4 Affected Environment

Dave Menke/USFWS

Sage Thrasher

Located in central Wyoming in a high plains basin near the headwaters of the Platte–Kansas Rivers ecosystem, Pathfinder NWR lies approximately 47 miles southwest of the city of Casper. Since the refuge was established on the Pathfinder Reservoir in 1909, many other reservoirs have been created, including Alcova to the north and Seminoe to the south, and the refuge no longer offers a unique environment for wildlife in this semiarid region of Wyoming.

This chapter describes the refuge's setting, as follows:

- physical environment
- biological resources
- cultural resources
- special management areas
- visitor services
- partnerships
- socioeconomic environment
- operations

4.1 PHYSICAL ENVIRONMENT

This section describes global warming as well as the climate, soils, water resources, and air quality at the refuge.

Global Warming

The U.S. Department of the Interior issued an order in January 2001 requiring federal agencies under its direction that have land management responsibilities to consider potential climate change effects as part of long-range planning endeavors.

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

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.

Climate

The annual precipitation as recorded at Pathfinder Dam averages 9.55 inches (Western Regional Climate Center [WRCC]). The average maximum temperature is 58.3°F, average minimum temperature is 33.4°F, and extremes range from a summer high of approximately 100°F to a winter low of approximately –40°F (WRCC). High winds buffet the area in all seasons, creating ground blizzard conditions in winter and windblown deposition of soils in the spring through fall.

Physiography

The Pathfinder Reservoir area consists almost entirely of Miocene age tertiary sediments with outcrops of Precambrian granite. A small area of quarternary alluvial bedrock is found on the west end of the Sweetwater Arm Unit, as well as small deposits of dune sand or loess (loamy deposits) on the Deweese Creek Unit (Larson and Letts 2003). There is little indication of geologic influence from glaciation, and the North Platte River primarily cuts through the granite in the area, creating spectacular canyons but little in the way of flood plains. The Sweetwater River, when reservoir conditions reveal it, seems to have had some history of meandering, and the formation of a flood plain with it. Shifting sand areas (dunes) occur on the western shore of the reservoir and further to the southwest. The high water mark of the reservoir is 5,850 feet, but lands are regularly exposed below this elevation. The highest point on the refuge is a 6,360-foot rock outcrop on the northwest portion of the Sweetwater Arm Unit.

Soils

Soils in the Sweetwater Arm Unit, located in Natrona County, are comprised of 13 different soil types. Soils found in the eastern half of the unit include Bosler-Alcova, Haverdad-Clarkelen, Delphill-Blazon, and Bronsto-Lupinto, and McFadden-Edin-Blackhall. Soils found in the western half of the unit include Zeomont-Ryan Park, Rock River-Ryan Park, Havermom, and Aquic Ustifluvents.

The west and east portions of the Sweetwater Arm Unit share four common soil types including Rawlings-Rock River, Rock Outcrop, Ryan Park, and the Typic Fluvaquents found in the Horse Creek area. The soil range includes saline subirrigated, loamy, shallow loamy, shallow sandy, sandy, and very shallow.

Mark Ely/USFWS

Soils at Pathfinder NWR, Wyoming

The three most common soil types across the Sweetwater Arm Unit are Ryan Park (in the eastern half) and Typic Fluvaquents and Aquic Ustifluvents (in the western half). Ryan Park is a sandy soil, which creates the blowing, sandy conditions depicted in the photograph of the eastern half of the Sweetwater Arm Unit in chapter 3. The more common soils in the western half of the unit, including Havermom, are subirrigated soils, which provide better growing conditions for vegetation. The sandy soil types (Rawlins-Rock River and Rock River-Ryan Park) in the western half of the unit are less impacted by reservoir operations. One area of Ryan Park in the western half of the unit abuts the reservoir on the south side of the water body.

Water Resources, Hydrology, and Water Rights

The refuge is situated on portions of the Bureau of Reclamation's Pathfinder Reservoir. The reservoir's dam, located on the North Platte River and backing water flowing in from the Sweetwater River, impounds 1,016,000 acre-feet. The reservoir serves as part of the North Platte Project, explained in chapter 2.

Water on the refuge's four units—the main Sweetwater Arm Unit and the satellite Goose Bay, Deweese Creek, and Sage Creek units—flows into the North Platte River. Reclamation retains ownership of all appurtenant state-based water rights. All of the state-based water rights appurtenant to the formerly ranched lands withdrawn for the reservoir are North Platte Project water and part of the reservoir pool, which

is maintained on behalf of the downstream water users who entered into repayment contracts for the construction of the project. The Service cannot obtain or purchase state-based water rights for this refuge, due to the lack of enabling legislation.

The Service may hold federal reserved water rights for refuge purposes on 2,554 acres of land withdrawn from the public domain. These public lands were outside earlier Reclamation withdrawals, and, prior to withdrawal, were administered by the BLM.

Four perennial streams on the Sweetwater Arm Unit empty into the reservoir: the Sweetwater River, Dry Creek, Arkansas Creek, and Horse Creek. Upstream of the reservoir pool, all of these streams are relatively free-flowing, with only small on-stream irrigation reservoirs. The largest of the four streams is the Sweetwater River, which has a watershed area of 2,338 square miles upstream of a USGS gauge, located 7 miles upstream of the reservoir. The station has been in operation from 1914 to 1924 and from 1939 to the present. A gauging station (USGS 06639500) was operated on Horse Creek near the dam from 1915 to 1924. The drainage area of Horse Creek at the gauging station was 117 square miles.

Stream discharge generally peaks from snowmelt and precipitation runoff in May and is at its lowest levels in September. Former oxbows of the Sweetwater River receive spring flood flows and serve as seasonal marshes. USGS gauging station records indicate the mean annual production is approximately 91,200 acre-feet for the Sweetwater River and approximately 2,400 acre-feet for Horse Creek.

The Sweetwater Arm Unit contains former ranchland that had several irrigation ditches. The Bothwell ditches divert water from the Sweetwater River, and the Smith ditches divert water from Horse Creek. The lands these ditches irrigated were designated to be inundated by Pathfinder Reservoir. However, over the years, the reservoir's storage obligations have decreased and some of the lands are not underwater. These state-based water rights were adjudicated and have not been abandoned. Table 3 shows the irrigation rights held by Reclamation for the Sweetwater River and Horse Creek.

Approximately 1,794 acres of the Sweetwater Arm Unit were withdrawn from the public domain for wildlife purposes. Because the federal government has not been enjoined into a general stream adjudication for Sweetwater and Horse creeks, and since it is not known if water was available for appropriation at the time of withdrawal, it is not known if the Service holds federal reserved water rights appurtenant to the reserved lands.

The Soda Lakes area contains a series of small, seep-fed alkali ponds. The ponds are shallow, and some dry up in the summer. Several of the ponds are connected by ditches; some have dams that allow water to impound to deeper levels. The structures are in poor condition. All of these lands were withdrawn from the public domain for Reclamation purposes.

A portion of the Goose Lake Unit is underwater when reservoir levels are high. In low-water conditions, it is dry. The unit's water derives either from reservoir storage or from surface moisture from high water tables resulting from reservoir storage. Approximately 320 acres of the unit were reserved for refuge purposes. It is not known if the Service holds federal reserved water rights appurtenant to the reserved lands.

The Deweese Creek Unit has small dams and water-spreader ditches, most of which are dilapidated. Some water from the creek is diverted and spread into small impoundments and moist areas that offer protection for waterfowl broods and afford growth of aquatic plants and grass. Because the soil has hardpan clay under it, the diverted water returns to the creek, which has a fairly constant flow. A gauging station (USGS 06637000) was operated on Deweese Creek from 1917 to 1924. The drainage area above the gauging station was 16.4 square miles. The mean annual production during the period of record was 1,960 acre-feet. Approximately 440 acres of the Deweese Creek Unit were reserved for refuge purposes. It is not known if the Service holds federal reserved water rights appurtenant to the reserved lands.

Sage Creek and the North Platte River run through the Sage Creek Unit. Sage Creek has a watershed of approximately 190 square miles, which produces flashy, torrential flows filled with silt and sediment. A gauging station (USGS 06636500) was operated on Sage Creek from 1915 to 1925. The mean production during the period of record was 13,800 acre-feet per year.

The Service has not pursued adjudication of federal reserved water rights for Pathfinder NWR and does not intend to pursue them in the future.

Air Quality

Air quality receives protection under several provisions of the Clean Air Act, including the national ambient air quality standards (NAAQS) and the prevention of significant deterioration program. NAAQS include maximum allowable pollution levels for particulate matter, ozone, sulfur dioxide, nitrogen dioxide, lead, and carbon dioxide.

Based on the Wyoming's most current data, the state has relatively clean air. In the area of the refuge (Carbon and Natrona counties), the levels of carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide, particulate matter (diameter <2.5 micrometers), particulate matter (diameter <10 micrometers), and lead did not exceed federal standards at any

Table 3. Bureau of Reclamation irrigation rights for the Sweetwater River and Horse Creek, Wyoming.

Permit No.	*Territorial Right*	*Priority Date*	*Name*	*Use*	*Source*	*CFS*	*Acreage*
	A.J. Bothwell	9/1/1886	Bothwell-Sweetwater No. 2 Ditch	Irrigation	Sweetwater River	6.77	474
	State of Wyoming et al.	9/1/1886	Bothwell-Sweetwater No. 2 Ditch	Irrigation	Sweetwater River	2.99	209
	A.J. Bothwell	6/1/1888	Bothwell-Sweetwater No. 3 Ditch	Irrigation and domestic	Sweetwater River	9.55	669
397-E	A.J. Bothwell	12/22/1898	Bothwell-Sweetwater No. 2 Ditch Enlargement	Stock and domestic	Sweetwater River	2.79	195
397-E	State of Wyoming	12/22/1898	Bothwell-Sweetwater No. 2 Ditch Enlargement	Stock and domestic	Sweetwater River	1.01	71
397-E	A.J. Bothwell	12/22/1898	Bothwell-Sweetwater No. 2 Ditch Enlargement	Stock and domestic	Sweetwater River	.79	55
1384	A.J. Bothwell	2/6/1897	Supplement of Bothwell No. 2 Ditch	Irrigation and domestic	A spring or seep supplements the Sweetwater River Bothwell-Sweetwater No. 2 Ditch rights in case they are not whole	8.8	
	A.J. Bothwell	6/17/1885	Smith No. 1 Ditch	Irrigation and domestic	Horse Creek	2.8	190
	A.J. Bothwell	6/17/1885	Smith No. 2 Ditch	Irrigation	Horse Creek	1.14	80

monitoring site in 2006 (U.S. Environmental Protection Agency [EPA] 2007a).

The air quality index (AQI) is an approximate indicator of overall air quality, because it takes into account all of the criteria air pollutants measured within a geographic area. Air quality in Carbon and Natrona counties is considered to be generally good, with no reported days of unhealthy air quality (EPA 2007b).

Prescribed burning is the refuge management activity that has the greatest effect on air quality (find more information in the description of the fire management program in appendix K). The management of smoke is incorporated into planning prescribed burns and, to the extent possible, in suppression of wildfires. Sensitive areas are identified and precautions are taken to safeguard visitors and local residents. Smoke dispersal is a consideration in determining whether a prescribed burn is within prescription. Generally, the fine-grass fuels and small burn size (80–600 acres) generate low volumes of smoke for short durations (4–5 hours). Prescribed burning activities have not yet occurred at Pathfinder NWR.

4.2 BIOLOGICAL RESOURCES

This section describes the existing habitat and wildlife at Pathfinder NWR. Appendixes L–O list species that occur on the refuge for plants (appendix L) and species that potentially occur on the refuge for birds (appendix M), amphibians and reptiles (appendix N), and mammals (appendix O).

Habitat

Major habitat types of Pathfinder NWR include open water wetlands, uplands consisting of shrub and grasslands, and alkali flats. The location and distribution of the major habitat types for the refuge is shown in figure 8.

Open Water Wetlands

Water rights throughout Wyoming are tightly regulated by the Wyoming State Engineer's Office. Central Wyoming is characterized by dry, arid uplands and unpredictable water runoff events. Due to these conditions, Pathfinder Reservoir was constructed to control flooding and to provide for irrigation water to ranches. Over time, the purposes of Pathfinder Reservoir expanded, and it now is used to provide water for hydropower and to deliver water to other downstream reservoirs.

Reservoir (Deepwater)

Pathfinder Reservoir is part of a system of dams and reservoirs operated by Reclamation in the North Platte River Basin for irrigation, hydroelectric power production, and municipal and industrial water supply (USBR). As such, the Service has little to no input into reservoir level management, although a significant portion of the refuge lies below the high water line of the reservoir. As a result, the available management options and long-term benefits of management actions are limited, as reservoir fluctuations can inundate, desiccate, or destroy wildlife habitats.

The spillway elevation for the reservoir is approximately 5,850 feet, at which point the storage capacity is 1,016,507 acre-feet. From 1996 to 2005, the reservoir level has seen a high of 5,849.89 feet in 1999 and a low of 5,784.84 feet in 2004. Annual variation between high and low reservoir levels during this time period ranged from 8 feet in 2005 to 26 feet in 2001 and 2002, and averaged nearly 17 feet annually (USBR).

The biological consequences of these variable water levels include a lack of reliable emergent or submergent vegetative growth; shorelines that are primarily sandy, varying from bare sand and rock to partially or fully vegetated with annuals; potentially significant weed issues in low-water years (tamarisk is currently scattered around the reservoir below the high water line); and substrates from the bottom of the reservoir being windblown and deposited on downwind uplands. With the low water levels of the past 5 years, the former floodplain of the Sweetwater River has produced some promising meadow habitat, but a relatively small rise in the reservoir elevation would inundate most of this area. Use of the reservoir by waterbirds is minimal likely due to poor water conditions resulting in poor food production, along with disturbance on the water and shorelines from boating, fishing, camping, and ATV use.

Fluctuations in reservoir water levels create cutbank and sandy shorelines, resulting in the establishment of little emergent vegetation (i.e., cattails and rushes) for brood cover and feeding areas. The Service's inability to control reservoir water levels to manage for habitat conditions to support migratory bird species, along with a decrease in migratory bird use of the reservoir, hinder the effectiveness of managing the reservoir area as a national wildlife refuge.

Artificial Ponds

The refuge's 1961 annual narrative (BSFW) makes reference to "pit type" ponds that were apparently in place on the Goose Bay Unit. Remnants of these ponds still exist, but only two to three appear to be functional in good water years. The 1962 annual narrative (BSFW) also notes that three dikes and ditches were constructed on Deweese Creek that year, along with one on Sage Creek. The dikes on Deweese Creek were designed to back up water that would not only create a small impoundment but also supply water for use in irrigating adjacent uplands for waterfowl nesting habitat. It appears the dikes were somewhat successful, as this area holds remnants of tame grasses that were probably planted at or near the same time. All of the dikes are currently breached, with the creek running back on its old course through them. The remnants of these ponds hold the only emergents found on the refuge.

The Sage Creek dike was reported to be 270 feet in length and included 1,300-foot ditch for irrigation (present-day refuge staff have not seen the Sage Creek dike and ditch). Some of the area was planted to a wheatgrass mixture. The dike and ditch were apparently subject to regular damage by high waters during spring flows and thunderstorms, as damage to these structures were reported in 1962, 1963, and 1964. In 1964–65, five dams were constructed on Horse Creek; they appear to be nonfunctional today and to have had little impact on habitat development.

Playas

The playa lakes that make up the Steamboat Lake area of the Sweetwater Arm Unit are influenced by runoff and appear to be supplemented by springs around Steamboat Lake. This area blends in with the upland and alkali flat habitat types, as it consists of small rolling "hills" not more than 10–15 feet higher

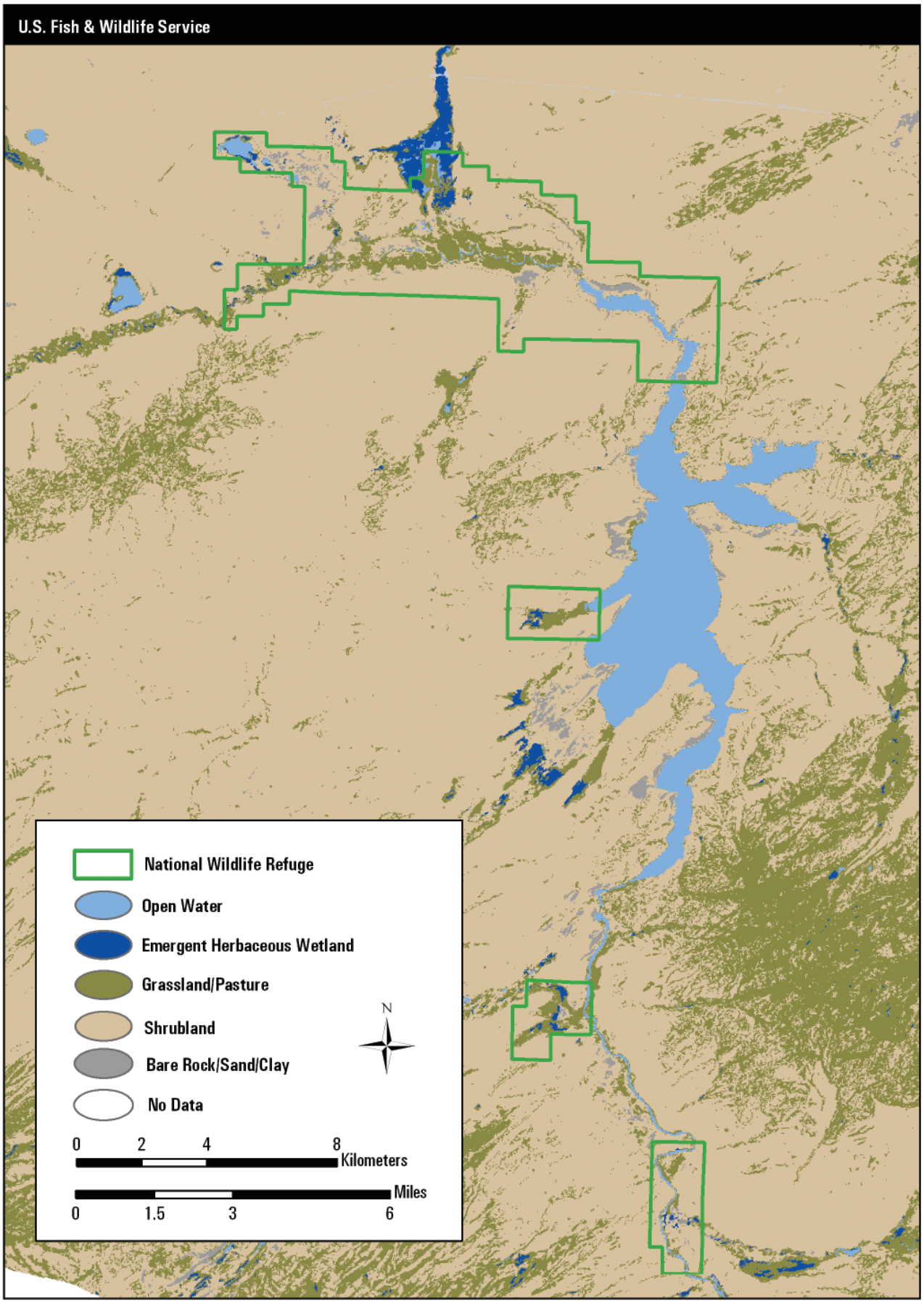


Figure 8. Habitats at Pathfinder NWR, Wyoming.

than the surrounding area with alkali areas between them. These hills and alkali areas vary in size from 100 square feet to many acres. After significant precipitation events, and/or runoff, these alkali areas hold water for a time. Typically, the smaller alkaline areas provide spring habitat but are mainly dry later in the summer months, and the larger alkaline areas to the east of the chain of lakes hold some water most of the year. Steamboat Lake and the next lake east hold water year-round in most years, but an alkali flat generally forms around them in late summer and early fall. The 1961 annual narrative (BSFW) noted that 1,650 linear feet of diking was constructed in the Soda Lake area to hold early water and decrease evaporation. This construction can be seen today. Emergent vegetation is limited to the edges of the ponds and includes rushes and sedges. Steamboat Lake and Soda Lakes are used by American avocet, Wilson's phalarope, and other shorebirds for migration and breeding, as well as several duck species, Canada geese, coot, and eared grebe. The smaller, drier lakes see some use by avocet, apparently when the water is fresher, but they are minimally used otherwise.

The 1966 annual narrative excerpted in chapter 3 on page 22 documents the Service's unsuccessful attempts to acquire water rights for Pathfinder NWR development.

Uplands Habitat: Shrub and Grasslands

Uplands consisting of shrub and grasslands are the dominant habitat type in the area. The upland areas adjacent to the reservoir in the area impacted by reservoir operations are characterized by blowing sand and dryland shrub communities. Areas further west on the Sweetwater Arm Unit (approximately west of Horse Creek) are characterized by more gentle terrain and grassy and wet meadow areas rather than sandy cutbanks. Located in the backwaters of the reservoir, these areas are wet only if the reservoir is full or near full.

The majority of the lands above the high water line of Pathfinder Reservoir—and likely, the area below and approaching the dam—consists of shrub-dominated uplands and rock outcrops. The upland habitats on the refuge slope upward from the reservoir where the North Platte and Sweetwater River channels lie, and in some places are 150 feet above the high water line. Rock outcrops occur on the north, northwest, southwest, and southeast portions of the Sweetwater Arm Unit and in the southeast corner of the Sage Creek Unit. In addition, the western part of the Sage Creek Unit adjacent to the North Platte River contains shear cliffs that rise up from the river 150 feet to an upland bench above. A notable feature on the refuge landscape, these cliffs appear to be made of a different rock than the other Precambrian rock outcrops. These outcrops, though dominated by rock, contain within them areas of sparse grass, forbs, and sage mixes characteristic of the surrounding uplands, as well as scattered limber pine and Rocky Mountain juniper.

The upland vegetation is primarily dominated by sagebrush of various species and heights, and probably age classes as well. The understory of grasses and forbs is sparse in general, but varies from site to site based on soil and range type. The south side of the Sweetwater Arm Unit and the upland areas of Deweese Creek and Goose Bay units consist primarily of well-dispersed sagebrush of 15–40 percent canopy cover, with a minimal grass-and-forb understory and considerable bare ground. Some draws on the western portion of the Goose Bay Unit and the southern part of the Sweetwater Arm Unit contain small areas of sage 2–4 feet tall and have a canopy cover of nearly 100 percent. Some uplands areas on the north side of the Sweetwater Arm Unit and east of Horse Creek are almost completely covered with pricklypear. The sage component is still present, but the shrubs are further apart and the understory is dominated by cactus.

An area in the northeast corner of the Sweetwater Arm Unit is apparently impacted by sediments blowing from the reservoir bottom when it is exposed. This area was once typical of the other sage-dominated uplands, but most of the plants have died, apparently as the result of being sandblasted or choked off in the sediments, as the soil deposits are several inches deep in spots and have formed drifts. The uplands adjacent to the Steamboat Lake area and the upper end of the Sweetwater River contain more greasewood than sage, and unless they are on a bench, contain very little undergrowth and appear to have very poor soils for vegetative growth. Historic use of the uplands has been for livestock grazing. The geography and soil types in this area are such that, for the most part, no thought seems to have been given to attempting irrigation. Wildlife use of these areas includes pronghorn, mule deer, sage thrasher, horned lark, meadow lark, sage-grouse, rattlesnake, and white-tailed prairie dog.

Wyoming has more sagebrush than any other state. Two cover types, Wyoming big sagebrush (30.8 percent) and mixed grass (20.2 percent), occupied about half of the land area of the Wyoming Gap Analysis (WY-GAP) land cover map, based on the proportional area of land cover (Merrill et al. 1996). WY-GAP is part of the national Gap Analysis Program (GAP), whose goal is to keep common species common by identifying species and plant communities that are inadequately represented in existing conservation lands. Begun in 1991, WY-GAP was officially completed in November 1996. The main goal of WY-GAP was to analyze the current status of biodiversity within Wyoming, focusing on two biodiversity elements: land cover types and terrestrial vertebrate species. Land ownership and management for the state of Wyoming was combined with the data on land cover and species distributions in a geographic overlay using geographic information

system (GIS) data to determine which biodiversity elements are inadequately protected within the current system of areas managed for conservation.

Wyoming sagebrush communities are as diverse as the landscape, which is covered by 13 different types of sagebrush. Sagebrush-associated vegetation types provide habitat for approximately 87 species of mammals; 297 species of birds; and 63 species of fish, reptiles, and amphibians (Wyoming Interagency Vegetation Committee 2002). These species have been influenced by historic fire intervals and both domestic and wild ungulate grazing.

Associated species occurring in saltbush and desert shrub cover type include greasewood, winterfat, galleta grass, alkali sacaton, Indian ricegrass, bottlebrush, squirreltail, foxtail barley, basin wildrye, and western wheatgrass.

Grazing Management History

As noted in chapter 2, in 1965, the Service signed an MOA (contract #14-06-700-4737) with the BLM that transferred grazing management at Pathfinder NWR to the BLM. Since that time, the BLM has administered the grazing in conjunction with BLM allotment grazing. Section 202 of the Federal Land Policy and Management Act of 1976 (FLPMA) requires the development and maintenance of land use plans for public lands. BLM land use plans are designed to provide guidance for future management actions and the development of subsequent, more detailed and limited-scope plans for resources and uses. Land use plans are developed under the multiple-use and sustained-yield mandate of FLPMA. Land use plans identify lands that are available for livestock grazing and the parameters under which grazing is to occur. BLM issues grazing permits or leases for available grazing lands. Grazing permits and leases specify the portion of the landscape BLM authorizes to the permittee or lessee for grazing (i.e., one or more allotments) and establish the terms and conditions of grazing use. Terms and conditions include, at a minimum, the number and class of livestock, when and where they are allowed to graze, and for how long. Grazing use must conform to any applicable allotment management plans, the terms and conditions of the permit or lease, land use plan decisions, the grazing regulations, and other applicable laws.

Alkali Flats

Alkali flats are predominately flat lands and seasonally dried-up wetland basins with strongly saline soils. These areas are associated with or adjacent to playas or intermittent lakes. The alkaline/saline soils appear to severely restrict plant growth, as vegetation is very spotty throughout much of this area. Vegetation includes saltgrass, alkali sacaton, and greasewood. Wildlife use by killdeer and American avocet (likely in association with water

Mark Ely/USFWS

Alkali Flats at Pathfinder NWR, Wyoming

nearby) is similarly sparse. The Steamboat Lake area supports alkali wetlands and associated vegetation and wildlife uses.

The soil characteristic of this area is Aquic Ustifluvents (saline), 0–3 percent slopes, and includes the playas mentioned in the open water wetlands section above. When there is no water in the basins of the playas, the soils have an alkaline cover. The alkali flats also include the "hilly" areas of the playas, which occur mainly in the northeast portion of the unit and between the larger playas. The dominant vegetation includes greasewood and saltgrass on the hilly areas, and sedges, rushes, slender spiderflower (a state species of concern), and other salt-tolerant species on the edges of some of the playas. The bottoms of the playa basins do not appear to support vegetation.

Meadows

The refuge does not contain irrigated meadows. Meadow areas exist in a limited capacity and vary with the reservoir level, as much of the meadowland is underwater in high-water conditions.

On the Deweese Creek Unit, the Service constructed a series of dikes and ditches in 1962 on the creek with the hope of irrigating the land to improve waterfowl-nesting habitat and create brood-rearing habitat with the ponds. The dikes blocked the creek and were constructed to continue into the adjoining upland area to serve as a ditch bank carrying water to irrigate these lands. When the Service realized, in 1966, that no water rights were available to support such projects, all construction and maintenance efforts were abandoned. Available historical documents do not indicate that these irrigated meadows were seeded, but the remnant stand of

tame grasses, as well as documentation of planting efforts in the 1960s on the Sage Creek Unit, indicate seeding could have been attempted on the Deweese Creek Unit as well. The meadow area on this unit is estimated to be less than 100 acres.

The Goose Bay Unit holds some meadow habitat that fluctuates based on water conditions. It is likely nonexistent at full reservoir pool, but may return when the pool is low. The meadows slope down the bay to the east toward the reservoir and are likely influenced by surface and subsurface water flows, presumably spring fed. In extremely low water years (such as 2006), the meadow at Goose Bay is estimated at 100–150 acres. In high water years, the area is likely less than 20 acres.

Another low reservoir phenomenon is the emergence of meadow habitat, which usually occurs after a few successive dry years, along the old floodplain of the Sweetwater River in the Sweetwater Arm Unit. This floodplain is some of the flattest terrain on the refuge when not inundated by the reservoir, and this aspect combined with water flowing from the Sweetwater River and also likely influenced by Horse Creek, probably raise the water table enough to create fairly lush meadows and emergents over time. The growth of this area was apparent in 2006 and was also noted in the 1966 annual narrative (BSFW). No vegetative surveys have been completed of these areas, but sedges, rushes, and unidentified taller grass species have been observed. Although the aforementioned narrative noted the lush vegetative growth in the meadows of the Sweetwater Arm Unit, it also noted that use of the area by waterfowl, especially nesting birds, appeared to be light.

With the dikes blown out at the Deweese Creek Unit, the pit ponds at the Goose Bay Unit functioning minimally, and no ponds along the Sweetwater River, the brooding areas may be limiting what waterfowl nesting occurs. Pronghorn heavily use the Sweetwater Arm Unit meadows. Snipe, Wilson's phalarope, meadowlark, and willet have been noted.

Contaminant Assessment

A contaminant assessment completed by the ecological services division of the Service (Ramirez, Dickerson, and Jennings 1995) did not find any major trace element problems at the Sweetwater Arm Unit, with the possible exception of arsenic and chromium in brine shrimp. Although elevated, arsenic and chromium concentrations do not pose a threat to aquatic birds. Major cations and anions (positively and negatively charged ions, respectively), specific conductance, and total alkalinity are typical of shallow alkaline wetlands in the semiarid western United States.

The assessment did not find any evidence of sodium toxicity in ducklings or goslings; however, management recommendations state that waterfowl nesting should not be encouraged at these ponds due to the potential for sodium toxicity. Nesting enhancement measures could be carried out at the southeast ponds closest to the Sweetwater Arm Unit of the reservoir where freshwater is available. Refuge managers should consider water-quality analysis at these ponds before intensive management for waterfowl production. The alkaline ponds provide good nesting habitat for American avocet. If possible, aquatic bird surveys should be conduced during the breeding season to determine productivity and use (Ramirez, Dickerson, and Jennings 1995).

Threatened and Endangered Species

Threatened and endangered species listed for Carbon County include black-footed ferret and blowout beardtongue. Although Canada lynx and yellow-billed cuckoo are potentially found in the county, the refuge does not contain habitat for either species. Currently, no known threatened or endangered species are listed for Natrona County or use the refuge. (Wyoming Natural Diversity Database [WYNDD] 2006).

Species of Concern

Table 4 indicates documented occurrences of vertebrate species of concern within Pathfinder NWR (WYNDD 2006). Observations were in the Steamboat Lake area of the Sweetwater Arm Unit.

Gary Kramer/USFWS

Black-crowned Night-heron

Table 4. Documented occurrences of vertebrate species of concern within Pathfinder NWR, Wyoming.

Bird Species	*Most Recent Observation*
American white pelican	2003
Black-crowned night-heron	2002
Brewer's sparrow	2007
Franklin's gull	2007
Great blue heron	2007
Greater sandhill crane	2006
Lark bunting	2007
Lesser scaup	2006
McCown's longspur	2006
Mountain plover	2006
Northern pintail	2007
Redhead	2005
Sage thrasher	2007
Western grebe	2005
White-faced ibis	2005

4.3 CULTURAL RESOURCES

The Service is responsible for managing archaeological and historical sites found on refuge lands.

Prehistoric Background

Although structured searches have been minimal in number, archaeological surveys on and near refuge lands have found numerous indications of substantial use of the area by prehistoric cultures. Ten prehistoric sites have been recorded on the refuge and 142 near refuge lands. They consist of chipped stone, hearths, stone circles, stone raw material procurement areas, rock shelters, and lithic scatters. The presence of the North Platte and Sweetwater rivers in this semiarid land were likely influential on prehistoric human use (Larson and Letts 2003). Arapaho, Cheyenne, Sioux, and Shoshone tribes were probably the most common users of the area.

Early Exploration

Although trappers and traders traversed and used the area in the early nineteenth century, by far the largest push of humans through the region came as a result of the Oregon Trail. The remnants of the trail can clearly be seen in numerous locations on the Steamboat Lake area of the refuge, as well as numerous off-refuge locations nearby. It is estimated that over 200,000 people traveled the Oregon Trail between 1840 and 1870, many leaving a record of their passing at Independence Rock just 3 miles west of the refuge (Larson and Letts 2003). Besides travelers to the west coast, the Oregon Trial was used briefly by the Pony Express in the 1860s, and the discovery of gold near South Pass City, Wyoming, in 1868 brought opportunistic travelers.

Early Settlement

European settlement of the refuge area was hindered by a combination of limited natural resources, the absence of major travel corridors (with the exception of the defunct Oregon Trail) and railways, and harsh environmental conditions. Indeed, even today very few people live in the vicinity of the refuge and reservoir. Settlement was almost exclusively dependent upon ranching. Some sheepherding occurred, but cattle ranching was preferred. Because the area is very dry, expanses of land were required to take advantage of what grass was available; ranches were large and included what is now BLM ground for grazing. As in much of the West, water was a critical commodity. At the base of the large rock outcrop on the north side of the Sweetwater Arm Unit is the gravesite of Ella Watson, better known as "Cattle Kate," and James Averal. They were reported to have been hung in 1889 just off the southwest portion of the Sweetwater Arm Unit over a water dispute.

History of Development

One of the biggest signs of development in the region is the reservoir created by Pathfinder Dam. The dam was constructed between 1905 an 1909, and later modified, on a stretch of the North Platte River. Numerous pipelines for oil and natural gas traverse the area, but successful mineral exploration has been minimal. The nearest communities to the refuge are Alcova, located to the east, which currently caters to recreationists on Alcova and Pathfinder reservoirs,

and Jeffrey City, a classic mining boom-and-bust town approximately 40 miles west of the refuge.

4.4 SPECIAL MANAGEMENT AREAS

There are no special management areas related to the refuge.

Wilderness

Due to human development in the area and current and past land use patterns, the refuge does not appear to meet the criteria for wilderness. As outlined in the Wilderness Act of 1994, a wilderness area:

- generally appears to have been affected primarily by the forces of nature, with the human imprint substantially unnoticeable;
- offers 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 as to make practicable its preservation and use in an unimpaired condition;
- may contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

4.5 VISITOR SERVICES

Refuge infrastructure (roads) and public use facilities (wildlife viewing area, county park) are shown in figure 9.

Visitor Services

The distance of the refuge from the complex headquarters at Arapaho NWR, combined with little boundary fencing and the fact that part of the reservoir is refuge land and part is not, create a situation that allows for unrestricted public use on the refuge.

Mark Ely/USFWS

Bishops Point, Pathfinder NWR, Wyoming

A developed campground and boat ramp are located at Bishops Point in the Sweetwater Arm Unit and is administered by the Natrona County Roads, Bridges, and Parks Department. Hunting of ducks, coots, mergansers, deer, and pronghorn is permitted throughout the refuge in accordance with state seasons.

An interpretive overlook located along Highway 220 above Steamboat Lake interprets the refuge and likely receives several visits a day from the spring through the fall. Opportunities specific to wildlife photography and wildlife observation are minimal, as there are no formal tour routes, hiking trails, or signs.

Several nonwildlife-dependent uses presently occur or are assumed to occur on the refuge, including off-road vehicle use (as the reservoir level fluctuates vehicles follow the shoreline); dispersed camping; water skiing, jet skiing, and pleasure boating; ATV use; Bishops Point campground and boat ramp use; rock climbing; and arrowhead hunting. Although refuge staff have known about these incompatible refuge uses for years, the lack of human and fiscal resources has made addressing them a low priority.

Refuge staff believe that most public use occurs on the refuge's largest unit, the Sweetwater Arm, due to its size and location close to a main highway and the city of Casper. The Sage Creek Unit is fairly small and remote. Goose Bay and Deweese Creek are small, extremely remote units surrounded by BLM lands that probably only see occasional use by hunters and jet skiers or boaters in high-water conditions.

Hunting

Hunting is allowed per state seasons. Because the refuge boundary is not appropriately posted or fenced, Service law enforcement officers cannot enforce hunting regulations. The number of hunters using the refuge is unknown but is predicted to be low due to the remote access to most of the refuge.

Fishing

Fishing is available on the main reservoir and in stream areas leading to it. Fishing is allowed per state seasons. The Service does not have control over fishing access, limits, or seasonal closures. Fishing is managed by the WGFD.

Wildlife Observation, Photography, Environmental Education, and Interpretation

Although wildlife viewing and photography probably occur on other areas of the refuge, the only known use occurs at the Steamboat Lake area, which offers the best opportunities for these activities. An interpretive overlook can be found off Highway 220 above Steamboat Lake.

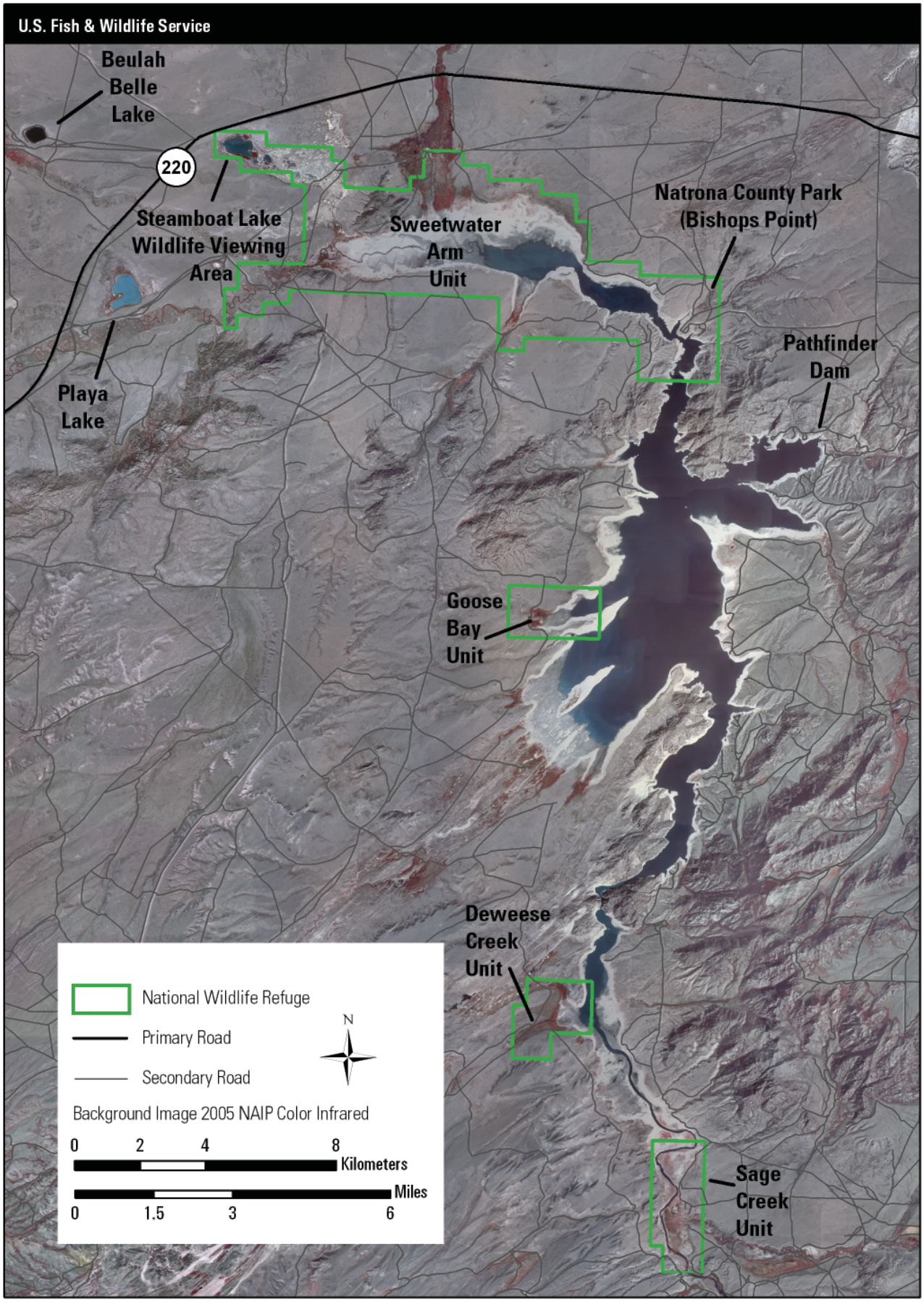


Figure 9. Infrastructure and public use areas at Pathfinder NWR, Wyoming.

4.6 PARTNERSHIPS

Refuge staff work with Audubon Wyoming to conduct annual breeding bird surveys. Audubon Wyoming conducts annual waterfowl and shorebird surveys at the Steamboat Lake area.

4.7 SOCIOECONOMIC ENVIRONMENT

The local and regional demographics (statistical data about the population) are described below for the communities in the five-county study area pertaining to Pathfinder NWR.

Socioeconomic Conditions

The following section illustrates the current socioeconomic conditions found within the study area, which is comprised of Albany, Carbon, Converse, Fremont, and Natrona counties. Pathfinder NWR is located with Carbon and Natrona counties; however, the remaining three counties included in the study area are located in close proximity to the refuge and could be affected by refuge management decisions.

Figure 10 shows the location of Pathfinder NWR in relation to nearby population centers. The refuge is located in central Wyoming near the cities of Casper, Rawlins, and Medicine Bow.

Population

The 2006 census shows the population of the study area has slowly increased since 2000, and total population was about 165,300 as of 2005 (U.S. Census Bureau 2006). Over the same period, the population of Wyoming decreased slightly (figure 11). The study area contained 33 percent of Wyoming's population in 2005. The city of Casper (2000 census population 49,644) is located within the study area and provides an ample tourist base for the refuge (U.S. Census Bureau 2006).

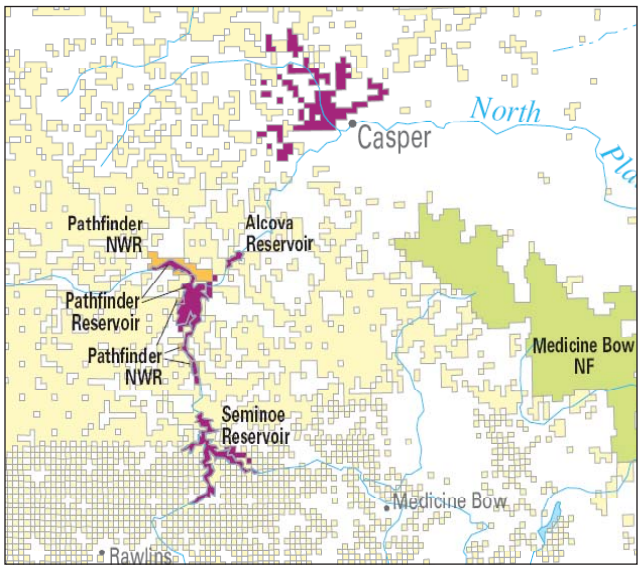


Figure 10. Location of Pathfinder NWR.
(Source: Nationalatlas.gov and BBC Research & Consulting.)

Age

Figure 12 illustrates the aging population of the study area. In 1990, 25 percent of the study area's population was under the age of 18. By 2011, this age group will only constitute about 21 percent of the population. It should also be noted that the percentage of residents aged 65 and older has steadily increased since 2000. This increase can possibly be attributed to the aging of the baby boom generation. The median age of the study area was about 36.9 years as of 2006.

Employment

The civilian workforce for the study area has increased by about 760 workers per year since 2000. As of 2006, the workforce consisted of 84,278 workers. The unemployment rate for 2006 was estimated at 4.0 percent, which is slightly higher than the state's 3.5 percent unemployment rate. Both the study area and the state have a lower unemployment rate than the nation, which was 4.4 percent as of October 2006 (U.S. Bureau of Labor Statistics 2006).

Local Industry

A wide range of occupations are represented in the study area; sales and office occupations is the largest sector at 26 percent (figure 13). Professional and related occupations employ 19 percent, while farming, fishing, and forestry occupations employ 1 percent of the population.

Visitation Levels

Pathfinder Reservoir receives approximately 170,000 visitors annually, buy very little data exists on actual visitation to the refuge. Service officials estimate that more than half of the 170,000 reservoir visitors visit the refuge, due to the Sweetwater Arm Unit's accessible location along the primary road entering the reservoir area. They also estimate that a high percentage of those who visit the refuge are locals, with the majority residing in nearby Casper.

Visitor Spending

Off-site spending by visitors helps support local lodging and retail establishments in surrounding towns such as Casper and Medicine Bow. Approximately 10 percent of refuge visitor days, or about 8,500 visitor days, are from nonlocal visitors. On average nonlocal visitors spend $60 per day for lodging, food, and supplies. If half of these guests spend the night locally in commercial lodging or campgrounds, then refuge activity may currently spur about $255,000 of new annual spending in the regional economy.

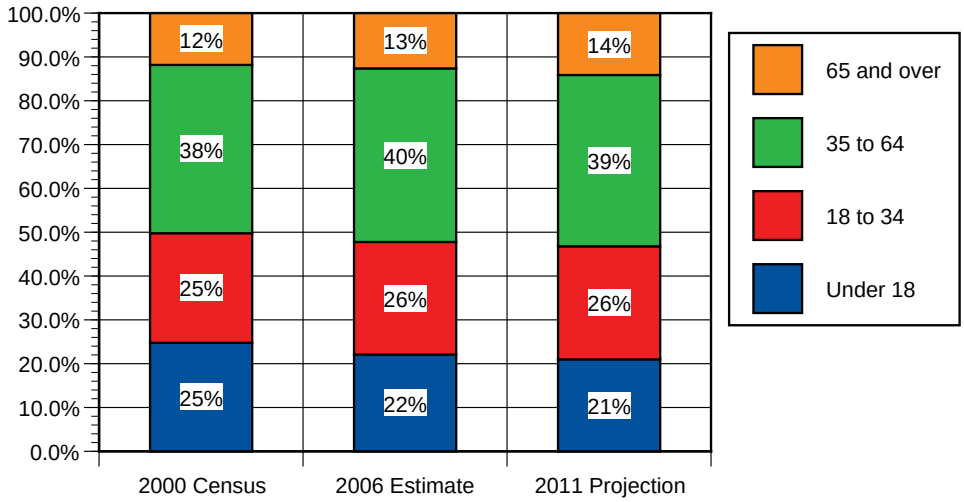


Figure 11. Wyoming and study area population.
(Source: State of Wyoming, Administration and Information, Economic Analysis Division.)

4.8 OPERATIONS

The Steamboat Lake area of the refuge has received some management and public use improvements. Surveys conducted demonstrate waterfowl and shorebird use at this very western end of Sweetwater Arm Unit. This area and the backwater reservoir areas are not impacted by the reservoir fluctuations that create sandy cutbank areas along the eastern half of the unit. As such, they have a higher potential for developing, protecting, and preserving quality trust resource habitats and quality wildlife-dependent public use opportunities.

STAFFING

Since 1967, Pathfinder NWR has been managed by Service staff headquartered at the Arapaho NWR in Walden, Colorado. The Arapaho NWR Complex includes Arapaho NWR, Pathfinder NWR, and the Laramie Plains refuges (Bamforth, Hutton Lake, and Mortenson Lake). The refuge staff of four FTEs and three to four seasonal employees are responsible for management activities on six refuges totaling 46,673 acres. Refuge staff travel approximately 240 miles to conduct management activities at Pathfinder NWR. Table 5 indicates the current staff for the complex.

The complex is also supported by Refuge System staff as part of a developing business unit concept. Contracting, budget tracking, travel, and payroll are supported remotely by Service staff stationed in Colorado and Kansas.

FACILITIES

The refuge has no operations facilities.

Table 5. Current staff for the Arapaho NWR Complex, Colorado.

Staff Group	*Current Positions*
Management	Project leader, GS-12 Refuge operations specialist, GS-11
Biology	Wildlife Biologist, GS-9
Maintenance	Maintenance worker, WG-8

GS=General Schedule Positions
WG=Wage Grade Positions

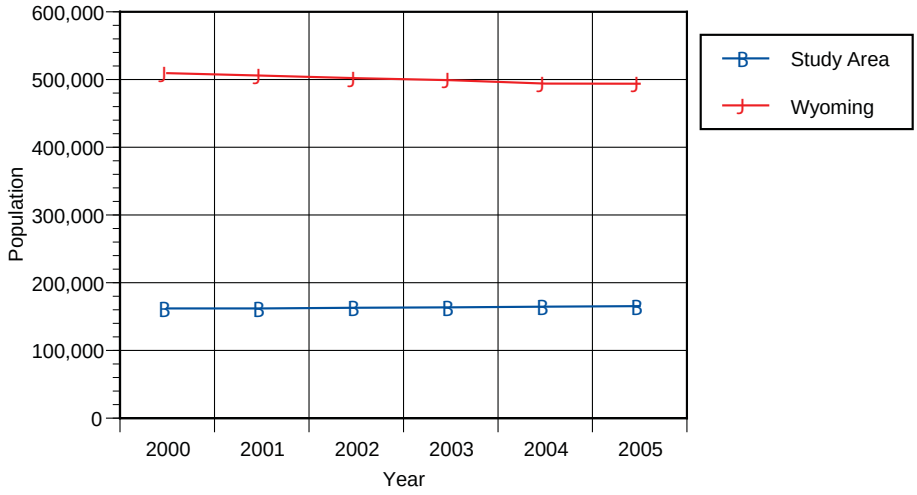


Figure 12. Study area age composition.
(Source: PCensus.)

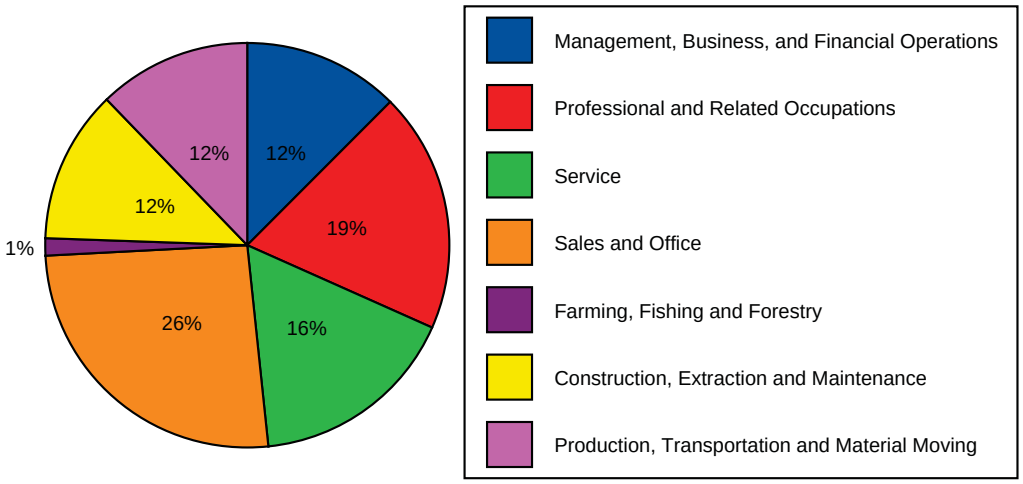
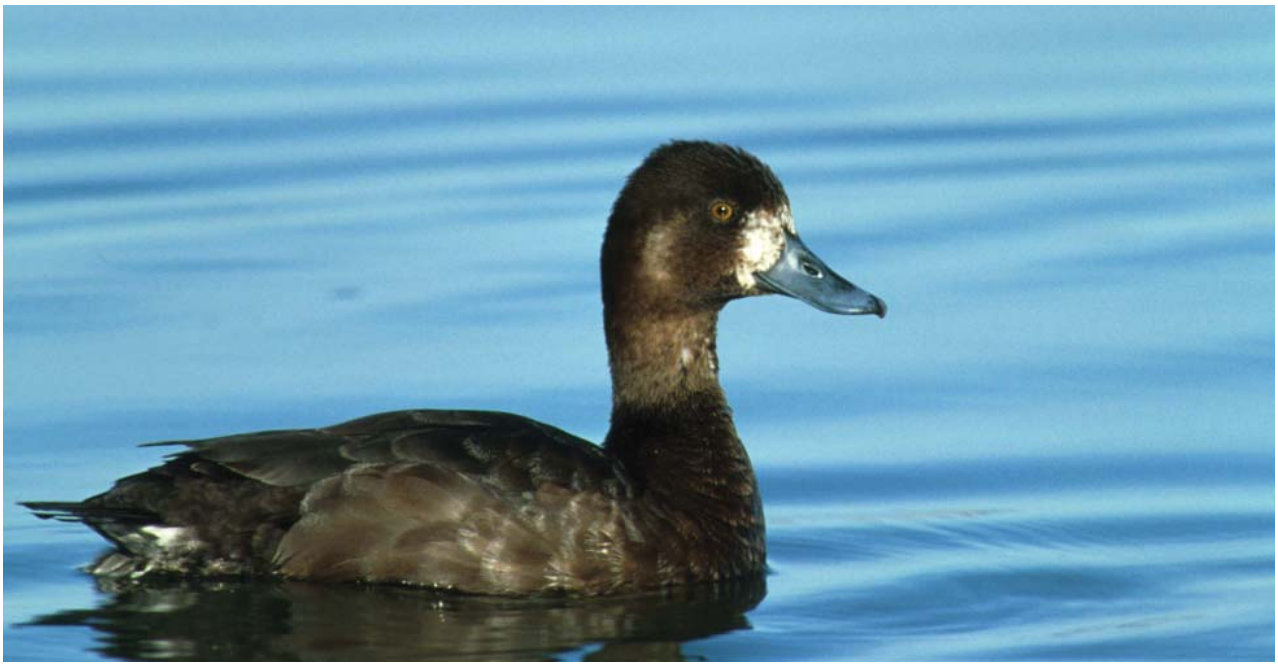


Figure 13. Study area employment distribution, 2006.
(Source: PCensus.)

5 Environmental Consequences



Dave Menke/USFWS

Lesser scaup

This chapter describes the environmental consequences for the management alternatives (see chapter 3) considered for Pathfinder NWR.

The planning team assessed the environmental consequences of implementing each alternative on the biological, physical, social, economical, cultural, and historical resources of the refuge.

This chapter contains descriptions of the (1) effects common to alternatives, (2) consequences by alternative, and (3) cumulative impacts of the alternatives. Table 2 in chapter 3 includes a summary of these consequences in relation to the actions for each alternative.

5.1 EFFECTS COMMON TO ALL ALTERNATIVES

Some projected effects would be similar for all alternatives:

- The implementation of any alternative would follow the Service's best management practices.
- The alternatives would minimize impacts to federally threatened and endangered species, to the extent possible and practicable.
- The refuge's staff, contractors, researchers, and other consultants would continue to acquire all applicable permits, for example, for future construction activities.

The sections below describe other projected effects common to all alternatives.

Cultural Resources

As a whole, cultural resources would be enhanced through protecting existing resources and extending such protections to newly discovered cultural resources.

Cultural resource surveys at the refuge have been limited. Therefore, additional surveys would be required prior to any new construction or excavation to fully satisfy provisions of the NEPA and applicable acts and policies related to historical and archaeological resources.

Potentially negative effects from construction of trails or facilities would require review by the regional archaeologist (region 6) and consultation with the Wyoming State Historic Preservation Office.

Environmental Justice

None of the management alternatives described in this EA would disproportionately place any adverse environmental, economic, social, or health effects on minority or low-income populations.

Implementation of any action alternative that includes visitor services and environmental education is anticipated to benefit minority and low-income citizens living near the refuge by stimulating the economy and creating jobs.

Air Quality

No adverse effects on air quality are expected. Short-term effects on air quality from prescribed burning on the refuge should not vary significantly between any of the alternatives. Prescribed burning operations are planned to reduce impacts to neighbors through ignitions that move the smoke up and out of the vicinity quickly. Rapid mop-up is completed to reduce overnight impacts to neighbors.

Climate Change Impacts

The primary climate-related impact to be considered in the CCP process is carbon sequestration, which helps offset global warming. Vegetated land is a tremendous factor in carbon sequestration. Terrestrial biomes of all sorts—grasslands, forests, wetlands, tundra, and desert—are effective both in preventing carbon emission and acting as a biological "scrubber" of atmospheric CO_2. The conclusions of the report on carbon sequestration by the U.S. Department of Energy (1999) noted that ecosystem protection is important to carbon sequestration and may reduce or prevent loss of carbon currently stored in the terrestrial biosphere.

Conserving natural habitat for wildlife is the heart of any long-range plan for national wildlife refuges. The actions proposed in this draft CCP and EA would conserve or restore land and habitat, and would thus retain existing carbon sequestration on the refuge. This in turn contributes positively to efforts to mitigate human-induced global climate change.

One Service activity in particular—prescribed burning—releases CO_2 directly to the atmosphere from the biomass consumed during combustion. However, there is actually no net loss of carbon, since new vegetation quickly germinates and sprouts to replace the burned-up biomass and sequesters or assimilates an approximately equal amount of carbon as was lost to the air (Dai et al. 2006). Overall, there should be little or no net change in the amount of carbon sequestered at Pathfinder NWR from any of the proposed management alternatives.

Several impacts of climate change have been identified that may need to be considered and addressed in the future:

- Habitat available for cold-water fish such as trout and salmon in lakes and streams could be reduced.
- Forests may change, with some species shifting their range northward or dying out, and other trees moving in to take their place.
- Ducks and other waterfowl could lose breeding habitat due to stronger and more frequent droughts.
- Changes in the timing of migration and nesting could put some birds out of sync with the life cycles of their prey species.

The managers and resource specialists on the refuge need to be aware of the possibility of change due to global warming. When feasible, documenting long-term vegetation, species, and hydrologic changes should become a part of research and monitoring programs on the refuge. Adjustments in refuge management direction may be necessary over the course of time to adapt to a changing climate.

Soils

All alternatives would positively affect soil formation processes on refuge lands. Some disturbances to surface soils and topography would occur at those locations selected for: (1) administrative, maintenance, and visitor facilities; (2) introduced and invasive species removal and eradication; and (3) restoration of native habitat.

Water Quality, Wetlands, and Floodplains

All alternatives would positively affect water quality. Positive effects are anticipated from protecting groundwater recharge, preventing runoff, retaining sediment, and minimizing nonpoint source pollution. The management alternatives are not anticipated to have any adverse effects on the area's wetlands and floodplains, pursuant to EO 11990 and EO 11988.

Public Health and Safety

Based on the nature of each alternative, the location of the refuge, and current land use, all alternatives are anticipated to have no significant negative effects on the quality of the human environment, including public health and safety.

5.2 DESCRIPTION OF CONSEQUENCES BY ALTERNATIVE

Management actions are prescribed by alternative as the means for responding to problems and issues raised by Service employees, the public, and governmental partners. Because management would differ for each alternative, the environmental and social effects resulting from implementation would likely differ as well.

Bob Savannah/USFWS

Wildlife Observation

The following section provides an analysis of the effects estimated to result from alternative A (no action), alternative B, and alternative C (proposed action). A summary of this narrative is contained in table 2 in chapter 3.

Alternative A—No Action

The estimated potential effects of alternative A are described by the major topics discussed throughout this document.

Refuge Administration

Three federal agencies currently have responsibilities for managing lands within the current boundary of Pathfinder NWR. The agencies' differing missions and regulations can create confusion regarding agency roles and responsibilities, which contributes to habitat degradation and public confusion about land management and usage.

The Bureau of Reclamation manages Pathfinder Reservoir for flood control, irrigation, and hydroelectric power. The MOU for management of lands (appendix D) limits the Service to actions that will not impact reservoir operations. As such, any improvements or management actions the Service undertakes to benefit wildlife on habitats below the reservoir high water mark (5,850 feet) are at risk by Reclamation operations because these habitats may be flooded out as reservoir levels rise, and habitat plantings may not succeed if reservoir operations lower water levels.

Public uses that are permitted within Reclamation or BLM mandates may be outside compatibility and/or allowed uses under Service policy and guidance, which can result in identity issues for the Service and confusion for the public regarding the Service's mission. At some areas of the refuge it is difficult for visitors to know what lands they are on due to lack of posting and regulations.

The Natrona County Road, Bridge, and Parks Department has management responsibility for the Bishops Point Recreation Area within the current boundary of Pathfinder NWR, which allows picnicking, boating, camping, campfires, and motorized watercraft access to the waters of Pathfinder Reservoir. Many of these uses may be considered inappropriate or incompatible uses of a national wildlife refuge.

Refuge Uses

The CCP process triggers the evaluation of all existing and proposed public uses and management actions on a national wildlife refuge. Uses found to be inappropriate or incompatible will be modified or eliminated as expediently as possible.

Habitat Management

Reservoir (Deepwater)

The reservoir would continue to provide resting areas for waterfowl and other migratory bird species during spring and fall migration. Emergent vegetation along the shoreline of the reservoir, which provides a food source for migratory birds and other wildlife, would be minimally present due to fluctuations in water levels (20 feet per year on average) and resulting steep, sandy cutbanks that prohibit vegetation growth.

Wetlands and Riparian Areas

Playas and impoundments would continue to fill and dry as natural processes dictate, with no management actions to affect them. Management actions below the high-water line of the reservoir are subject to impacts of inundation if and when the reservoir water level rises, precluding investment of Service funds or staff time in these areas. Few options exist for effective habitat management on wetland areas (e.g., development of water control structures and seeding in low-lying areas).

Uplands

Little change in upland habitat conditions on the refuge would occur. Grazing would continue on refuge lands in conjunction with BLM allotments. The BLM and the Service have different purposes for grazing on federal lands. The Service uses grazing as a habitat management tool specifically for the benefit of wildlife, whereas the BLM manages grazing in accordance with the Taylor Grazing Act.

A lack of Service coordination with the BLM results in grazing on the refuge that may not be compliant with refuge policy. The Service may not be fulfilling its mandate for trust resources by not

staying actively involved in annual grazing planning and management with BLM. Updating the grazing program to comply with Service grazing standards may affect BLM permittees. Continued unanalyzed impacts from grazing could result in criticism that the Service is not appropriately managing lands in the Refuge System.

Threatened and Endangered Species and State Species of Concern

Currently, no known federally listed species or state species of concern have been located on the refuge. If located, they would be protected from intentional or unintended impacts by banning or modifying activities where these species occur. Surveys are not occurring, which restricts discovering the presence of these species on the refuge.

Invasive Species

Management of invasive species on the refuge would continue to be reactionary, addressed as problems are identified and as resources permit. Some invasive species may become established or expand.

Visitor Services

Hunting

Unlimited vehicle access negatively impacts vegetation and wildlife. Public use programs would be reviewed for compatibility and modified or eliminated as needed. Understaffing prohibits active law enforcement and educational programs to ensure a quality hunting experience and the ability to manage hunting in accordance with the Service's policy and guidelines. Limited law enforcement efforts increase the potential for illegal hunting activities.

John and Karen Hollingsworth/USFWS

Pronghorn

Fishing

Enforcing refuge regulations would result in the loss of a public fishing opportunity and may result in a negative public image, as the Service would be restricting a use that has occurred in previous years.

Wildlife Observation, Photography, Environmental Education, and Interpretation

With no formal tour routes or walking trails on the refuge, it is assumed that most wildlife observation and photography is conducted by visitors walking through refuge habitats, which may damage vegetation and disturb wildlife. Lack of dedicated staff time precludes the development of quality, compatible wildlife observation and photography, educational, and interpretation activities. Uses may be modified to ensure compatibility and appropriate use.

Nonwildlife-dependent Recreation

Changes to public use of refuge areas may reduce recreation opportunities at Bishops Point (i.e., waterskiing, jet skiing, wind surfing, sailing, motorboating, ATV use, and overnight camping would be prohibited). While visitation to the refuge by some user groups (recreational boaters) may decline, visitation by others (wildlife enthusiasts) may increase with the implementation of compatibility policies. The Service may experience a negative public image by restricting public uses that have been permitted for over 40 years.

Research and Science

Under this alternative, little more would be learned about the four units' habitat and wildlife use to guide management decisions. Habitat conditions could degrade due to the lack of information gathering on wildlife and habitats.

Partnerships

Partnership development would not occur due to lack of Service resources. With limited funding and no dedicated staff, little improvement or repair to infrastructure or habitat improvements would occur. Partnerships would be reliant on interested parties approaching the Service as well as managing and funding agreed-upon projects. Opportunities for habitat improvements likely would not occur for these reasons.

Operations

The remote location of refuge staff at Arapaho NWR Complex headquarters 240 miles away would continue to impede proper management of the refuge. Specific annual funding would not be earmarked for Pathfinder NWR, but special project funding may become available through the SAMMS. Minimal on-the-ground accomplishments and management of refuge units would occur due

to competing priorities. Loss of opportunities for habitat improvements and other projects would continue due to staff shortages within the complex.

Socioeconomic and Economic Impacts

The refuge would continue to be managed much as it is today and socioeconomic change would therefore be minimal. Visitation and revenues spurred by the refuge would remain at or near current levels. Visitor spending would likely remain at or very close to current levels.

Alternative B—Enhanced Refuge Management

The estimated potential effects of alternative B are described by the major topics discussed throughout this document.

Refuge Administration

Agency coordination would be improved and roles would be clarified, resulting in improvement of habitat conditions to support migratory bird species.

Refuge Uses

The CCP process triggers the evaluation of all existing and proposed public uses and management actions on a national wildlife refuge. Uses found to be inappropriate or incompatible would be modified or eliminated as expediently as possible.

Habitat Management

Reservoir (Deepwater)

The reservoir would continue to provide resting areas for waterfowl and other migratory species during spring and fall migration. Emergent vegetation along the shoreline of the reservoir, which provides a food source for migratory birds and other wildlife, would be minimally present due to fluctuations in water levels (20 feet per year on average) and resulting steep, sandy cutbanks that prohibit vegetation growth.

Wetlands and Riparian Areas

By studying the wetland characteristics, staff and partners could develop management actions that may improve wetlands for the benefit of waterfowl and waterbirds.

Uplands

Increased monitoring and evaluation of grazing effects would assist with management decisions. Some fence construction would likely occur. Fencing of the three small units (Goose Bay, Deweese Creek, and Sage Creek) may be detrimental to wildlife. Small, fenced parcels impede migration and animal movement. Fenced parcels may create higher-quality habitat, but also may create wildlife sinks by increasing predators' ability to find ground nesting birds or young in a concentrated area. Grazing operations for BLM permittees may be affected. Small, isolated parcels and areas with steep, sandy cutbanks would still be difficult to manage for grazing purposes.

Threatened and Endangered Species and State Species of Concern

Currently, no known federally listed species or state species of concern have been located on the refuge. If located, they would be protected from intentional or unintended impacts by banning or modifying activities where these species occur. Dedicated staff time would allow for surveys to occur, and the potential for protective management actions would increase.

Invasive Species

A proactive approach by refuge staff and partners to monitor for infestations and obtain the necessary resources to manage them would eradicate some invasive species from the units and control new invasive species before they become established. Coordination with Reclamation staff to obtain information on the presence of invasive species on the three isolated units would continue. Efforts within the reservoir pool level would be limited to areas where reservoir operations would not impact the success of controls.

Visitor Services

Hunting

Vehicle access would be controlled to minimize negative impacts to vegetation and wildlife. Public use programs would be reviewed for compatibility and modified or eliminated as needed. Dedicated staff would allow for better coordination and efforts to improve hunting programs. A stronger law enforcement presence may increase compliance with hunting regulations. Through development of an MOU, WGFD would become an active partner with the Service in addressing issues and effecting solutions.

Fishing

Public fishing opportunity would be provided upon completion of the CFR process to open the refuge to fishing. Boat use would be controlled to minimize negative impacts to shoreline vegetation through wake action. Disturbance to waterbirds using the reservoir for molting and feeding would be reduced. Water uses would need to be evaluated under compatibility and modified or eliminated accordingly. Through development of an MOU, WGFD would become an active partner in addressing issues and effecting solutions. Dedicated staff time would allow for an increase in law enforcement patrol, education, and compliance.

USFWS

Family Opportunities.

Wildlife Observation, Photography, Environmental Education, and Interpretation

Dedicated staff time would enhance opportunities for wildlife observation and photography in selected areas. Improving and developing partnerships would increase the opportunities for these public uses. All uses would be reviewed and may be modified to ensure compatibility and appropriate use.

Nonwildlife-dependent Recreation

Changes to public use of refuge areas may reduce the number of recreation opportunities at Bishops Point (i.e., waterskiing, jet skiing, wind surfing, sailing, motorboating, ATV use, and overnight camping would be prohibited). While visitation to the refuge by some user groups (recreational boaters) may decline, visitation by others (wildlife enthusiasts) may increase with the implementation of compatibility policies. The Service may experience a negative public image by restricting public uses that have been allowed for over 40 years.

Research and Science

Acquiring baseline data would assist in management efforts to improve or maintain the units for the benefit of wildlife. Dedicated staff would develop plans and partner with interested parties to gather and interpret data. Habitat conditions may improve due to increased knowledge. Efforts would be focused on the Steamboat Lake area and other areas of the Sweetwater Arm Unit not heavily influenced by reservoir operations.

Partnerships

With assistance from partners, infrastructure improvements and an increase in active management may be seen. Dedicated staff would be available to lead and coordinate quality projects and develop positive partnership experiences over time. Partnership development is an important aspect of refuge management and, with staff available, time would be dedicated to develop and nurture such partnerships. Efforts would only focus on lands not influenced by reservoir operations, leaving other lands unattended.

Operations

A budget increase would improve on-the-ground accomplishments in refuge habitat conditions. Efforts would focus on areas that provide the highest potential gain for trust resources. The ability to provide funding for staff efforts at Pathfinder NWR and the Laramie Plains refuges would increase. Areas heavily impacted by reservoir operations and small, isolated units would see only minor improvements due to the difficulty in managing these areas.

Socioeconomic and Economic Impacts

Under Alternative B, the refuge would be managed for enhanced wildlife habitat, which would prohibit many popular recreational activities (e.g., sailing and jet skiing) at the refuge. The long-term socioeconomic effects of such actions are unclear. While restriction of recreational activities within the refuge boundary would reduce visitation to the refuge in the near future, these activities would continue to be permitted and enjoyed on reservoir areas outside the refuge boundary. However, if such restrictions result in larger and more diverse wildlife populations within the refuge, a potential increase in visitation from wildlife enthusiasts could offset the socioeconomic impact caused by the decrease in recreational visitors.

Improved wildlife habitat and increased wildlife populations could draw additional visitors to the refuge in the long term. As a result, the study area economy could see up to a 10 percent increase in visitor spending, which could introduce an additional $25,500 in economic activity to the region. Additional visitors would generate more business for local proprietors and raise regional tax revenues. However, if the alternative did not increase wildlife populations and visitation from wildlife enthusiasts, overall visitation levels and visitor spending in the local economy would be uncertain.

Alternative C—Modify Refuge Boundary (Proposed Action)

The estimated potential effects of alternative C are described by the major topics discussed throughout this document

Refuge Administration

Concentrating resources on manageable lands would improve agency credibility by allowing limited funds to be spent on a smaller area that meets the Service mission (i.e., quality migratory and resident bird habitat).

Refuge Uses

The CCP process triggers the evaluation of all existing and proposed public uses and management actions on a national wildlife refuge. Uses found to be inappropriate or incompatible would be modified or eliminated as expediently as possible. By modifying the map associated with the MOU, certain refuge areas would not need to be evaluated under compatibility or appropriate use policies.

Habitat Management

Reservoir (Deepwater)

The reservoir would continue to provide resting areas for waterfowl and other migratory species during spring and fall migration under management by Reclamation or its designee.

Wetlands and Riparian Areas

Playas and impoundments would continue to fill and dry as natural processes dictate. By studying the wetland characteristics, Service staff and partners could develop potential management actions to improve wetlands for the benefit of waterfowl and waterbirds. The eastern half of the Sweetwater Arm Unit and the Goose Bay, Deweese Creek, and Sage Creek units in their entirety would be removed from the refuge. As a result, reservoir level fluctuations would no longer be an issue for refuge lands. The final configuration of refuge lands would concentrate the area of responsibility and focus efforts on lands that meet habitat requirements for trust resources.

Uplands

Increased monitoring and evaluation of grazing effects would assist with management decisions. Isolated parcels would be removed the refuge boundary. With less uplands acreage to manage, refuge staff would be better able to control and implement an appropriate grazing program and to fence the area. The gentle slopes of backwater and riparian areas are better suited for fencing and posting of signage.

Threatened and Endangered Species and State Species of Concern

Currently, no known federally listed species or state species of concern have been located on the refuge. If located, they would be protected from intentional or unintended impacts by modifying activities where these species occur. Dedicated staff time would increase the opportunity for surveys and protective management actions.

Invasive Species

A proactive approach by refuge staff and partners to monitor for infestations and obtain the necessary resources to manage them would eradicate some invasive species from the refuge and control new invasive species before they become established. Early preemptive efforts would best help to eradicate or control any invasive species.

Visitor Services

Hunting

Vehicle access would be controlled to minimize negative impacts to vegetation and wildlife. Dedicated staff would allow for better coordination of and efforts to improve hunting programs. A stronger law enforcement presence may increase compliance with hunting regulations. Through development of an MOU, WGFD would be an active partner in addressing issues and effecting solutions. Refuge lands would be easier to patrol for law enforcement purposes. Clearly designated boundaries would increase compliance with regulations and raise public awareness of and appreciation for Service efforts at providing quality hunting programs.

Fishing

Fishing opportunities for visitors to Pathfinder Reservoir and the regional fishing community would continue. Service regulations and potential seasonal restrictions would not apply to the deepwater habitats outside the refuge boundary.

Public fishing opportunity on refuge lands would be provided upon completion of the CFR process to open the refuge to fishing. Boat use would be controlled to minimize negative impacts to shoreline vegetation through wave action. Disturbance to waterbirds using the reservoir for molting and feeding would be reduced. Water uses would need to be evaluated under compatibility and modified or eliminated accordingly. Through development of an MOU, WGFD would become an active partner in addressing issues and effecting solutions. Dedicated staff time would allow for an increase in law enforcement patrol, education, and compliance.

Wildlife Observation, Photography, Environmental Education, and Interpretation

Dedicated staff time would enhance opportunities for wildlife observation and photography to occur in selected areas. Improving and developing new partnerships would increase the opportunities for these public uses. All uses would be reviewed and may be modified to ensure compatibility and appropriate use. Focusing efforts on properly marked and posted lands would enhance the Service's

image and raise public awareness of the Service's mission and role in managing trust resources.

Nonwildlife-dependent Recreation

Because the lands and waters associated with Bishops Point would be outside the refuge boundary, the activities that occur there would not be subject to Service compatibility and appropriate use policies. Existing recreational uses would likely continue to be permitted in areas outside the refuge under management by Reclamation or its designee (e.g., Natrona County).

Research and Science

Acquiring baseline data would assist in management efforts to improve or maintain the refuge for the benefit of wildlife. Dedicated staff would develop plans and partner with interested parties to gather and interpret data. Improved habitat conditions may occur due to increased knowledge.

Partnerships

With assistance from partners, infrastructure improvements and an increase in active management may be seen. Dedicated staff would be available to lead and coordinate quality projects as well as develop positive partnership experiences over time. Partnership development is an important aspect of refuge management and, with staff available, time would be dedicated to develop and nurture such partnerships.

Operations

A budget increase would improve on-the-ground accomplishments in refuge habitat conditions and help the Arapaho NWR Complex compete for limited funding to support staff efforts for Pathfinder NWR and the Laramie Plains refuges. Focusing management efforts on remaining refuge lands would increase the potential to successfully support the mission of the Refuge System. Retaining only lands with the highest potential benefit to migratory birds would most efficiently use limited resources and help secure needed funds.

Socioeconomic and Economic Impacts

The refuge would no longer include lands that are difficult to maintain and manage. With reduced land area, it is uncertain whether the refuge would experience the same visitation levels. However, if the reduced land area spurred wildlife population growth, visitation by wildlife enthusiasts could increase.

Improved wildlife habitat and increased wildlife populations could draw additional visitors to the refuge in the long term. As a result, the study area economy could see up to a 10 percent increase in visitor spending, which could introduce an additional $25,500 in economic activity to the region. Additional visitors would generate more business for local proprietors and raise regional tax revenues. However, if the alternative did not increase wildlife populations and visitation from wildlife enthusiasts, overall visitation levels and visitor spending in the local economy would be uncertain.

5.3 CUMULATIVE IMPACTS

Cumulative impacts are the potential effects of each alternative in combination with past, present, and future actions. NEPA regulations define cumulative effects as "the impact on the environment which results from the incremental impact of the actions when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant actions taking place over time" (40 CFR 1508.7).

The cumulative effects analysis for this project is based on reasonably foreseeable future actions that, if carried out, would contribute to the effects of the alternatives. No reasonably foreseeable negative actions are anticipated. Impacts will be monitored during the implementation of the final CCP. Implementation over an extended period will reduce the likelihood of negative cumulative impacts.

The NEPA requires mitigation measures when the environmental analysis process detects possible significant impacts to habitats, wildlife, or the human environment. All activities proposed under alternative C are not expected or intended to produce significant levels of environmental impacts that would require mitigation measures. Nevertheless, the final CCP will contain the following measures to preclude significant environmental impacts from occurring:

- Federally listed species will be protected from intentional or unintentional impacts by banning or restricting activities where these species occur.
- All proposed activities will be regulated to reduce potential impacts to wildlife and plant species, especially during their sensitive reproductive cycles.
- Monitoring protocols will be established to determine goal achievement levels and possible unforeseen impacts to resources for application of adaptive management to ensure wildlife and habitat resources, as well as cultural resources, are preserved.
- The final CCP can be revised and amended after 5 years of implementation, for application of adaptive management to correct unforeseen impacts that occur during the first years of the plan.