



# **3 Refuge and Resource Descriptions**



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Arapaho National Wildlife Refuge, situated at an elevation of 8,200 feet, is located in an inter-mountain glacial basin in north-central Colorado. The refuge is situated along the western edge of the central waterfowl flyway (figure 7).



Figure 7. Waterfowl flyways within the United States

Jackson County opens north into Wyoming and is rimmed on the west by the Park Range, on the south by the Rabbit Ears Range, and on the east by the Medicine Bow Range. The basin floor between these ranges is locally known as North Park and encompasses approximately 600 square miles. The basin is relatively flat with an elevation range of 7,900–8,300 feet.

Slow, meandering streams, which crisscross the basin, flow toward the north-central part of the basin to form the North Platte River. Most of the floodplain is irrigated meadow (irrigated to produce a single hay crop per year), while sagebrush grasslands characterize the adjacent low rises. Sagebrush uplands are the dominant vegetative community and encompass 80 percent of North Park.

Bailey (1995) described the Jackson County area as part of the southern Rocky Mountain eco-region. The Service has adopted an ecosystem approach to natural resource management and has identified 53 watershed-based, eco-regions in the United States (figure 8). Within this approach, the refuge lies within the boundaries of the Platte/Kansas Rivers ecosystem.

The Service is developing a nationally coordinated approach involving ecosystem teams, partners, and stakeholders to preserve natural resources for the American people. Ecosystem teams are fundamental to the Service in sustaining good land

health. Ecosystem teams should be the primary delivery mechanism for establishing priorities and identifying areas of greatest conservation concern in their ecosystems (Fulfilling the Promise, 1999).

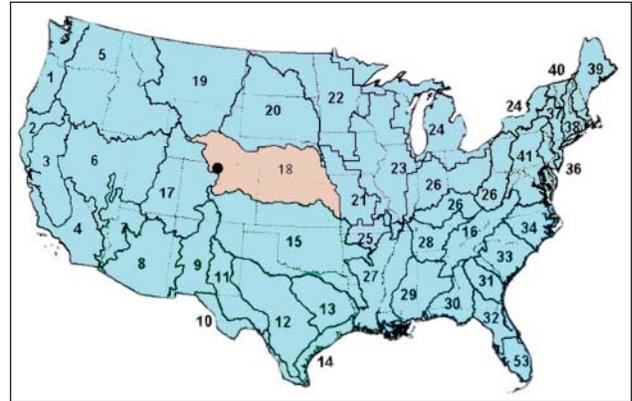


Figure 8. Eco-regions of the U.S. Fish and Wildlife Service

The following sections describe the resources and use of the refuge:

- physical resources
- biological resources
- cultural resources
- special management areas
- public use

## Physical Resources

The climate, geology, and soils of the refuge are described below. In addition, a brief description is given for the water, reserved, and mineral rights related to the refuge.

### Climate

The climate is semiarid—characterized as having short, cool summers followed by long, cold winters.

Temperatures and precipitation vary greatly with elevation and location. Mean annual air temperature in Walden, near the center of North Park, is 36.4 degrees Fahrenheit. Temperature extremes are minus 39 degrees to 90 degrees Fahrenheit, based on the National Weather Bureau’s 30-year average data.

The average length of the growing season in Walden is 43 days. The average date for the last killing frost in Walden is July 1, and the average first killing frost is August 14, based on North Park weather station's 70-year average. The relatively short frost-free season inhibits any form of agriculture, except hay near floodplain areas.

The mean rainfall in Walden is 10.83 inches of precipitation annually. Annual precipitation generally increases as elevation increases, from the floor to the outer edge of North Park. Elevation ranges from slightly below 8,000 feet on the valley floor to 12,965 feet on Clarks Peak. Seventy percent of the annual precipitation falls as snow. Walden averages 53 inches of snow per year, the lowest of any point in North Park. The highest average monthly precipitation occurs in March, April, May, and August (Lischka et al. 1983).

## **Geological Resources**

North Park is a structural basin between the Precambrian granites, gneisses and schists of the Medicine Bow and Park Ranges and Independence Mountain. The sandstones, conglomerates, and shales of the Tertiary Coalmont Formation dominate the surface geology of the North Park floor. Coal is found in the lower members of the formation (Hail 1968).

The North Park Formation overlies the Coalmont Formation and consists of white, calcareous conglomerates. The Coalmont Formation is exposed along a long, narrow, syncline ridge trending northwest from Owl Mountain to the confluence of Roaring Fork and Grizzly Creeks. The syncline includes Owl Ridge and Peterson Ridges.

Pierre Shale underlies the Coalmont Formation and is exposed primarily in the northwestern and northeastern quadrants of North Park. Evidence of Tertiary volcanics is obvious along the south boundary of North Park. Quantities of breccia and other volcanics are common in the Rabbit Ears Range in the form of dikes, flows, and ash.

Significant glacial activity occurred in North Park during the Pleistocene. Fluvial gravels and interfluvial terraces are examples of the influence of glacial activity upon the current landscape of North Park's floor. Several natural lakes in the area are likely the remnants of Pleistocene glaciation.

Winds also influenced the geology of North Park. Prevailing southwesterly winds, possibly caused by the low ridge between Rabbit Ears Peak and Arapaho Pass, have deposited fine grains of alluvium, some of which reaches thicknesses of 30 feet. Winds may have created several shallow lakes within the basin, including Hebron Sloughs, located southwest of the refuge (Lischka et al. 1983).

## **Soil Resources**

Soils that have the capacity to reproduce the same kinds, amounts, and proportions of range plants are grouped into range sites. Fletcher (1981) defined 15 different range sites and 2 forest types within Jackson County. Five range sites (floodplains) are found on the refuge.

- Randman-Blackwell-Dobrow association (deep, poorly drained, dominantly sandy soils)
- Spicerton-Stumpp association (deep, well-drained, sandy loams and clay loams on bench and upland sites); Fluetch-Bosler-Tealson association (deep and shallow, well-drained, sandy loams)
- Tiagos-Cabin association (deep, well-drained, fine, sandy loams); and Coalmont-Brinkerton-Aaberg association (moderately deep, of soft shale and well-drained sandy loams)



*Prairie Lupine*

Everett and Nancy Collin

The refuge contains 31 individual soil types within the 5 range sites (Fletcher 1977). Dominant soil types include Spicerton sandy loam, Fluetsch-Tiagos association, Bosler sandy loam, and the Boettcher-Bundyman association. These soils are found on slopes less than 15 percent, and generally have slow to moderate permeability. Mean soil temperature at Walden is 58 degrees Fahrenheit.

## **Water Resources and Rights**

The refuge is located on the Illinois River and its tributaries. The Illinois River is tributary to the Michigan River, which is tributary to the North Platte River.

Prior to settlement, the bottoms and meadows of the Illinois River and its tributaries flooded annually from snow melt and spring runoff, creating significant waterfowl nesting habitat. With settlement, much of the natural floods and pond creation were reduced, with irrigated meadows replacing ponds and marshes.

Since the refuge's first land acquisition in 1967, the Service created new wetland habitat through

the management of acquired irrigation and stock reservoirs, diversion of water into natural depressions, and diversion of water into Service-constructed ponds.

The refuge has a decreed diversion rate of 515.05 cubic feet per second, most of which is diverted from the Illinois River. Lesser amounts are diverted from tributaries of Willow, Spring, Potter, and Antelope Creeks. This water is either ditched for storage in 9 decreed reservoirs and 73 un-decreed ponds, or ditched to meadows for direct irrigation.

The refuge has decreed rights to 7,626.4 acre-feet for reservoir and pond initial fills and refills, and is seeking an additional 2,582.5 acre-feet of junior storage rights. The total capacity of refuge storage units is 5,678.5 acre-feet. Approximately 814 surface acres in ponds and approximately 9,499 acres are irrigated meadow grass.

Since 2001, the U.S. Geological Survey (USGS) has measured Illinois River flow at gauging stations at the upstream and downstream ends of the refuge to determine the effect of diversions, wildlife use, and return flow on river discharge.

Groundwater is present in an unconfined, sand, and gravel alluvial aquifer, which underlies the entire refuge. The water table is shallow, with the elevation of the groundwater table approximating the water-surface elevations in nearby rivers, creeks, reservoirs, and ponds.

The Colorado Division of Water Resources, commonly referred to as the State Engineer's Office, administers the refuge's water rights according to the prior appropriation doctrine.

Whereas much of the refuge's acquired land has senior appurtenant water rights, conversion of ranch land to wildlife habitat has required obtaining junior water rights that cannot be exercised in dry or semidry years.

Sufficient water rights are held by the refuge to implement goals and objectives (appendix I).

### ***Reserved Rights and Privately Owned Mineral Estate***

Purchase of some land tracts on the refuge were subject to existing rights-of-way at the time of purchase. Some of these rights-of-way include Jackson County Roads 31, 32, and 34. The Colorado State Highway Department owns a 100-foot right-of-way on Highway 125 and a 50-foot right-of-way on Highway 14.

Additional rights-of-way include buried telephone lines along Highway 125 and 14, and power lines

along Highway 125, through the length of the east side of the refuge and across the Case tract on the south side.

With the purchases of land tracts, the refuge acquired surface mineral rights on all its land except the transfers from Bureau of Land Management (BLM). The refuge owns the majority of the subsurface mineral rights; the State of Colorado, BLM, and private landowners hold the remainder.

## **Biological Resources**

Refuge habitats provide for a variety of animals and plants. Brief descriptions of these resources follow; more details can be found in appendix H.

### ***Habitat Management Units***

Habitat on the refuge can be divided into four broad types: riparian, wetland, meadow, and upland.

Acreages for each habitat type were calculated using geographic information system (GIS) software (Environmental Systems Research Institute's ArcView), with refuge boundary topographic base maps and map layers from the national wetland inventory (NWI).

Estimating width of the historic floodplain—using topography and vegetative community changes as a guide—determined width of the riparian area.

Meadow habitats were derived primarily using maps from the NWI, with corrections for recent wetland additions.

Acreage of the other three habitat types was subtracted from the refuge's base acreage to calculate upland acreage.

Descriptions of the refuge's habitat types follow.

### **Riparian Habitat**

The riparian habitat covers 4,374 acres on the refuge. It is composed of the channel, floodplain, and transitional upland fringe along portions of the Illinois River and Spring Creek.

Historically, the floodplain and transitional fringe have been considered irrigated meadow. However, this plan uses the terms channel, floodplain, and transitional fringe because these components more appropriately represent the collective functions and processes of riparian habitats.

Such designation allows management potential of the entire area to be more thoroughly evaluated (figure 9—habitat management units).

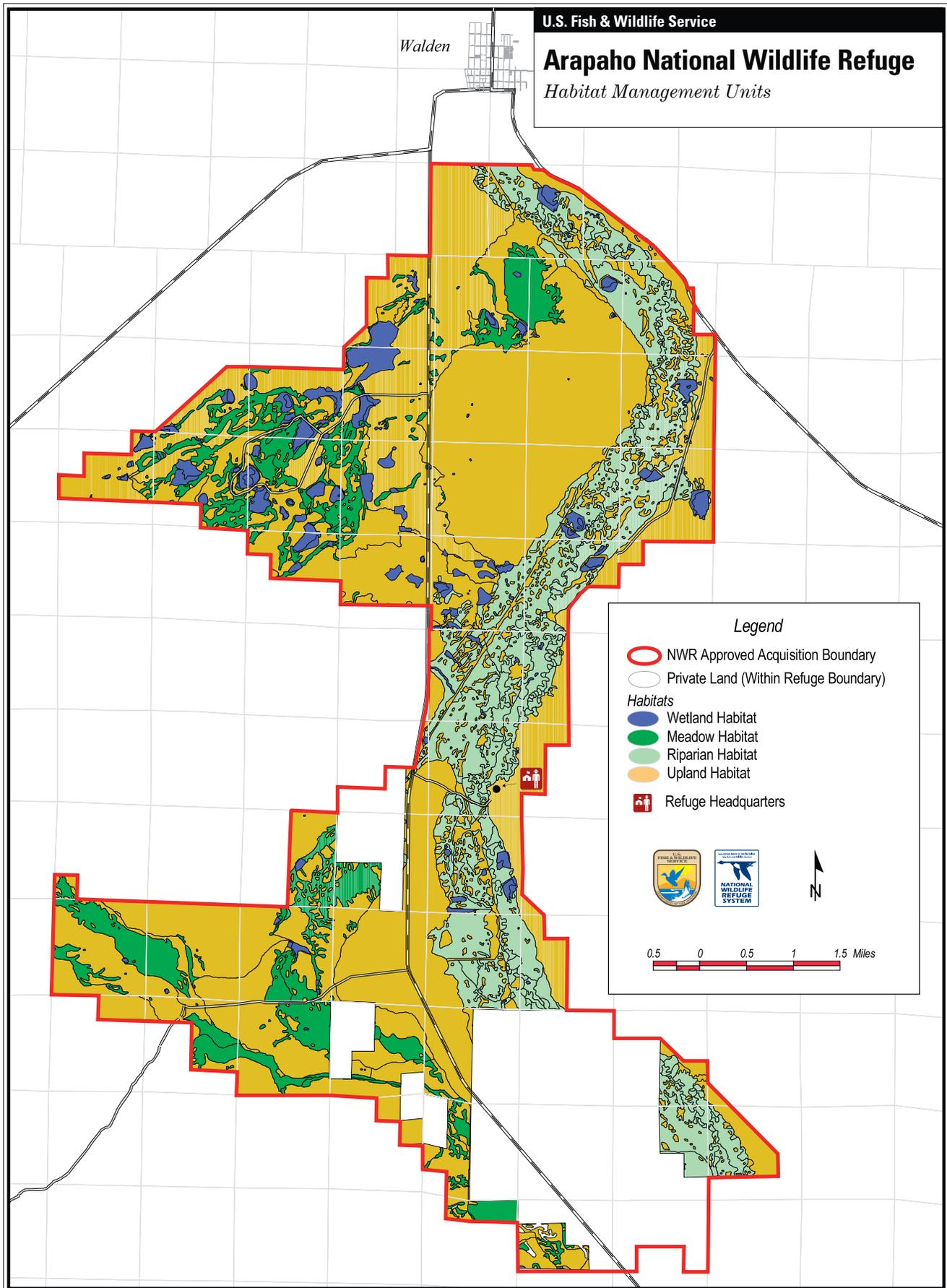


Figure 9. Habitat management units of Arapaho National Wildlife Refuge, Colorado

These willow species are found along the Illinois River:

Drummonds's willow	whiplash willow
coyote willow	mountain willow
Geyer's willow	planeleaf willow

Grass species common to these moist soil areas include the following:

bluejoint reedgrass	tufted hairgrass
timothy	saltgrass
mannagrass	Nebraska sedge
smooth brome	rush species
meadow foxtail	Nuttall's alkaligrass
meadow barley	redtop
Nevada bluegrass	winter bentgrass
sloughgrass	

The runs and pools in the river channel typically contain aquatic vegetation including waterweed, pondweed, and filamentous algae. Canada thistle is the main invasive plant in this area.

Wildlife species that use the riparian-habitat grasslands include waterfowl such as northern pintail, mallard, gadwall, and green-winged teal. Sage grouse broods use these areas to forage for high-protein invertebrates.

The willow complex supports at least 40 species of migrating songbirds such as yellow warbler and willow flycatcher, along with moose, river otter, beaver, and wintering elk. Water birds—including common snipe, spotted sandpiper, sora, American white pelican, and black-crowned night-heron—extensively use this habitat type.



*Yellow Warbler*

Cornell Lab of Ornithology

The cold-water system of the Illinois River supports 7 species of native and non-native fish and at least 17 taxa of aquatic invertebrates.

## Wetland Habitat

Wetland habitat includes 824 acres of natural and created ponds and lakes up to the high water mark, excluding surrounding meadows and riparian corridors. Ponds and lakes, henceforth referred to as basins or wetlands, were delineated using both NWI maps and refuge coverage maps. Approximately 79 shallow wetlands exist on the refuge (figure 6—base map).

For management purposes, three wetland complexes were developed: the Case, Illinois, and Soap Creek complexes (figure 10—wetland complexes). The majority (90 percent) of wetland basins are constructed. The purpose for these artificial wetlands is to offset wetland losses occurring elsewhere in the central flyway. Maintenance of these facilities provides benefits to a host of wetland-dependent species, including waterfowl.

Specific wetland objectives only account for approximately 50 percent of the total wetland surface area to be managed in a given year. Drought, evaporative losses, periodic drawdowns for aquatic vegetation enhancement, dike maintenance activities, and fall migration drawdowns account for the remainder of the wetland surface area.

Aquatic vegetation of wetland habitats includes both emergent species (e.g., cattail, spike rush, and bulrush) and submerged species (e.g., sago pondweed, leafy pondweed, and widgeongrass). Invertebrate abundance is high in wetland basins. Common invertebrates include true bugs, as well as invertebrate families of the water boatman, backswimmer, predacious diving beetle, and crawling water beetles.

Invertebrates are a critical food source to many waterfowl and shorebirds. Waterfowl species include both diving ducks (e.g., lesser scaup, canvasback, redhead, and ruddy duck) and puddle ducks (e.g., mallard, northern shoveler, gadwall, and American wigeon). Over-water nesting birds such as the black-crowned night-heron, white-faced ibis, marsh wren, coot, and blackbirds also extensively use wetland habitats.

## Meadow Habitat

Meadow habitat includes 2,683 acres of grasslands and old hay meadows, except those along the riparian corridor, which are considered riparian habitat. These historically irrigated fields provide the majority of the nesting habitat for waterfowl, shorebirds, and songbirds. Meadow habitats represent common feeding, resting, and loafing areas for most birds and mammals on the refuge (figure 9—habitat management units).

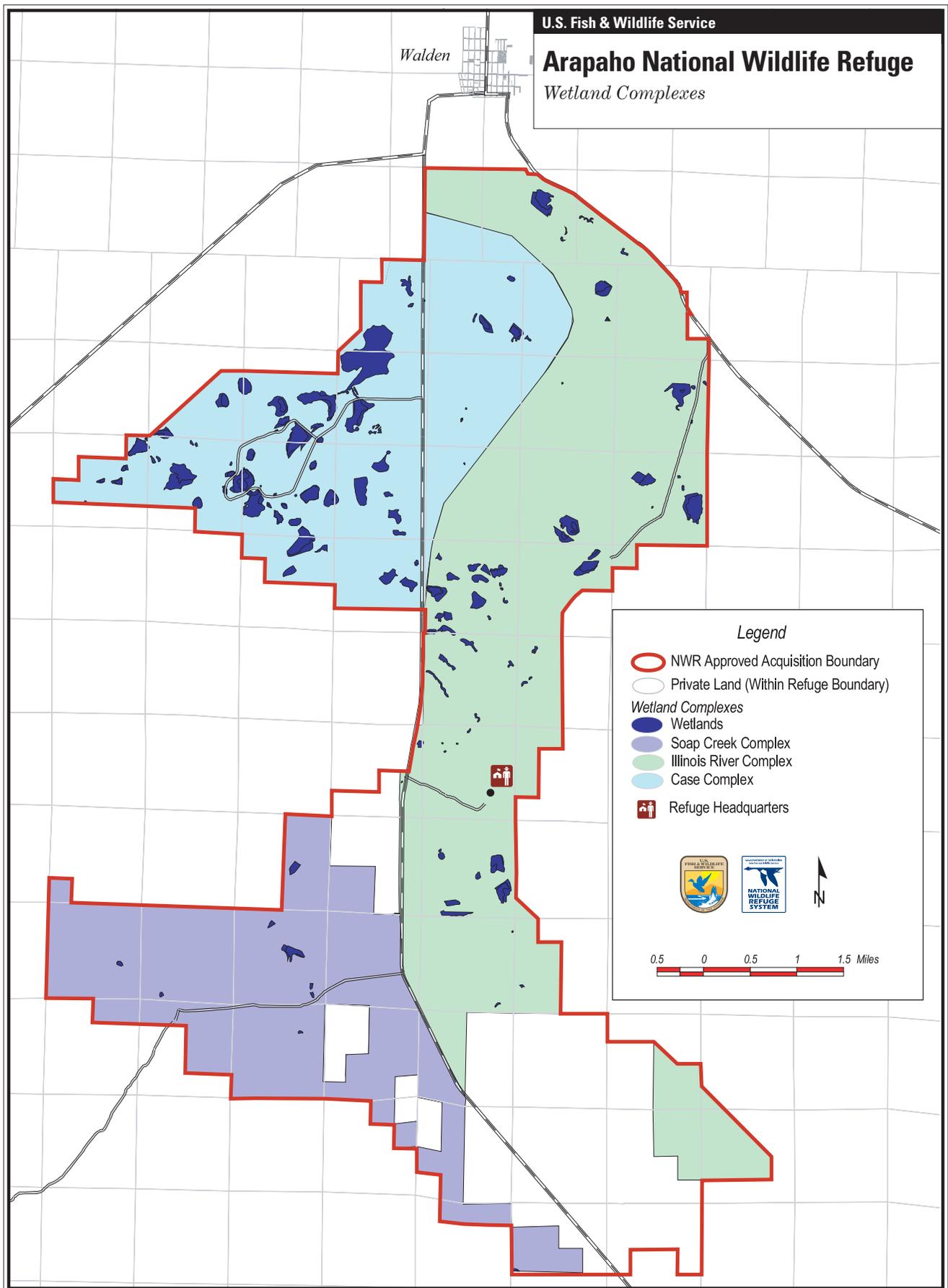


Figure 10. Wetland complexes of Arapaho National Wildlife Refuge, Colorado

The following vegetation, primarily native plants, is common to meadow habitat:

slenderbeak sedge	golden sedge
capitate sedge	softleaf sedge
Hayden's sedge	new sedge
narrowleaf sedge	valley sedge
elk sedge	Colorado rush
woolly sedge	Baltic rush
Nebraska sedge	dagger-leaf rush
dunhead sedge	longstyle rush
beaked sedge	tuberous rush
shortbeak sedge	field woodrush
water sedge	smallflowered woodrush

Grass species common to these moist soil areas include the following:

bluejoint reedgrass	sloughgrass
timothy	tufted hairgrass
mannagrass	saltgrass
smooth brome	Nuttall's alkaligrass
meadow foxtail	redtop
meadow barley	winter bentgrass
Nevada bluegrass	

The following are common forbs:

sulphur buckwheat	small bluebells
Hood's phlox	cinquefoil
longleaf phlox	early cinquefoil
rosy pussytoes	stonecrop
silvery lupine	wormleaf stonecrop
prairie lupine	daisy species
groundsel species	beardtongue
narrow-leaved maertensia	

Canada thistle is the main invasive plant in this area.

Wildlife species that use the meadow habitat include waterfowl such as the northern pintail, northern shoveler, gadwall, and green-winged teal. Sage grouse broods use these areas to forage for high-protein invertebrates. Snipe broods and other grassland-nesting songbirds use this habitat type, along with elk, pronghorn, and coyote.

## Upland Habitat

The upland habitat consists of 14,285 acres of a shrub-steppe plant community dominated by sagebrush, drought-tolerant perennial bunchgrasses, and forbs.

Uplands are the dominant refuge habitat type and include all lands not accounted for in the

wetland, meadow, and riparian descriptions. Many upland habitats exhibit a mosaic pattern around meadow sites; these sites are generally managed as meadows (figure 9—habitat management units).

Historical reports of the sagebrush-steppe plant community are conflicting, and pre-settlement community conditions may never be fully known.

The focus of past management efforts has been devoted to wetland-dependent birds, therefore information is limited about the upland plant community.

Available information suggests that sagebrush historically was the dominant plant species, although perhaps taller (greater than 3 meters) plants may have existed.

Floristic diversity in North Park has likely decreased, especially within the grasses and forbs. Management efforts for the past 50 years have attempted to increase grass and forb abundance through mechanical and chemical means.

In general, the sagebrush plant community appears to be in fair condition, but given the lack of basic information, management alternatives are difficult to define. Therefore, management objectives center on developing an upland habitat database that defines plant species, location, abundance, and characteristics.

Secondly, the refuge proposes to “experiment” with 4,000 acres of uplands to create a preferred plant community structure. Lessons learned will be applied to larger pieces of upland habitats.

Upland vegetation consists primarily of the following shrubs:

mountain big sagebrush	Douglas rabbitbrush
Wyoming big sagebrush	broom snakeweed
alkali sagebrush	gray horsebrush
fringed sage	black greasewood
black sagebrush	winterfat
rubber rabbitbrush	

The grasses below are dominant in the uplands:

muttongrass	western wheatgrass
Nevada bluegrass	blue grama
Sandberg bluegrass	elk sedge
bottlebrush squirreltail	needle and thread
Idaho fescue	green needlegrass
bluebunch wheatgrass	

Common forbs are listed below:

sulphur buckwheat	small bluebells
Hood's phlox	cinquefoil
longleaf phlox	early cinquefoil
rosy pussytoes	stonecrop
silvery lupine	stonecrop
prairie lupine	wormleaf
groundsel species	daisy species
narrow-leaved maertensia	beardtongue

Invasive plants include yellow toadflax and musk thistle and occur primarily in disturbed sites.

Sage grouse are a sagebrush-obligate species, requiring sagebrush plants for cover and food. Vesper sparrow, Brewer's sparrow, and sage thrasher are songbirds common to the uplands.

Elk, mule deer, and pronghorn are common big-game users of upland habitats.

## **Wildlife Resources**

A broad diversity of wildlife reflects the refuge's habitat diversity.

Only those species that are residents or frequent visitors to the refuge are discussed below. Many species, especially birds, may infrequently inhabit or migrate through the refuge.

All species of birds, mammals, fish, amphibians, and reptiles are listed in appendix J.

### **Birds**

A large number of ducks and Canada geese depend on wetland, riparian, and meadow habitats for foraging, nesting, brood-rearing, and molting. The most common type of ducks breeding on the refuge include lesser scaup, gadwall, American wigeon, northern shoveler, and cinnamon teal.

Most of the ducks common to the refuge use the three habitats listed above and, occasionally, some species use the upland habitat. These ducks include the green-winged teal, mallard, northern pintail, cinnamon teal, northern shoveler, blue-winged teal, gadwall, and American wigeon.

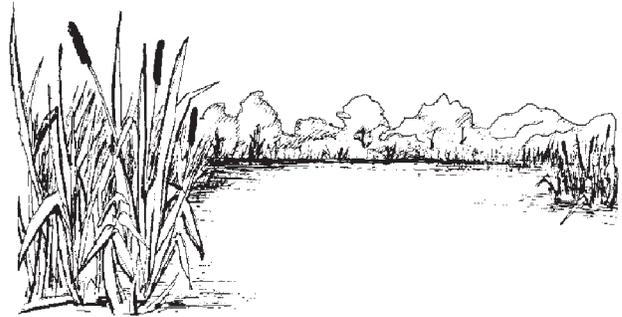
Redhead, ruddy duck, and lesser scaup depend on wetlands for most of their life needs, with the scaup and redhead nesting in meadows occasionally.

The ring-necked duck, canvasback, and bufflehead are generally spring and fall migratory visitors, but the canvasback does infrequently nest on the refuge. The common merganser primarily inhabits riparian areas to meet their life requirements.

Canada goose is an abundant species that is the first to arrive in the spring and the last to migrate in the fall. The geese use wetland, riparian, and meadow habitats for foraging, nesting, and brood-rearing.

Wading birds are water birds that usually do not swim or dive for food, but wade in shallow edges of water for prey. Black-crowned night-heron, great blue heron, and white-faced ibis are the common breeding species on the refuge.

The ibis and black-crowned night-heron use wetlands with heavy cattail/hardstem bulrush vegetation for nesting and brood-rearing. They forage in riparian, meadow, and wetland areas.



The great blue heron uses riparian habitat primarily for nesting and foraging, but can be observed in wetlands.

Shorebirds are most often found foraging for food along the water margins; they use the refuge as a migratory stopover and some nest there. American avocet, willet, killdeer, spotted sandpiper, and Wilson's phalarope are the common nesters.

Avocet and willet mainly use the wetland habitat for their needs. The killdeer is more of a generalist and can be found in all habitats.

The spotted sandpiper and common snipe reside mostly in riparian habitat. Wilson's phalarope use the meadow and riparian habitats for nesting and forage; they rear young in the wetlands. Black-necked stilt is an occasional nester in the wetlands.

Dowitchers, yellowlegs, and other sandpipers use the area for a stopover during spring and fall migration.

Other water birds are represented by a variety of species. Pied-billed grebe, eared grebe, and American coot use wetlands for nesting, foraging, and brood-rearing. Virginia rail, sora rail, and common snipe use the meadow/riparian habitats extensively.

American white pelican, double-crested cormorant, and California gull do not nest on the refuge but use the area for foraging. Black and forester's terns

nest in areas of dense sedge, cattail, and bulrush, and forage in the wetlands.

Raptors consist of several families of hawks, falcons, and owls. The most common raptors of the refuge include the following:

northern harrier	American kestrel
Swainson's hawk	prairie falcon
rough-legged hawk	short-eared owl
golden eagle	great horned owl

Only the golden eagle and great horned owl are year-round residents. The rough-legged hawk is a winter visitor while the rest of the birds are present in the spring, summer, and fall.

The raptors use all habitats for nesting and foraging. Red-tailed hawk, ferruginous hawk, sharp-shinned hawk, and Cooper's hawk use the area occasionally.

Upland bird species rely on the uplands primarily to subsist. Several of the common upland birds are sage grouse, horned lark, sage thrasher, vesper sparrow, and Brewer's sparrow.

The sage grouse and horned lark are year-round residents. The sage grouse resides primarily in the uplands, but uses the edges of riparian and meadow habitats.

The sage thrasher, horned lark, and sparrows depend on the upland area for nesting, but may forage in the other habitats.

Neotropical migrants are birds that breed in North America—north of Mexico—but winter in Mexico, Central and South America, or the West Indies.



Everett and Nancy Collin

House wren

The following species are commonly found on the refuge during either migration or the nesting

season. These birds rely heavily on riparian habitat for foraging, cover, and nesting:

common nighthawk	western kingbird
belted kingfisher	gray catbird
willow flycatcher	Wilson's warbler
warbling vireo	savannah sparrow
house wren	fox sparrow
marsh wren	song sparrow
yellow warbler	Lincoln's sparrow
MacGillivray's warbler	white-crowned sparrow
common yellowthroat	

A few of these species also use the meadow and wetland habitat for nesting or foraging, such as the savannah sparrow and the marsh wren. The cliff, barn, and tree swallows use a combination of habitats including wetland, riparian, and meadow.

Resident and migrant songbirds breed in North America and migrate throughout a limited North American range:

mountain bluebird	pine siskin
American robin	American goldfinch
dark-eyed junco	lark bunting
rosy finch	

These birds use riparian, meadow, and upland habitats. Red-winged, yellow-headed, and Brewer's blackbirds use both wetlands and riparian for nesting and foraging. Species such as the black-capped chickadee, red-breasted nuthatch, and ruby-crowned kinglet use woody, riparian areas for foraging, but tend to nest off the refuge.

The northern flicker is the most common woodpecker. This species inhabits riparian willow habitat, but also uses uplands and meadows. Other less common woodpeckers include downy and hairy woodpeckers, and red-naped sapsucker.

## Mammals

Big game animals common to the refuge include pronghorn, mule deer, moose, and elk. As many as 20 moose can be found on the refuge at any one time, spending most of their time in the riparian habitat.

The mule deer population is approximately 40 animals that roam on and off the refuge, spending time in the riparian, meadow, and upland habitats. White-tailed deer, with a population of about 20 animals, use the same areas as mule deer.

Pronghorn use the upland habitat primarily, but can be found in the riparian and meadow habitats.

Pronghorn use the refuge in the spring, summer, and fall, with a population of about 50 animals present at any one time. In the winter, the pronghorn generally move north off the refuge, making them a rare sight in the area.



Pronghorn  
© Cindie Brunner

A resident herd of approximately 150 elk resides primarily in the riparian area in the southern half of the refuge and on neighboring land.

During the winter (November through March) the refuge and surrounding area hosts about 1,200 elk. These animals are usually in several herds and use riparian, meadow, and upland habitats.

The refuge has many small mammals, which use all habitat types depending on their life requirements.

Common species of small mammals are listed below:

- |                          |                    |
|--------------------------|--------------------|
| Nuttall's cottontail     | montane vole       |
| white-tailed jackrabbit  | muskrat            |
| least chipmunk           | porcupine          |
| Wyoming ground squirrel  | coyote             |
| white-tailed prairie dog | long-tailed weasel |
| beaver                   | mink               |
| deer mouse               | badger             |
|                          | striped skunk      |

## Fish

The Illinois River and wetlands are two main types of aquatic communities present on the refuge. The Illinois River is a transition stream.

The river begins as a trout stream at the headwaters and down to the southern end of the refuge, to a native species stream by the time it reaches the northern half of the refuge. The splitting of the stream channel into two channels appears to be the basis of this fishery transition.

The low flows of the split are ultimately responsible for trout giving way to the more tolerant native species.

These species are common in the Illinois River on the refuge:

- |                        |                   |
|------------------------|-------------------|
| brown trout            | creek chub        |
| rainbow trout          | long-nosed sucker |
| northern redbelly dace | white sucker      |
| fathead minnow         | Johnny darter     |

Potter and Spring Creeks are tributaries of the Illinois River. These creeks provide little fishery habitat, with only a few native fish such as long-nosed sucker, white sucker, fathead minnow, and creek chub found in them.

Many of the wetlands will not support a fishery, with water depth and winter survival being the limiting factors. The most common fish found in the wetlands is the fathead minnow, a native fish that has evolved in this type of habitat.

## Reptiles and Amphibians

The wandering garter snake is the only reptile known to inhabit the refuge. Sightings of this snake are rare, with only one or two seen in a year.

Amphibians are slightly more numerous with the following species: barred tiger salamander, western toad, wood frog, northern leopard frog, and striped chorus frog.

Chorus frogs are found in the wetland, meadow, and riparian areas;



Tiger Salamander  
© Cindie Brunner

they are the most abundant amphibian on the refuge. The salamanders are primarily associated with the wetlands but are seen in all habitats.

The wood frog has been documented once on the refuge, in riparian habitat. The western toad is extremely rare, as the habitat types on the refuge are not ideal for this species. Leopard frogs have been observed in the riparian habitat and in irrigation ditches in the meadow habitat.

## Invertebrates

Some sampling of invertebrates has been done on wetland and riparian areas. Wetland invertebrates were the most diverse, with 20 different families represented in the sampling. Stream sampling identified 17 different taxa in the Illinois River.

Further sampling of invertebrates to establish a quantitative baseline would assist in identifying problems in wetland and riparian areas in the future.

## Threatened, Endangered, and Candidate Species and Other Species of Special Concern

Table 4 lists special-status wildlife, fish, and amphibians that are known to use habitat types on the refuge.

The bald eagle, a federally-listed species, is an intermittent visitor on the refuge and a year-round resident of the county. Nesting habitat does not exist on the refuge but the eagle does use all habitat types for foraging.

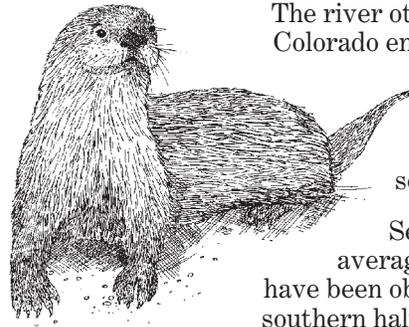
The peregrine falcon, which is proposed for federal de-listing, is also an intermittent visitor, using all the habitat types for foraging.

Burrowing owl, ferruginous hawk, northern sage grouse, long-billed curlew, and white pelican are State of Colorado special-concern species.

Burrowing owls nest on the refuge, with an occurrence of one nest found every 5 years. They are a migrant in the fall of the year. Ferruginous hawk occurs in the spring, summer, and fall, foraging on refuge habitats.

Northern sage grouse are an abundant year-round resident. The grouse use the upland, riparian, and meadow habitats for breeding (one lek found on the refuge), nesting, foraging, and brood-rearing.

Long-billed curlews are observed every few years. White pelicans nest off the refuge on MacFarlane Reservoir, frequenting the refuge to forage in wetland and riparian habitats.



River Otter  
© Cindie Brunner

The river otter is a State of Colorado endangered species.

The otter was reintroduced into a watershed south of the refuge.

Several otters (an average of one per year) have been observed in the southern half of the refuge's riparian habitat.

Little is known about the northern redbelly dace on the refuge. This State of Colorado endangered species is found in the Illinois River.

Northern leopard and wood frogs are special-concern species for the State of Colorado. The leopard frog is common and found in riparian and meadow habitats. Wood frogs occur along the Illinois River, south of refuge headquarters.

**Table 4. Special-status wildlife, fish, plant, and amphibian species potentially occurring on Arapaho National Wildlife Refuge, Colorado**

<i>Common Name</i>	<i>Seasonal Occurrence<sup>1</sup></i>	<i>Federal and State Status<sup>2</sup></i>	<i>Date Last Observed<sup>3</sup></i>
<b>Birds</b>			
American peregrine falcon	SR	CDOW species of concern	2004
bald eagle	YR	USFWS threatened species (proposed delisting)	2004
western burrowing owl	B, M	CDOW threatened species	2004
ferruginous hawk	SR	CDOW species of concern	2004
northern sage grouse	B, YR	CDOW species of concern	2004
long-billed curlew	M, SR	CDOW species of concern	2004
American white pelican	SR	CDOW species of concern	2004
<b>Mammals</b>			
river otter	YR, B	CDOW endangered species	2004
<b>Plants</b>			
North Park phacelia	YR	USFWS endangered species	2004
<b>Amphibians</b>			
northern leopard frog	YR	CDOW species of concern	2004
wood frog	YR	CDOW species of concern	2004

Source: Colorado Division of Wildlife and U.S. Fish and Wildlife Service.

<sup>1</sup>Seasonal occurrence: B=breeding (assumes summer resident), SR=summer resident (no evidence of breeding), YR=year-round resident, M=migrant.

<sup>2</sup>See glossary for special-status definitions. CDOW=Colorado Division of Wildlife; USFWS=U.S. Fish and Wildlife Service.

<sup>3</sup>Data is from the refuge's wildlife observation log.

## Cultural Resources

Humans have used the mountains of Colorado for thousands of years. Spear points dating to the Paleoindian Period have been recovered in North Park. The Paleoindian Period extends from 12000 B.C. to around 5740 B.C.

Although numerous other Paleoindian sites have been located in Middle Park, including evidence of bison hunting 10,000 years ago, known occurrences of Paleoindian occupation in North Park have been limited to small campsites. Some archaeologists think Paleoindian groups lived in the Parks year-round; others propose winter camps in the foothills with exploitation of various mountain resources during summer months.

The Archaic Period followed the Paleoindian Period and lasted until A.D. 150. Hunters used darts and throwing sticks called atlatls. There was also a higher reliance on small game and plant resources. A major drought on the Plains (ca. 5000–2500 B.C.) caused change to settlement and subsistence patterns. People moved into the mountains for longer periods and exploited a wider variety of plant and animal resources. Increased moisture during the latter part of the Archaic Period brought people back onto the Plains, but the mountains continued to be an important part of their subsistence. Activity increased in North Park during this period.

The Late Prehistoric Period (A.D. 150–1540) saw the introduction of the bow and arrow and ceramics. Bison hunting again became an important part of the economy, but the people of this period continued to rely on a variety of available plant and animal resources. Researchers have proposed a seasonal round of activities. People would leave their foothills winter camps and head north into the Laramie Basin, then south through North and Middle Parks, collecting and hunting until fall. From there, they would turn east to hunt bighorn sheep along the Continental Divide on their way back to the foothills.

The Protohistoric Period starts with European contact, around A.D. 1540. Of the modern tribes, the Utes are most often associated with the mountains and long-term utilization of the resources of North Park. There are also historic accounts of visits to North Park by the Shoshone, Arapaho, and Cheyenne peoples.

Archaeological sites in North Park are generally small and associated with seasonal use of the area. They include open campsites and lithic scatters with stone circles (tepee rings) located along the ridges. Culturally scarred trees and wickiups in forested areas represent Protohistoric Ute use. Rock art

and bison kill sites, although uncommon, have been reported in North Park.

The first European visitors to New Park (now known as North Park) were probably trappers. Alexander Sinclair and Robert Bean headed the first known party of trappers in 1825. Several famous trappers, miners, and hunters made their way through North Park. Kit Carson, Jim Baker, Sublette, Gervais and Vasquez, Calvin Jones, Henry Fraeb, John Gantt, and Pegleg Smith visited North Park in the 1840s.

The second western expedition of John C. Fremont took him through North Park in 1844. Sir George Gore passed through the area on a hunting expedition in 1855, and found mule deer, elk, beaver, bear, and mountain sheep. By 1917, most of the game species were gone.



*Blue Grama*

Cyrus Mendenhall began grazing cattle in North Park in 1879. By 1885, the beef industry was booming, and North Park had its share of large ranches.

Overgrazing and severe winters decimated herd sizes in the area and by 1889 ranching was no longer as profitable as it had been.

In the late 1800s, the economy of North Park shifted to mining. Mining of coal, gravel, fluorspar, copper, silver, and gold—along with logging and ranching—became the main economic developments of the area.

Cultural resource studies have been completed on approximately 50 percent of the refuge. Significant cultural resources have been located, including prehistoric stone circles and open campsites, and historic ranches, graves, and other features associated with Euro-American settlement of North Park. Future efforts will continue to identify existing cultural resources and protect them from degradation. A detailed cultural resource overview of North Park (Larson and Letts 2003) is available from the Service's regional archaeologist.

## Special Management Areas

Limited special management areas currently exist on the refuge. The refuge has no wilderness designation or other similar land-use restriction beyond refuge policy.

Arapaho National Wildlife Refuge does not contain any area that qualifies for wilderness designation.

All the lands within the refuge have been highly manipulated and contain roads, since it was a working ranch prior to its becoming a refuge.

The only specific historical or cultural areas include grave sites, which will continue to be protected.

The refuge is operating under a 1982 habitat management plan that provides guidance for land management. This CCP replaces the 1982 plan. Additionally, the refuge uses a hunting plan and zone system (management units A, B, and C) to distribute hunters, anglers, and other public uses. This hunting plan will remain in effect until completion of step-down management plans for public use and hunting.

This CCP identified other issues that may require special management, as follows:

- **North Park phacelia**—Preservation of this endangered plant may require fencing and plans to minimize disturbance and ensure the survival and recovery of the species.
- **Elk road closures**—During winter months, the refuge will continue to close roads to minimize disturbance to wintering elk. Coordination with the CDOW and implementation of the revised, step-down management plan for hunting may alter this strategy.
- **Multi-use trail**—Although this trail will be located on the refuge boundary to minimize wildlife and habitat disturbance, the potential for litter and trespass will be higher. Signage and additional law enforcement patrols will be used to minimize these conflicts.
- **Owl Ridge Overlook**—Located 0.25 mile south of the headquarters, this site will facilitate viewing of moose, elk, and mule deer. This site is located on an existing road, therefore, the potential for litter and trespass will be higher. Signage and additional law enforcement patrols will be used to minimize these conflicts.
- **Case Barn interpretive site**—Located along the auto tour route, this site may facilitate historical interpretation of North Park and the role ranching has played to preserve wildlife habitats. The refuge will pursue partners to rehabilitate and interpret these important structures. This site is located on an existing road; therefore, the potential for litter, vandalism, and trespass will be higher. Signage and additional law enforcement patrols will be used to minimize these conflicts.
- **Hampton Barn**—Depending on the outcome of the review by the State Historical Preservation Office, the site may be used to facilitate historical interpretation of North Park and the role ranching has played to preserve wildlife habitats. The refuge anticipates only developing one barn interpretive site. The Case Barn

will be first priority, based on its proximity to the auto tour route. This site is located on an existing road, therefore, the potential for litter, vandalism, and trespass will be higher. Signage and additional law enforcement patrols will be used to minimize these conflicts.

## Public Use

The annual number of visits to the refuge is estimated at 7,200, which is an average for the past 6 years. This estimate is based broadly on a traffic counter on the auto tour route, visitors entering the visitor center, and general observation. Table 5 summarizes estimated visits in four categories from 1997–2002.

Figure 11 displays location information for the plan's approved public use.

The visitor center is open Monday through Friday (7:00 am–4:30 pm). Information, regulations, and universally accessible restrooms are available during the same hours.

A general leaflet contains a refuge map, describes the refuge and its management, addresses habitats, lists wildlife interpretational and recreational activities, and cites regulations.

Three other leaflets provide information for refuge visitors: wildlife list, hunting guide, and self-guided auto tour. The leaflets are available in three dispensers (auto tour entrance, headquarters entrance, and Brocker Overlook) and at the visitor center.

## Compatible Wildlife-Dependent Recreation

Arapaho National Wildlife Refuge offers visitors a variety of self-guided recreation opportunities. The Improvement Act states that public use of a refuge may be allowed only

where the use is compatible with the refuge system mission and the purpose of the individual refuge.

The Improvement Act sets forth a current standard by which the Secretary of the Interior shall determine whether such

uses are compatible. The term “compatible use” means a proposed or existing wildlife-dependent



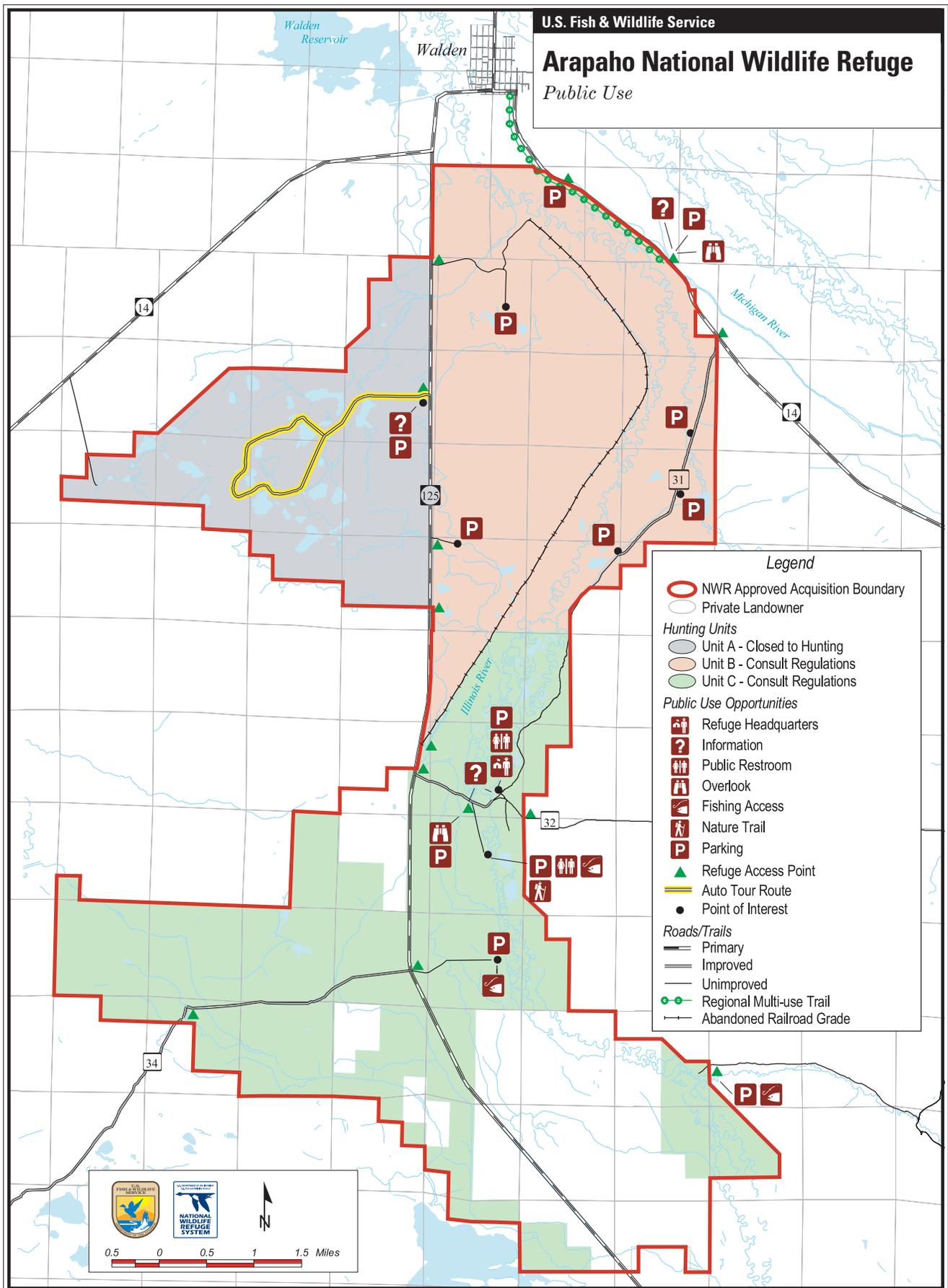


Figure 11. Public use of Arapaho National Wildlife Refuge, Colorado

**Table 5. Estimated annual visitors to Arapaho National Wildlife Refuge, Colorado**

Visitor Activity	1997	1998	1999	2000	2001	2002
Observation and interpretation	6,762	6,361	6,263	6,360	7,220	7,496
Hunting	357	228	302	522	152*	61*
Fishing	64	84	70	45	34*	18*
Environmental education	65	132	162	180	167	135
Total	7,248	6,805	6,797	7,107	7,575	7,710

\*Severe drought conditions limited hunting and fishing opportunities.

recreational use or any other use that, in the sound professional judgment of the Service, will not materially interfere with or detract from the fulfillment of the system's mission or refuge's purpose.

Wildlife observation and photography, hunting, fishing, environmental education, and interpretation are the six priority public uses of the National Wildlife Refuge System.

## Wildlife Observation and Photography

Wildlife observation with interpretation is the most popular public use on the refuge (table 5). Most observation activity occurs on the auto tour route and interpretive nature trail.

- The auto tour route is on the west side of the refuge and passes through meadow, wetland, and upland areas, offering a diversity of wildlife viewing (figure 11—public use). The wetlands on this route offer optimum waterfowl and water bird viewing.
- The interpretive nature trail is just south of the visitor center and meanders through a riparian area (figure 11—public use). This area is great for birding and the chance to encounter mammals large and small.

## Hunting

Hunting seasons begin in late August with archery season for pronghorn, and continue through mid-January. The most common species hunted are pronghorn, sage grouse, Canada goose, and ducks. Other species that are open to hunting include Nuttall's cottontail, white-tailed jackrabbit, American coot, common snipe, Virginia rail, sora, and mourning dove.

Certain areas are closed to hunting to protect refuge facilities, limit public use conflicts, and provide resting and feeding habitat for migratory birds (figure 11—public use). Closed areas such as the Case tract (unit A) are posted with signs and mapped in the hunting leaflet.

## Fishing

Fishing is limited to designated areas of the Illinois River. The Illinois River runs north, through the east side of the refuge. Three parking areas provide fishing access.

Fishing is in accordance with State of Colorado fishing regulations for the Illinois River. The refuge is closed to fishing from June 1 to July 31 each year to minimize disturbance to nesting waterfowl.

## Environmental Education

Environmental education activities are limited at the refuge, with an on-demand approach. The refuge staff has worked with various groups such as Boy and Girl Scouts, colleges, the county extension office, and local elementary and junior and senior high schools.



The refuge hosts the outdoor science class for North Park Middle School.

USFWS

## Interpretation

There are three interpretive kiosk sites: auto tour entrance, headquarters entrance, and Bocker Overlook. These sites have panels with information ranging from refuge management activities to specific wildlife species.

The self-guided tour route has numbered signs along the route corresponding to the tour route brochure. The interpretive nature trail is signed with information about management tools and wildlife species found in riparian and wetland habitats.

The refuge staff is in the midst of a contract to update the interpretive information for the visitor center. The new displays should be in place by September 2004.

The Brocker Overlook is currently under modification and construction. The updated, improved overlook will be completed by September 2004.

Several brochures are available:

The wildlife brochure is a list of all wildlife species documented on the refuge, along with the best time of year for viewing each species.

The hunting brochure contains regulations and a map of the hunting units.

The self-guided auto tour brochure contains basic refuge information, map, viewing tips, and interpretation for the auto tour route signs.

### ***Non-wildlife-dependent Recreation***

Currently, some non-wildlife-dependent uses occur on the refuge. These uses include biking, cross-county skiing, picnicking, and horseback riding.

These uses are infrequent and not a major management concern. However, they are not authorized uses of the refuge; law enforcement personnel handle these inappropriate uses.

The refuge will strive to eliminate these non-wildlife-dependent uses by maintaining quality signage and brochures for all users.