

Summary Refuge and Resource Descriptions

Geographic/Ecosystem Setting

Arapaho National Wildlife Refuge, situated at an elevation of 8,200 feet, is located in an intermountain glacial basin in north-central Colorado. The Refuge is situated along the western edge of the Central Waterfowl Flyway (Figure 1). 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 is locally known as North Park and encompasses approximately 600 square miles. The basin floor is relatively flat with an elevation range of 7,900 to 8,300 feet. Slow, meandering streams, which criss-cross the basin, flow toward the north-central part of the basin to form the North Platte River. Most of the floodplain is irrigated meadow, while the adjacent low rises are characterized by sagebrush grasslands.

Sagebrush uplands are the dominate vegetative community encompassing 80 percent of the Park. Sagebrush uplands are dominated by seven primary species of sagebrush, with a perennial bunchgrass and forb understory. Meadows are typically irrigated to produce a single hay crop per year. Meadow grasses typical include timothy, red top, garrison creeping foxtail, and foxtail barley. Riparian areas are dominated by willows (*Salix sp.*) and other low growing shrub species.

Climate

The climate is semiarid which can be characterized as having short-cool summers, followed by long, cold winters. The mean rainfall in Walden is 10.83 inches of precipitation annually. Temperatures and precipitation vary greatly with elevation and location. Mean annual air temperature in Walden, near the center of the Park, is 36.4 degrees Fahrenheit. Temperature extremes are minus 39 degrees to 90 degrees Fahrenheit, based on the National Weather Bureau 30-year average. 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 today except hay near floodplain areas. Generally, annual precipitation 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 the 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 Surface geology of the Park floor is dominated by the sandstones, conglomerates, and shales of the Tertiary Coalmont Formation. 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 Ridge. 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 the Park. Quantities of breccia and other volcanics are common in the Rabbit Ears Range in the form of dikes, plugh, 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 the Park floor. Several natural lakes in the area are thought to be remnants of Pleistocene glaciation. Winds also influenced the geology of the Park. Prevailing southwesterly winds, thought to be caused by the low ridge between Rabbit Ears Peak and Arapaho Pass, have deposited fine grains alluvium, some of which reaches thicknesses of 30 feet. Winds are suggested to have created several shallow lakes within the basin, including Hebron Sloughs, located just 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 two forest types within Jackson County. Five range sites are found on the Refuge: (Floodplain sites):

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

The Refuge contains 31 individual soil types within the five range sites (Fletcher, 1977). Dominate 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.

Ecosystem Setting

Bailey (1995) described the Jackson County area as part of the southern Rocky Mountain Ecoregion. The Service has adopted an ecosystem approach to natural resource management and has identified 53 watershed-based ecoregions in the United States (Figure 2). Within the Service ecosystem organization, 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).



Refuge Resources, Cultural Resources, and Public Uses

Water 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 with snowmelt and spring runoff, creating significant waterfowl nesting habitat. As the area became settled, much of the natural flooding and ponding were reduced and irrigated meadows replaced 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; as well as 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, with lesser amounts diverted from the Big, Willow, Spring, Potter, and Antelope Creek tributaries. This water is either ditched for storage in 9 decreed reservoirs and 73 undecreed ponds, or ditched to meadows for direct irrigation. Currently, the Refuge has decreed rights to 7,626.4 acre-feet for reservoir/pond initial fills and refills, and is seeking an additional 2,582.5 acre-feet. The total capacity of Refuge storage units is 5,678.5 acre-feet. Approximately 814 surface acres are ponded, and approximately 9,499 acres are irrigated meadow grass.

Since 2001, the U.S. Geological Survey has measured Illinois River flow at gauging stations at the upstream and downstream ends of the Refuge in order to determine the effect of Refuge 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 Refuge's water rights are administered according to the prior appropriation doctrine by the Colorado Division of Water Resources, commonly referred to as the State Engineer's Office. Whereas much of the Refuge's acquired land has rather senior appurtenant water rights, conversion of ranch land to wildlife habitat has required obtaining junior water rights which cannot be exercised in dry or semidry years. The Refuge staff believes it holds sufficient water rights to implement Refuge goals and objectives. Water rights held by the Refuge are summarized in Table 2.

Table 2. Summary of Water Rights Held by the Refuge				
Court	Admin #	Name	Flow, Storage, Use	Approp. Date
11	12179	Home No. 1 and Upland Ditch	4.0 cfs (Refuge 2.0 cfs)	5/6/1883
81	13635	Dryer Ditch	5.2 cfs	5/1/1887
80	13635	North Park Ditch No. 6	9.0 cfs	5/1/1889
86	13642	Everhard Baldwin Ditch	10 cfs (Refuge 5 cfs)	5/8/1887
100	13686	Hubbard Ditch No. 1	1 cfs	6/21/1887
110	13849	Hubbard Ditch No. 1	3 cfs	6/21/1889
122	14015	Ward Ditch No. 1	3 cfs	5/15/1888
161	14148	Hill, Crouter Ditch	6 cfs	9/25/1888
167	14337	Hubbard Ditch No. 2	3 cfs	4/2/1889
170	14350	Oklahoma Ditch No. 1	41 cfs	4/15/1889
180	14370	Home No. 1 and Upland Ditch	2 cfs	5/5/1889
190	14403	Ward Ditch No. 2	.5 cfs	6/7/1889
196	14417	Hubbard Ditch No. 1	2 cfs	6/21/1889
195	14417	Ward Ditch No. 1	3 cfs	6/21/1889
217	14731	Hubbard Ditch No. 2	3 cfs	5/1/1890
229	14762	Everhard Baldwin Ditch	8 cfs	6/1/1890
232	14805	Home No. 1 and Upland Ditch	2 cfs	7/14/1890
243	15151	Oklahoma Ditch No. 1	10 cfs	6/25/1891
264	15891	Hubbard Ditch No. 2	8 cfs	7/4/1893
270	16215	Dryer Ditch	3.6 cfs	5/24/1894
275	16360	Boyce Bros Ditch No. 1	9.25 cfs	10/16/1894
276	16362	Oklahoma Ditch No. 2	9 cfs	10/18/1894
382	16942	Ish and Baldwin Ditch	1.6 cfs (Refuge .9 cfs)	5/20/1896
286	17420	Hubbard Ditch No. 2	15 cfs	9/10/1897
287	17496	Ward Ditch No. 1	13 cfs	11/25/1897
296	17806	Dryer Ditch	2.4 cfs	10/1/1898
302	18395	Ward Ditch No. 3	2.25 cfs	5/12/1900
306	18507	Midland Ditch	15 cfs (Refuge 5 cfs)	9/1/1900
329	20270	Potter Ditch No. 2	5 cfs	7/1/1905
344	21367.91160	North Park Ditch No. 6	6 cfs	5/1/1903
344	21367.91160	Oklahoma Ditch No. 1	10 cfs	5/1/1903
344	21367.91160	Oklahoma Ditch No. 2	4 cfs	5/1/1903
346.5	21367.93177	Hubbard Ditch No. 2	16 cfs	7/5/1904
349	21367.94726	Everhard Baldwin Ditch	5 cfs	10/17/1947
353	21367.99593	Riddle Ditch	3 cfs	4/6/1908
355	21367.99710	Midland Ditch	6 cfs	5/1/1908
357	21392	Hubbard Ditch No. 2	27 cfs	7/26/1908
364	22189	Howard Ditch	75 cfs	10/1/1910
375	23017.81853	Hubbard Ditch No. 1	6 cfs	8/1/1901
None	23017.92901	Hubbard Ditch No. 4	2 cfs	7/18/1908
378.2	23017.95734	Hubbard Ditch No. 2	31 cfs	5/1/1910
398	24008	Midland Ditch	20.5 cfs (Refuge 5 cfs)	9/24/1915
700	30281.61915	Boyce Bros Ditch No. 1	20.5 cfs	5/1/1901
707	30281.70359	Antelope Ditch No. 1	5.47 cfs	5/1/1908
726	30281.91011	State Walden Pipeline	.75 cfs	6/20/1939

Table 2. Summary of Water Rights Held by the Refuge cont'd.

Court	Admin #	Name	Flow, Storage, Use	Approp. Date
	49102	Howard Ditch	70 cfs (Refuge 35 cfs)	6/8/1984
2	22208	MacFarlane Reservoir	6507AF (Refuge3253.5AF)	10/20/1910
11	30281.70643	Case Reservoir #1	124 AF	7/26/1908
12	30281.70646	Case Reservoir #2	106 AF	7/27/1908
14	30281.75467	Case Reservoir #3	67 AF	7/26/1912
18	30281.91011	State Walden Reservoir	37.9 AF	6/20/1939
	48578.98394	Muskrat Pond	390 AF	11/12/1980
	51499.47542	Spring Creek Pond	93 AF	3/1/1980
	51499.47999	Fox Pond	140 AF	6/1/1981
	30280.21308	Antelope Well	.10 cfs	5/1/1908
	47481.33602	Arapaho NWR Domestic Well	.10 cfs	12/31/1941
	47481.33602	Arapaho NWR Stock Well	.10 cfs	12/31/1941

Reserved Rights and Privately-Owned Mineral Estate

Purchase of some of the land tracts on the Refuge were subject to existing rights-of-way at the time of purchase. Some of these existing rights-of-way include Jackson County Roads 32, 34, and 21. A 100 foot right-of-way on Highway 125 and a 50 foot right-of-way on Highway 14 are owned by the Colorado State Highway Department. 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 the land tracts, the Refuge acquired the surface mineral rights of all its land except the BLM transfers. The Refuge owns the majority of the subsurface mineral rights with the State of Colorado, BLM, and some private landowners holding the rest.

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 ArcView GIS software, with Refuge boundary topographic base maps, and National Wetland Inventory map layers. Width of the riparian area was determined by estimating width of the historic floodplain using topography and vegetative community changes as a guide. Meadow habitats were derived using primarily National Wetland Inventory Maps with corrections for recent wetland additions. Upland acreages were calculated by subtracting the other three habitat types from the Refuge base acreage. Descriptions of these habitat types follows:

Riparian Habitat

The riparian habitat contains 4,374 acres on Arapaho NWR and is composed of the channel, floodplain, and transitional upland fringe along portions of the Illinois River and Spring Creek. Historically, the Refuge staff has considered the floodplain and transitional fringe collectively as irrigated meadow. However, we have chosen to use channel, floodplain, and transitional fringe in this document because these components more appropriately represent the collective functions and processes of riparian habitats, and such a designation allows management potential of the entire area to be more thoroughly evaluated (Map 7 - Habitat Management Units).

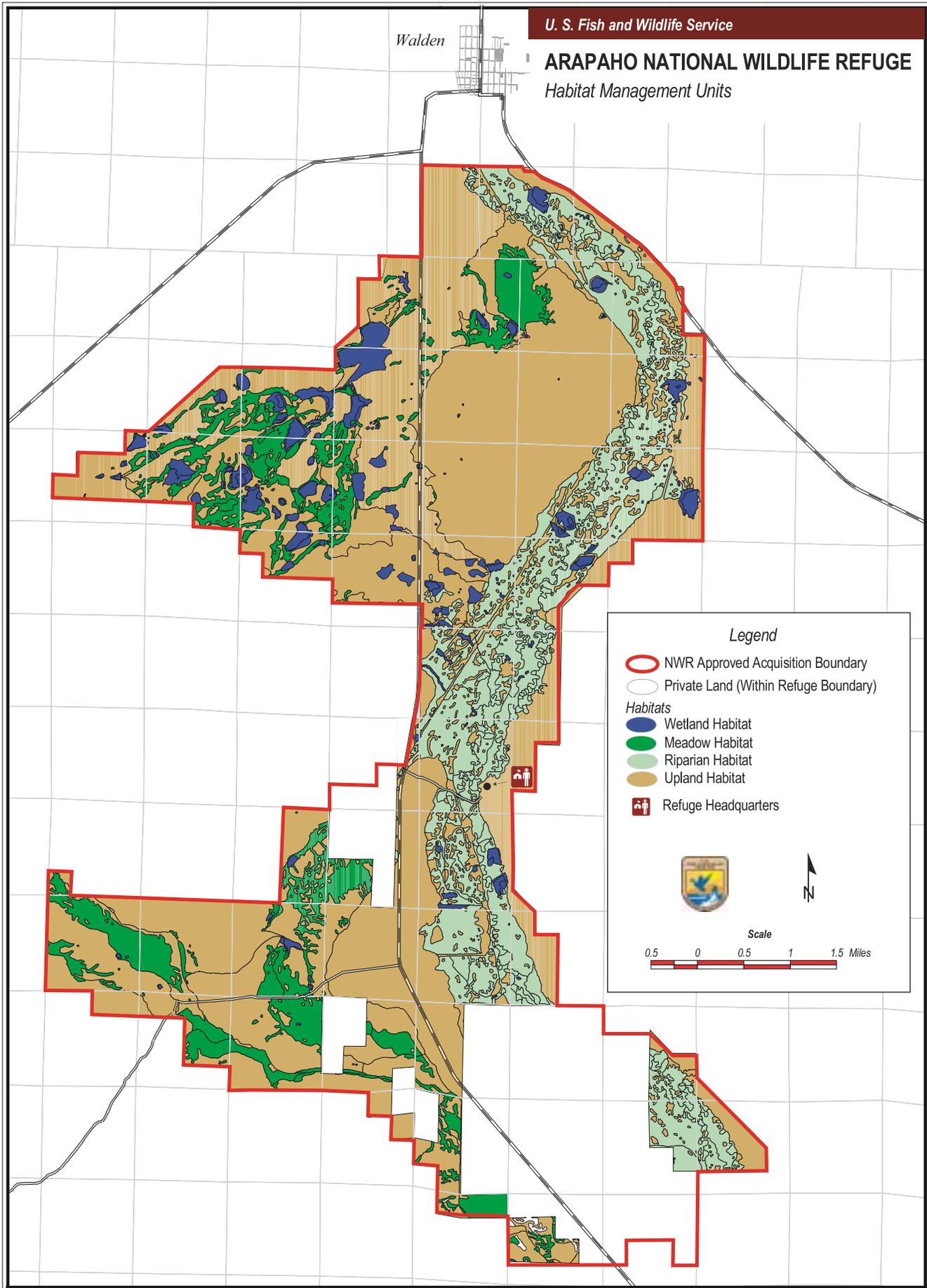
Plant species found along the Illinois River include: Drummonds's willow, coyote willow, Geyers willow, whiplash willow, mountain willow, and planeleaf willow. Grass species common to these moist soil areas include bluejoint reedgrass, Timothy, mannagrass, smooth brome, meadow foxtail, meadow barley, Nevada bluegrass, sloughgrass, rufted hairgrass, saltgrass, *Carex nebrascensis*, *Juncus* spp., nuttall alkaligrass, redtop, and winter bentgrass. The runs and pools in the river channel typically contain aquatic vegetation (*Elodea*, *Potamogeton*, and *filamentous algae*). Canada thistle is the main noxious weed in this area. Wildlife species that utilize the riparian habitat grasslands include waterfowl (northern pintail, mallard, gadwall, green-winged teal) and sage grouse broods in search of high protein invertebrates. Additionally, the willow complex supports at least 40 species of migrating songbirds (yellow warbler, willow flycatcher) along with moose, river otter, beaver, and wintering elk. Water birds, including common Wilson's snipe, spotted sandpiper, sora, American white pelican, and black-crowned night herons also extensively utilize this habitat type. Within the Illinois River, 7 species of native and nonnative fish and at least 17 taxa of aquatic invertebrates can be found in this cold water river system.

Walden

U. S. Fish and Wildlife Service

ARAPAHO NATIONAL WILDLIFE REFUGE

Habitat Management Units



Map 7 - Habitat Management Units

Wetland Habitat

Wetland habitat includes 824 acres of natural and created ponds and lakes up to the high water mark, excluding the surrounding meadows and riparian corridor. Ponds and lakes, henceforth referred to as basins or wetlands, were delineated using both National Wetland Inventory (NWI) maps and Refuge coverage maps. Currently, approximately 78 shallow wetlands exist within the Refuge boundary (Map 2 - Base Map). For management purposes, three wetland complexes were developed: the Case, Illinois, and Soap Creek Complexes (Map 8 - Wetland Complexes).

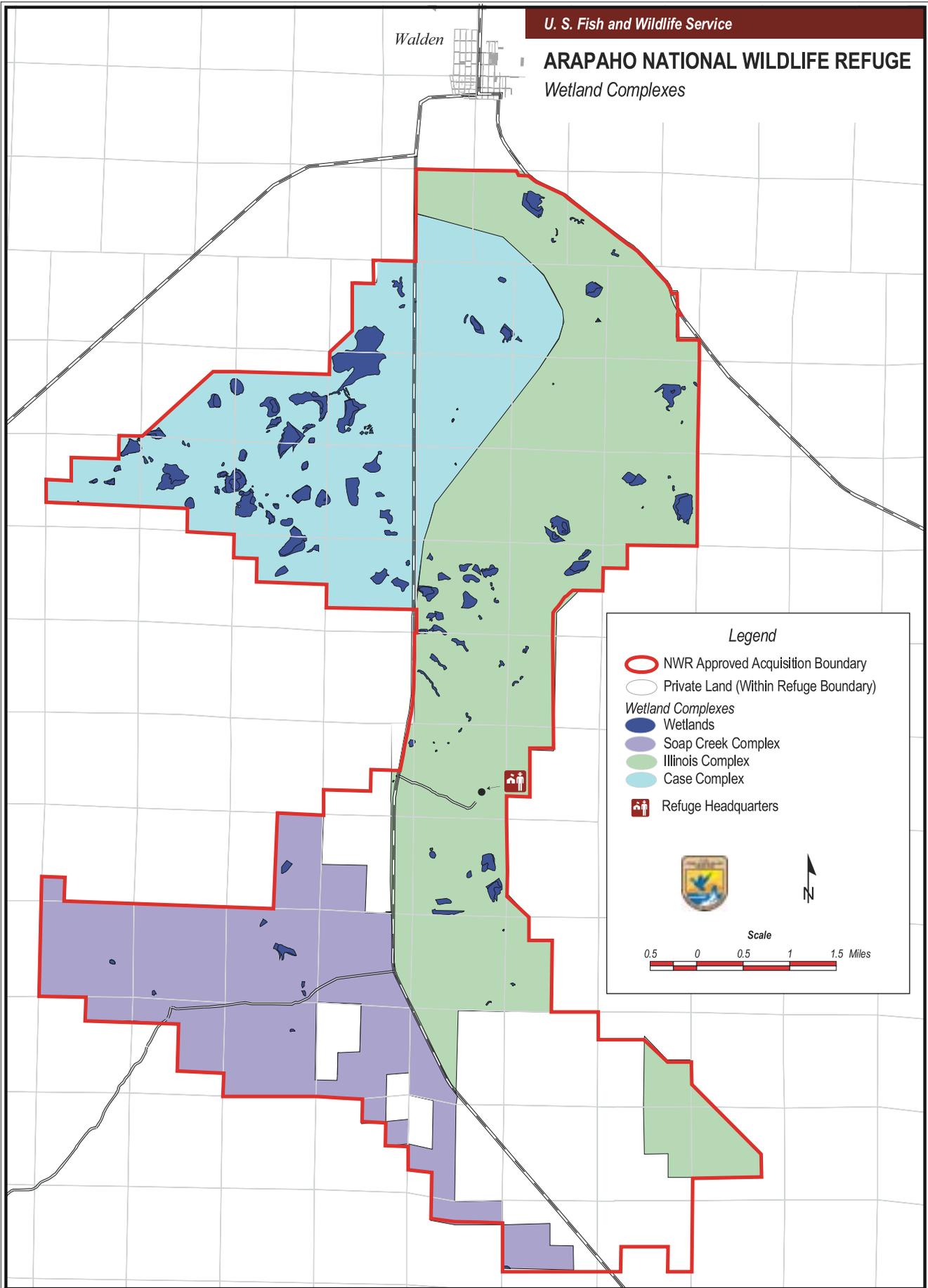
The majority (90 percent) of the wetland basins on the Refuge are man-made. Construction of these “artificial” wetlands is intended to offset wetland losses occurring elsewhere in the Central Flyway. Maintenance of these facilities provides benefits to a host of wetland-dependent species, including waterfowl. 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 Refuge wetland habitats includes both emergent (cattail, spike rush, bulrush) and submerged (sago pondweed, leafy pondweed, widgeon grass) species. Invertebrate abundance is high in the wetland basins. Common invertebrates include *Hemiptera* (true bugs), and the families *Corixidae* (water boatman) and *Notonectidae* (backswimmers), *Dytiscidae* (predacious diving beetle), and *Haliplidae* (crawling water beetles). Invertebrates are a critical food source to many waterfowl shorebirds. Waterfowl species include both diving ducks (lesser scaup, canvasback, redhead, ring-necked) and puddle ducks (mallard, northern shoveler, gadwall, American wigeon). Over-water nesting birds (black-crowned night-heron, Wilson’s phalarope, white-faced ibis, marsh wrens, coots, rails, and blackbirds) also extensively utilize wetland habitats.

ARAPAHO NATIONAL WILDLIFE REFUGE

Wetland Complexes

Walden

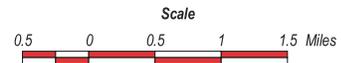


Legend

- NWR Approved Acquisition Boundary
- Private Land (Within Refuge Boundary)

- Wetland Complexes
- Wetlands
 - Soap Creek Complex
 - Illinois Complex
 - Case Complex

- Refuge Headquarters



Map 8 - Wetland Complexes

Meadow Habitat

Meadow habitat includes 2,683 acres of grasslands and old hay meadows on the Refuge except those along the riparian corridor (which are considered part of the “Riparian” habitat). These historically irrigated fields provide the majority of the Refuge nesting habitat for waterfowl, shorebirds, and songbird species. Meadow habitats represent common feeding, resting and loafing areas for most avian and mammal species found on the Refuge (Map 7 - Habitat Management Units).

Vegetation common to meadow habitat is primarily native plants including: rushes; Colorado rush, baltic rush, dagger-leaf rush, long-styled rush, tuberous rush, field woodrush, smallflowered woodrush; sedges: slenderbeaked sedge, capitate sedge, Hayden’s sedge, narrow-leaved sedge, elk sedge, wooly sedge, Nebraska sedge, dunhead sedge, beaked sedge, shortbeaked sedge, water sedge, golded sedge, soft-leaved sedge, new sedge, valley sedge. Grass species common to these moist soil areas include: bluejoint reedgrass, Timothy, mannagrass, smooth brome, meadow foxtail, meadow barley, Nevada bluegrass, sloughgrass, tufted hairgrass, saltgrass, Nuttall alkaligrass, redtop, and winter bentgrass; Common forbs include sulphur buckwheat, hoods phlox, longleaf phlox, rosy pussytoes, silvery lupine, prairie lupine, groundsels, narrow leaved maertensia, small bluebells, cinquefoil, early cinquefoil, stonecrop or wormleaf sedum, daisys, beard tongue. Canada thistle is the main noxious weed in this area. Wildlife species that utilize the meadow habitat include: waterfowl (pintail, shoveler, gadwall, green-winged teal) and sage grouse broods in search of high protein invertebrates. Snipe broods and other grassland nesting songbirds utilize this habitat type. Additionally, elk, pronghorn antelope, and coyote are common habitat users.

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 dominate 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 meadows sites on the Refuge, these sites are generally managed as meadows (Map 7 - Habitat Management Units).

Historical reports of the sagebrush-steppe plant community are conflicting, and pre-settlement community conditions may never be fully known. Additionally, the focus of past Refuge management efforts have been devoted to wetland-dependent birds, therefore current Refuge upland plant community information is limited. Available information suggests that sagebrush historically was the dominate plant species, although perhaps taller >3m plants may have existed. Floristic diversity in North Park and on the Refuge 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 degraded, but given the lack of basic information, management alternatives are difficult to define. Therefore, Refuge upland 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 habitats in an attempt to create a preferred plant community structure. Lessons learned will be applied to larger pieces of Refuge upland habitats.

Upland vegetation consists primarily of shrubs including: mountain big sagebrush, Wyoming big sagebrush, alkali sagebrush, fringed sage, rubber rabbitbrush, Douglas rabbitbrush, broom snakeweed, gray horsebrush, black greasewood, and winterfat. Dominant grasses include mutton grass, Nevada bluegrass, sandberg bluegrass, bottlebrush squirreltail, Idaho fescue, bluebunch wheatgrass, western wheatgrass, blue grama, elk sedge, needle and thread grass, and green needlegrass. Common forbs include sulphur buckwheat, hoods phlox, longleaf phlox, rosy pussytoes, silvery lupine, prairie Lupine, groundsels, narrow leaved maertensia, small bluebells, cinquefoil, early cinquefoil, stonecrop or wormleaf sedum, daisys, beard tongue. Noxious weeds included yellow toadflax and musk thistle, and occur primarily in disturbed sites. Sage-grouse are a sage-obligate species, and requires sagebrush plants for cover and food. Elk, mule deer, white-tailed deer, and pronghorn antelope are common big-game users of upland habitats. Additionally, vesper sparrow, brewers sparrow, and sage thrasher are songbirds common to Refuge uplands.

Wildlife Resources

Arapaho NWR's habitat diversity is reflected in the broad diversity of wildlife found here. Only those species that are residents or frequent visitors to the Refuge are discussed in the following text. Many species, especially birds, may infrequently inhabit or migrate through the Refuge. Threatened, Endangered, and Candidate Species and Species of Special Concern are listed in Table 3. All species of birds, mammals, fish, amphibians, and reptiles are listed in Appendix A.

Avian

Waterfowl – ducks and Canada geese: A large number of waterfowl depend on the Refuge's wetland, riparian, and meadow habitat 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: 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 the wetlands for most of their life needs, with the scaup and redhead nesting in the meadows occasionally. Ring-necked duck, canvasback, and bufflehead are generally spring and fall migratory visitors but the canvasback does infrequently nest on the Refuge. Common merganser primarily inhabit the 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 the 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. The 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 across the Refuge in riparian, meadow, and wetland areas. The great blue heron uses the riparian habitat primarily for nesting and foraging but can be observed in the wetlands.

Shorebirds are most often found foraging for food along the water margins, they use the Refuge as a migratory stop-over, and some nest here. American avocet, willet, killdeer, spotted sandpiper, common snipe, and Wilson's phalarope are the common nesters. Avocet and willet mainly use the wetland habitat for their needs, where the killdeer is more a generalist and can be found in all habitat sites. The spotted sandpiper and common snipe reside mostly in the riparian habitat. Wilson's phalarope use the meadow/riparian for nesting and forage and rear young in the wetlands. Black-necked stilt are an occasional nester in the Refuge wetlands. Dowitcher, yellowleg and other sandpipers use the area for a stop-over 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 and sora 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 carex, cattail, and bulrush foraging in the wetlands.



Black-crowned Night-Heron
© Cindie Brunner

Raptors consist of several families of hawks, falcons, and owls. The most common raptors of the Refuge include: northern harrier, swainson's hawk, rough-legged hawk, golden eagle, American kestrel, prairie falcon, short-eared owl, and 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 utilize 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 upland but uses the edge areas of the 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. The following species are found commonly on the Refuge either during migration or the nesting season. These birds rely heavily on the riparian habitat for foraging, cover, and nesting, they include: common nighthawk, belted kingfisher, willow flycatcher, warbling vireo, house wren, marsh wren, yellow warbler, MacGillivray's warbler, common yellowthroat, western kingbird, gray catbird, Wilson's warbler, savannah sparrow, fox sparrow, song sparrow, Lincoln's sparrow, and white-crowned sparrow. 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. This group includes mountain bluebird, American robin, dark-eyed junco, rosy finch, pine siskin, American goldfinch, and lark bunting. These birds use riparian, meadow, and upland habitats. Red-winged, yellow-headed, and brewer's blackbirds utilize both wetlands and riparian for nesting and foraging. Species like the black-capped chickadee, red-breasted nuthatch, and ruby-crowned kinglet use the riparian woody areas for foraging but tend to nest off the Refuge.

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



Golden Eagle © Cindie Brunner



Northern Flicker © Cindie Brunner

Mammals

Big game animals common to the Refuge include: pronghorn antelope, mule deer, white-tailed deer, moose, and elk. Fifteen to 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, population of about 20 animals, use the same areas as the mule deer. Pronghorn antelope utilize the upland habitat primarily but can be found in the riparian and meadow habitats. They 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 antelope generally move north off the Refuge, making them a rare sight in the area. The Refuge has a resident herd of approximately 150 elk; these animals reside 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 1,400 elk, these animals are usually in several herds and can be found using riparian, meadow, and upland habitats.

The Refuge has many small mammals which utilize all habitat types, depending on their life requirements. Common species are Nuttall's cottontail, white-tailed jackrabbit, least chipmunk, Wyoming ground squirrel, white-tailed prairie dog, beaver, deer mouse, montane vole, muskrat, porcupine, coyote, long-tailed weasel, mink, badger, and striped skunk (Appendix A).

Fish

The Illinois River and wetlands are two main types of aquatic communities present on the Refuge. The Illinois River is a transition stream beginning as a trout stream in the headwaters 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. The following species are common in the Illinois River on Arapaho NWR: Brown trout, rainbow trout, Northern redbelly dace, fathead minnow, creek chub, long-nosed sucker, white sucker, and Johnny darter (Appendix A).

Potter and Spring Creeks are tributaries of the Illinois River on the Refuge. These creeks provide little fishery habitat with only a few native fish such as long-nosed dace, 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 which has evolved in this type of habitat.



Pronghorn antelope © Cindie Brunner



Brown Trout © Cindie Brunner

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. The salamanders are primarily associated with the wetlands but have been seen in all habitats. The wood frog has only been documented once on the Refuge, and that was in the riparian habitat. The toad is rare but should frequent all the habitat types. Leopard frogs have been observed in the riparian habitat and also in irrigation ditches in the meadow habitat. Chorus frogs can be found in the wetland, meadow, and riparian areas; they are the most abundant amphibian on the Refuge.

Invertebrates

Some sampling of invertebrates has been done on Refuge 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 wetlands and riparian areas in the future.

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

Table 3 lists special status wildlife, fish, amphibian species that are known to use habitat types on Arapaho NWR. This list includes Endangered Species, Threatened Species, Candidate Species, and Species of Concern (Source: Colorado Division of Wildlife and U.S. Fish & Wildlife Service).

Table 3. Special Status Wildlife, Fish, Plant, and Amphibian Species Potentially Occurring on Arapaho NWR			
Common Name	Seasonal Occurrence¹	Federal and State Status²	Date Last Observed³
Birds			
American Peregrine Falcon	SR	CDOW SC	WOL2001
Bald Eagle	YR	USFWS Threatened (proposed delisting)	WOL2002
Western Burrowing Owl	B, M	CDOW Threatened	WOL2002
Ferruginous Hawk	SR	CDOW SC	WOL2002
Northern Sage Grouse	B, YR	CDOW SC	WOL2002
Long-billed Curlew	M, SR	CDOW SC	WOL2000
White Pelican	SR	CDOW SC	WOL2002
Mammals			
River otter	YR, B	CDOW Endangered	WOL2001
Fish			
Northern Redbelly Dace	YR	CDOW Endangered	No Records
Plants			
North Park Phacelia	YR	USFWS Endangered	WOL 2002
Amphibians			
Northern Leopard Frog	YR	CDOW SC	WOL2002
Wood Frog	YR	CDOW SC	WOL1994

¹ Seasonal occurrence: B =breeding (assumes summer resident); SR = summer resident (no evidence of breeding); YR = year-round resident; M = migrant

² See Glossary for special status definitions

³ WOL = Refuge Wildlife Observation Log. Includes data through 2002.

⁴ CDOW = Colorado Division of Wildlife

⁵ SC= Species of Concern

⁶ Threatened - See Appendix B for definition

⁷ Endangered - See appendix B for definition

The bald eagle, a federally-listed species, is an intermittent visitor on the Refuge; it is 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 on the Refuge using all the habitat types for foraging.

Burrowing owl, Ferruginous hawk, northern sage grouse, long-billed curlew, and white pelican are all listed as Colorado State Special Concern species. Burrowing owls have been documented as nesting on the Refuge with an occurrence of one nest found every 5 years. They are more commonly observed as a migrant in the fall of the year. Ferruginous hawk can be seen in the spring, summer, and fall foraging on Refuge habitats. Northern sage grouse are an abundant year-round resident of the Refuge. The grouse use the upland, riparian, and meadow habitats for breeding (one lek found on Refuge), nesting, foraging, and brood-rearing. Long-billed curlews are observed every few years on the Refuge. White pelicans nest off the Refuge on MacFarlane Reservoir, frequenting the Refuge to forage in the wetland and riparian habitats.

The river otter is a Colorado State Endangered Species, which was re-introduced into a watershed south of the Refuge. The Refuge staff has observed (average one a year) several otters in the southern half of the riparian habitat.

Little is known about the northern redbelly dace on the Refuge. This Colorado State Endangered Species is found in the Illinois River.

Northern leopard and wood frogs are listed as Colorado State Special Concern species. The leopard frog is fairly common and found in Refuge riparian and meadow habitats. Only one observation of the wood frog has occurred; this was in the Illinois River south of the Refuge Headquarters.

General Public Use

Arapaho NWR annual number of visits is estimated at 7,200 which is an average of the past 6 years. This estimate is based broadly on a traffic counter on the auto tour route, visitors entering the Visitor Center/Office, and general observation. Table 4 summarizes estimated visits in five categories from 1997 to 2002.

	1997	1998	1999	2000	2001	2002
Total Estimated Visitors	7,248	6,805	6,797	7,107	7,575	7,710
Interpretation/Observation	6,762	6,361	6,263	6,360	7,220	7,496
Environmental Education	65	132	162	180	167	135
Hunters	357	228	302	522	152*	61*
Fishing	64	84	70	45	34*	18*

* Severe drought conditions limited hunting and fishing opportunities.

The Refuge Visitor Center is open Monday through Friday (7:00 am to 4:30 pm). Information, regulations, and universally accessible rest rooms are available during the same hours.

The Refuge has a general leaflet which contains a Refuge map, describes the Refuge and its management, addresses habitats, lists wildlife interpretation / recreation activities and cites the Refuge regulations. The Refuge also provides three other leaflets: wildlife list, hunting guide, and self-guided auto tour. The leaflets are available in three dispensers (Auto Tour entrance, Headquarters entrance, Brocker Overlook) and at the Visitor Center.

Compatible Wildlife-Dependent Recreation

Arapaho NWR offers visitors a variety of self-guided recreation opportunities. The Refuge Improvement Act (1997) 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 Act also 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 recreational use' or any other use of a refuge, that in the sound professional judgement of the Service, will not materially interfere with or detract from, the fulfillment of the Refuge System's mission or the purpose of the refuge. Hunting, fishing, wildlife observation and photography, and environmental education and interpretation are the six priority general 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 4). Most of the observation activity occurs on the auto tour route and the 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 [Map 9 - Public Use Map - Alternative B and D (Preferred)]. 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 [Map 9 - Public Use Map - Alternative B and D (Preferred)]. This area is great for birding and also the chance to encounter mammals large and small.

Hunting

Hunting seasons range between early September to mid-January. These seasons are in accordance with State regulations for this area. The most common species hunted are pronghorn antelope, sage grouse, ducks, and Canada geese. Other species which are open to hunting include Nuttall's cottontail, white-tailed jackrabbit, American coot, common snipe, Virginia rail, sora, and mourning dove.

Certain areas of the Refuge are closed to hunting to protect Refuge facilities, limit public use conflicts, and provide resting and feeding habitat for migratory birds (Map 9 - Public Use Map - Alternative B and D (Preferred)]. Closed areas, such as the Case tract (Unit A), are posted with signs and mapped in the hunting leaflet.

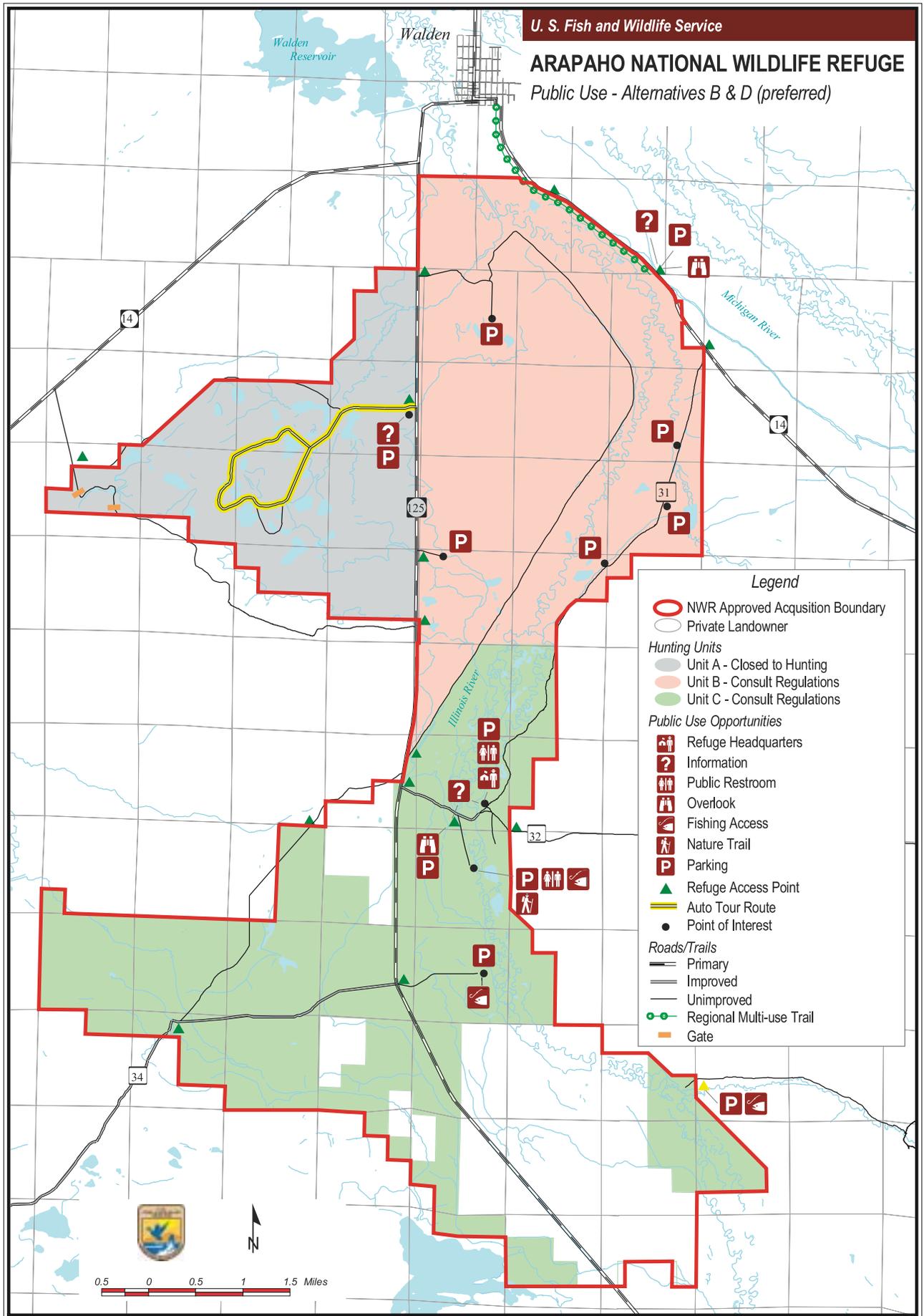
Fishing

Fishing on the Refuge is limited to the Illinois River and focuses mainly on brown trout. The Illinois River runs north through the east side of the Refuge. Two parking areas are designated for fishing access. Fishing is in accordance with Colorado State fishing regulations for the Illinois River. The Refuge is closed to fishing from June 1 through July 31 each year to minimize disturbance to nesting waterfowl. Periodic stocking of trout in the Illinois River occurs to maintain and enhance the Refuge fishery.

Environmental Education

Environmental education activities are limited at Arapaho NWR, with an on-demand type of approach. The Refuge staff has worked with various groups such as Boy/Girl Scouts, colleges, County Extension Office, and local elementary and Junior/Senior high schools.

Programs and talks that the Refuge staff has participated in include 'Day in the Woods,' 'Water Carnival,' Junior/Senior high school science class requirements, scout badge work, and summer hands-on environmental work for college students. In addition, the Refuge has conducted special programs for International Migratory Bird Day.



Map 9 - Public Use - Alternative B and D (Preferred)

Interpretation

Three interpretive kiosk sites are on the Refuge: Auto Tour entrance, Headquarters entrance, and Brocker Overlook. These sites have panels ranging from Refuge management activities to specific wildlife species information. The Auto Tour route is self-guided with interpretive signs and a leaflet. The Interpretive Nature Trail is signed with information about management tools and wildlife species found in riparian/wetland habitats. The Refuge staff is in the process of contracting new interpretive information for the visitor center which will deal with water history and management and also the four Refuge habitats and associated wildlife.

The Refuge staff publishes several brochures. 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 and 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, camping, and horseback riding. These uses are infrequent, and not a major management concern. However, they are not an authorized use of a National Wildlife Refuge. Therefore, these inappropriate uses are handled by Refuge law enforcement personnel. The Refuge will strive to eliminate these non-wildlife-dependent uses by maintaining quality signage and brochures for all users.

Cultural Resources

The Colorado mountains have been used by humans for thousands of years. Spears points dating to the Paleoindian Period have been recovered in North Park. The Paleoindian Period extends from 12,000 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 is also a higher reliance on small game and plant resources. A major drought on the Plains (ca. 5,000 to 2500 B.C.) caused change to settlement and subsistence patterns. People moved into the mountains for longer periods of time and exploited a wider variety of plant and animal resources. Increased moisture during the latter part of the Archaic brought people back onto the Plains, but the mountains continued to be an important part of their subsistence. Activity increased in North Park during the Archaic. The Late Prehistoric Period (A.D. 150 to A.D. 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 the Late Prehistoric continued to rely on a variety of available plant and animal resources. Researches 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 Park collecting and hunting until fall. From there, they would turn east hunting 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.

Archaeological sites in North Park are generally small in size and associated with seasonal use of the area. They include open campsites and lithic scatters with stone circles (tipi rings) located along the ridges. Culturally scarred trees and wickiups representing Protohistoric Ute use may be found in the forested area. Rock art and bison kill sites, though uncommon, have been reported in North Park.

The first European visitors to New Park (now known as North Park) were probably trappers. The first known party of trappers was headed by Alexander Sinclair and Robert Bean 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 all visited the Park in the 1840s. The second western expedition of John C. Fremont took him through the Park in 1844. Sir George Gore passed through the Park 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. 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 Park, and by 1889, ranching was no longer as profitable as it had been. In the late 1800s, the economy of the 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 lands. Significant cultural resources have been located on the Refuge including prehistoric stone circles and open campsites and historic ranches, graves, and other features associated with Euroamerican 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 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. This 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 this was a working ranch prior to its becoming a Refuge. The only specific historical or cultural areas include grave sites that will continue to be protected. The Refuge is operating under a 1982 habitat management plan that provides guidance for lands management. This plan will be replaced with guidance provided within the CCP. Additionally, the Refuge currently utilizes a hunting plan, and “zone” system (Management Units A, B, and C) to distribute hunters, anglers, and other public uses. This plan will remain in effect until completion of the step-down management plans for public use and hunting.

Other issues identified in this Plan which may require special management:

- **North Park Phacelia** - Preservation of this endangered plant may require fencing and/or plans to minimize disturbance, and ensure the survival and recovery of the species.
- **Elk Road Closures** - During winter months, the Refuge staff will continue to close roads to minimize disturbance to wintering elk. Coordination with the Colorado Division of Wildlife, and implementation of the revised hunting step-down management plan 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.
- **Moose Overlook** - Located ¼ mile south of the Headquarters, this site will facilitate moose, elk, and mule deer viewing. 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 State Historical Preservation Office review, 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.