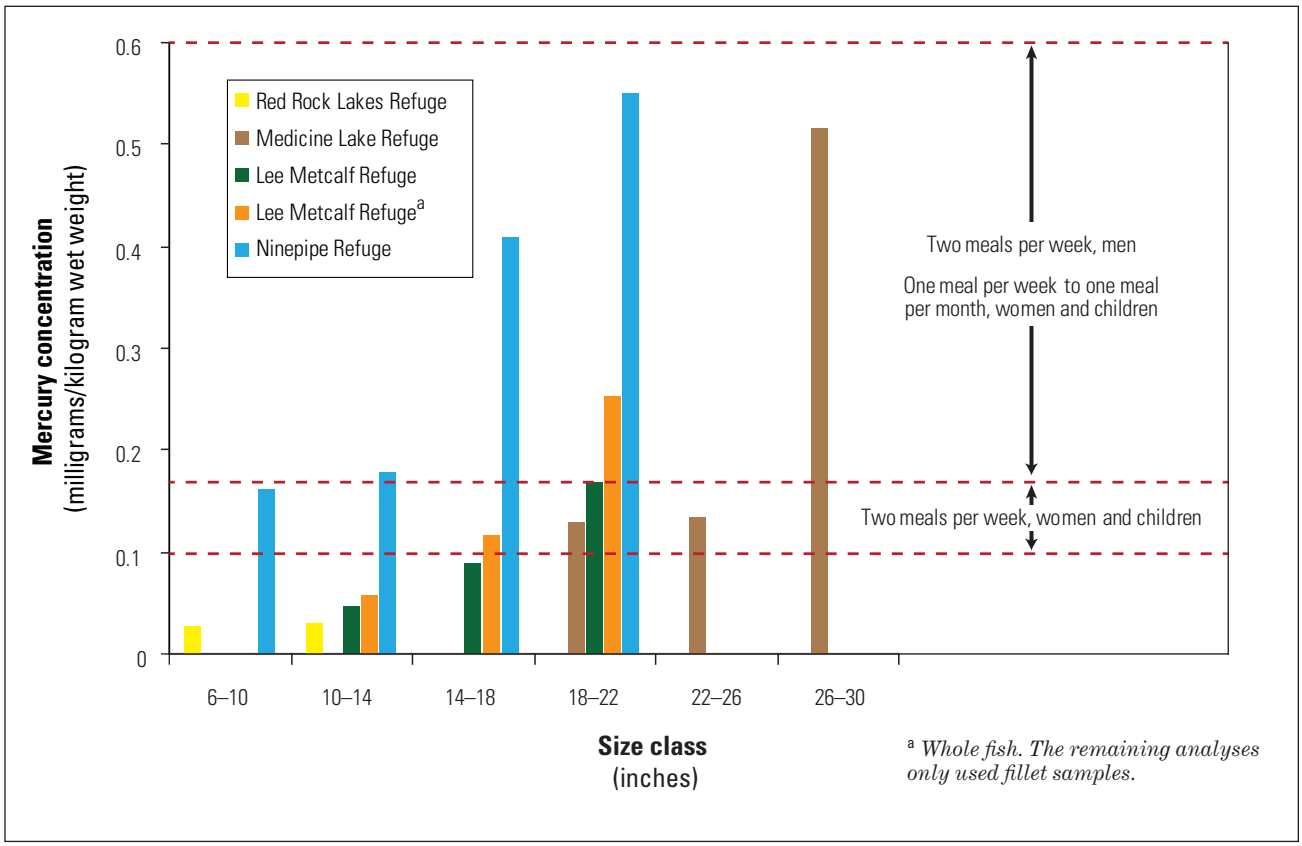

Figure 20. Mercury concentration in fish from Montana national wildlife refuges.

diverted waterflows, sedimentation, and increased water temperatures in the creek and the impounded Francois Slough area on the refuge (Stringer 2009); heavy irrigation modifications upstream of the refuge have also contributed to the decline of this species.

Upland Habitat

The Lee Metcalf Refuge's 1,186 acres of uplands consist of floodplain and terrace grasslands, combined grasslands and shrublands, and shrublands. These communities are characterized by having grassland and shrubland species that usually occur in non-wetland habitats. Historical documents suggest that most higher elevations within the refuge's floodplain region were covered with grasses and some scattered shrubs (Eckmann and Harrington 1917, Cappious 1939, Popham 1998). Sites with occasional surface flooding contained more wet meadow or grassland communities interspersed with wetland herbaceous plants (like smartweed), while higher floodplain terraces, slopes, and alluvial fans included both wetland and upland-type grasses (like needle and thread and Junegrass) and shrubs (like rabbit brush and sage). Most floodplain grassland areas have Corvallis, Hamilton, and Grantsdale silt loam and loam soils. Certain small sites in the refuge have saline soils that could have supported more salt-tolerant species. Larger alluvial fans, such as those near Three Mile Creek, are present on "Qafy" surfaces with Lone Rock mixed erosion soils, and these sites historically had a mixed grassland-sagebrush community (for example, Clary et al. 2005).

The uplands in the valley have historically been disturbed by a variety of land uses since Euro-American settlement in 1841. In 1872 Peter Whaley broke the first sod on what would become the refuge. The primary land use in the valley was cattle grazing and, later, agricultural crops (vegetables and grains). Once the refuge was established, the uplands were still disturbed by grazing, farming, haying, and other land practices. Eventually, these grazed and farmed areas were retired and seeded with nonnative grasses. These practices greatly altered the land, decreasing overall habitat and animal diversity and increasing the presence of invasive plant species (Graham 2009). Most wet meadows have disappeared, and potential saline grasslands are now mostly thistle and wheatgrass. Historical grassy upland terraces no longer contain substantial amounts of native forbs, grass, or shrub species. It is estimated that invasive and other nonnative species now affect more than 70 percent of refuge uplands. Dominant species now found in those areas include, but are not limited to, cheatgrass, smooth brome, common tansy, mustard species, spotted knapweed, and musk and Canada thistle.

Characteristic Wildlife

Some of the more common wildlife species observed in the upland habitat are small mammals like the Columbian ground squirrel, meadow vole, American deer mouse, white-tailed deer, striped skunk, coyote, red fox, and American badger. Common reptile species include the terrestrial garter snake and the common garter snake. Sandhill cranes have also been seen foraging in the upland fields. The abundance of small mammals in this habitat provides feeding opportunities for great blue herons and raptors including red-tailed hawk, rough-legged hawk, American kestrel, and prairie falcon. Upland habitats also provide browsing opportunities for white-tailed deer. As uplands are dominated by invasive and other nonnative species, most upland areas do not provide adequate nesting cover and protection from predators for many species of grassland-dependent migratory birds.

Riparian Habitat

The Bitterroot Valley is bisected by the Bitterroot River, which originates in the Anaconda-Pintler Wilderness and the Bitterroot Mountains and flows north to empty into the Clark Fork River near Missoula. Alongside the river are riparian habitats consisting of woodlands (riverfront and gallery forest), scattered grasslands, and wetlands.

The Bitterroot River is characterized by constantly shifting stream channels through the riparian habitat. This habitat provides some of the most productive wildlife habitat in the State and is a home to a wide variety of birds, mammals, reptiles, and amphibians (MFWP 2005). According to the Bitterroot Audubon Society, the Lee Metcalf Refuge is a cornerstone of the Bitterroot River Important Bird Area: it is the place where all key valley habitats come together and provide bird species richness (Sherry Ritter, Chair of the Important Bird Area Committee, Bitterroot Audubon Society, Montana; email; August 14, 2010).

The riparian habitat also includes wetlands in low elevation oxbows, depressions, and tributary off-channel areas that contain more permanent water regimes and support water-tolerant wetland vegetation species edged by persistent emergent species such as cattail.

Riparian Woodlands (Riverfront and Gallery Forests)

The riparian woodlands of the refuge consist of 483 acres of riverfront and gallery forest. Each community has different vegetation and succession requirements.

Riverfront forest includes early successional species such as black cottonwood and sandbar willow characterized by very little, if any, understory. Wood's rose, fescue, and wheatgrass species may be present. This vegetation is present on newly deposited and scoured gravelly-sand, sand, and fine sandy-loams near the active channel of the Bitterroot River and in sand outcrop sites next to floodplain drainages. These sites have high water tables for most of the year and are inundated for short periods during high spring riverflows almost annually. Regularly scoured soils provide bare soil sites for seed deposition and subsequent germination and growth of willow and cottonwood (Cooper et al. 1999).

© Kimi Smith

A bull moose browses on the refuge.

The riverfront forest lies alongside the Bitterroot River, running south to north within the boundary of the refuge. In some places, the riverfront forest occupies both sides of the river; in others, the riverfront forest occupies only the eastern side, primarily due to land clearing on the western side for other uses. Upstream development and riprap efforts along the river have caused increased flow velocity and energy reaching the refuge, resulting in the loss of riverfront forest in several areas in the refuge.

Gallery forest is located mostly on the western portion of the refuge, west of the river as well as east of the river, between the riverfront forest and the wetland impoundments. This habitat is more closely associated with backwater and overbank flooding than with drier upland conditions. Dominated by mature black cottonwood and ponderosa pine, it is found on higher floodplain elevations with layers of Chamokane loams over underlying sands along natural levees and point bar terraces next to minor floodplain tributaries. Indicator tree and shrubs species for gallery forest include ponderosa pine with black cottonwood along with an understory of large woody shrubs such as thinleaved alder, river hawthorn, red osier dogwood, and Wood's rose. There may also be mixed grasses such as bluebunch and fescue under and between trees and shrubs. Historically, gallery forests were flooded by occasional overbank or high backwater floods from the Bitterroot River and secondary floodplain channels. When flooding did occur, it was for short durations during spring. Fire and grazing by native ungulates probably sustained the savanna nature of these sites and encouraged a mix of grass, shrubs, and overstory trees (Fischer and Bradley 1987).

Riparian Wetlands

The wetland component of the refuge's riparian habitat community is 20 acres of oxbows, sloughs, remnants of former gravel pits and creeks—specifically, Barn Slough, Oxbow, North Island Slough, Francois Slough, North Burnt Fork Creek, and Three Mile Creek. These wetlands are interspersed in the southern portion of the refuge with the exception of Three Mile Creek, Oxbow and North Island Slough, which are in the north. A bypass was constructed in the mid-1980s to channel Three Mile Creek directly to the Bitterroot River to end sediment buildup in the open-water impoundments. Waterflow in some of these sloughs and creeks varies seasonally according to spring rainfall, upstream irrigation use, and the upstream snowpack and the rate at which it melts.

Barn Slough is fed by natural springs; North Island Slough was created by the migration of the Bitterroot River and is now becoming a more established river channel. Oxbow was the river channel in the mid-1950s but was closed at both ends when the river moved back north. North Burnt Fork Creek and Three Mile Creek originate in the Sapphire Mountains and flow westward down the valley slope, ending at the Bitterroot River on the refuge. North Burnt Fork Creek feeds Francois Slough, which then empties into the river. Dominant vegetation in these riparian habitats consists of alder willow, snowberry, horsetail, various sedges, rushes, and reed canarygrass.

Characteristic Wildlife

Riverfront woodlands and wetlands provide important nesting, foraging, and stopover habitat for many birds. These include neotropical songbirds such as least flycatcher, yellow warbler, Vaux's swift, and Lewis's woodpecker, and waterbirds such as common merganser and wood duck. Riverfront forest is also important for nesting and perching sites for large raptors such as bald eagles and osprey. There is at least one known eagle nest on the refuge, and trees and numerous nesting platforms provide desirable nesting sites for osprey. The most common reptiles are garter snakes. Mammals that use the riverfront forest include the northern river otter, mink, white-tailed deer, raccoon, beaver, muskrat, and the yellow-pine chipmunk.

As the gallery forest is found upslope from the riverfront corridor, many of the same bird species found in the riverfront forest—including Lewis's woodpecker, Vaux's swift, and wood duck—are present in the gallery forest, along with the red-naped sapsucker and brown creeper. These last two species rely on the mature trees found in the gallery forest for feeding and nesting. Yellow warbler, least flycatcher, and MacGillivray's warbler feed and nest in the understory of the forest. Some mammals include the red squirrel, raccoon, white-tailed deer, porcupine, yellow-bellied marmot, red fox, and coyote. There are eleven bat species found on the refuge (appendix G), all of which depend on the gallery forest for various stages of their life cycles. Of these 11 species, 3 of them are State species of concern including Townsend's big-eared bat, hoary bat, and fringed myotis.

Dave Menke/USFWS

Lewis's woodpecker nests in tree cavities on the refuge.

Throughout the riparian woodlands are various wetland types including ephemeral pools, sloughs, and remnants of former gravel pits which provide breeding grounds for amphibians such as the long-toed salamander and the boreal toad, a State species of concern. Documented fish species include both native fish (pike minnow and longnose sucker) and nonnative fish (largemouth bass, pumpkinseed, and brook and brown trout). Native beavers and Columbia spotted frogs and nonnative American bullfrogs also inhabit these wetlands.

The Service designated North Burnt Fork Creek as critical habitat for bull trout in October 2010. Historically, bull trout used North Burnt Fork Creek as a passageway to return to their spawning grounds in the headwaters in the Sapphire Mountains where populations are still viable. This no longer occurs. The refuge installed several structures along the refuge portion of the creek in an effort to create more pond-like habitat for waterfowl and warm-water fish (providing more fishing opportunities in the public area). Off-refuge, along the creek, ditching and irrigation occurred on private land. These actions resulted in a loss of stream habitat and fish passage for the federally listed bull trout (listed as threatened in 1994). Fish occupying the creek still consist of native species including minnows, suckers, and whitefish. Nonnative species such as brown and brook trout and pumpkinseed also use the stream (unpublished refuge files: Fish Trap Data 2009).

Wetland Impoundment Habitat

Wetland habitat on the refuge, other than that described above, consists of wetland impoundments and their surrounding areas. Wetland impoundments were created throughout the refuge to provide wetland habitat for migratory birds, particularly waterfowl.

Levees were constructed, and water control structures were installed. A number of impoundments were semi-permanently flooded, constituting the largest area of open water in the Bitterroot Valley. The refuge now manages many impoundments for migratory birds by periodic drawdowns to increase their productivity. Water to flood the impoundments is provided by natural springs, tile drains, creeks, and irrigation ditches.

The impoundments have areas of open water with mudflat edges and are surrounded and interspersed with submergent and emergent vegetation. Submergent flowering aquatic vegetation in many areas of the open water includes northern water milfoil, hornwort, and Richardson and Sago pondweed. Emergent vegetation includes, water smartweed, cattail, and various species of rushes and sedges. The combination of these and similar vegetative species is often referred to as persistent/robust emergent habitat, and it provides cover and nesting opportunities for American bitterns, rails, wrens, blackbirds, and waterfowl. However, if left unmanaged, emergent vegetation such as cattail can grow into a monoculture and leave little edge, outcompeting other emergent vegetation and reducing the amount of open water.

Characteristic Wildlife

The wetland impoundments and surrounding emergent vegetation make up 958 acres of the refuge. These impoundments provide stopover habitat for migrant waterbirds including waterfowl species such as mallard; gadwall; northern pintail and shoveler; cinnamon, green-winged, and blue-winged teal; and wood, redhead, and ruddy duck. Other waterbirds documented on these impoundments includes six species of grebe, American white pelican, white-faced ibis, and occasionally a great egret. Both trumpeter and tundra swans stopover at the refuge, and bitterns are sometimes seen hiding amongst the cattail. When extensive mudflats are present, migrant shorebirds such as least sandpiper, semipalmated plover, American avocet, black-necked stilt, dowitcher, and yellowleg are seen feeding in these areas. Double-crested cormorants can usually be found in the north ponds and have historically nested over water in dead trees. Abundant yellow-headed and red-winged blackbirds can be found nesting in the summer among the cattails along with marsh wren, sora, and Virginia rail.

Remaining refuge acres

Habitats that do not fall in the above categories include 63 acres of the Bitterroot River channel and 90 acres of bare or sparse vegetation that includes gravel bars, parking lots, roads, and facilities.

Invasive species

Nonnative species are prolific on the refuge, displacing native plants and affecting more than 70 percent of refuge lands as a result of alterations to topography, drainages, clearing, conversion to various agricultural crops or livestock forage, grazing by cattle and sheep, and sedimentation pre- and post-establishment of the refuge. Many of the species are transported to the refuge as "hitchhikers" on vehicles, pedestrians, and animals. Wildfowl Lane, a county road that bisects the refuge, is used by more than 143,000 visitors annually in vehicles from all over the country. These factors have contributed to the introduction and distribution of invasive species, as have the surrounding development, landscape level invasive species in western Montana, the vulnerable exposed soil on the refuge (from wetland habitat construction and prior agricultural uses), and the locations of the Bitterroot River, the railroad bed, Highway 93, and Eastside Highway.

The State of Montana has 32 plant species on the Montana Noxious Weed List, 15 of which are found on the refuge in various degrees of infestation. During the past several years, new invaders (hoary alyssum, Dalmatian toadflax, and blueweed) have been detected. These species rank as high priority species for early detection and rapid response treatment. Some species, while not considered noxious by the State of Montana, are considered undesirable and problematic by refuge staff; these include musk thistle, cheatgrass, kochia, reed canarygrass, and teasel (table 6).

The refuge has a number of resources to respond to the invasive species problem. The refuge provides office space and other support for one of the Service's Montana Invasive Species Strike Teams. This team works with refuges throughout the State, including Lee Metcalf Refuge, inventorying and treating new invaders and high priority invasive and nonnative plants. Additionally, a partnership with the Ravalli County Weed District has provided several crew members wholly dedicated to treating more established noxious weeds. An annual volunteer weed-pull event for the public occurs, and youth groups like the Montana Conservation Corps, Youth Conservation Corps, and Selway-Bitterroot Foundation interns have also assisted in refuge treatment efforts. Also, invasive species spread and control is integrated into staff fieldwork.

The main planning tool for treating invasives on the refuge is using integrated pest management (IPM). IPM is a structured and logical approach to managing weeds by using a combination of biological, mechanical, and chemical tools. Past IPM efforts have included mapping, treating, and monitoring invasive species on the refuge. Treatment methods for invasives vary with species, daily weather conditions, plant growth stage, and time of year. Methods used to treat invasives have included herbicide application, prescribed fire, biological controls (including goats, flower and root weevils, and flower and root moths), hand pulling, mowing, and cultivating. Along with prescribed burning and grazing, chemical applications of herbicides

Table 6. Documented invasive and nonnative plant species on Lee Metcalf National Wildlife Refuge, Montana, as of 2010 and the degree of infestation, priority for treatment, and State noxious status.

Common name	*Degree of infestation*	*Area of infestation or number of plants found*	*Priority for treatment*	*State noxious status*[1] *and comments*
Tall buttercup	Medium	0.23 acre[2]	High	Priority 2A—common in some areas, eliminate or contain
Yellowflag iris	Medium	0.82 acre[2]	High	Priority 2A
Blueweed	Low	Two plants found	High	Priority 2A
Hoary alyssum	Low	3.56 acres[2]	High	Priority 2A
Canada thistle	High	50 acres[3]	Medium	Priority 2B—abundant and widespread, eradication or containment where less abundant
Field bindweed	Low	1 acre	High	Priority 2B
Leafy spurge	Medium	7.51 acres[2]	High	Priority 2B
Spotted knapweed	High	6.64 acres[2]	Medium	Priority 2B
Dalmatian toadflax	Low	<5 plants	High	Priority 2B
St. Johnswort	Medium	15.2 acres[2]	Medium	Priority 2B
Sulfur cinquefoil	Low	0.06 acre[2]	High	Priority 2B
Common tansy	High	28.89 acres[2, 3]	Medium	Priority 2B
Oxeye daisy	Medium	6.43 acres[2]	Medium	Priority 2B
Houndstongue	High	48.33 acres[2, 3]	High	Priority 2B
Yellow toadflax	Medium	1.48 acres[2, 3]	Medium	Priority 2B
Cheatgrass	High	26.74 acres[2, 3]	Low	Priority 3—regulated plant with potential to have significant impacts, may not be intentionally spread or sold
Musk thistle	High	70 acres[3]	Medium	n/a
Italian bugloss	Medium	2.97 acres[2]	High	n/a
Teasel	Low	0.5 acre[3]	Medium	n/a
Kochia	High	7 acres[3]	Medium	n/a
Reed canarygrass	High	200 acres[3]	Low	n/a

1 *Sources: Montana Department of Agriculture 2010, USDA 2010.*
2 *Estimated acreage of infestation (treated and untreated) within areas surveyed based on USFWS, Montana Invasive Species Strike Team 2009; additional infestations may occur within unsurveyed areas.*
3 *Acreage is estimated.*
Additional source: unpublished refuge data.

have significantly aided efforts to control the spread of invasive plant species and possibly the elimination of invasives from specific areas on the refuge. Chemical applications are used on specific species and applied during the optimal plant stage of growth to increase the effectiveness of the application. All chemicals must be approved by the Service for use on refuges, and the application of a specific chemical onsite must undergo a pesticide use proposal evaluation. Approximately 400 acres per year are treated for invasive plants, using chemical applications and mechanical means.

Wildlife Diseases and Contaminants

Several wildlife diseases have the potential in the near future to spread to the refuge from western Montana and neighboring states. Contaminants from surrounding residential development, historical mining activity, and atmospheric deposition also pose a threat.

Wildlife Diseases

Two common avian diseases have been documented near the refuge in very small numbers (less than 30 birds): aspergillosis and salmonellosis. Often fatal, aspergillosis is caused by birds ingesting or inhaling toxic fungi in contaminated feeds. Salmonellosis can also be fatal; it is caused by Salmonella bacterium that spreads through (1) the air via bacteria shed from seed kernels or insects, (2) an infected organism's feather dust or feces, or (3) through other contact. While these are the only two diseases documented in this area, there may

be impacts on the refuge in the future from unknown or emerging contaminants or diseases.

Highly pathogenic avian influenza has not yet been documented in North America, but because of the serious health risks to humans and domestic fowl, the Service has entered into an interagency agreement to develop an early detection system should this influenza migrate to the continent. Additionally, in 2006 the refuge completed a "Highly Pathogenic Avian Influenza Disease Contingency Plan." This plan will be reviewed annually and updated as new information becomes available.

Since 2006, the refuge has collaborated with MFWP to sample for avian influenza. More than 200 samples (obtained through cloacal and pharyngeal swabbing of hunter-killed ducks) were collected. All of these samples tested negative for highly pathogenic avian influenza. Another avian influenza testing effort was led by the University of California, Los Angeles and the Institute for Bird Populations. The goal of this project was to determine the pattern, distribution, and transmission of various strains of avian influenza between migratory and resident species. Neotropical migrants and resident passerines were sampled for avian influenza in 2007 and 2008 at the refuge bird banding station. No highly pathogenic avian influenza was documented in refuge birds.

Chronic wasting disease (CWD) is a transmissible spongiform encephalopathy that is found in deer and elk in North America. Spongiform encephalopathy is a progressive neurodegenerative disorder that produces changes in the brain and causes fatal chronic weight loss. The main theory of a causative agent is the abnormality of a group of proteins called prions. These prions infect the host and cause tissue damage in the brain, resulting in a "sponge-like" appearance. CWD is contagious and can be transmitted directly between animals through nose-to-nose contact and indirectly through shedding of infectious prions into the environment that are later ingested by healthy animals (U.S. Geological Survey, National Wildlife Health Center 2007). All 48 contiguous states have some form of CWD surveillance in place, and CWD has been found in Montana but only in game farms. It is anticipated that CWD will appear in wild populations because it is documented in the neighboring states of North Dakota, South Dakota, and Wyoming, as well as in Alberta and Saskatchewan. The refuge completed a "Chronic Wasting Disease Surveillance and Contingency Plan" in 2005. Beginning in 2014, this plan will be reviewed annually and updated as new information becomes available.

Contaminants

Concerns about links between mining-related contaminants in river sediment and their occurrence in nesting osprey prompted scientists to study the refuge and other areas throughout the Clark Fork River Basin (Langner et al. 2011). The refuge participated in this 3-year research project conducted between 2006 and 2009 by the University of Montana. The Bitterroot River was used as a control site, including the stretch alongside the refuge. The study tested mercury levels from several sources: river sediments, aquatic invertebrates, trout, and blood and feathers from osprey chicks. Osprey were chosen as subjects in this study as they are regarded as indicators of aquatic ecosystem health. Chicks were sampled because virtually all of their biomass grew from consumption of local fish, thus reflecting local environmental conditions.

One discovery was that osprey chicks within and downstream of the refuge were found to have methylmercury in their blood and tissue samples. An organic form of mercury, methylmercury is the most toxic form, and it bioaccumulates in fish (USGS 2012). In the Lee Metcalf Refuge Bitterroot River reach, the mercury concentration of the fine-grain sediment is relatively low; nevertheless, the blood analysis showed the presence of methylmercury in refuge osprey chicks. Methylation occurs when elemental mercury enters the water and is taken up by bacteria that convert it to methylmercury in anaerobic conditions (Langner et al. 2011). Many of the sampled chicks from the refuge were in nests alongside wetland impoundments. The wetland impoundments likely enhance methylation rates and mercury biomagnification within the aquatic food web (Langner 2011). Both methylation rates and the stability of methylmercury in sediments appear to be enhanced under anaerobic conditions, whereas methylation rates are low under aerobic conditions, probably because of the reduced activity of anaerobic sulfate-reducing bacteria. On the other hand, the degradation of methylmercury appears to be generally favored by aerobic conditions (Ullrich et al. 2001). The resulting methylmercury is moved through the food chain, eventually reaching osprey and other top predators such as otter. This could be a cause of the 20-year decline in chicks fledged on the refuge from a peak of 40 in 1988 to 9 in 2007 (figure 19). The precise mechanism of forming methylmercury is still unclear as the synthesis of methylmercury in aquatic systems is influenced by a wide variety of environmental factors. The efficiency of microbial mercury methylation generally depends on factors such as microbial activity and the concentration of bioavailable mercury (rather than the total mercury pool), which in turn are influenced by parameters such as temperature, pH, redox potential (gain or loss of electrons), and the presence of inorganic and organic complexing agents. While there is no simple relationship, it appears that enhanced rates of methylmercury production are linked in particular with low pH, low salinity, and the presence of decomposable organic matter in reducing environments (Ullrich et al. 2001).

Other contaminant concerns on the refuge are pharmaceuticals and nutrients (which enter the refuge ground water from the many subdivisions next to the refuge), acid rain, and residual pesticides.

3.3 State and Federally Listed Species

The Service has not documented any current candidate or federally listed species under the Endangered Species Act using any lands or water within the Lee Metcalf Refuge. Many of the species found within the refuge have been designated as species of concern by MFWP and the Montana Natural Heritage Program (Montana Natural Heritage Program 2012) or as birds of conservation concern by the Service (USFWS 2008).

Species of Concern

According to the Montana Natural Heritage Program, species of concern are native animals breeding in Montana that are considered to be at risk due to their declining population trends, threats to their habitats, or restricted distribution (Montana Natural Heritage Program 2012). The Service identifies birds of conservation concern as migratory and nonmigratory birds of the United States and its territories that have declining populations, naturally or human-caused small ranges or population sizes, threats to their habitat, or other threats. Bird species considered for inclusion on this Federal list include non-gamebirds, gamebirds without hunting seasons, subsistence-hunted non-gamebirds in Alaska, birds that are candidates or proposed as threatened or endangered under the Endangered Species Act, and birds that recently have been removed from a Federal listing (USFWS 2008). Some of these Federal birds of conservation concern are not listed as State species of concern (for example, the horned grebe). This Federal species list covers the entire Northern Rockies, not just Montana; therefore, the species may not be imperiled in Montana and not warrant listing as a State species of concern. This designation helps stimulate coordinated and proactive conservation actions among Federal, State, tribal, and private partners.

A total of 42 wildlife State species of concern and 21 Federal birds of conservation concern have been found in the Bitterroot Valley (USFWS 2008). These wildlife species are identified on the State and/or Federal lists as species that require special attention to prevent them from becoming threatened or endangered. All but eight of these species have been documented using the refuge. There are also two plant species of concern found on or near the refuge, Guadalupe waternymph and shining flatsedge.

The State forest and grassland bird species of concern that have been recorded on Lee Metcalf Refuge are peregrine falcon, black swift, burrowing owl, great gray owl, Lewis's woodpecker, olive-sided flycatcher, Clark's nutcracker, loggerhead shrike, black-and-white warbler, Le Conte's sparrow, and bobolink. There are also three documented mammal State species of concern on the refuge: hoary bat, fringed myotis, and Townsend's big-eared bat. A damselfly, the boreal bluet, and an amphibian, the boreal toad, are also species of concern that have been recorded on the refuge.

The State wetland bird species of concern that have been recorded on the refuge are common loon, American white pelican, American bittern, great blue heron, black-crowned night-heron, white-faced ibis, trumpeter swan, bald eagle, long-billed curlew, Franklin's gull, black tern, common tern, Caspian tern, and Forster's tern.

The bull trout is federally listed as threatened and historically used North Burnt Fork Creek, which traverses through the refuge, as passage to spawning grounds. Although it has not been documented on the refuge, there is a population off the refuge in the upper reaches of North Burnt Fork Creek in the Sapphire Mountains. On September 30, 2010, the Service designated 18,795 miles of streams and 488,252 acres of lakes and reservoirs in Idaho, Oregon, Washington, Montana, and Nevada as critical habitat for the wide-ranging native fish. The Bitterroot River and North Burnt Fork Creek are both located within this designated area. This designation and the status of the bull trout emphasize the need for coordination with other efforts to restore this critical habitat including special consideration in management of refuge resources.

Table 7 lists State species of concern and Federal birds of conservation concern that have been found in the Bitterroot Valley and on the refuge.

Jim Mogen/USFWS

Bull trout, a threatened species, are not found in refuge waters but once crossed the refuge to spawning grounds.

Table 7. Montana listed species of concern and Federal birds of conservation concern recorded in the Bitterroot Valley and on Lee Metcalf National Wildlife Refuge, Montana.

Species	*State species of concern*[1]	*Federal birds of conservation concern*[2]	*Recorded using the refuge*[3]
Boreal toad[4]	X	n/a	X
Trumpeter swan	X	—	X
Common loon	X	—	X
Horned grebe	X	X	X
Clark's grebe	X	—	X
American white pelican	X	—	X
American bittern[4]	X	X	X
Great blue heron	X	—	X
Black-crowned night-heron	X	—	X
White-faced ibis	X	—	X
Bald eagle	X	X	X
Northern goshawk	X	—	X
Swainson's hawk	—	X	X
Golden eagle	X	X	X
Peregrine falcon	X	X	X
Prairie falcon	—	X	X
Black-necked stilt	X	—	X
Long-billed curlew	X	X	X
Marbled godwit[4]	—	X	X
Short-billed dowitcher	—	X	X
Franklin's gull	X	—	X
Forster's tern	X	—	X
Black tern	X	—	X
Caspian tern	X	—	X
Common tern	X	—	X
Least tern	X	—	X
Black-billed cuckoo	X	X	X
Burrowing owl	X	X	X
Short-eared owl	—	X	X
Great gray owl	X	—	X
Flammulated owl	X	X	X
Black swift	X	X	X
Calliope hummingbird	—	X	X
Lewis's woodpecker[4]	X	X	X
Pileated woodpecker	X	—	X
Willow flycatcher[4]	—	X	X
Olive-sided flycatcher	—	X	X
Loggerhead shrike	X	X	X
Clark's nutcracker	X	—	X
Pinyon jay	X	—	X
Brown creeper[4]	X	—	X
Winter wren	—	—	X
Veery	X	—	X

Table 7. Montana listed species of concern and Federal birds of conservation concern recorded in the Bitterroot Valley and on Lee Metcalf National Wildlife Refuge, Montana.

Species	*State species of concern*[1]	*Federal birds of conservation concern*[2]	*Recorded using the refuge*[3]
Sage thrasher	X	X	X
Le Conte's sparrow	X	—	X
Bobolink[4]	X	—	X
Fringed myotis	X	n/a	X
Townsend's big-eared bat	X	n/a	X
Hoary bat[4]	X	n/a	X
Bull trout[5]	X	n/a	—
Boreal bluet	X	n/a	X
Boreal whiteface	X	n/a	X
Shining flatsedge	X	n/a	X
Guadalupe water-nymph	X	n/a	X

[1] *Source: Montana Natural Heritage Program 2012.*
[2] *Source: USFWS 2008.*
[3] *Source: unpublished refuge data, includes casual sightings.*
[4] *Proposed target species for refuge management.*
[5] *Listed under the Federal Endangered Species Act as threatened.*

3.4 Cultural Resources and History

The following section describes the cultural resources and history of the refuge and the Bitterroot Valley, starting with the earliest documented occupation by Native Americans circa 12–15,000 years before present (B.P.). It then discusses Euro-American settlement in the valley and changes to the area's land uses, including those within the refuge boundary.

Prehistoric Occupation

The cultural sequence for prehistoric occupation in this area is split into three major subdivisions based on Malouf (1956) including Early Hunter (10,000 to 6,000 before Christ [B.C.]), Middle Period (6,000 B.C. to Anno Domini [A.D.] 800), and Late Hunter (A.D. 800 to 1870).

Early Hunter

Woodside (2008) examined oral histories and other documentation to propose the presence of Paleo-Indians in Oregon and Washington before the flooding of Glacial Lake Missoula. Paleo-Indians, or Paleoamericans, is a classification term given to the first peoples who entered, and subsequently inhabited, the North American continent during the final glacial episodes of the late Pleistocene period. Woodside examined the Native American oral history of tribes in Oregon and Washington that described the cataclysmic flooding of Glacial Lake Missoula and how the tribes survived this event, dating about 15,000 years ago. Her research did cover other areas impacted by Glacial Lake Missoula, including the refuge. Ryan (1977) recovered two Cascade Points (projectiles) while performing archaeological research along the Clark Fork River west of Missoula. These points are indicative of this period and definitive evidence of Paleo-Indian presence. Ryan hypothesized that the Clark Fork Valley was an important corridor connecting the Columbian Plateau and the Northern Plains. Ryan also found an abundance of sites containing prehistoric activity. Alternately, Ward (1973) found a small number of archaeological sites in the Bitterroot Valley; many were pictographs only and not considered evidence of this period, nor did they date to this period of time.

Middle Period

Glacial Lake Missoula receded about 12,000 B.P., according to Alt (2001). Eventually native people occupied the new valleys formed by this event. Ward (1973) searched the Bitterroot Valley for middle prehistoric evidence of occupation. She found 19 sites no older than 5,000 B.P. None contained the traditional pottery, roasting pits, tipi rings, battle pits, rock piles, or fishing gear associated with this time period. Many had pictographs, which connect site occupation to the middle period. Ward refers to other work including that done in 1951 by Carling Malouf and his University of Montana archaeology class who found jasper and flint chips at the mouth of the North Burnt Fork Creek (a small occupation site on the refuge) (Malouf 1952).

Late Hunter

Malouf (1952) notes that in A.D. 1730 the Shoshoni of Idaho gave horses to the Salish of this area. This significantly changed the culture of the Salish people. Malouf stated that the Salish have occupied western

Montana for several centuries dating back at least A.D. 1700. He cites tribal myths of animals that occupied this area, specifically coyote, beaver, otter, jay, and owl.

Protohistoric and Early Native Americans

The protohistoric period is the period of time between the arrival of horses and manufactured goods but before the arrival of Euro-American traders and explorers. This time period lasted only about 70 years due to the arrival of the Lewis and Clark expedition in 1805. Malouf (1952) noted that these intermountain areas of western Montana were the last areas of the United States to be settled by whites. Many traits of aboriginal times survived through this period without influence from Euro-American culture.

When early Euro-American explorers arrived, the area of western Montana was occupied primarily by three tribal groups: the Flathead and Pend d'Oreille (both considered Salish) and the Kutenai. In 1855, Governor Isaac Stevens stated the tribal population in western Montana to be 2,750 (Ryan 1977). In an unpublished University of Montana paper, Malouf (1952) reconstructed economy and land use by these tribes in western Montana using ethnographical and historical data.

All tribes were hunters and gatherers, and as such they did not allow for the accumulation of surplus food and supplies. However, famines were rare. Approximately 28 species of plants were the main sources of foods, medicines, cookware, and housing. The root of the bitterroot plant was a central dietary feature. One of the best places to dig the root was a mere 3 miles north of the refuge boundary at the mouth of Eight Mile Creek. Families could dig 50–70 pounds of bitterroot in late March or April. Arrowleaf balsamroot, an abundant plant in most elevations of western Montana, was also extensively eaten. Stems were typically peeled and eaten raw before flowering, and later roots were harvested and cooked. Ponderosa pine provided four forms of food: inner bark, sap between woody layers, cone nuts, and moss hanging from branches. Narrow leaf willow, a pioneer species on river gravel bars, was used in the construction of sweat lodges and baskets for cooking (sealed with gum). Most of the common mammals present today in western Montana were hunted including white-tailed deer and mule deer. Columbian ground squirrel, which is still abundant in places on the refuge, was also harvested. Woodchuck Creek, about 5 miles north of the refuge, was a site where Salish regularly used dead fall traps to harvest marmots. Most birds were not harvested except waterfowl, yet mallard eggs were particularly plentiful and popular. Other gamebirds were not numerous. Fishing was employed on bison hunts and by those left behind when these bison hunt parties were gone. The place name for Missoula refers to the bull trout caught there.

The vicinity of Stevensville was the center of social and economic life for the Salish. Most tributaries in the Bitterroot Valley had one or more families inhabiting it. The alluvial fan at the mouth of North Burnt Fork Creek (partially on refuge property) was also home for a considerable number of Salish families. JoAnn BigCrane, a Native American historian, visited this part of the refuge in August 1990 (refuge annual narrative) and agreed that a seasonal encampment was here at one time. North Burnt Fork Creek doubled as a highway of sorts for Native American travel to the Clark Fork Valley over the Sapphire/Rock Creek divide. This was the shortest route requiring only one night of camping.

HISTORY OF THE SALISH

The Salish–Pend d'Oreille Culture Committee furnished the following narrative for use on the Lee Metcalf Refuge Web site.

> The Bitterroot Mountain range is the backbone of the valley. The Salish call the Bitterroot Mountains "VCk Welk Welqey" which means "the tops are red." The life way of the Salish people is a cooperative dependent relationship with the land, plants, and animals.
>
> Salish is the name of a group of people, consisting of several tribes, and the language they spoke. The Bitterroot Valley was the permanent home of their forefathers. The Stevensville vicinity was their main winter camp.
>
> After the Hellgate Treaty of 1855, pressure increased for the removal of the Salish from the Bitterroot to the Jocko Valley on the Flathead Reservation. In 1872, General James Garfield presented the three Salish Chiefs Charlo, Arlee, and Adolf, with a second treaty which Charlo refused to sign. Charlo remained in the Bitterroot for 20 more years until he and his band were escorted from the valley by General Carrington in October 1891.
>
> The respect and love for the Bitterroot can be summed up in the words of Louise Vanderburg, a Salish elder:
>
> *"When we go home I think about our old people. I walk lightly when I walk around. The bones of my Grandparents and their Grandparents are all around here. We return to the Bitterroot each year on a Pilgramage to honor our connection with our homeland. Also to ensure the preservation of our ancestors' graves and sacred sites. In doing so we acknowledge the gifts left here by those who have gone on before us, gifts of language, songs, dance, spirituality. This way of life has been sustained for generations by our ancestors' prayers."*

EURO-AMERICAN SETTLEMENT AND LAND USE CHANGES

The Bitterroot Valley was used by the first Euro-American explorers to the western United States, including Lewis and Clark. Following the Lewis and Clark expedition, fur traders from the Hudson's Bay Company entered the Bitterroot Valley to secure furs from the Indians and establish forts and missions. The oldest consistently occupied town in Montana was initially established at the present day site of Stevensville by Catholic missionaries in 1841 (Stevensville Historical Society 1971). At the request of four separate Indian delegations from the Salish tribe, Father Pierre De Smet came to the valley from St. Louis in the late 1830s. De Smet and other priests were eventually joined by Father Anthony Ravalli in 1845. Named St. Mary's Mission, this community kindled additional settlement in the region. St. Mary's Mission was closed in 1850, and the community was renamed Fort Owen, and then later Stevensville, after Isaac Stevens, the first Governor of the Montana territory.

The primary early land use by settlers in the Bitterroot Valley was cattle grazing. By 1841 extensive areas of the valley were grazed and used for winter range as cattle were moved from summer grazing and calving locations in mountain slopes and foothills back into the valley in the fall (Clary et al. 2005).

In the mid-1850s, the discovery of gold in western Montana fueled immigration to the State, and a short flurry of gold exploration and mining occurred in the Bitterroot Valley. Early workers in the gold camps subsisted on wild meat and the importation of produce, meat, and dairy products. At this time some residents began growing vegetable crops to feed the miners, and this demand stimulated the first agricultural development in the Bitterroot Valley. Subsequently, the Bitterroot Valley became the "breadbasket" that nourished Montana's genesis, and Fort Owen was the nucleus of the first Euro-American settlement. Gold exploration was short-lived in the Bitterroot region, and by the 1870s the area's economy was almost solely based on local agricultural crops and cattle production. Ravalli County was created in 1893, and by 1914 extensive settlement had occurred in the region. Timber harvest and grazing were the predominant economic uses of the area at that time (Clary et al. 2005).

The dry climate of the Bitterroot Valley created annual variation in the availability of water to support agricultural crops. As early as 1842, priests at St. Mary's Mission successfully planted and irrigated crops of wheat, potatoes, and oats (Stevensville Historical Society 1971), and thus by appropriation, the first water right in Montana was established. A water right on the North Burnt Fork Creek was filed in 1852 by Major John Owen, who used creek water to run a grist mill and sawmill.

Two methods of water appropriation occur in Montana. The first—used by early settlers, miners, and mill operators—applies the "relation back" rule of law, meaning that the right is dated to the beginning of construction of a ditch or a means to use the water in a so-called "beneficial" way. The second method involves posting a POD on a creek or other drainage and filing notices in the courthouse. A stream inevitably becomes over-appropriated when many people and industries make demands on it. Over-appropriation usually ends in "quick frozen" or "decreed" action, and adjudication of a stream becomes necessary when rights are conflicting.

In the early 1900s, the Bitterroot Valley Irrigation Company (formerly the Dinsmore Irrigation and Development Company) began construction of a major irrigation system for the Bitterroot Valley (U.S. Bureau of Reclamation 1939, 1982; Stevensville Historical Society 1971). This system included water storage and conveyance facilities along the Bitterroot River and its tributaries as well as several reservoirs, including Lake Como west of Darby, and a diversion dam on Rock Creek. In 1905 the existing dam at Lake Como was raised 50 feet, and by the winter of 1906, 17 miles of canals were built to convey Lake Como water northward in the Bitterroot Valley. Eventually, a channel was built from Lake Como to the Bitterroot River, at which point it was reverse siphoned into a 24-foot-wide canal, capable of carrying water 6 feet deep. Water was then flumed across several small gulches, across Sleeping Child Valley, and around the foothills for 75 miles to the Eight Mile Creek east of Florence. By 1909, 56 miles of canal had been built northward to North Burnt Fork Creek. Subsequently about 14,000 acres of cropland were sold, and irrigation water was delivered to the acreage. The company's Main Supply Canal (known as the "Big Ditch") was originally constructed to primarily deliver water to apple orchards. The canal, however, was only able to supply about half an inch of water per acre, which was barely enough to support fruit trees and only about half enough for other crops. The land was bought by local farmers and then re-sold in promotional schemes to eastern families for mainly apple production. Limited water and poor yields collapsed orchard production, and by 1918 the Bitterroot Valley Irrigation Company went bankrupt.

In 1920, a reorganized Bitterroot Irrigation District was formed, and it issued bonds to purchase water rights and to develop water storage and distribution works. Drought conditions in the late 1920s and 1930s coupled with the Depression-era economics further exacerbated water problems in the valley and curtailed agricultural expansion in the region during this period (Cappious 1939, Stevensville Historical Society 1971). Following further financial difficulty, in 1930 Congress authorized the Bureau of Reclamation to liquidate private indebtedness and rehabilitate

the Bitterroot Irrigation District (U.S. Bureau of Reclamation 1939). Extensive rehabilitation to the district's Main Supply Canal and its distribution system was conducted from 1963 to 1967. Flood damage occurred in 1974, and extensive repairs were made on many structures. Currently the Bitterroot Irrigation District provides water to about 16,665 acres on the east side of the Bitterroot River (U.S. Bureau of Reclamation 1982).

Today, the Bitterroot Irrigation District's Main Supply Canal runs 1 mile east of the Lee Metcalf Refuge; however, it does not supply water to the refuge. Instead, irrigation water is supplied by the Supply Ditch Association, a private company formed in 1909. The association's Supply Ditch delivers Bitterroot River water to the refuge via three lateral ditches: the North Lateral Ditch (also called the Alleman Ditch), the Middle Lateral Ditch (also called the McElhaney Ditch), and the South Lateral Ditch (also called the Warburton Ditch) (figure 21).

Most of the Bitterroot Valley was unfenced in the early era of settlement from 1850 to 1910. However, in the early 1900s, the "apple boomers" who bought land in the valley began fencing most of the area. By the mid-1930s, more than 50,000 sheep and 30,000 cattle were present in the Bitterroot Valley; only about 22 percent of the valley was harvested cropland (Richey 1998). In the late 1940s and early 1950s generally wet conditions stimulated agricultural production in the Bitterroot Valley. Large-scale cattle grazing and haying operations and some small grain farming were conducted in and near the Lee Metcalf Refuge. Some native riparian forest and grassland in the Lee Metcalf Refuge region had been cut, cleared, or converted to alternate land uses by the mid-1900s. Two of the larger minor floodplain channels, Nickerson and McPherson Creeks (now called Ditches), were partly ditched in the early 1900s, and some minor impoundment of low elevation depressions and drainages occurred. By the 1960s, lands that became part of the refuge were controlled by about 13 landowners who heavily cropped and grazed the area. Much of the site was irrigated crop and pastureland using the extensive ditch and irrigation diversion system constructed across the floodplain (figure 21). These impounded ponds probably were created as water sources for livestock. Another development—a golf course—was established in 1933 within the southwest side of what became the refuge. It still exists today.

Many roads have been built in the Bitterroot Valley starting with a stage coach road in 1867 (Stevensville Historical Society 1971). This route eventually became Highway 93. Part of the main county road through the refuge follows the existing road shown on the 1873 plat map. Other early roads in the area were constructed from 1870 to 1900. These roads skirted higher ground and avoided the river, but eventually bridges were built across the Bitterroot River beginning in the late 1800s. These bridges were often destroyed by high water levels and floods.

The Bitterroot Branch of the Northern Pacific Railroad was constructed from Missoula to Grantsdale in 1889 and soon thereafter was extended to Darby. This rail line was built primarily to transport timber from the slopes of the Bitterroot Mountains and sawmills that sprang up all along the west side of the valley. Rail spurs connected mills, and eventually logging and mills expanded to the east side of the valley. Transporting lumber from the east side of the valley eventually led to the construction of rail bridge crossings over the Bitterroot River including the bridge and line at the northern boundary of the Lee Metcalf Refuge. In the high waters of June 1943, this bridge collapsed under the weight of a train loaded with logs. In 1927 and 1928, the railroad was relocated from south of Florence to the east side of the river.

By the late 1970s, farm sizes in the Bitterroot Valley increased greatly, but agricultural economies prevented more extensive small grain farming in the valley and landowners began subdividing holdings for residential development (Richey 1998). By the early 1990s, Ravalli County had the fastest growing population and residential expansion in Montana, expanding from about 25,000 residents in 1990 to more than 40,000 in 2010 (U.S. Census Bureau 2010). Today, most Ravalli County residents live on the Bitterroot Valley floor within a few miles of the river. Much of the increase in population occurred outside of established towns and became concentrated in areas where each dwelling or subdivision has its own well and septic system. Several hundred residential structures now essentially surround Lee Metcalf Refuge (figure 22).

Whaley Homestead (National Register of Historic Places)

The Whaley Homestead, which was included as part of a major land acquisition by the refuge in 1988, is listed on the National Register of Historic Places.

The Whaley Homestead was home to the family of Peter Whaley, an Irish immigrant who came to Montana in the 1860s, lured by gold strikes at Bannack and Alder Gulch. Whaley's wife, Hannah, and their nine children shared his adventures, including his service as the first agent on the Flathead Reservation, until the family settled on deserted land claimed in 1877. The house, built circa 1885, survives as an outstanding example of vernacular frontier architecture. Weatherboard siding conceals a massive, complicated understructure of square-hewn logs.

The Whaley family farmed and raised livestock until 1905 when they sold the property to a short-lived horse breeding operation. At the height of the "apple boom" in 1909, the Bitterroot Valley Irrigation Company purchased the homestead, planting the

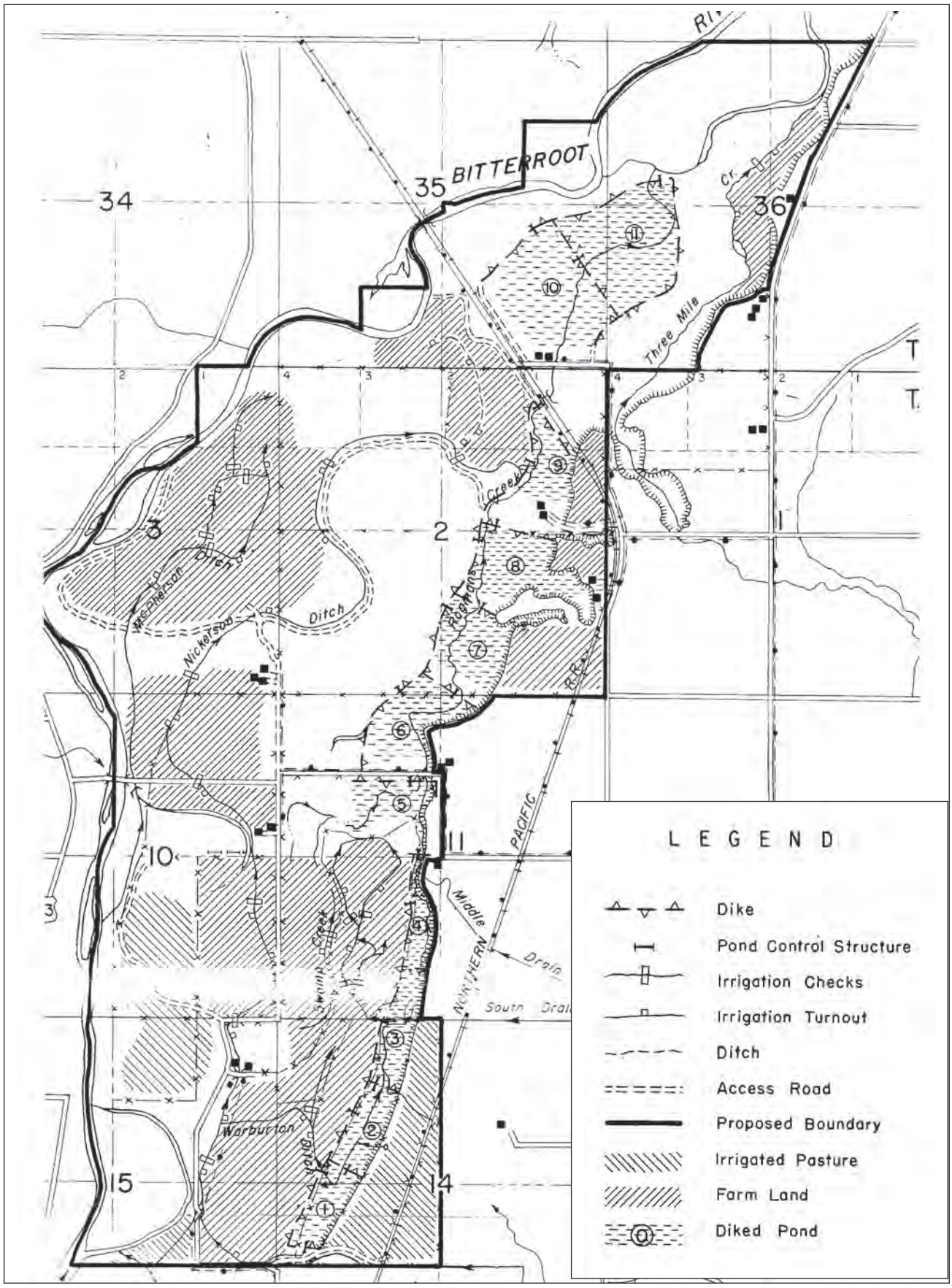

Figure 21. Proposed land use and drainage and irrigation infrastructure on Lee Metcalf National Wildlife Refuge, Montana, in the 1960s (Heitmeyer et al. 2010).

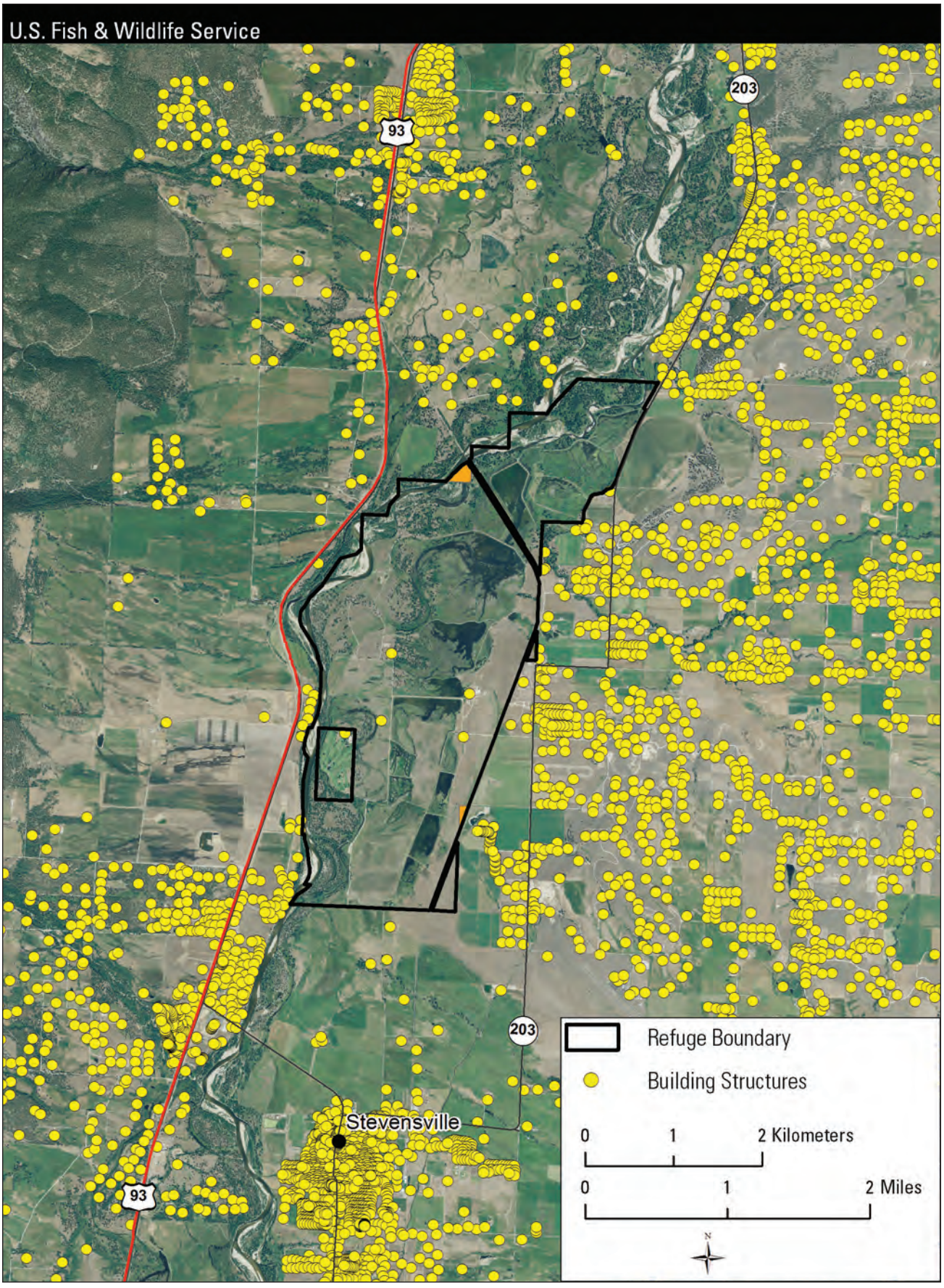

Figure 22. Locations of structures near Lee Metcalf National Wildlife Refuge, Montana (Heitmeyer et al. 2010).

upper fields with McIntosh apple trees and gooseberry bushes for nursery stock.

In 1921 new owners Fred and Anna Hagen returned the homestead to a self-sufficient farm, raising corn, potatoes, hogs, and dairy cows. After more than 50 years of farming, they sold the land to the refuge and their son, Harold, and his wife remained there until 1988. During the 1979 ceremony renaming the refuge in Senator Lee Metcalf's honor, Harold Hagen waxed philosophical of the agricultural practices on the family farm that became refuge property: "I believe that we have attempted to mold the land to our ideas, to what it should produce when the land should have shaped our ideas and dictated to us what it could best produce" (refuge files).

3.5 Special Management Areas

Areas with official designations are managed to retain the special features that led to their designation. While not suitable for inclusion in the Wilderness System, the Lee Metcalf Refuge has been identified as a significant part of the Bitterroot River Important Bird Area.

Wilderness review

A wilderness review is the process used for determining whether to recommend Service lands or waters to Congress for designation as wilderness. The Service is required to conduct a wilderness review for each refuge as part of the CCP process. Lands or waters that meet the minimum criteria for wilderness would be identified in a CCP and further evaluated to determine whether they merit recommendation for inclusion in the Wilderness System. To be designated as wilderness, land must meet certain criteria as outlined in the Wilderness Act of 1964:

- generally appears to have been affected primarily by the forces of nature, with the imprint of human work substantially unnoticeable
- has outstanding opportunities for solitude or a primitive and unconfined type of recreation
- has at least 5,000 acres of land or is of sufficient size to make practicable its preservation and use in an unimpaired condition
- may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value

The refuge is only 2,800 acres and is altered by roads, ditches and levees. The refuge is also bordered by private land that has been developed for agriculture or housing. Although the refuge does provide visitors with opportunities for solitude and educational and scenic value, overall the refuge does not meet the criteria for wilderness designation and is not being recommended for inclusion in the Wilderness System.

Important bird area

The Important Bird Areas program, initiated in Montana in 1999, is a global effort managed by the National Audubon Society to identify and conserve areas vital to birds and biodiversity. To date 39 sites have been designated as important bird areas in Montana, encompassing more than 10 million acres of outstanding wildlife habitat, including streams and wetlands. To qualify as an important bird area, sites must satisfy at least one of the following criteria to support the following types of bird species groups:

- species of conservation concern (for example, threatened and endangered species)
- restricted-range species (species vulnerable because they are not widely distributed)
- species that are vulnerable because their populations are concentrated in one general habitat type or biome
- species or groups of similar species (such as waterfowl or shorebirds) that are vulnerable because they occur at high densities due to their behavior of congregating in groups

Lee Metcalf Refuge is part of the Bitterroot River Important Bird Area, one of the largest riparian and wetland important bird areas in the State, and part of an important bird area network crucial for bird survival throughout the year. The boundaries of the entire Bitterroot River Important Bird Area were made to correspond closely to the 500-year floodplain, and the northern and southern extent of the area was decided based on wanting to capture the most extensive cottonwood gallery forest that was present. Lee Metcalf Refuge is a cornerstone of the Bitterroot River Important Bird Area. From the cottonwood galleries to willow shrubland, extensive wetlands, and valley bottom coniferous forests patches, all key valley habitats come together on this refuge to provide great bird species richness. The important bird area documentation notes that more than 30 species of waterfowl, 20 species of shorebirds, and 20 species of riparian-dependent bird species, plus marshbirds, terns, and gulls are found on the refuge.

3.6 Visitor Services

Visitors to the Lee Metcalf Refuge enjoy a variety of compatible wildlife-dependent public use activities: hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation.

Bob Danley/USFWS

Members of the Audubon Society spot birds at the refuge.

The Lee Metcalf National Wildlife Refuge office and visitor contact area are open Monday–Saturday, 8:00 a.m.–4:30 p.m. The remaining areas open to the public can be accessed from dawn to dusk, except during hunting season when hunters are allowed reasonable time to access hunting areas. Brochures containing area maps, public use regulations, wildlife checklists, and general information are available to the public at the visitor contact area or the WVA kiosk.

Hunting and Fishing

The refuge is open to waterfowl hunting and archery-only hunting for white-tailed deer, both of which have occurred on the refuge since 1965 (USFWS 1966, refuge narratives).

A refuge hunting and fishing brochure was developed and printed in 2010. In addition to the site-specific regulations mentioned in the hunting brochure, all State of Montana hunting regulations apply to Service lands. All entry to refuge hunting areas is restricted to five specific parking areas, and all hunter parking areas have sign-in boxes to collect harvest data. A kiosk in the parking lot for the waterfowl hunting area provides refuge-specific waterfowl hunting regulations and information.

White-Tailed Deer Archery Hunting

The refuge is located in a State hunting district that only permits white-tailed deer to be harvested using a bow, also known as archery hunting. The earliest reference to archery hunting for deer on the refuge is found in the "Wildlife Inventory Plan" (USFWS 1966), which states that controlled archery hunts were taking place on the refuge but only in the river bottom. Today, 82 percent of the refuge (2,275 acres) land is open to archery hunting for deer. Hunters sign in at each of the five parking and access sites and may use tree stands. Hunters must walk to designated hunting areas from these access sites. Archery hunting in the waterfowl hunt area (see restricted archery deer hunting area in figure 23) is permitted in September except during the youth waterfowl hunt weekend; thereafter, archery hunting is permitted during waterfowl hunting season on Mondays and Thursdays. An average of 949 archery visits have occurred annually between 2005 and 2010 (refuge unpublished data), and the trend is moving upward. The highest documented usage was in the 2009–2010 season at 1,321 hunt visits. An analysis of harvest data collected between 2000 and 2009 revealed an average of 891 visits annually totaling 2,318 hours and resulting in an average harvest of 32 deer per year.

In 1966, the population of white-tailed deer was "about 10 head" (USFWS 1966). In the 1980s, refuge staff began to observe that parts of the refuge were being overbrowsed, resulting in fewer shrubs and little understory in forested areas, both of which are important habitat components for a variety of migratory bird species. It is suspected that the larger number of deer (100–300 deer between 2001 and 2005) (unpublished refuge data) residing on the refuge today may be the cause; however, additional data will be needed to make this determination.

Waterfowl Hunting

The size of the waterfowl hunting area has remained fairly consistent at 654 acres. In 1983 the refuge established 28 hunting blinds within this area. Today 14 blinds remain and 2 blinds (numbers 2 and 7) are reserved for hunters with Montana disability licenses. Hunters with disabilities are allowed to park near these blinds along Wildfowl Lane. All other hunters must enter and exit on foot through the waterfowl hunt area parking lot. Waterfowl hunters may only possess and use nontoxic shot on refuge lands and waters when hunting waterfowl. From 2005 to 2010, an average of 1,029 waterfowl hunting visits occurred annually. Between 2000 and 2009, the average waterfowl harvest was 786 birds per year from an average of 1,299 annual hunt visits totaling 4,111 hours. Refuge staff meet with duck hunters each year to discuss the upcoming season and address issues to improve the quality of the hunt.

Fishing

Refuge anglers must adhere to the fishing regulations designated by MFWP. Designated fishing sites are located in the WVA (figure 23) and include Francois Slough and the Bitterroot River shoreline. A fishing platform is located along the paved portion of the WVA nature trail at a water control structure that moves water from Francois Slough to the Bitterroot River. The area where Francois Slough intersects the Bitterroot River provides shallow water habitat with a solid gravel bottom that is used for fly fishing.

There are no boat launches within the refuge. However, people can float and fish the part of the Bitterroot River that passes through the refuge, but they must remain below the high watermark and must not access the refuge from the river.

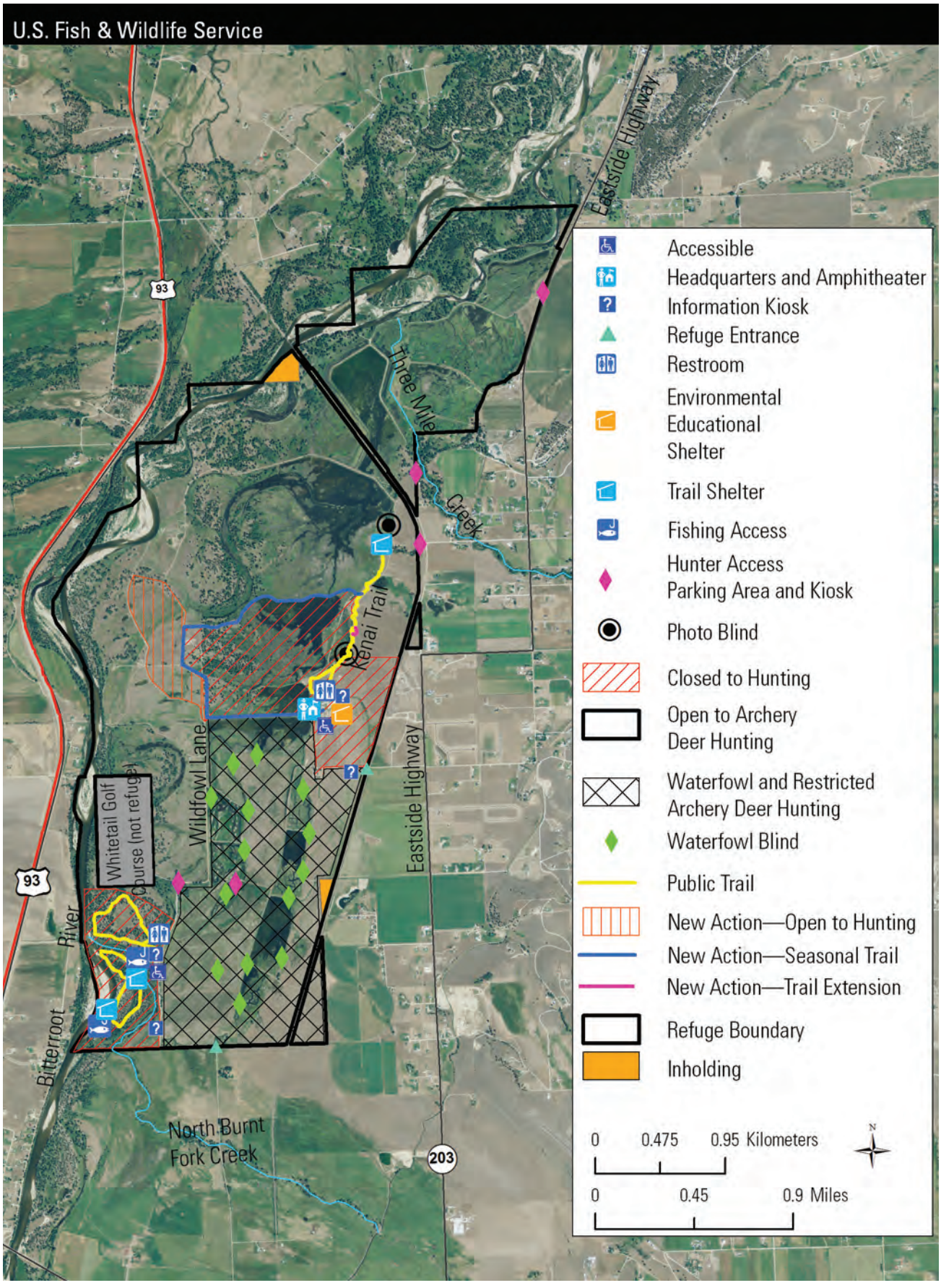

Figure 23. Public use map for Lee Metcalf National Wildlife Refuge, Montana.

It is difficult to obtain an accurate count on the number of anglers. In recent years fishing seems to be less popular within the WVA and Francois Slough.

Wildlife Observation and Photography

Opportunities for wildlife observation and photography are located at or along the following places: (1) the WVA; (2) visitor contact area (3) Kenai Nature Trail; and (4) Wildfowl Lane, a county road that runs through the refuge (figure 23). Visitors must follow refuge regulations to protect wildlife and their habitats while enjoying the opportunity to view and photograph them.

Commercial filmmakers must acquire a special use permit to work on the refuge. Commercial photographers need a permit if they are granted access to areas not normally opened to the general public. The permit specifies regulations and conditions that the permittee must follow to protect the wildlife and habitats they have come to capture on film.

Wildlife Viewing Area

The WVA is about 188 acres and has a trail 2.5 miles long (figure 23). The trail passes through different vegetation communities, specifically riverfront and gallery forest and persistent emergent wetland. This trail is designated as a National Recreation Trail. The first 0.55 mile of the trail is a 10-foot-wide paved path that is considered accessible for visitors with disabilities. This paved section of trail starts immediately at the trailhead, located at a large parking area, and ends at a turn-around point at the refuge's shelter at the edge of the Bitterroot River. Other sections of the trail are soil or gravel. Facilities at the trailhead include an information kiosk and restroom facilities ("porta-potties"). This area is open year-round from dawn to dusk and is probably the most popular area with refuge visitors. Parking at the trailhead is very spacious; motorhomes or buses can easily enter and exit. Dogs on leashes are allowed here but not bicycles or horses.

Visitor Contact Area and the Kenai Nature Trail

Visitors are provided a spotting scope to view waterfowl and other waterbirds and raptors on the ponds next to the visitor contact area. This is one of the most popular wildlife observation and photography sites for visitors, including school groups. The visitor contact area is just over 500 square feet and provides some interpretation of refuge resources, including numerous taxidermy displays of local wildlife species.

The Kenai Nature Trail is a 1.25-mile trail accessed just north of the refuge headquarters (figure 23). At the start of this trail is a 0.25-mile paved loop that is 5 feet wide. This part of the trail meets Americans with Disabilities Act guidelines. A stationary, all-weather spotting scope and viewing bench are also along this section of trail. The remaining trail is a soil and gravel

© Kimi Smith

Painted turtles can be found along refuge ponds.

footpath that tracks northward, above and parallel to the eastern shorelines of Ponds 8 and 10 (figure 23). The views of the Bitterroot Mountains are spectacular between this point and the end of the trail, where a viewing platform with an all-weather spotting scope is available. This part of the trail travels through a closed area, so visitors are not permitted off this trail and no dogs are allowed.

Two permanent photo blinds are located along the Kenai Nature Trail. Blind 1 is located one-third of a mile from the visitor contact area on Pond 8; it sits on the edge of 5 acres of open water and marsh land and is sheltered to the east by cottonwood, aspen and alder trees. Blind 2 is located 1.25 miles from the visitor contact area on approximately 85 acres of open water on Pond 10. These blinds are positioned on the edge of two different wetlands and face open water. Photographers who have regularly contributed photos and volunteer time to the refuge helped determine the design, construction, and placement of these photo blinds. Photographers are gently reminded that subjects and habitats are more important than photographs; nevertheless, there is always the potential to disturb wildlife.

The Kenai Nature Trail traverses the following vegetation communities: persistent emergent wetland, floodplain and terrace grassland, and grassland-sagebrush. The plant communities and views differ from those in the WVA, offering visitors a different wildlife viewing experience.

Wildfowl Lane

Wildfowl Lane (figure 24) is a Ravalli County road that travels almost 3 miles through the southern half of the refuge. This road loops through the refuge and connects at both ends to Eastside Highway. It is not an official auto tour route, but all refuge visitors use this road to access the refuge and view wildlife in the adjoining lands and wetland impoundments. Most of the road is gravel, but the southern third is tar and chip pavement, and the first 3,200 feet of the east end is coated with recycled asphalt chipping. Ravalli County

is attempting to make the road more maintenance-free so that it requires less summer blading and fewer applications of anti-dust chemical.

A superior feature of this road is the width—greater than 33 feet—so motorists can safely pull over and view wildlife. Automobiles make great wildlife viewing blinds, and with modern optics visitors can easily see wildlife from the road, causing minimal disturbance.

Environmental Education

Environmental education is a process designed to teach citizens and other visitors the history and importance of conservation and share scientific knowledge of our Nation's natural resources. Through this process, we can help develop a citizenry with the awareness, knowledge, attitudes, skills, motivation, and commitment to work cooperatively towards the conservation of our Nation's environmental resources. Environmental education within the Refuge System incorporates onsite, offsite, and distance learning materials, activities, programs, and products that address the audience's course of study, refuge purposes, physical attributes, ecosystem dynamics, conservation strategies, and the Refuge System mission. The refuge headquarters has a conference room (the Okefenokee Room) that can be used for larger groups. There is an amphitheater and an environmental education shelter for refuge programs and three public restrooms, all within the footprint of the refuge headquarters.

Schools

On average, the refuge hosts 2,309 students annually. Students come from communities as far as Darby to the south and Ronan to the north. Most students are from grades 3 through 5. Most visits occur during May and are usually restricted to one visit per year. Since 2005, the philosophy of the environmental education program has centered on introducing students to common, native wildlife of the refuge. The refuge does not have a dedicated or formal curriculum for student visits. There is no visitor services plan, but one will be produced following the completion of this CCP.

Bob Danley/USFWS

The refuge provides environmental education and research opportunities for students from surrounding schools and universities.

Most onsite environmental education programs take place in the area immediately around the refuge headquarters due to the availability of ample parking, the Okefenokee Room, visitor contact area, restrooms, the environmental education shelter and amphitheater, habitat diversity, and the Kenai Nature Trail. This infrastructure gives staff opportunities and flexibility for providing quality environmental education. The Okefenokee Room is especially valuable because of its multimedia capabilities; it functions much like a formal classroom space. Environmental education partner organizations and self-guided teachers and school groups also use the WVA. A diverse supply of materials and equipment, including a refuge reference library, is available for these spaces for use in refuge programs or for visiting teachers and students.

Onsite Educators

The refuge outdoor recreation planner is the only staff position dedicated to environmental education. However, all refuge staff participate in environmental education activities when possible. Volunteers also assist with programs and staffing the visitor contact area. Many of these volunteers are self-taught, but the refuge works with volunteers in both formal and non-formal learning settings to augment their wildlife knowledge and associated skills. Without assistance from volunteers and partner organizations, the refuge could not accommodate the often large groups of students or visitors requesting environmental education programs. Nevertheless, there are requests that cannot be met due to a lack of staff. The refuge has been investigating the possibility of recruiting skilled naturalists as volunteers at the refuge.

Teacher Workshops

Teacher workshops were offered many years during the 1990s and in 2006. In 2006 the workshop was based on the "Flying Wild Educator's Guide." The goal of these teacher workshops is to build teachers' wildlife knowledge so they may appreciate and use the refuge appropriately for student learning and become self-directed when using the refuge for environmental education.

Off-Refuge Efforts

Refuge staff have visited local schools and attended community organization meetings to perform environmental education, interpretation, and outreach using established education kits and programs highlighting refuge resources.

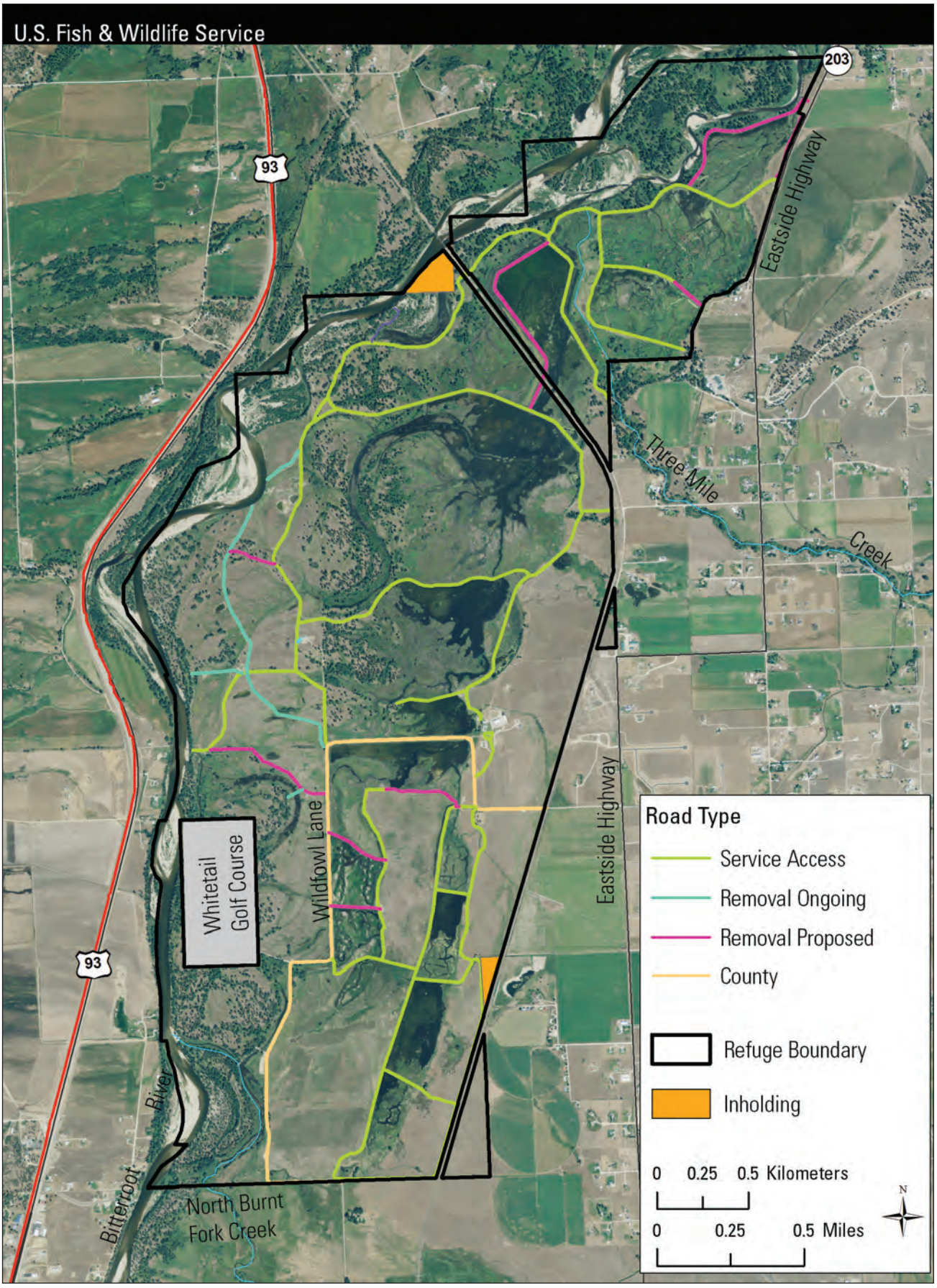

Figure 24. Roads in Lee Metcalf National Wildlife Refuge, Montana, including Service roads proposed for removal.

Bob Danley/USFWS

Attendees of the 2011 Montana Junior Duck Stamp Award Ceremony gather at the refuge amphitheater.

Montana Junior Duck Stamp Program

The refuge outdoor recreation planner is also the State coordinator for the Montana Junior Duck Stamp program. Both Houses of Congress passed H.R. 3679, the Junior Duck Stamp Conservation and Design Act in 1994. This is a national program managed by the Service. Its goals are to connect children with nature through science and art.

A national curriculum is available but is currently being updated. Students are asked to depict a North American duck, goose, or swan in its natural habitat. At the State level, the artwork is then judged by a distinguished panel of local wildlife experts, artists and photographers and the entry deemed "best of show" is sent to Washington, DC to compete at the national level. The winner from the Federal competition is then made into the Federal Junior Duck Stamp, available for purchase for $5. All proceeds from the sale of the Federal Junior Duck Stamps support conservation education. Awards include savings bonds, art supplies, and various other gifts.

Nationally, about 25,000 entries are received per year. In Montana, the average annual number of participants in kindergarten through grade 12 is 391 (2000–2010, refuge files). A Montana entry has won the national championship twice between 1994 and 2010. Montana's best of shows have finished in the national top ten in 2009 and 2010, a sign of continued excellence by Montana students.

For program support within Montana, two trunks have been developed that contain a variety of waterfowl reference materials; these trunks can be loaned to schools. A portable exhibit showcases the program and winning entries and is sent to libraries, schools and post offices around the state. A detailed overview of the program is available at www.fws.gov/juniorduck.

Interpretation

Interpretation provides opportunities for visitors to make their own connections to resources. By providing opportunities to connect to the resource, interpretation provokes participation in resource stewardship. It helps refuge visitors understand their relationships to, and impacts on, those resources. Well-designed interpretive programs can be effective resource management tools. For many visitors, taking part in an interpretive program may be their primary contact with a refuge, the Refuge System, and the Service. It is their chance to learn about refuge resource management objectives and could be their first contact with conservation and wildlife. Through such contact, the Service has the opportunity to influence visitor attitudes about natural resources, refuges, the Refuge System, and the Service and to influence visitor behavior when visiting units of the Refuge System.

Brochures

Refuge brochures contain area maps, public use regulations, and general information. The current refuge brochures are available at the refuge headquarters and at the main kiosk of the WVA.

Most of the public brochures have not been updated to meet Service standards, with the exception of the new hunting and fishing brochure. Brochures that require updating include the general brochure and the wildlife checklist for Lee Metcalf Refuge.

Kiosks

There are five kiosks on the refuge that are used to interpret refuge resources and provide information to visitors including maps and refuge regulations. The kiosk at the WVA has three interpretive panels displaying a location map, general refuge information, wetland facts, and information on habitat management techniques. There is a kiosk at each of the entrance points on both the south and east end of Wildfowl Lane that primarily highlight information about the Refuge System. At the start of the Kenai Nature Trail there is a small interpretive kiosk primarily used to distribute refuge brochures (figure 23). There is also a kiosk in the waterfowl hunting area that provides updated hunting regulations.

Visitor Contact Area

The refuge has a 513-square-foot visitor contact area that provides a small library of books, natural history displays (including representations of refuge wildlife), interpretive displays, other environmental education materials, a small bookstore, and a large screen television. There are many interpretive displays on local plant and animal life. The information is updated based on the season or changing refuge activities. The refuge also has a Web site that provides information about resources, programs, and regulations.

Media

The refuge has a Web site (http://leemetcalf.fws.gov), blog, and social media sites (Facebook, Twitter, and Flickr) that provide up-to-date information about

refuge resources, programs, upcoming activities, and refuge regulations. Refuge staff provide the three local newspapers with periodic news articles on refuge activities and events and informative articles on the natural resources found throughout the refuge.

3.7 Management Tools

In recent years, the Service has manipulated habitat using various management tools that are carried out under specific, prescribed conditions to meet the needs of wildlife. These management tools have included water level manipulation, prescribed burning, and prescriptive grazing or mowing, and cooperative farming.

Water level manipulation

The refuge manipulates the water levels in 17 wetland impoundments that provide approximately 800 acres of open water and mudflats for migratory waterbirds. The development of these wetland impoundments began in 1964 when levees and berms were constructed to capture and impound water. Water control structures were added to control the inflow and outflow of water in attempt to mimic wetland cycles. Water levels continue to be timed to the needs of wildlife and the season. For example, during the migrating shorebird season, water levels are lowered to create mudflats. For migratory and breeding waterfowl, water levels are raised slowly to create optimum foraging conditions and to provide for brood and roosting habitat. Wetland impoundments are occasionally drained to improve the health and productivity of these impoundments for waterbirds. This also allows the opportunity to reduce cattail monocultures, thereby restoring open water areas.

Prescribed burning

Prescribed burning is a management tool that has been used on the refuge since 1988 to control some invasive plant species or undesirable monotypic vegetation stands, particularly cattails. It is also used to clear ditches of vegetation that may impede waterflow. One of the most widespread uses of prescribed fire on the refuge is to rejuvenate grassland vigor.

Since 2004, the refuge has burned 491 acres to improve grassland habitat and 463 acres to improve wetlands. Each year 3–5 acres of ditches are burned to keep them free of vegetation allowing water to travel more freely.

Prescriptive grazing or mowing

Historically, the Bitterroot River Valley was grazed and browsed by native ungulates such as white-tailed deer, mule deer, moose, and elk. Following Euro-American settlement, these valley lands were used for cattle grazing, primarily as winter range as cattle were moved in the fall from the summer grazing and calving locations in the mountain slopes and foothills (Clary et al. 2005). Cattle grazing on the refuge grasslands continued until 1975. Between 1993 and 1997 sheep and goats were brought into the refuge in an attempt to control cattails and invasive species; however, prescriptive cattle grazing was not consistently used as a management tool until 2006. To control monotypic stands of cattails in the wetland impoundments, cattle were brought in to graze primarily on the young cattail plants. This is one part of a multi-step process of thinning cattails.

Cooperative farming

Cooperative farming is an arrangement whereby a farmer is compensated for planting crops on a refuge through keeping a certain percentage of the harvest. The refuge can retain its share (1) as standing cover for wildlife forage, (2) in exchange for additional work from the cooperator such as invasive plant control and grass seeding, or (3) in exchange for supplies from the cooperator such as herbicides and fence materials. Any income received by the refuge is deposited in the Refuge Revenue Sharing Account.

Before cooperative farming can take place, the refuge manager must issue a cooperative farming agreement or a special use permit. Subsequently, cooperators are allowed to (1) till, seed, and harvest small grain, (2) control invasive plants, or (3) harvest hay on the restoration site until native seed can be planted and becomes established. These agreements are generally issued for 2–4 years to achieve a specific management objective, such as preparing a field for restoration to native species. In some cases these agreements may extend longer to allow time for the establishment of native plants.

When the refuge was first established, farming was used to grow grains including wheat and barley. Historically, the 800 pounds of grain that was harvested was sent to Red Rock Lakes National Wildlife Refuge to feed wintering swan. Cooperative farming stopped in 2002, partly due to the difficulty of finding cooperative farmers and partly due to a trend of restoring farmlands to native grasslands.

While cooperative farming can assist with restoration efforts, unfortunately most of these restoration efforts have not succeeded on the refuge, primarily due to competition from invasive species.

3.8 Socioeconomic Environment

Most of the Lee Metcalf Refuge is open to the public for uses including hunting, fishing, wildlife observation,

and photography. These recreational opportunities attract outside visitors and bring in dollars to the community. Associated visitor activities—such as spending on food, gasoline, and overnight lodging in the area—provide local businesses with supplemental income and increase the local tax base. Management decisions for the refuge about public use, expansion of services, and habitat improvement may either increase or decrease refuge visitation and, in turn, affect the amount of visitor spending in the local economy.

Population and Demographics

The refuge is located approximately 4 miles northeast of Stevensville, Montana in Ravalli County. During the 1990s, Ravalli County was the fastest growing county in Montana and became one of the fastest growing counties in the entire United States, as measured by percentage change in population. For the period from 1990 to 2009, the county's population increased from 25,010 to 40,431—an increase of 62 percent. A key factor in the character and change of the Bitterroot area economy is the county's proximity to a mid-size regional center, the city of Missoula, which is located 25 miles to the north in Missoula County. During the 1980s, the county of Missoula grew from 76,016 to 78,687, an increase of only 3.5 percent. However, between 2000 and 2009, Missoula County grew by 13.4 percent.

The communities of the Bitterroot Valley are located on a "peninsula" of largely private lands occupying the valley floor and mountain foothills surrounded by a "sea" of public forest lands. Within the boundaries of Ravalli County itself, there are 1,850 square miles of forest lands administered by the USDA Forest Service, representing about 77 percent of the entire county's land base. Beyond the perimeters of the county, these forest lands and wilderness stretch for many miles. The presence of these public forest lands has heavily influenced the settlement and economic development of the Bitterroot Valley, and wood products manufacturing has been a key component of the area's economic base. Historically, the economic role of these forest lands has been primarily one of a supplier of raw material for lumber processing in the area. However, the role these lands play in the area's development is changing. The Bitterroot Valley's economy is now being increasingly shaped by rapid growth spurred by in-migration. The amenities of this picturesque mountain valley with its surrounding forests appear to be the primary attraction for many of the valley's recent migrants. Similar migration patterns are occurring in non-metropolitan forest land areas like the Bitterroot Valley throughout the west.

The recent rise in population in the Bitterroot Valley has not been evenly shared by various age groups within the population. While Ravalli County's population as a whole grew by 43 percent between 1990 and 1999, the greatest growth occurred among persons in their mid-to-late 40s and 50s. The population 45–54 years of age increased from 2,994 persons to 6,356—a 112 percent increase in less than a decade. The population of age group 55–64 increased by 71 percent. The county's 65-and-older population increased by only 24 percent during this period and actually decreased as a percentage of the population between 1990 and 1999. The area may in fact be losing a disproportionate number of people 65 or older who move away from the area.

The area's population is racially non-diverse, as is the population of the larger region. Of Ravalli County's 40,431 residents in 2009, more than 97 percent were white. The population of Hispanic or Latino origin is the largest racial minority group at 2.8 percent. American Indians, who have a distinct cultural connection to this area, make up only 0.9 percent of the population.

Employment

The unemployment rate in Ravalli County in 2010 was 10.4 percent, which is greater than Montana's average of 7.4 percent. In 2009, the median family income was $45,691, which is close to the rest of State but less than the national 2008 average of $52,029.

The fastest growing industries are administrative and support services, followed closely by waste services, arts, entertainment, and recreation.

Public Use of the Refuge

During 2010, 166,767 visits were recorded on the refuge. Between 2005 and 2010 (the period after which the new refuge office and visitor contact area opened) annual visits averaged 142,971. During this time period, the maximum visitation was 177,563 in 2005 and the minimum was 90,000 in 2008. These numbers are based on mechanical counters strategically located at the WVA, Wildfowl Lane, and the Kenai Nature Trail. These numbers do not account for the refuge visitors on the Bitterroot River or on refuge lands west of the Bitterroot River. The average number of individuals who actually came into the visitor contact area during this same period was 6,118. Visitors attending special events accounted for 1,741 visitors annually. These latter figures are recorded manually by refuge volunteers. During hunting and fishing seasons from 2005–2010, the visitors participating in these activities accounted for 2 percent of all visits (Carver and Caudill 2007). It is assumed that the remaining visitors were participating primarily in wildlife observation and photography activities along the county road and nature trails. Most wildlife observers visit in the spring and summer, when the greatest numbers of migratory birds inhabit the area.

Camping and fires are not allowed on the refuge; however, the Bitterroot National Forest manages land throughout Ravalli County, including campgrounds, one of which is near Stevensville. There is a motel

located in the town of Stevensville, a few in Hamilton and Lolo, and dozens more in Missoula, as well as several recreational vehicle campgrounds.

Baseline Economic Activity

It is difficult to place a value on the worth of outdoor experiences or the importance of maintaining and preserving habitat vital to migratory birds and a variety of resident wildlife species. One way of defining a refuge's value and the opportunity to experience wildlife-dependent recreation on the refuge may be to ask what the area would be like without the refuge (Carver and Caudill 2007). According to the latest "Banking on Nature" economic analysis (Carver and Caudill 2007), 13 percent of expenditures associated with a wildlife-dependent recreational visit to a refuge come from local residents, thus 87 percent of revenue comes from outside area visitors. These expenditures include purchases of food, lodging, transportation, and other expenses. In 2007, refuge visits generated approximately $185.3 million in tax revenue at the local, county, State, and Federal levels (Carver and Caudill 2007).

Public use is just one way that Lee Metcalf Refuge generates revenue and contributes to the economic engine of the local economy. Other economic benefits include spending by the refuge, spending by refuge employees, payment in lieu of taxes ($13,439 in 2010), the economic value of the function of the refuge's habitats, and the increased value of lands next to the refuge.

U.S. Fish and Wildlife Service Employment

In 2010, Lee Metcalf Refuge was staffed by nine permanent employees and six seasonal employees. Its payroll equaled approximately $601,000. Based on the Bureau of Labor statistics, approximately 79 percent of each employee's annual income is spent locally. Using this figure, refuge employees contribute nearly $475,000 to the local economy.

Visitor Spending

An average of 143,000 visitors enjoy Lee Metcalf Refuge every year though wildlife observation, photography, hiking, and environmental education (sometimes referred to as nonconsumptive uses). On Lee Metcalf Refuge it is estimated that more than 97 percent of visitors participate in these activities. The remaining visitors participate in fishing and hunting (often referred to consumptive uses).

According to the 2007 "Banking on Nature" report, 87 percent of refuge visitors travel more than 30 miles to visit a refuge (Carver and Caudill 2007). This same report stated that 77 percent of these visitors engage in nonconsumptive activities. Nonresident visitors tend to contribute more money to the local economy. Based on refuge visitor numbers and the estimated percentage of nonresident visitors, it is estimated that Lee Metcalf Refuge could possibly contribute as much as $15 million annually to the local economy from nonresident, nonconsumptive users, and nearly $4 million from nonresident consumptive users. Resident nonconsumptive users spend an additional $356,000 while resident hunters and anglers spend approximately $140,000.

3.9 Partnerships

Lee Metcalf Refuge has a history of fostering partnerships that help accomplish the refuge mission and implement programs. From 2005 to the present, the Service has entered into various projects and activities with more than 65 organizations including local and national conservation organizations, private companies and businesses, other Federal agencies, State agencies, universities, local schools, and county and city governments. The refuge also has a very active volunteer program that primarily assists visitor services programs. The refuge could not begin to meet the needs of the thousands of refuge visitors without these volunteers.

These partners have assisted in wildlife and habitat management, visitor services and recreational activities, land protection, law enforcement, and community outreach. Several of these relationships have developed into formalized partnerships with written agreements or memoranda of understanding while others remain more informal.

Bob Danley/USFWS

The Hollingsworth Wetland Project was a collaborative effort among the Service and numerous partner organizations.

3.10 Operations

Service operations consist of the staff, facilities, equipment, and supplies needed to administer resource management and public use programs throughout the Lee Metcalf Refuge.

Staff

Lee Metcalf Refuge provides supervision, logistical support, office space, storage, and supplies to multiple positions that serve a broader set of responsibilities than the mission of the refuge. Current staff at the refuge consists of five permanent full-time employees including a refuge manager, outdoor recreation planner, law enforcement officer, maintenance worker, and an administrative support assistant. There are also four permanent Service employees who are based out of this office, but they are not assigned to exclusively support refuge programs. These positions include the district fire management officer, fire technician, regional maintenance team member, and the Montana Invasive Species Strike Team leader. These employees and their programs are supported partially or wholly by Lee Metcalf Refuge with logistics, equipment, and materials, and most of these positions are supervised by the refuge manager. The refuge does receive some assistance on refuge projects from these positions if they are not dedicated to other priority projects.

Seasonal employees are often hired each year. In addition to the above refuge positions, the refuge uses its management funding to annually hire one to two seasonal workers, including a biological technician and a maintenance assistant. Since 2009, the refuge has hosted a Youth Conservation Corps Crew and leader. In 2010, the refuge coordinated with Ravalli County Weed District to employ three, 5-month seasonal employees to treat invasive species on the refuge.

Facilities

Facilities are used to support habitat and wildlife management and wildlife-dependent public use activities. The refuge's buildings have been updated over the years, yet much of the habitat management infrastructure such as irrigation components, some wetland impoundment levees, and water control structures are in disrepair.

The refuge headquarters and visitor contact area were developed in 2004 from an existing maintenance garage. The current maintenance shop, a metal Butler building, was constructed in 2000, and a cold storage equipment bay building was constructed in 2005. The refuge has a bunkhouse, built in 2005, to provide housing for seasonal workers. The refuge historically had one refuge house but it was recently deemed unsafe for occupancy, and in August 2010 it was removed.

Most of the refuge wetland impoundments were constructed in the late 1960s through the early 1970s. Roads and dikes associated with these wetlands were constructed at that time and many are in need of repair. In addition to the visitor contact area, visitor service facilities include the amphitheater, shelters, and 5 miles of trails.

The following is a list of most of the facilities found on the Lee Metcalf Refuge:

- headquarters and visitor contact area (4,488 square feet)
- maintenance shop (7,200 square feet)
- cold storage building (3,500 square feet)
- outdoor amphitheater (4,000 square feet) and two shelters
- bunkhouse (2,080 square feet)
- hazmat building (390 square feet)
- pole barn (3,000 square feet)
- Grube Barn (3,162 square feet) (poor condition)
- Whaley Homestead (1,416 square feet)
- approximately 23 miles of dikes and roads
- 22 large (greater than 2-foot diameter) water control (stoplog) structures
- 10 small (less than 2-foot diameter) water control (stoplog) structures
- 3 water delivery ditches, totaling 6 miles, plus 2 tile drain ditches
- 3 pumping stations for Fields I–1 through I–7
- 4 domestic wells
- 2 recreational vehicle pads with septic, electrical, and water hookups
- 3 vehicle bridges
- 5 miles of walking trails
- 5 walking bridges
- 2 wooden photo blinds
- wildlife observation deck (Kenai Nature Trail)
- 3 entrance signs
- 5 interpretive kiosks
- universally accessible fishing deck (168 square feet)
- 14 waterfowl hunt blinds (includes 2 blinds for hunters with disabilities)
- 5 archery hunter parking lots