APC chicks. CREDIT: Fossil Rim Wildlife Center

3.0 REFUGE RESOURCES AND CURRENT MANAGEMENT

This chapter provides a detailed description of the Refuge, its habitats, the species that occur, how habitat and species are managed, and the recreational opportunities it offers. It is divided into five major sections: Landscape Setting; Physical Environment; Biological Environment; Socioeconomic Environment; Archeological, Cultural, and Historical Resources; and Current Management.

3.1 Landscape Setting

To effectively achieve the Refuge System mission of conserving fish, wildlife, and their habitats, the Attwater Prairie Chicken NWR took a landscape-scale approach to identifying Refuge resources, issues, and management direction. The Refuge is one small portion of land within a larger landscape, and as such, the planning team looked beyond its boundaries to determine its role in the larger conservation effort. This section describes the landscape setting in which Attwater Prairie Chicken NWR is located (Map 3-1. Landscape Scale Conservation).

3.1.1 Central Flyway

Bird migration is the seasonal movement of birds between summer nesting habitat in Canada and the northern United States and wintering habitat in the southern United States and Central and South America. These movements generally follow regular routes called flyways. There are four administrative flyways in North America: the Atlantic, Mississippi, Central, and Pacific. The Service established refuges along these flyways to provide resting and nesting habitat for migrating birds.

The administrative Central Flyway spans the Canadian Northwest Territories, two Canadian

provinces (Alberta and Sakatchewan), and 10 U.S. states: Montana, North Dakota, South Dakota, Wyoming, Nebraska, Colorado, Kansas, New Mexico, Oklahoma, and Texas. Attwater Prairie Chicken NWR is one of 13 refuges located within the State of Texas.

3.1.2 Strategic Habitat Conservation and Gulf Coast Prairie Landscape Conservation Cooperative

Strategic habitat conservation (SHC) is a way of thinking and doing business that requires the Service to set biological goals for priority species. It allows for making strategic decisions and encourages constant reassessment and improvement of actions. These are critical steps in dealing with a range of landscape-scale resource threats such as urban development, invasive species, and water scarcity—all magnified by accelerating climate change.

SHC incorporates five key principles in an ongoing process that changes and evolves:

- Biological planning (setting targets)
- Conservation design (developing a plan to meet the goals)
- Conservation delivery (implementing the plan)
- Monitoring and adaptive management (measuring success and improving results)
- Research (increasing our understanding)

To ensure that science entities are strategically placed, the Service and U.S. Geological Survey (USGS) have developed a national geographic framework for implementing strategic habitat conservation at landscape scales. The framework provides a platform upon which the Service can work with partners to connect project- and site-specific efforts to larger biological goals and outcomes across the continent.

The framework serves as a base geography for Landscape Conservation Cooperatives (LCCs), which are management-science partnerships between the Service, Federal agencies, states, tribes, NGOs, universities, and other entities. These partnerships inform and assist integrated resource management actions by addressing climate change and other stressors within and across landscapes. LCCs are fundamental units of planning and science capable of carrying out the functional elements of SHC.

The Attwater Prairie Chicken NWR is located in the Gulf Coast Prairies geographic area and LCC. The area encompasses portions of five states (Texas, Oklahoma, Louisiana, Mississippi, and Kansas), three Service regions (two, four, and six), and four terrestrial ecoregions (Oaks and Prairies, Gulf Coast Prairie, Tamaulipan Brushlands, and Edwards Plateau). Eventually, it is envisioned to include portions of three Mexican states that share similar habitats (Tamaulipas, Nuevo Leon, and Coahuila).

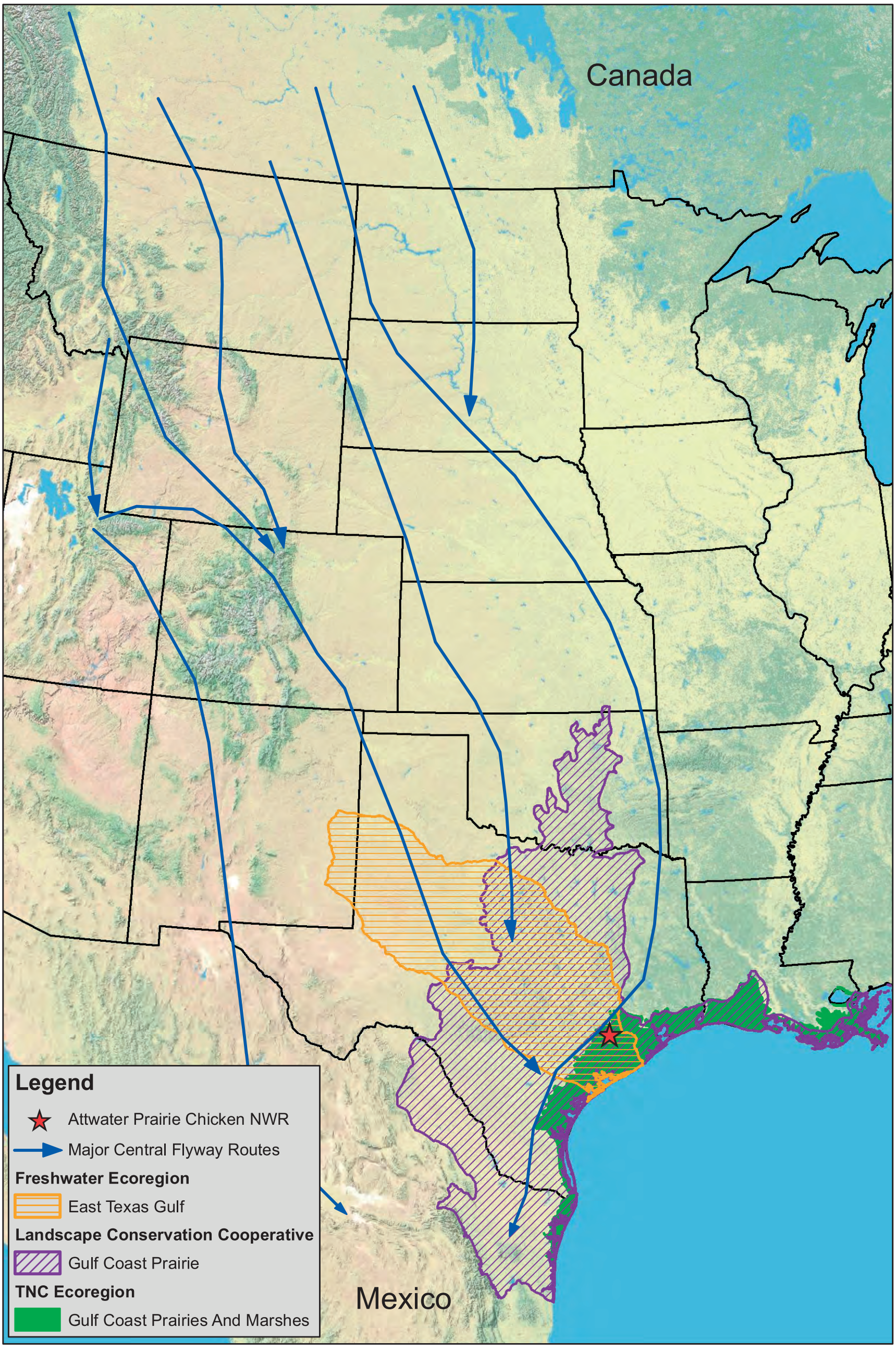
Key organizations involved in the Gulf Coast Prairies (GCP LCC) partnership include the Service, the U.S. Geological Survey, National Park Service, Natural Resource Conservation Service, Department of Commerce (NOAA), Texas Parks and Wildlife Department, Louisiana Department of Wildlife and Fisheries, Oklahoma Department of Wildlife Conservation, The Conservation Fund, Ducks Unlimited, and The Nature Conservancy. The existing conservation network includes three Joint Venture partnerships (Gulf Coast Joint Venture, Rio Grande Joint Venture, Oaks and Prairies Joint Venture), the Southeast Aquatic Resources Partnership, and the Reservoir Fisheries Partnership. The GCP LCC has also expanded its capacity through close working relationships and cooperative agreements with Texas A&M University and The Wildlife Management Institute. Over time, other forums within the cooperative will be developed to encourage further participation by the broader conservation community.

U.S. Fish & Wildlife Service

Attwater Prairie Chicken National Wildlife Refuge

Austin/Colorado County, Texas

Map 3-1. Landscape Scale Conservation



PRODUCED IN THE DIVISION OF REFUGE PLANNING
ALBUQUERQUE, NEW MEXICO
LAND STATUS CURRENT TO: 5/31/09
MAP DATE: May, 2011
BASEMAP: N/A
MERIDIAN: N/A
FILE: atw_landscape_scale_5.2.11_shl

0 140 280 560 Miles

0 140 280 560 Kilometers

UTM ZONE 14
NAD 83

[This page intentionally left blank.]

3.1.3 Ecoregion Setting

Ecoregions denote areas of general similarity in ecosystems and in type, quality, and quantity of environmental resources. They are designed to serve as a spatial framework for research, assessment, management, and monitoring of ecosystems and ecosystem components. Ecoregions are critical for structuring and implementing ecosystem management strategies across Federal agencies, State agencies, and nongovernment organizations that are responsible for different types of resources within the same geographical areas.

The Attwater Prairie Chicken NWR is located within the Gulf Coast Prairies and Marshes (GCP&M) ecoregion as identified by the Nature Conservancy.

The nearly 22-million-acre GCP&M ecoregion encompasses two countries and two states. Within this area, there are 22 primary bays, 19 major rivers, and approximately 600 miles of shorelines. This ecoregion is characterized by its great biodiversity—notably, the number and types of birds and the butterfly and reptile diversity. The region's productive bays and estuaries are economically significant by providing fish and shellfish upon which people depend. At the same time, the ecological diversity of the GCP&M faces drastic declines, with habitat loss and fragmentation posing some of the most serious threats to the ecoregion's biological health (Ricketts et al. 1999).

Pre-Settlement Landscape

Before European settlement, the GCP&M was composed of a mosaic of tallgrass coastal prairie, riparian bottomland hardwood forests, ephemeral freshwater wetlands, canebrake swamps, extensive coastal forests, chenier woodlands, freshwater tidal wetlands, brush mottes and corridors, barrier islands, estuaries, saltwater marshes, hypersaline lagoons, and lomas and associated Tamaulipan thornscrub habitats. This integrated matrix of habitat types combined to form one of the most productive and biologically rich ecosystems in the world (Briggs 1974, Smeins et al. 1991).

Humans in the GCP&M

Human inhabitants have always been drawn to the Gulf of Mexico. Nomadic native peoples took advantage of the bounty of food resources, such as oysters, shrimp, fish, alligators, and birds available in the nearshore waters and coastal prairies (Ricklis 1997). Today, the attraction is fueled by industrial development and distribution, business infrastructure, agricultural production, tourism, and the appeal of a coastal lifestyle with associated recreational and aesthetic attributes.

Although certain areas of the ecoregion are sparsely populated, other areas, such as Houston, the fourth largest city in the U.S., and Harris County, the second most populous county in the U.S., locally impact biodiversity (TNC, 2002). The ecoregion supports the world's second largest petrochemical complex and some of the United States' busiest port facilities (USFWS 2000). In Texas, more than one-third of the State's population lives within 100 miles of the coast.

Alteration of the Landscape

The ecoregion has been transformed dramatically since the early 1900s. Freshwater wetlands have been reduced by 30 percent (Moulton 1997), coastal forests have been cleared and fragmented (USFWS 1997), the chenier woodlands of the upper Texas coast are essentially gone (Gosselink et al. 1979), and less than one percent of the tallgrass coastal prairie remains (Smeins et al. 1991).

3.1.3.1 Terrestrial Description

Coastal Prairies

The prominent feature of this ecosystem includes the coastal prairies, which in many places contain small depressional wetlands. This ecosystem is now largely fragmented by agricultural, urban development, and woody species encroachment resulting from fire

suppression. Natural forces that shape the system include prevailing southeast winds, tropical weather systems, and rainfall of more than 60 inches per year on the upper Texas coast to about 40 inches per year at APCNWR.

Less than one percent of original coastal prairie grasslands remain in relatively pristine condition (Smeins et al. 1991). Remaining representative pieces of most habitat types are generally small, fragmented, and degraded in some way (i.e., exotic plants, disrupted hydrology, overgrazing, channelization). Large landholdings are also becoming less common due to inheritance tax and developmental pressures. Theses prairies are threatened by brush encroachment and invading exotic species such as Macartney rose (*Rosea bracteata*), Chinese tallow (*Triadica sebifera*), deep-rooted sedge (*Cyperus entrerianus*), and red imported fire ants.

Tallgrass coastal prairie is found along the coast of Texas and Louisiana. Similar in many ways to the tallgrass prairie of the midwestern United States, coastal prairie is maintained by natural processes of fire and drought, thus impeding the successional continuum that would otherwise result in woody species dominating the grasslands. In healthy coastal prairies, a diverse variety of wildflowers (nearly 1,000 plant species have been identified thus far) are found but are under constant threat from habitat fragmentation, exotic species, overgrazing and lack of fire (The Nature Conservancy 2002). Functional prairies and insects naturally go together. The result is a unique insect diversity, including butterflies, dragonflies, and numerous species of bees, wasps, leafhoppers, ants, grasshoppers, beetles, and praying mantis.

Many bird species rely upon remnant prairie habitat where more red-tailed hawks (*Buteo jamaicensis*), northern harriers (*Circus cyaneus*), white ibis (*Eudocimus albus*), and white-faced ibis (*Plegadis chihi*) reside than in any other ecoregion of North America (The Nature Conservancy 2002). There are also abundant numbers of waterfowl, wading birds, and shorebirds. The TNC Gulf Coast Prairies and Marshes Ecoregional Plan identifies the APC as a bird of particular concern due to low population size. Attwater's prairie-chickens historically were the number one breeding bird in Texas coastal prairies (Bailey 1905).

3.1.3.2 Aquatic Description

The Attwater Prairie Chicken NWR is located in the East Texas Gulf freshwater ecoregion of North America. The East Texas Gulf is an ecoregion of the Mississippi Complex located in the Arctic-Atlantic Bioregion. This ecoregion stretches from eastern New Mexico to southeastern Texas. It is defined by the watersheds of the Brazos and Texas' Colorado rivers and their tributaries. Other freshwater habitats in this karst area include caverns and springs (Abell et al. 2000). There are around 100 fish species, of which at least two are endemic (Conner and Suttkus 1986). There are also 12 endemic hydrobiid snails, two endemic unionid mussels, and one endemic salamander (Bowles and Arsuffi 1993). The ecoregion is considered vulnerable, meaning that remaining habitat occurs in blocks or segments, and established exotic species may invade other areas (Abell et al 2000).

3.1.4 Protected Areas in the Gulf Coast Prairies and Marshes Ecoregion

The International Union for Conservation of Nature (IUCN) defines a protected area as "a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (Dudley 2008). Protected areas serve a variety of purposes for society. They are an expression of our community's goals to maintain the value of biodiversity and to ensure these values are passed on to future generations. They represent the diversity of the Earth's history and the current natural processes, and provide many environmental services such as clean air, water,

and nutrients. They are treasured landscapes, reflecting the inherited cultures of many generations, and they hold spiritual values for many societies (IUCN 2005).

Protected areas cover over 13 percent of the Earth's land surface (IUCN 2005). In the United States, over 10,480 protected areas, including State level protected areas, account for 27 percent of the land area (1,006,619 square miles) (UNEP 2008). Within the GCP&M there are approximately 156 protected areas, with 40 Federal (52.8 percent of the total acres), State (45.1 percent), or privately owned and/or managed conservation and recreation units (2.1 percent). Appendix H identifies all conservation and recreation areas within the Gulf Coast Prairies and Marshes Ecoregion. Presently, there is one UNESCO Biosphere Reserve and one Wetland of International Importance as designated by the Ramsar Convention on Wetlands in Mexico; however, their level of ecological protection is unknown. These protected areas total over 1.88 million acres (9.8 percent) of the entire Gulf Coast Prairies and Marshes Ecoregion (Map 3-2. Managed Lands within the Gulf Coast Prairies and Marshes Ecoregion). (Note: Some private, nongovernmental lands are not shown on map due to shapefiles being unavailable.) These existing protected areas are critical to meeting overall conservation goals set for the GCP&M ecoregion.

3.1.5 Conservation Corridors

Conservation corridors are physical connections between disconnected fragments of plant and animal habitat. Without such connections, some species would be unable to reach necessary resources like food, water, mates, and shelter. Working with partners to identify key conservation corridors and crucial habitats is needed to conserve the habitat and wildlife species that depend on it.

The Attwater's Prairie-Chicken Recovery Plan (2010) outlines the need to establish grassland corridors (1–3 miles wide) interconnecting core areas of suitable APC habitat capable of supporting an APC population of 500 (250 displaying males), assuming a carrying capacity of 1 bird per 50 acres. These corridors within the APC's historic range would allow for dispersal and genetic exchange and hedge against environmental stochasticity (e.g., hurricanes).

Areas such as national wildlife refuges, TNC preserves (e.g., Mad Island, Texas City Prairie Preserve), State wildlife management units and parks, and private lands will be pivotal in making these grassland corridors a reality.

3.1.6 Refuge Location

Attwater Prairie Chicken NWR is located in Colorado and Austin counties in Texas. The Refuge is approximately 60 miles west of Houston, Texas, the nation's fourth most populated city. It is situated about 75 miles inland from the Gulf of Mexico.

3.1.7 Surrounding Land Uses

The conservation land status of Attwater Prairie Chicken NWR is just one of a variety of land uses found across the larger landscape. Agricultural and livestock land uses exist around the Refuge that could offer an array of threats to fish, wildlife, and their habitats, including invasive plants, feral animals, crop monocultures, habitat fragmentation, pathogens (i.e., avian cholera), and pollutants. Attwater Prairie Chicken NWR is surrounded by mainly rice fields and cattle ranches.

[This page intentionally left blank.]

Map 3-2. Gulf Coast Prairies and Marshes Ecoregion

PRODUCED IN THE DIVISION OF REFUGE PLANNING
ALBUQUERQUE, NEW MEXICO
LAND STATUS CURRENT TO: 5/31/09
MAP DATE: June, 2011
BASEMAP: N/A
MERIDIAN: N/A
FILE: atw_gulf_coast_eco_6.8.11_shl

0 50 100 200 Miles
0 50 100 200 Kilometers

UTM ZONE 14
NAD 83

[This page intentionally left blank.]

3.2 Physical Environment

This section describes the physical environment in which the Attwater Prairie Chicken NWR is found. It includes a description of the climate, air quality, water resources, geology and soils, and mineral resources. It concludes with a short discussion about the Service's concerns pertaining to those physical resources.

3.2.1 Climate

According to Larkin and Bomar (1983), this narrow region along the Gulf coast is characterized as a subtropical humid climate caused by the predominant onshore flow of tropical maritime air from the Gulf of Mexico. This onshore flow is modified by a lateral decrease in moisture content from east to west across the State and by intermittent seasonal intrusions of continental air. The Gulf of Mexico is a dominant geographical feature, moderating temperatures along the Gulf Coast and, more importantly, providing the major source of moisture for the State. Temperatures within this region are fairly uniform, with hot, humid summers and mild winters. Annual average temperatures range from 70 °F to 74 °F. The subtropical climate on the Gulf Coast ranges from average temperatures during the winter months of 55 ºF to summer average temperatures of 91 º F. Humidity drops to low relative humidity values of 16 percent or lower during the winter months, yet humidity values are often sustained near 100 percent during the summer. These high humidities are generally associated with incoming pressure systems. Prevailing winds are from the southeast unless northern fronts pass through, which usually dominate the wind direction for several days. Annual precipitation can vary dramatically. During years of drought (most recently in 2011), annual precipitation was below 30 inches. During years of heavy rainfall, precipitation approaches 60 inches.

Rain may occur throughout the year and is typically associated with frontal passages during the winter and tropical disturbances during the summer months. In nearby Sealy, the wettest months are typically May (4.7" average) and October (4.4" average) (National Climatic Data Center et al. 2001). Hurricanes may occur any time from early June through late November but are most common in August and September. Rainfall amounts vary at different sites due to coastal influences and variability at individual sites.

3.2.2 Air Quality

Pursuant to the Clean Air Act, as amended in 1977, the Service has an affirmative responsibility to protect air quality related values on national wildlife refuges. Congress gave the Service, a Federal land manager of wilderness area, the responsibility to protect the air quality and natural resources, including visibility, of the area from man-made pollution. Polluted air injures wildlife and vegetation, causes acidification of water, degrades habitats, accelerates weathering of buildings and other facilities, and impairs visibility.

Under the Clean Air Act, the U.S. Environmental Protection Agency (EPA) has established primary air quality standards to protect public health. The EPA has also set secondary standards to protect public welfare. Secondary standards relate to protecting ecosystems, including plants and animals, from harm, as well as protecting against decreased visibility and damage to crops, vegetation, and buildings.

The EPA has developed National Ambient Air Quality Standards (NAAQS) for six principal air pollutants (also called "criteria pollutants"). They are ground-level ozone (O_3), particulate matter (PM), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), and lead (Pb).

There are no major air pollutant sources affecting the Refuge, despite its proximity to the major metropolitan area of Houston, because predominate winds are from the south-southeast. However, the ambient air quality within the boundaries of the Refuge can still vary considerably, but ambient criteria pollutant concentrations have not been recorded near the

maximum concentration permitted by the NAAQS. According to the Texas Commission of Environmental Quality (TCEQ), Colorado and Austin County have no reported long-term adverse air quality conditions. Occasionally, the smell of sewage from the application of sludge on adjacent private lands does affect air quality. The Refuge monitors atmospheric pollutants in rain as part of the National Atmospheric Deposition Program (NADP) "acid rain" program. There have been no conclusive findings from this program.

3.2.3 Water Resources

Attwater Prairie Chicken NWR lies within the San Bernard River watershed, a 120-mile river whose headwaters originate one mile south of New Ulm in Austin County and empties into the Gulf of Mexico. The east side of the main Refuge tract in Colorado County borders the San Bernard River for about seven miles. Coushatta Creek, a tributary of the San Bernard River, bisects the Refuge towards the southern third of the Refuge for about four miles until it empties into the San Bernard River. The Crooked Branch Creek bisects the Refuge's Bollinger Tract and nips the north end of the Zaruba Tract in Austin County, and the Middle Bernard Creek nips the Refuge's most southern end in Colorado County.

The Floating Water-primrose Aquatic Marsh association also potentially occurs on the Refuge. Its global rank is G4G5 (which means, demonstrably secure globally- uncommon to common, but not rare; usually widespread, but may be rare in some parts of its range). Vegetation from this association occurs in shallow water of flats in slow-moving streams, shallow lakes, and natural and artificial impoundments.

The 80-acre Teal Marsh and 115-acre Pintail Marsh are located on the southwest portion of the auto tour route. Although proposed as early as the 1960s by Service managers and regional biologists, these two artificial impoundments were eventually constructed in the mid-1980s by Refuge staff to supplement prairie wetlands. The 12-acre Horseshoe Lake is another man-made reservoir located one-half mile north of the Refuge headquarters. Horseshoe Lake impounds a drainage that leads to Coushatta Creek; it was constructed prior to the establishment of the Refuge for watering livestock and recreational fishing. During years with adequate rainfall, water levels in Teal and Pintail Marsh may be managed to provide habitat for migrating waterfowl, shorebirds, and wading birds. Other species such as turtles and alligators also use these impoundments, offering additional wildlife viewing opportunities for Refuge visitors. In addition, exotic species such as nutria (*Myocastor coypus*), deep-rooted sedge, and Macartney rose can be found in these impoundments. An irrigation well located upstream of Teal Marsh can provide supplemental water in dry years or when it is necessary to flush the marshes in the case of waterfowl disease outbreaks.

Aquifers and Groundwater

The Chicot Aquifer (in Holocene- and Pleistocene-age sediments) is the primary source of fresh ground water (less than 1,000 milligrams per liter dissolved solids concentration) in the Eagle Lake area and is part of the Gulf Coast aquifer system. Recharge to the aquifer generally occurs through the percolation of freshwater (e.g., precipitation, streamflow, lakes) along the aquifers' area of outcrop at the surface. Groundwater movement is generally from the area of outcrop toward the southeast (down-dip) but may vary in the vicinity of natural discharge points (along stream banks) or artificial discharge points (groundwater wells).

About a dozen windmills scattered throughout the Refuge provide livestock and/or wildlife watering sites with water pumped from the ground. Using a large pump and diesel engine, the Refuge also has the capability to add ground water to two man-made impoundments (Teal Marsh and Pintail Marsh) as needed.

Water Quality

Water quality is a measure of the suitability of water for a particular use based on physical, chemical, and biological characteristics. Natural water quality varies from place to place, with the seasons, with climate, and with the types of soils and rocks through which water moves. Water quality is also affected by human activities, including but not limited to urban and industrial development, farming, mining, combustion of fossil fuels, and stream-channel alteration (U.S. Geological Survey 2001).

Red-eared slider. CREDIT: USFWS

The Clean Water Act of 1977 requires states to identify and prioritize waters that do not currently support designated uses. Waterbodies that do not meet one or more applicable water quality standards and those that are threatened for a designated use by one or more pollutants are listed on each state's 303(d) list. The 303(d) list includes waters impaired by both point and non-point source pollution. Point source pollution occurs when contaminants enter the waterbody from a distinct localized source, such as a chemical plant or equipment exhaust. Non-point source pollution occurs when contaminants enter the waterbody from indirect sources, such as residential development or agricultural practices.

Attwater Prairie Chicken NWR is near one waterbody that is listed as impaired on TCEQ's 303(d) list. The San Bernard River has been classified as impaired due to bacteria levels. Tests conducted by State agencies report that river bacteria counts just south of the Refuge (at the FM 3013 bridge) are usually at acceptable levels or better for most of the year than at points further downstream. The Houston-Galveston Area Council has initiated the development of a Watershed Protection Plan with public participation for this watershed.

3.2.4 Geology and Soils

In the region, the Lissie Formation consists of varying proportions of sand, silt, clay, and minimal amounts of gravel. Concentrations of calcium carbonate, iron oxide, and iron-manganese oxides are common in the weathered zone. Loamy prairie, sandy prairie, and coarse sand range sites predominate on the Refuge, with interspersed claypan and lowland range sites. Geological characteristics of the virgin coastal prairie include small mounds or hills called "mima" or "pimple" mounds. Formation of these mounds is not well understood.

3.2.5 Mineral Resources

The Service does not own mineral interest underlying the lands within the Refuge and must provide reasonable access to mineral owners to explore and develop their mineral interests.

Oil and gas activities are allowed to take place on refuges for a number of reasons. On the majority of refuges, oil or gas activities occur where private entities, states, or Native corporations, rather than the Federal government, own the mineral rights. Owners of these mineral rights have the right to develop, produce, and transport the oil and gas resources located within a refuge (U.S. General Accounting Office 2001). However, the Department of the Interior's regulations require, "to the greatest extent practicable," that "all exploration, development and production operations" be conducted in such a manner as to "prevent damage, erosion, pollution, or contamination to the lands, waters, facilities, and vegetation of the area." Further, "so far as practicable, such operations must also be conducted without interference with the

operation of the refuge or disturbance to the wildlife thereon" (50 C.F.R. Part 29.32).

Under the National Wildlife Refuge System Administration Act of 1966, as amended, the Service is responsible for regulating all activities on refuges. The Act requires the Service to determine the compatibility of activities with the purposes of the particular refuge and the mission of the Refuge System and not allow those activities deemed incompatible. However, the Service does not apply the compatibility requirement to the exercise of private mineral rights on refuges. Department of the Interior regulations also prohibit leasing Federal minerals underlying refuges outside of Alaska, except in cases where Federal minerals are being obtained by operations on property adjacent to the refuge. Nevertheless, the activities of private mineral owners on refuges are subject to a variety of legal restrictions, including Service regulations. Federal laws affect how private mineral rights owners conduct their activities. Also, Service regulations require that oil and gas activities be performed in a way that minimizes the risk of damage to the land and wildlife and the disturbance to the operation of the refuge. The regulations also require that land affected be reclaimed after operations have ceased. Information about oil and gas operations and management on APCNWR can be found in Section 3.6.1.3.

3.2.6 Concerns Regarding the Physical Environment

Water issues are very real for the area. Agriculture and municipal growth are placing more and more demands on water that is already scarce (Abell et al. 2000). Pollution also contributes to the vulnerability of the East Texas Gulf freshwater ecoregion. Extensive agriculture and pasturage in the region introduce large amounts of sediment, nutrients, fecal coliform bacteria, and agrochemicals into the surface water and groundwater (Abell et al. 2000).

During the late 1990s, Refuge personnel were approached by PureTex Water Works, Inc., a water company wanting to pump ground water from underneath the Refuge to be piped to the Houston area for a bottled water plant. Also, the Lower Colorado River Authority (LCRA) signed an agreement with the San Antonio Water System to study the potential for piping water from the Colorado River (8–9 miles from the Refuge) to San Antonio, Texas, for municipal use. Neither project materialized.

Environmental Contaminants

The Service assesses existing and potential environmental contaminants found on national wildlife refuges through a Contaminant Assessment Process (CAP). A CAP was conducted for APCNWR in 1999. Since the Refuge is mostly surrounded by agricultural fields, there is a potential for pesticide drift. However, sampling efforts involving APC tissue samples have not revealed this kind of contamination on the Refuge. With heavy rainfall in October 1998, the San Bernard River flooded, resulting in the breaking of gas pipelines off-Refuge upstream. As a result, a light petroleum film blanketed areas along the San Bernard River. No other forms of environmental contamination have been documented on the Refuge.

3.3 Biological Environment

This section describes the biological environment in which the Attwater Prairie Chicken NWR is found. It includes a description of the present and historical condition of terrestrial and aquatic habitat types, as well as the natural processes that influence them. It identifies priority wildlife species and includes a discussion of the wildlife found on the Refuge. The section concludes with a short discussion about the concerns pertaining to the biological environment.

3.3.1 Habitat Types

Attwater Prairie Chicken NWR remains one of the largest contiguous pieces of coastal prairie in southeast Texas. The majority of the 10,541-acre APCNWR contains coastal prairie—about 6,400 acres are dominated by the climax community which includes little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon gerardii*), Indiangrass (*Sorghastum nutans*), and switchgrass (*Panicum virgatum*). About 2,500 acres are considered old field or formerly cultivated areas. About two-thirds of the old field acreage has been revegetated to native grasses within the last 15 years with mixed success. The majority of this acreage comes from lands acquired from 1998–2001. About 150 acres are currently being managed as food plots for wildlife. Intermixed within the coastal prairie/old field habitat are prairie wetland, riparian/woodlot components, and administrative lands, totaling a little more than 1,600 acres. For this document, the Refuge used the National Vegetation Classification System (NVCS) to describe habitat types at the ecological system level (Map 3-3 and 3-4, Vegetation Maps.). *Note: The National Land Cover Data map for APCNWR has been altered substantially to more accurately reflect the actual vegetation communities present. In addition, location-specific vegetation communities that are not part of the NVCS classification system have been represented on the map and roughly described. Many managed, previously altered, and invasive communities are not covered in the NVCS system, which tends to focus on native communities only.*

3.3.1.1 Vegetation Classes

Agriculture – Cultivated Crops

Food plots are planted for use by APC and other wildlife. Crops include millet, soybeans, milo, or sunflowers. Refuge staff conducts farming.

Former Exotic Grass Pasture – Prerestoration

Area is predominantly bahia (*Paspalum notatum*), has not been actively restored yet, but broomsedge bluestem (*Andropogon virginicus*), brownseed paspalum (*Paspalum plicatulum*), and some native forbs (Euthamia [*Euthamia* sp.], false wild indigo [*Baptisia australis*], etc., have begun to recolonize.

Food plot at APCNWR. CREDIT: USFWS

Former Rice Field – Prerestoration

Dominants are deep-rooted sedge (*Cyperus entrerianus*), Brazilian vervain (*Verbena brasiliensis*), and other typical early successional species.

Open Water

Seasonal open water occurring in managed wetlands and ponds.

Riverine Sand Bars

Sparsely vegetated sand deposits in the river channel.

Texas – Louisiana Coastal Prairie (description provided by NVCS)

This system encompasses non-saline tallgrass prairie vegetation ranging along the coast of Louisiana and Texas. This vegetation is found on Vertisols and Alfisols, which developed over Pleistocene terraces flanking the Gulf Coast. It is often characterized by a ridge-and-swale or mound-and-intermound microtopography and encompasses both upland and wetland plant communities. Upland dominants include little bluestem, brownseed paspalum, Indiangrass, and big bluestem. Wetland dominants in undisturbed

occurrences include switchgrass and Eastern gamagrass (*Tripsacum dactyloides*); disturbed occurrences may be dominated by bushy bluestem (*Andropogon glomeratus*). Some estimates state that 99 percent of coastal prairie has been lost through conversion to other uses and environmental degradation due to the interruption of important ecological processes, such as fire, needed to maintain this system. In the absence of regular fire, this system will be invaded by woody shrubs and trees. Some prairie features on APCNWR included in this class and not mapped separately are potholes, mima mounds, and wet depressions.

APCNWR prairie. CREDIT: USFWS

*Texas – Louisiana Coastal Prairie Slough (description provided by NVCS)**

This ecological system includes small streams and sloughs that course through the coastal prairie in Louisiana and Texas. They are typically wooded, in contrast to the adjacent prairie. Species composition varies with latitude and longitude, with eastern species being replaced by western ones in drier landscapes.

**Classification comments: This system was developed as a placeholder for undefined vegetation associations of the Outer Coastal Plain in Louisiana and Texas. It may be superfluous to West Gulf Coastal Plain Small Stream, River Forest (CES203.487), Southeastern Great Plains Riparian Forest (CES205.709), and Southeastern Great Plains Floodplain Forest (CES205.710).*

Transitional/Grassland Restoration

Areas of former agricultural use, mainly old rice fields, where the process of restoration has begun by eliminating levees and correcting altered hydrology. Some have already been seeded with little bluestem obtained from elsewhere on the Refuge. Early successional and/or non-native species will persist while the native grasses and forbs increase, eventually returning to a coastal prairie system.

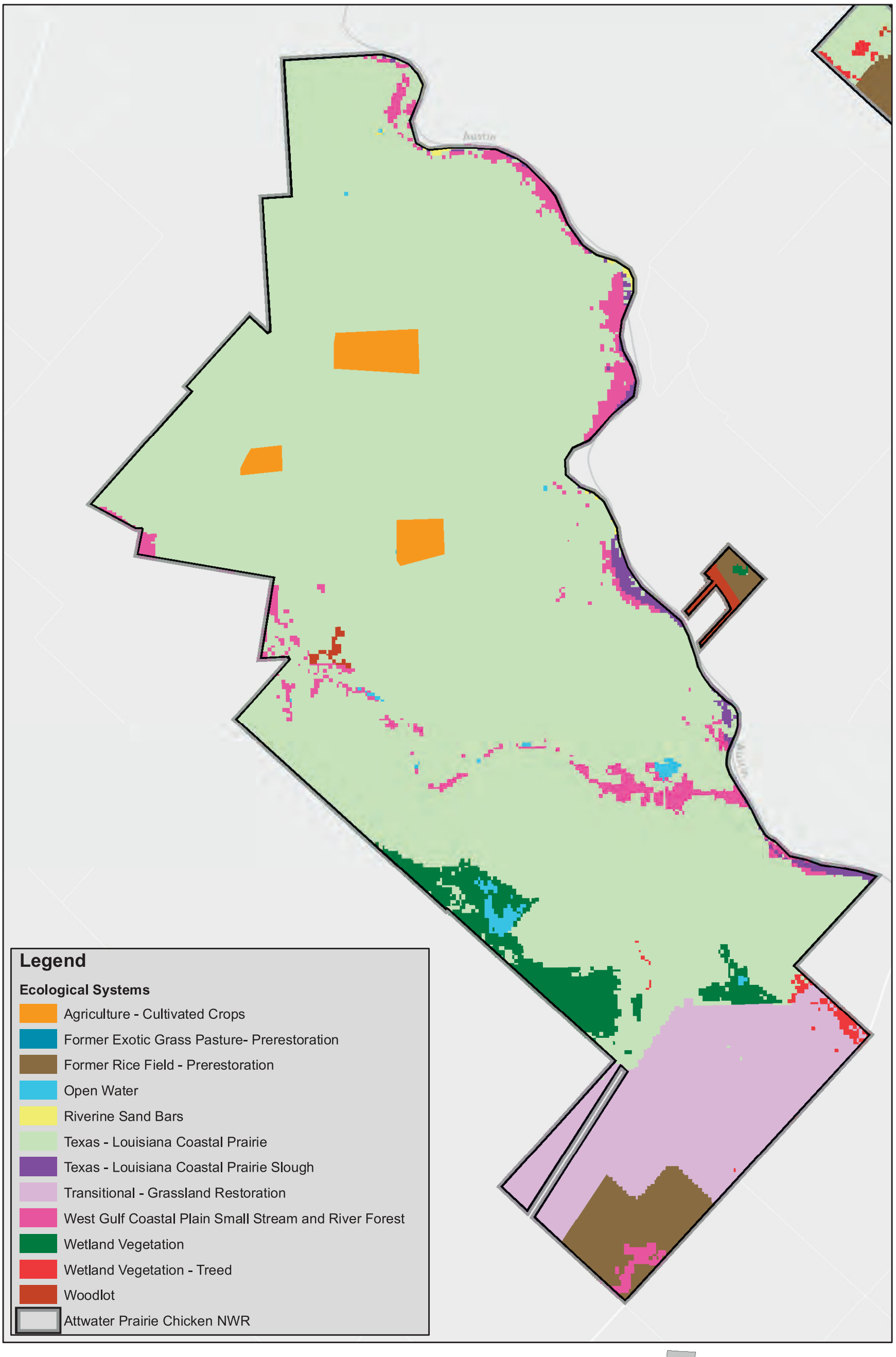
Lotus flower. CREDIT:USFWS

U.S. Fish & Wildlife Service

Attwater Prairie Chicken National Wildlife Refuge

Austin/Colorado County, Texas

Map 3-3. Vegetation, West Section



PRODUCED IN THE DIVISION OF REFUGE PLANNING
ALBUQUERQUE, NEW MEXICO
LAND STATUS CURRENT TO: 5/31/09
MAP DATE: march 2012
BASEMAP: N/A
MERIDIAN: N/A
FILE: atw_veg_west_3_16_12sk

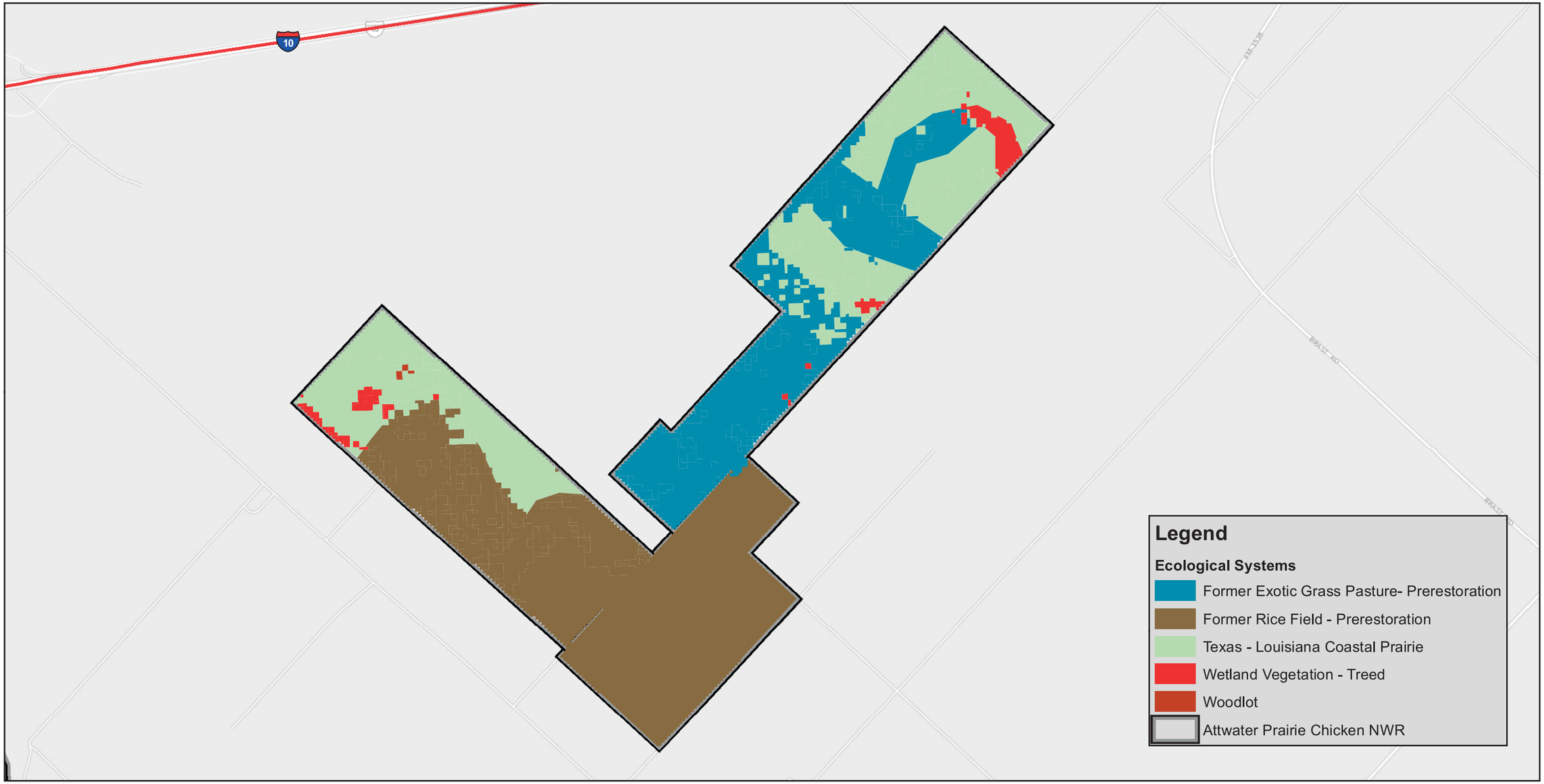
0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

UTM ZONE 14
NAD 83

[This page intentionally left blank.]

Map 3-4. Vegetation, East Section



PRODUCED IN THE DIVISION OF REFUGE PLANNING
ALBUQUERQUE, NEW MEXICO
LAND STATUS CURRENT TO: 5/31/09
MAP DATE: March 2012
BASEMAP: N/A
MERIDIAN: N/A
FILE: atw_veg_east_3_20_12sk

0 0.25 0.5 1 Miles
0 0.25 0.5 1 Kilometers

UTM ZONE 14
NAD 83

[This page intentionally left blank.]

West Gulf Coastal Plain Small Stream and River Forest (description provided by NVCS)

This is a predominantly forested system of the West Gulf Coastal Plain associated with small rivers and creeks. In contrast to West Gulf Coastal Plain Large River Floodplain Forest (CES203.488), examples of this system have fewer major geomorphic floodplain features. Those features that are present tend to be smaller and more closely intermixed with one another, resulting in less obvious vegetational zonation. Bottomland hardwood tree species are typically important and diagnostic, although mesic hardwood species are also present in areas with less inundation, such as upper terraces and possibly second bottoms. As a whole, flooding occurs annually, but the water table usually is well below the soil surface throughout most of the growing season. Areas impacted by beaver impoundments are also included in this system. Also present are invasive tree and brush species such as Chinese tallow, chinaberry (*Melia azedarach*), trifoliate orange (*Poncirus trifoliata*), and Macartney rose.

Wetland Vegetation

Areas of managed wetlands or moist soil where native wetland and lowland vegetation exists along with introduced wetland species. Some species present include *Polygonum spp.*, lotus, cattail, sumpweed, ragweed, native sedges, *Panicum spp*., maidencane, *Sesbania spp*, bulrush, Macartney rose, and deep-rooted sedge.

Wetland Vegetation – Treed

Areas along creek and canals, Chinese tallow, Macartney rose, and chinaberry occur with some native species, including willow, ash, and oak.

Woodlot

Areas that were previously planted to trees, including a pine woodlot and live oak woodlots.

3.3.1.2 Natural Disturbance Processes

Wildland fire is a random event at Attwater Prairie Chicken NWR. Although fires have occurred, frequency of occurrence does not allow for determination of "seasonal" patterns. Rather, the possibility of wildland fire occurrence increases as fuel moisture decreases due to seasonal senescence or during drought conditions. Drought conditions can occur anytime throughout the year, but are often more prevalent during the summer-fall period. Numerous wildland fires have occurred on APCNWR since its establishment, ranging in size from less than 1 acre to 350 acres. From 1974 to 1990, four wildland fires occurred on the Refuge. Since 1991, 10 wildland fires have been documented, with 3 of these occurring in 1999, an extremely dry year.

In addition to 1999, drought also occurred from 1988–1990, in 2008 and 2011. Extremely dry conditions during the late 1980s triggered avian cholera outbreaks throughout the area, negatively affecting large concentrations of ducks and geese. Antibodies to avian cholera were identified in APC blood samples during or just following these outbreaks (Peterson et al. 1998). According to the David R. Wintermann Rice Research Station monitored by the Texas Agrilife Research and Extension Center at Eagle Lake, the rainfall in 2008, 19.81 inches. In 2011, rainfall was the lowest ever recorded since the Refuge was established at 18.52 inches. Both 2008 and 2011 are less than half of the annual average rainfall since 1976.

The dry, late 1980s were followed by several extremely wet years (1991–1993) triggered by the "El Nino" effect. These wet years affected APC nesting efforts and likely contributed to the dramatic decline of APC numbers. The wettest year recorded since the Refuge was established occurred in 1993, with more than 63 inches of rainfall (54 percent above average).

The area also experienced an unusual flood in October 1998 when a cold front stalled over the area, dumping more than 15 inches of rain within a 24-hour period on an already-saturated terrain. As a result, the majority of the Refuge was flooded. In addition, a gas pipeline located north

of the Refuge broke, creating an oily residue along the San Bernard River.

In April 1981, a heavy wind or tornado and hail storm hit the Refuge, causing damage to many Refuge buildings. In addition, several windmills on the Refuge were also damaged.

3.3.1.3 Historical Habitat Description

Early settlers described the upper coastal prairie as being covered by "verdant wild grass…tall and coarse and full of seed at the top when young. And before it has grown its stem, it resembles the early growth of wheat" (Smeins et al. 1991). The only relief that bisected this "sea of grass" was the heavily wooded riparian habitats along major rivers. In addition, early observers described the coastal prairie "…as having a profusion of flowers of great diversity of colors" (Smeins et al. 1991).

From recorded accounts of early European explorers and settlers, fires were a common occurrence on the coastal prairies (Smeins et al. 1991). Fires were often ignited by lightning activity during the late spring to early autumn seasons. Further, these writings note that the prairies were often on fire because of Native American activities (e.g., to signal others, to herd game, to adjust the vegetation mix, to clear campsites). Following the influx of European settlers in the mid- to late 1800s, most human-caused prairie fires resulted from carelessness. However, human use of fire essentially ended in the late 1940s, resulting in increased brush within formerly open prairie grasslands (Lehmann 1965).

Mammals, birds, insects, plants, and other life forms flourished in this ecosystem as described by LaSalle's ill-fated colonization party in 1687: "...found 'prairie chicken' and other 'wild fowl' numerous in many places…" (Smeins et al. 1991). Up to one million Attwater's prairie-chickens were estimated to have roamed throughout this unique ecosystem (Lehmann 1968).

Habitat-wise, much of APCNWR resembled the rest of this 6- to 7-million-acre ecosystem, representing a unique diversity. As far as it is known, fire, climate (such as drought), and natural grazing were the major driving ecological processes that kept this pristine area dominated by prairie grasses (Askins et. al 2007), such as little bluestem, big bluestem, Indiangrass, and switchgrass, and free of invading woody species.

APCNWR May 1973. CREDIT: USFWS

A number of plant and animal species have declined or become extirpated since pre-settlement times, most notably the critically endangered Attwater's prairie-chicken. Much of this can be attributed to the loss of coastal prairie habitat due to urban sprawl (construction of roads, utility right of ways, irrigation and drainage canals, growth of cities and towns), conversion of prairie to croplands, improper grazing, and suppression of prairie fires. Today, less than one percent of this habitat remains, much being highly fragmented (Smeins et al. 1991). The Refuge is currently an "island of grasses" surrounded by a "sea of crop fields" and brush. A number of exotic plant and animal species have invaded APCNWR habitats, potentially altering ecosystem functions.

3.3.1.4 Estimated Conditions due to Climate Change

Climate projections are inherently more difficult for a small sub-area of the globe than for the globe as a whole. This is particularly true for Texas, whose climate is inherently variable

throughout the year. Climatic variations over the past century in Texas do not correspond to changes expected from global warming, according to present-day climate models (Nielsen-Gammon 2008). Projections indicate that there will be close to a 4°F increase in temperature from 2000–2059. Global trends show increases in precipitation along the equator and decreases in other parts of tropics and subtropics. Texas lies within the 30° N latitude band where precipitation should have decreased consistent with global trends, but Texas has observed increased precipitation (Nielsen-Gammon 2008). When looking at projections of both temperature and precipitation, environmental and human water systems will be under increased stress due to changes in water supply and demand. Temperatures are projected to increase across Texas (Nielsen-Gammon 2008). A warmer and drier climate would lead to greater evaporation, as much as a 35 percent decrease in streamflow, and less water for recharging groundwater aquifers. Increased rainfall could mitigate these effects but could also contribute to localized flooding. Additionally, climate change could give rise to more frequent and intense rainfall, resulting in flash flooding (Zing et.al. 2003).

According to *The State of the Birds 2010 Report on Climate Change*, birds are good indicators of environmental conditions; their predicted changes illustrate how ecosystems are likely to change (North American Bird Conservation Initiative 2010). Of the 10 habitat types discussed (Oceans, Hawaiian, Coasts, Arctic, Pacific Island, Grasslands, Caribbean, Aridlands, Wetlands, and Forest), grassland habitats are the only habitat type that does not have any species categorized as highly vulnerable; however, 57 percent of grassland species have medium vulnerability to climate change, and grassland birds are at risk for many other reasons. Prairie-chicken and grouse are less likely than other grasslands birds to move in response to changing conditions because they are closely tied to their leks, where males display to attract females (North American Bird Conservation Initiative 2010).

3.3.1.5 Concerns Regarding Refuge Habitat

Urbanization

Increased urbanization in the area has further increased the loss, fragmentation, and degradation of the coastal prairie landscape. The population of Texas is expected to double by 2050. Located 60 miles west of Houston (the fourth largest city in the U.S.), the area surrounding the Attwater Prairie Chicken NWR (Austin and Colorado counties) is already experiencing a human population boom with “ranchettes” being established adjacent to Refuge properties. The increase of urbanization around the Refuge increases the potential for numerous other forms of habitat degradation to occur on the landscape, including increased pollution (e.g., litter, noise, air, water), introduction of non-native invasive plants and animals, and disturbance to or competition with native flora and fauna.

Within the last several years, new homes and subdivisions have encroached closer to Refuge lands. Rural residential development increases the potential for habitat fragmentation, wildlife-people conflicts, pest management problems, prescribed fire risks, and need for law enforcement. Development adjacent to APCNWR lands may increase market pressure on private landowners to sell their property for further development.

In addition, increased urbanization has the potential to dramatically reduce or inhibit Refuge habitat management activities such as prescribed burning. As more homes surround the Refuge, prescribed burning, used to attain and maintain high quality prairie habitat for the endangered Attwater’s prairie-chicken and other prairie-dependent wildlife, becomes more expensive and more difficult to conduct safely. As a result, the quality and quantity of coastal prairie habitat degrades further, adding to the loss of this unique habitat.

Invasive Species

The introduction of exotic invasive plants and animals has affected the entire Refuge—both its habitat and its management. Most notable of these invasive species are Macartney rose, deep-rooted sedge, Chinese tallow, feral hogs (*Sus scrofa*), red imported fire ants (RIFA), nutria, vaseygrass (*Paspalum urvillei*), Johnsongrass (*Sorghum halepense*), Bahiagrass, and trifoliate orange. Unfortunately, total eradication of most of these may be cost prohibitive and time consuming. Ongoing control and containment is often the mode of operation to combat these exotic species.

Invasive deep-rooted sedge (left side- untreated area, right side- treated). CREDIT: USFWS

Prairie Habitat

Coastal prairie once occupied over six million acres, but today substantially less than one percent remains. Estimates are that less than 200,000 fragmented acres remain in Texas (USFWS 1998), but, according to Smeins et al. (1991), as little as 65,000 acres remain, and very little prairie can be found in Louisiana—most along narrow strips of land near railroad rights-of-way (USFWS and USGS 1999). Nonetheless, these prairie remnants are critical sources of biodiversity and genetic material for the ecoregion and must be protected and managed properly.

Prairie habitat surrounded by a "sea of crop fields" and exotic brush requires constant, intensive management to control a barrage of invasive plant species and maintain its unique grassland characteristics. Continued use of habitat management tools such as prescribed burning, brush control to include chemical treatments, and moderate grazing is necessary to achieve recovery goals for the Attwater's prairie-chicken. An increase in the number of acres restored to native grasses on the Refuge would greatly benefit many prairie-dependent species.

Any changes in the use of these habitat management tools need to be accomplished very carefully to avoid irreparable damage to the habitat. Elimination of these habitat tools would dramatically alter the prairie landscape within a few years. When applied properly, however, these tools have the potential to provide and maintain quality prairie habitat for many years to come.

While popular with the wildlife-viewing enthusiasts, almost 200 acres of coastal prairie were flooded on the Refuge to create two artificial impoundments during the 1980s at a time when prairie-chicken numbers on the Refuge were significantly higher than they are today. In the winter of 1988–1989, snow goose (*Chen caerulescens*) numbers were at an all-time high with a peak of over 50,000 geese utilizing Refuge impoundments. A regional outbreak of avian cholera that winter exposed the potential for the spread of disease to prairie-chickens by concentrating large numbers of waterfowl on the Refuge. For these reasons, the return of these impounded wetlands to native prairie has been identified by the Attwater's prairie-chicken recovery team as a project that would improve prairie habitat quality and quantity, and reduce the potential for the transmission of avian diseases to the Refuge prairie-chicken population. Because of its relatively small size and location near tree-lined riparian corridors, neither the loss of quality prairie-chicken habitat nor potential for disease transmission are issues of concern at Horseshoe Lake.

3.3.2 Wildlife

As one of the last and largest remnant tracts of coastal prairie habitat remaining in southeast Texas, Attwater Prairie Chicken NWR harbors numerous wildlife species, including grassland bird species, migratory waterfowl, water birds, mammalian, amphibian, and reptilian species, and—most noteworthy—the Attwater's prairie-chicken. About 428 species have been documented on or potentially could occur on APCNWR: 266 birds, 55 mammals, 57 reptiles, 31 amphibians, and 19 species of fish.

3.3.2.1 Priority Species

Threatened and Endangered Species

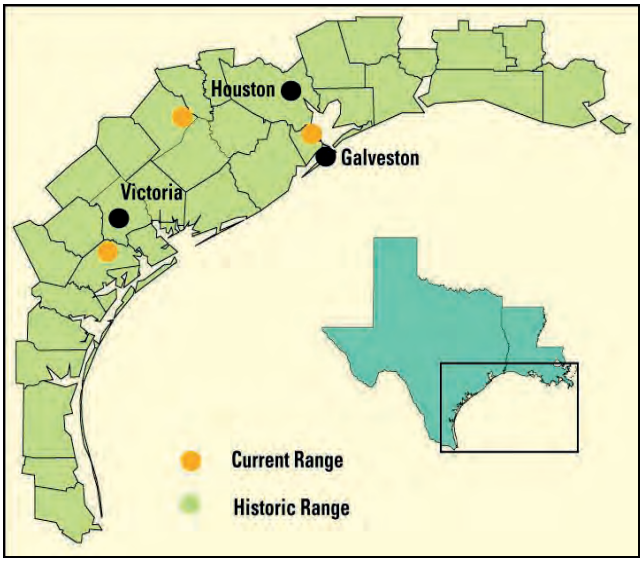
The purpose of the Endangered Species Act is to conserve "the ecosystems upon which endangered and threatened species depend" and to conserve and recover listed species. Under the law, species may be listed as either "endangered" or "threatened." Endangered means a species is in danger of extinction throughout all or a significant portion of its range. Threatened means a species is likely to become endangered within the foreseeable future. All species of plants and animals, except pest insects, are eligible for listing as endangered or threatened.

The following federally-listed endangered or threatened species are known to occur or have potential habitat on the Refuge:

Federally Endangered

Attwater's prairie-chicken – sub-species of the now extinct heath hen (*T. c. cupido*) and conspecific with the greater prairie-chicken (GPC) (*T. c. pinnatus*); 1.6 pounds (737 grams) to 2.5 pounds (1,112 grams) (Lehmann 1941); similar to GPC, but smaller and lack of feathering extending onto the feet of the APC, less feathering on the tarsus, and lack of well-developed pectinae on the toes of the APC during winter (Bendire 1894, Oberholser 1974).

The Attwater's prairie-chicken, an indicator species of the Texas Gulf Coast Ecosystem, is a member of the grouse family with historic populations reaching an estimated one million birds. Dating back to pre-settlement times, the coastal native prairie grasslands and inland plains of Texas and Louisiana have declined dramatically from over six million acres to less than 200,000 fragmented acres (USFWS 1998). Simultaneously, the APC has gone from an estimated pre-settlement population of up to one million birds to approximately 110 wild birds confined to three separate Texas locations in 2011. The APC was listed as endangered in 1967.



APC Current and Historic Range

Houston Toad (*Bufo houstonensis*) – generally brown and speckled, but individual coloration can vary considerably, with some appearing to be light brown and others almost black. They also may have a slightly reddish, yellowish, or grayish hue. Their legs have darker bands across them, and two dark bands extend from each eye down to the mouth. A variable white stripe usually extends down the middle of the back, but can be absent, and there are irregular white streaks along the sides of the toad's body. Their undersides are generally white with variable amounts of black speckling. In males, the throat is black. Adult Houston toads are medium-sized (2 to 3.5 inches) with females larger and bulkier than males. As with most toads, they are stout-bodied animals with short legs and rough, warty skin. Although releases of captive-reared

Houston toads occurred on APCNWR during the early to mid-1980s, no Houston toads have been documented on the Refuge in recent years.

Candidate Species

Candidate species are those species for which the Service has enough information to warrant proposing them for listing as threatened or endangered, but these species have not yet been proposed for listing due to other higher priority listing activities. The Service works with states and private partners to carry out conservation actions for candidate species to prevent their further decline and possibly eliminate the need to list them as endangered or threatened. The Sprague's pipit (*Anthus spragueii*) is the only candidate species that occurs on the Refuge. The probability of seeing Sprague's pipits on the Refuge is high during the spring, fall, and winter months.

State Threatened

The Refuge potentially has 13 species that are listed by the State of Texas as threatened. The bird species include white-faced ibis, white-tailed hawk (*Buteo albicaudatus*), bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrines*), and wood stork (*Mycteria americana*). The white-faced ibis frequents marshes, swamps, ponds, and rivers and is a common bird on the Refuge, especially during the summer months. White-tailed hawks are abundant on the Refuge with a very high chance of seeing them throughout the year. Although bald eagles use the area during the winter months (nest), they are rarely seen on Refuge property. There is a chance of seeing migrating peregrine falcons on the Refuge during the fall months. Wood storks are mostly seen during the spring-summer months on the Refuge.

State-listed threatened reptile species potentially occurring on the Refuge include Texas horned lizard (*Phrynosoma cornutum*), timber/canebrake rattlesnake (*Crotalus horridus*), smooth green snake (*Opheodrys vernalis*), and alligator snapping turtle (*Macrocelmys temminckii*) (Texas Parks and Wildlife Department, Annotated County Lists of Rare Species). The Texas horned lizard can be found in arid and semiarid habitats in open areas with sparse plant cover. They are rarely seen on APCNWR. Timber rattlesnakes prefer moist lowland forests and hilly woodlands or thickets near permanent water sources such as rivers, lakes, ponds, streams, and swamps where tree stumps, logs, and branches provide protection. Although APCNWR is within the reported range and distribution of this snake, there has never been a rattlesnake documented on the Refuge. If the smooth green snake is present on the Refuge, it is more likely to be found on Refuge property in Austin County. The Refuge is located at the western extent of alligator snapping turtle range (Conant 1975). None have been documented on the Refuge to date.

The status of four mollusks and one mussel is listed as State threatened, but very little is known about them or whether they occur on APCNWR. These mollusks are the smooth pimpleback mollusk (*Quadrula houstonensis*), Texas fawnsfoot mollusk (*Truncilla macrodon*), Texas pimpleback mollusk (*Quadrula petrina*), and false spike mussel (*Quincuncina mitchelli*).

Other Species of Concern

The Refuge has six bird species and two mammals that are considered species of concern. The Northern bobwhite quail is common throughout the APCNWR; however, over the last three decades, quail numbers have declined. The mottled duck has always been of conservation concern due to its limited range and small population size. Mottled ducks nest on APCNWR and have a very high probability of being seen. The Henslow's sparrow (*Ammodramus henslowii*), which is a State species of concern, occurs on the Refuge in the fall and winter, but chances of seeing this bird are low. The mountain plover (*Charadrius montanus*) is native to short grass prairies and can be seen in the southern regions of Texas during the winter; it is very rarely seen on the Refuge during the spring months. The western burrowing owl (*Athene cunicularia*) is a State

species of concern and is rarely seen on the Refuge during the fall and winter months. The plains spotted skunk (*Spilogale putorius interrupta*) lives in open tallgrass prairies, forests, brushy areas, and cultivated land; although the spotted skunk occurs on APCNWR, their numbers are unknown. The thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*) numbers have declined on APCNWR since the early 1990s. Today, they are rarely seen.

3.3.2.2 Focal/Representative Species

The Migratory Bird Program Strategic Plan 2004–2014 identified 139 focal species or populations to increase the percent of migratory birds that are at healthy and sustainable levels. Focal species are a subset of priority species and represent larger guilds of species that use habitats in a similar fashion. Focal species are selected based on the knowledge that factors limiting their populations are sensitive to landscape scale characteristics and that by addressing the needs of these focal species, other priority species within a guild are expected to benefit. In addition, an appropriate set of focal species includes consideration for the specifics of the respective ecoregion, availability of data and information, and programmatic obligations, as defined in the Strategic Habitat Conservation Report (USFWS 2006).

Coastal Prairie Focal Species

APCNWR was established primarily to conserve habitat for the endangered Attwater's prairie-chicken. The majority of APCNWR consists of grassland habitat with wetland and riparian components interspersed throughout. This is what made up the coastal prairie ecosystem historically and this is what makes up this ecosystem today on a much smaller, fragmented scale. The Attwater's prairie-chicken is recognized as an indicator species of the coastal prairie ecosystem. This imperiled grouse requires grassland habitat to meet its life requirements. Extremely low APC numbers and the dramatic drop in grassland bird numbers in general are indications that the coastal prairie ecosystem is currently imperiled. Improvements in prairie-chicken numbers or other grassland birds would indicate an improvement in the health of the coastal prairie.

3.3.2.3 Birds

About 266 species of birds have been documented on the Refuge (Appendix C). Since APCNWR is one of the last large, contiguous parcels of coastal prairie habitat remaining in southeast Texas, it is not surprising that many grassland birds use this area.

Grassland Species

Most noteworthy, of course, is the critically endangered Attwater's prairie-chicken. Other grassland bird species that use the Refuge include northern bobwhite quail, Le Conte's sparrow, Sprague's pipit, dickcissel (*Spiza americana*), eastern meadowlark (*Sturnella magna*), Henslow's sparrow, vesper sparrow (*Pooecetes gramineus*), and savannah sparrow (*Passerculus sandwichensis*). Unfortunately, the loss of prairie habitat has affected many of these grassland bird species, making them a guild of birds with one of the fastest rates of decline (Samson and Knopf 1994). About 48 percent of these species are of conservation concern, and 55 percent are showing significant declines (NABCI 2009).

Waterfowl

Waterfowl use on the Refuge during the winter months is mostly confined to two man-made impoundments; however, especially during wet winters, many duck species (including mottled ducks) use the many, small ephemeral wetlands and ponds scattered throughout the prairie. In addition, rice farming operations surrounding the Refuge attract more than 100,000 geese (mostly snow geese) annually to the area, allowing the town of Eagle Lake to boast that it is "The Goose Hunting Capital of the World." Large flocks of sandhill cranes (*Grus canadensis*) are often seen feeding in newly burned areas on the Refuge during January and February. Peak numbers of waterfowl can be found on the Refuge from November through February. Some of the more

common duck species that use the Refuge include green-winged teal (*Anas crecca*), blue-winged teal (*Anas discors*), cinnamon teal (*Anas cyanoptera*) (mostly in late winter/early spring), gadwall, American widgeon (*Anas americana*), northern shoveler (*Anas clypeata*), ruddy duck (*Oxyura jamaicensis*), and northern pintail. Fulvous whistling ducks and black-bellied whistling ducks (*Dendrocygna autumnalis*) also use the Refuge during the spring and summer months.

Shorebirds and Waterbirds

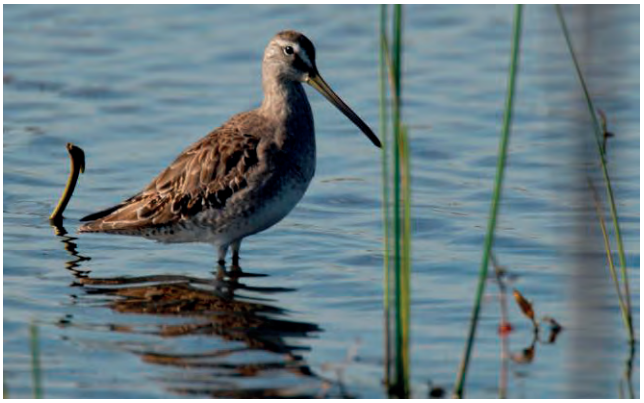
Shorebird and waterbird use on the Refuge during the summer months is aided by the rice farming habitat provided by adjacent landowners. Some of the more common shorebirds and waterbirds seen include great blue herons (*Ardea herodias*), great egrets (*Ardea alba*), snowy egrets (*Egretta caerulea*), black-necked stilts (*Himantopus mexicanus*), greater yellowlegs (*Tringa melanoleuca*), lesser yellowlegs (*Tringa flavipes*), and least sandpipers (*Calidris minutilla*). Green-backed herons (*Butorides virescens*), little blue herons (*Egretta caerulea*), white and white-faced ibis and roseate spoonbills also frequent the Refuge. Upland sandpipers (*Bartramia longicauda*) are often seen in prairie grasslands during spring months.

Raptors

Attwater Prairie Chicken NWR is also home to a number of raptors. Resident raptors include white-tailed hawks, crested caracara (*Caracara cheriway*), turkey (*Cathartes aura*) and black vultures (*Coragyps atratus*), and red-tailed hawks. Wintering raptors include northern harriers, American kestrels (*Falco sparverius*), short-eared (*Asio flammeus*) and burrowing owls, and sharp-shinned hawks (*Accipiter striatus*). Several other species pass through during migration. Great horned owls (*Bubo virginianus*) are also very common throughout the year.

Perching Birds

In addition to grassland birds, waterfowl, shorebirds, waterbirds, and raptors, a number of other interesting bird species that use the Refuge include loggerhead shrikes, yellow-billed cuckoos (*Coccyzus americanus*), common nighthawks (*Chordeiles minor*), red-bellied woodpeckers (*Melanerpes carolinus*), northern mockingbirds (*Mimus polyglottos*), scissor-tailed flycatchers (*Tyrannus forficatus*), and painted buntings (*Passerina ciris*).



Long-billed dowitcher. CREDIT: USFWS

Crested caracara. CREDIT: USFWS

Accidental Bird Species

Fourteen species have been seen on the Refuge only once or twice and are considered accidental. These include: reddish egret (*Egretta rufescens*), black swan (*Cygnus atratus*), black phoebe (*Sayornis nigricans*), zoned-tailed hawk (*Buteo albonotatus*), royal tern (*Thalasseus maximus*), Harris hawk (*Parabuteo unicinctus*), red-breasted nuthatch (*Sitta canadensis*), wild turkey (*Meleagris gallopavo*), black-headed grosbeak (*Pheucticus melanocephalus*), bobolink

(*Dolichonyx oryzivorus*), yellow-headed blackbird (*Xanthocephalus xanthocephalus*), red-billed pigeon (*Patagioenas flavirostris*), violet-green swallow (*Tachycineta thalassina*), and Lapland longspur (*Calcarius lapponicus*).

3.3.2.4 Mammals

About 55 species of mammals potentially occur or are found on the Refuge (Appendix C). Common species include raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), eastern cottontail rabbit (*Sylvilagus flordianus*), black-tailed jackrabbit (*Lepus californicus*), nine-banded armadillo (*Dasypus novemcinctus*), Virginia opossum (*Didelphis virginiana*), bobcat (*Lynx rufus*), white-tailed deer (*Odocoileus virginiana*), coyote (*Canis latrans*), and several small rodent species including hispid cotton rat (*Sigmodon hispidus*), and Attwater's pocket gopher (*Geomys attwateri*). American bison are used as a grazing tool on the Refuge and can be seen by visitors who utilize the Refuge's auto tour route. Some of the more uncommon mammals include thirteen-lined ground squirrel, eastern fox squirrel (*Sciurus niger*), and eastern spotted skunk (*Spilogale putorius*). Most of these animals can be found throughout the Refuge in various habitats dependent on cover and food requirements.

White-tailed deer. CREDIT: USFWS

3.3.2.5 Reptiles

Fifty-seven species of snakes, lizards, and turtles utilize or potentially utilize the Refuge, representing three orders and 14 families (see Appendix C). American alligators (*Alligator mississippiensis*), western slender glass lizard (*Ophisaurus attenuatus attenuatus*), western coachwhips (*Masticophis flagellum testaceus*), western cottonmouths (*Agkistrodon piscivorus leucostoma*), Texas coral snakes (*Micrurus fulvius tener*), Gulf Coast ribbon snakes

(*Thamnophis proximus ora*), ground skinks (*Scincella lateralis*), and red-eared sliders (*Trachemys scripta elegans*) represent some of the more common reptiles found on the Refuge. An uncommon species includes the western mud snake (*Farancia abacura reinwardtii*). Although the western pigmy rattlesnake (*Sistrurus miliarius streckeri*) and timber rattlesnake potentially could occur on the Refuge, there has never been a rattlesnake documented on APCNWR.

Speckled kingsnake. CREDIT: USFWS

3.3.2.6 Amphibians

Amphibians that occur or potentially occur on APCNWR account for 31 species, representing two orders and 10 families (see Appendix C). Some of the more common amphibians include the green tree frog (*Hyla cinerea*), southern leopard frog (*Rana sphenocephala*), Blanchard's cricket frog (*Acris crepitans blanchardi*), and western lesser siren (*Siren intermedia nettingi*).

During the mid-1980s, Houston toads were released on the Refuge in an effort to increase this endangered species' numbers. Efforts were unsuccessful in establishing a population on the Refuge; however, there is genetic evidence that Houston toads found several miles north of the Refuge came from a group released on the Refuge more than two decades ago (personal communication, Ron Jones, Clear Lake ES).

3.3.2.7 Fish

At least 19 fish species have been documented on the Refuge (see Appendix C). The most common species include blacktail shiner (*Cyprinella venusta*), spotted gar (*Lepisosteus oculatus*), green sunfish (*Lepomis cyanellus*), bluegill (*Lepomis macrochirus*), and carp (*Cyprinus carpio*).

Unknown spider. CREDIT: USFWS

3.3.2.8 Invertebrates

A wide variety and number of invertebrates occur on APCNWR; however, many are not well documented in this area. Some of the more common invertebrate species include tiger swallowtail butterflies (*Papilio glaucus*), June beetles (*Phyllophaga* sp.), redlegged grasshoppers (*Melanoplus femurrubrum*), and the invasive red imported fire ant (RIFA). More than 153 species of spiders, representing 24 families, have been documented on the Refuge (A. Calixto, Texas A&M University, unpublished data).

3.3.2.9 Concerns Regarding Wildlife Populations

Endangered Attwater's Prairie-chicken Recovery

Obviously, one of the biggest concerns regarding wildlife populations involves the rapid decline of Attwater's prairie-chickens numbers during the late 1980s and early 1990s, not only on the Refuge, but also throughout its range. Other ground nesting animals suffered similar declines during the same timeframe (e.g., northern bobwhite quail, thirteen-lined ground squirrel, six-lined racerunner [*Cnemidophorus sexlineatus sexlineatus*]). Extreme weather conditions (drought followed by excessive wet conditions) may have contributed to the decline of these and other species that were trying to survive in an ecosystem marred by invasive plants and animals, most noteworthy, the red imported fire ant.

Invasive Species

The impacts of RIFA in the State of Texas is estimated to be $1.2 billion annually. RIFA are pests of urban, agricultural, and wildlife areas and can pose a serious health threat to plants and animals (Texas Imported Fire Ant Research and Management Project - Texas A&M Extension Services). Originally from South America, RIFAs began to appear on the Texas coastal prairie landscape during the mid-1970s (Allen et al. 1995). The disruptive impacts of RIFA on native insect communities are well documented. Refuge personnel have concerns that invasive

red imported fire ants have negatively affected native prairie invertebrates. Studies have also documented negative impacts on a diverse group of bird species, including loggerhead shrikes, northern bobwhites, and colonial waterbirds (Allen et al. 2004, Allen et al. 2001). It is hypothesized that RIFA have decimated insect populations to the point of negatively affecting APC brood survival. APC chicks are primarily insectivorous during the first weeks of life. Further research needs to be conducted to confirm this hypothesis.

Unfortunately, another invasive ant species currently found in the Houston area also poses a major threat to APCs and other prairie wildlife. Rasberry crazy ants (*Paratrechina* sp. nr. *pubens*) are considered to be more aggressive than RIFA and have the potential to further destroy the prairie's biodiversity. Unfortunately, little is known about their biology. Masses of crazy ants affect ground and tree nesting birds and have the potential to cause domestic chickens to die of asphyxia due to ants obstructing the birds' nasal passages (Texas Parks and Wildlife Department 2010).

Some non-native mammals that use the Refuge include feral hogs and nutria. Feral hogs tend to "pass through" the Refuge using brush corridors along drainage ditches, Coushatta Creek, and/or the San Bernard River. An elevated feral hog population can adversely affect habitats and native animal populations by competing for food, transmitting disease, and damaging habitat through rooting. These tenacious animals also pose a potential threat to nesting Attwater's prairie-chickens. Their rooting of habitat opens the door for invasive plants to invade and negatively affect the environment (Spatz and Mueller-Dombois 1975).

Disease

Transmission of disease is another concern for prairie wildlife populations, especially the Attwater's prairie-chicken. APCs and northern bobwhite quail sampled during the late 1990s revealed that 14.8 percent and 5.7 percent, respectively, were serologically positive for *Pasteurella multocida* (causative agent for avian cholera) antibodies. Periodic outbreaks of avian cholera have occurred in wintering waterfowl in coastal Texas; however, how easily avian cholera can be transmitted from waterfowl to other species, including prairie-chickens, is not known.

Climate Change

The vulnerability of grassland birds is not as high as for birds in other habitat types; however, grassland birds are at risk for many reasons other than climate change. Sharp-tailed Grouse (*Tympanuchus phasianellus*) and lesser and greater prairie-chicken are less likely than other grassland birds to move in response to changing conditions because they are closely tied to their leks (North American Bird Conservation Initiative 2010). If climate change causes woody species to replace the grassland vegetation, dependent species will also begin to shift. Grassland species have different thresholds of tolerance for woody invasion; some, like loggerhead shrike and northern bobwhite quail, do best in mixed areas. Once grasslands are gone, the species will depart (North American Bird Conservation Initiative 2010). For APC, habitat requirements are relatively simple: they require grass and open space (U.S. Fish and Wildlife Service 2010). If woody species invasion increases due to climate change, the Refuge may have to increase its control mechanisms to meet habitat requirements for APC.

3.4 Socioeconomic Environment

This section describes the socioeconomic environment of the Refuge. It includes a discussion of nearby human populations and economies.

3.4.1 Population

The Refuge is located in Austin and Colorado counties within the Gulf Coast region, which consists of 13 counties: Austin, Brazoria, Chambers, Colorado, Fort Bend, Galveston, Harris, Liberty, Matagorda, Montgomery, Walker, Waller, and Wharton. Houston-Sugar

Land-Baytown metropolitan statistical area (MSA) is the nation's sixth-largest metro area and the second largest in Texas with an estimated population of 5,728,143 people in 2008 (Texas Comptroller of Public Accounts 2010). Only four of these counties (Colorado, Matagorda, Walker, and Wharton) are not in the Houston-Sugar Land-Baytown MSA. The entire State of Texas is projected to have a population above 28 million people by 2025. Figure 3-1 indicates the region's population increased by an estimated 20.8 percent between 2000 and 2008, led by strong growth in Fort Bend, Montgomery, and Brazoria counties (Texas Comptroller of Public Accounts 2010).

From 2007 to 2008, the Houston metro area experienced the nation's second-largest total population increase, adding 130,185 people (Texas Comptroller of Public Accounts 2010). Population change can be an indicator of economic vitality, the types of economic sectors that are likely to be strong, probable development and disturbance impacts on wildlife habitat, and trends in real estate markets.

Eagle Lake and Sealy, Texas, have populations of 3,679 and 5,248 respectively. Table 3-1 and 3-2 show the population projections for Austin and Colorado counties.

Figure 3-1. Population Growth from 2000-2008 listed by percentages.

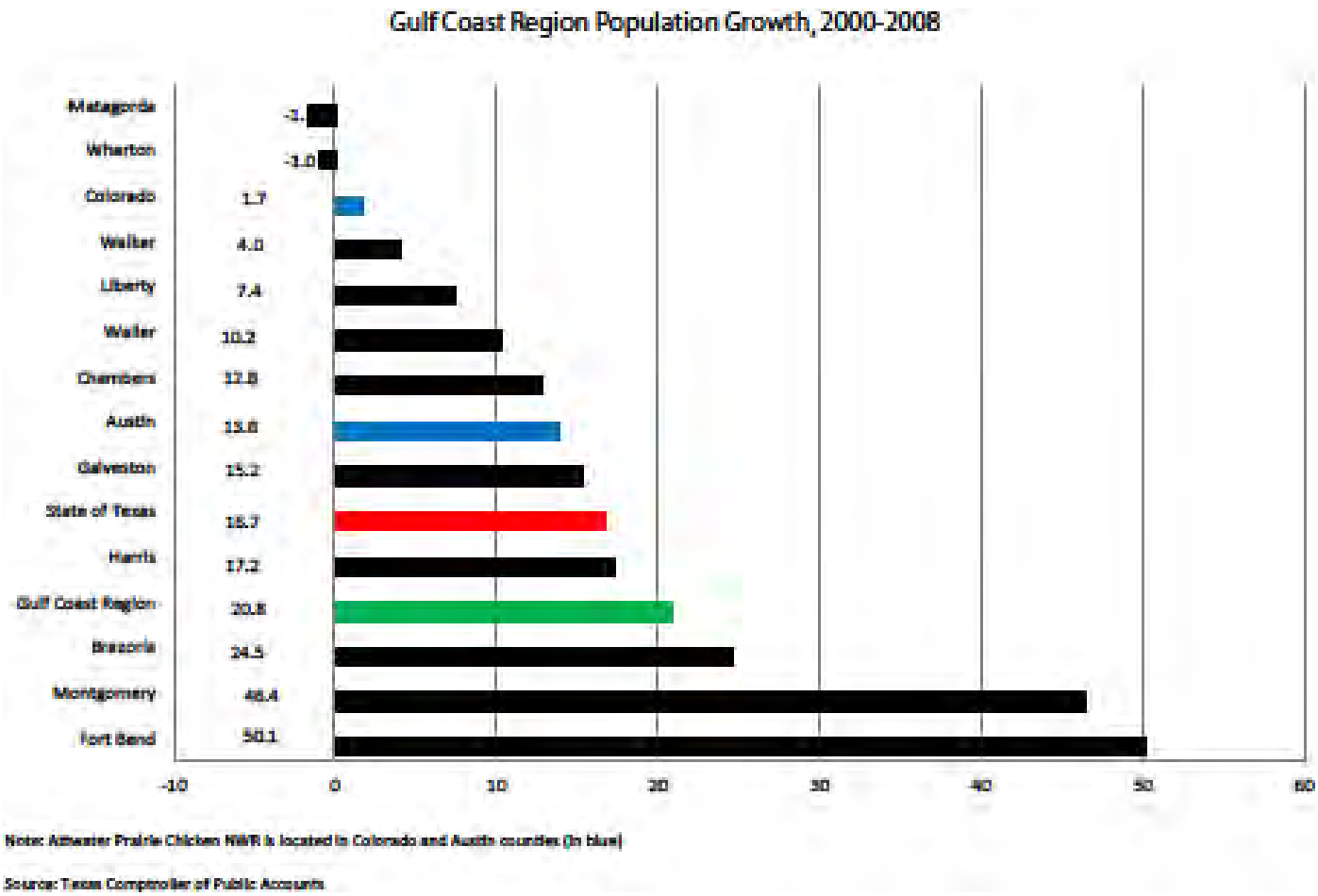


Table 3-1. Austin County Population 2000-2030

Year	Population
2000	23,590
2005	23,830
2010	27,248
2015	27,603
2020	28,962
2025	30,140
2030	31,106

Table 3-2. Colorado County Population 2000-2030

Year	Population
2000	20,390
2005	20,978
2010	21,696
2015	22,484
2020	23,113
2025	23,643
2030	24,062

Source: Texas Office of the State Demographer: http://idserportal.utsa.edu/sdc/projections/

3.4.2 Economy

3.4.2.1 Regional Economic Profile

The median income for all Texas households was $50,049 in 2008. The 10 counties of the Houston-Sugar Land-Baytown MSA had the highest median household incomes in the region, ranging from $38,244 to $83,968 (Texas Comptroller of Public Accounts 2010). Table 3-3 shows the median household incomes for Austin and Colorado counties.

Table 3-3. Household Income by County

County	Median Household Income, 2008
Austin	$49,721
Colorado	$39,441

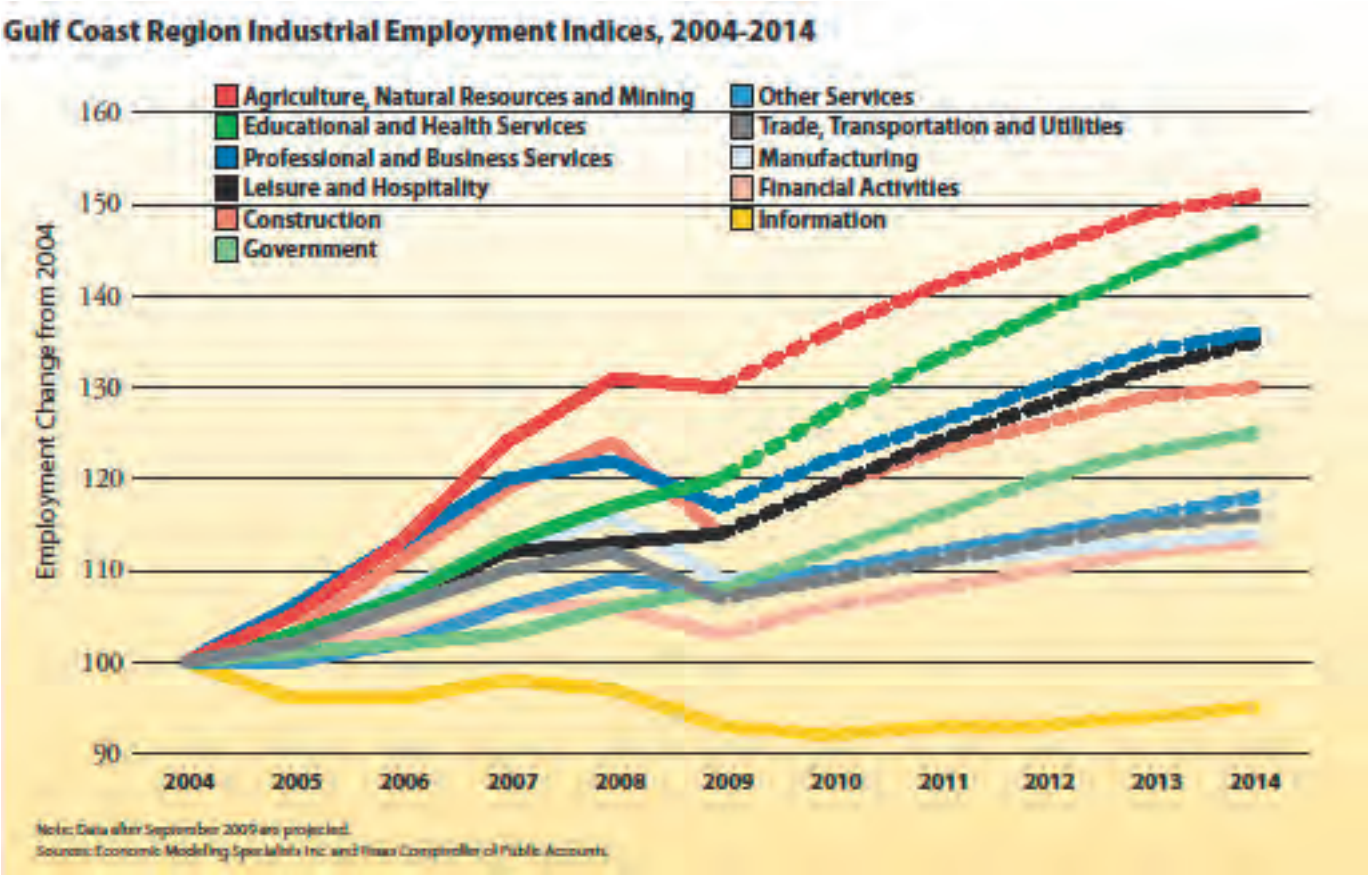
Source: Texas Comptroller of Public Accounts

The region's proximity to the Texas coast makes the area a center for commerce, industry, and recreation. Ship and rail transport facilities support such industries as petroleum refineries, metals fabrication, plastics, and chemical plants. These industries were originally attracted to the area because of available natural gas supplies, freshwater, distance from heavily populated areas, and the Gulf Intracoastal Waterway (GIWW). In 2009, Gulf Coast region employers provided 2.6 million jobs, representing nearly a quarter of the jobs in Texas (Texas Comptroller of Public Accounts 2010). Figure 3-2 provides a picture of projected employment trends in the region. A vast majority of growth is due to new jobs in oil and gas well drilling, oil and gas extraction, and support activities.

Agriculture is a prevalent industry in this region because of its proximity to the coast. In 2008, the Gulf Coast region produced crops, livestock and other agricultural goods worth $1.69 billion (Texas Comptroller of Public Accounts 2010). Rice crops in this region account for 79 percent of the total rice acreage in Texas. Colorado County is one of the State's top three rice producing counties (Texas Comptroller of Public Accounts 2010).

Another industry that has rapidly developed and is particularly important to the Refuge and the region's economy is nature tourism. Nature tourism is defined as "discretionary travel to natural areas that conserve the environmental and social and cultural values while generating an economic benefit to the local community" (State of Texas Tourism Tip Sheet, March 2004). Nature tourism includes such things as wildlife or bird watching, photography, nature study, hiking, boating, camping, biking, and visiting parks. Nature tourism also provides opportunities for communities to promote their cultural and ethnic diversity.

Figure 3-2. Gulf Coast Region Industrial Employment from 2004-2014.



Source: Texas State Comptroller of Public Accounts

3.4.2.2 Economic Significance of the Refuge

The socioeconomic impact of Attwater Prairie Chicken NWR consists primarily of the contributions it makes to local retail trade in the form of equipment rental and purchases, as well as in the purchase of services. The Refuge also contributes to the area's socioeconomic well-being through the salaries of its staff. Annual salaries totaling more than $531,000 are currently paid to Refuge employees, many of whom own homes and pay taxes in Austin or Colorado County.

The Refuge supports two economic uses. The Refuge administers a cooperative grazing program, which provides opportunities for local ranchers to graze cattle and bison on the Refuge. This program supports coastal prairie habitat management specifically for Attwater's prairie-chicken. Grazing is an important management tool used to maintain optimal habitat for APC. Additionally, the Refuge has a cooperative agreement for prairie seed harvesting on the Refuge. The Refuge keeps 15 percent of harvested seed for restoration on the Refuge, and the cooperator keeps the remaining seed.

Land acquired by the Service in fee title is removed from county tax rolls. To help pay for lost tax revenues, the county receives an annual payment in lieu of taxes, as provided by the Refuge Revenue Sharing Act of 1935 (16 U.S.C. 7145:49 Stat. 383, as amended). In 2010, Attwater Prairie Chicken NWR's payment to Colorado County was $11,130; Austin County's payment was $1,950.

In addition, the Refuge hosts the Attwater's Prairie-Chicken Festival every spring to provide an opportunity for visitors to view this critically

endangered grouse. Visitors come from all parts of the world to view these birds, thus providing an economic stimulus to local towns through the use of hotels, gas stations, and restaurants.

3.4.3 Concerns Regarding Socioeconomics

With nature tourism growing in Texas, one concern that Refuge personnel struggle with is the inability to provide adequate APC viewing opportunities to Refuge visitors on a consistent basis. With APC numbers so close to extinction, it is imperative that disturbance of the birds, especially during their breeding season, be tightly monitored and minimized as much as possible. However, Refuge personnel also realize the importance of creating a constituency that is supportive of Service, Refuge, and APC recovery efforts and programs. People tend to be more supportive of a cause when they can actually see and interact with the subject. Limited APC viewing opportunities limits opportunities to garner support for Refuge and APC recovery efforts.

3.5 Archeological, Cultural, and Historical Resources

The Texas Gulf Coast prairie was historically home to several Native American nations and early European settlers. This region is also significant for its history in the spread and development of early American ranchers, pioneers, and especially oil prospectors, known as wildcatters. When Álvar Núñez Cabeza de Vaca was shipwrecked along the Texas coast in 1528, he and three surviving shipmates became the first Spaniards to explore the territory that would become Texas (Chipman 2011). Cabeza de Vaca and his companions lived among the Native Americans for eight years before returning home to what is now Mexico. They took with them tales of cities of gold that caused great excitement. In 1540, Francisco Vásquez de Coronado set off with an army to find the fabled cities of gold. Coronado searched all the way to present day Kansas without ever finding the wealth described by Cabeza de Vaca.

Numerous historic sites such as homes, buildings, cemeteries, farmsteads, and settlements dot the region. The banks of many local rivers are considered to have good potential for archaeological sites, as indigenous cultures preferred to locate near sources of water. The Tonkawan, Coushatta, and Karankawa tribes were known to inhabit the coastal region before European settlement.

The following historical information was provided by the Texas State Historical Association's website:

> The Colorado County area has been the site of human habitation for some 12,000 years. Archaic-age hunters and gatherers lived in the county on deer, bison, roots, and nuts. Within the historic period, the Coco branch of the Karankawa tribe hunted through the area, and Tonkawa Indians ranged up into the area from the south. When La Salle's party camped on Skull Creek on January 20, 1687, the Frenchmen found an Indian village that they called the Hebemes. It is probable that the fourth expedition of Alonso De León crossed the county in search of Fort St. Louis in 1689. Martín de Alarcón traversed the area on his way to La Bahía del Espíritu Santo in 1718, and in 1766 and 1767 the Marqués de Rubí crossed the Colorado River near the site of present Columbus on his tour of inspection of East Texas. (Odintz 2011)
>
> The territory that is now Colorado County was settled by Anglo colonists, many of whom belonged to Stephen F. Austin's Old Three Hundred, beginning in 1821. In August of 1823, the Baron de Bastrop, Rawson Alley, Austin, and a party of slaves surveyed 170 acres above the Atascosito Crossing on the Colorado. The site was to be the capital of Colorado

Municipality and the headquarters of the whole Austin colony, but the location was later abandoned in favor of San Felipe de Austin. The frequency of Indian raids in the area and the fact that more colonists were located on the Brazos River than on the Colorado River probably caused the change in plans. (Odintz 2011)

San Felipe de Austin, located in Austin County, was founded in 1824 by Stephen F. Austin as the unofficial capital of his colony. By 1828, the community comprised a population of about 200, three general stores, two taverns, a hotel, a blacksmith shop, and some forty or fifty log cabins. The town, generally called simply San Felipe, was the unquestioned social, economic, and political center of the Austin colony. Regular mail service in the colony was inaugurated in 1826 when Samuel May Williams was appointed postmaster in San Felipe; with seven separate postal routes converging here, the town remained the hub of the Texas postal service until the Texas Revolution. (Jackson 2011)

By the eve of the Texas revolution, San Felipe ranked second in Texas only to San Antonio as a commercial center. Its population in 1835 approached 600, and many more settlers resided nearby within the boundaries of the municipality. The conventions of 1832 and 1833 were held in the town, and as the site of the Consultation of November 3, 1835, San Felipe served as the capital of the provisional government until the Convention of 1836 met the following March at Washington-on-the-Brazos. (Jackson 2011)

After the fall of the Alamo, Gen. Sam Houston‘s army retreated through San Felipe. On March 30, 1836, the small garrison under Moseley Baker remaining at San Felipe to defend the Brazos crossing ordered the town evacuated and then burned it to the ground to keep it from falling into the hands of the advancing Mexican army. The terrified residents hastily gathered what few belongings they could carry before fleeing eastward during the incident known as the Runaway Scrape. By May 1836, as news of the Texans’ victory at the battle of San Jacinto spread, San Felipeans began to return, and a semblance of community life was soon restored near the original townsite. Yet many families never returned, and the government of the republic was unable to resume operation in the town for want of the necessary buildings. San Felipe was incorporated in 1837 and became county seat of the newly established Austin County. Though a courthouse was constructed, the town never recovered its former stature. By the mid-1840s the only other buildings in the settlement were six or seven log houses and a tavern. In 1846, a county election made the new community of Bellville the county seat; the removal of administrative functions from San Felipe was completed in January 1848. (Jackson 2011)

In the early 1880s Sealy, four miles to the west of San Felipe, developed rapidly as a station of the new rail line, and many residents and businesses moved from San Felipe to the new commercial center. A post office was established in the community, which was named in honor of George Sealy, a director of the Gulf, Colorado and Santa Fe railroads. The Missouri, Kansas and Texas railroads extended a spur through the town in 1895, and the Cane Belt Railroad completed a third road six years later. Around 1900, the town experienced a series of misfortunes, including a disastrous Brazos River flood in 1899, the relocation of the Gulf, Colorado and Santa Fe division headquarters to

Bellville in January of the next year, and the devastating hurricane of 1900, which struck in September. The establishment of such manufacturing enterprises as the Sealy Mattress Factory, the Engleking Brothers Broom Factory, and the Sealy National Bank helped to build the commercial reputation of the growing community. (Jackson 2011)

The rails reached the town of Eagle Lake in 1859. Later the Southern Pacific, the Cane Belt, the San Antonio and Aransas Pass, and the Santa Fe railroads all made Eagle Lake accessible for shipment of crops and, later, of gravel. In 1888, the town was incorporated, and Capt. J. W. McCarty was elected the first mayor. (Harrison 2011)
After the Civil War, Capt. William Dunovant started raising sugarcane and built a sugar mill at Lakeside, on the eastern shore of the lake. In 1913 the mill was sold and moved to Jamaica. Dunovant also introduced the cultivation of rice irrigated by lake water in 1896. John Linderholm of Chesterville expanded the rice industry, irrigated by wells, to the prairie north of Eagle Lake. The city's name was probably given in 1821 by two of Austin's scouts, when one of them killed an eagle on the lake. (Harrison 2011)

Hay planting. CREDIT: USFWS

3.6 Current Management

3.6.1 Administration

3.6.1.1 Staffing

In fiscal year 2011, Attwater Prairie Chicken NWR had a staff consisting of eight permanent full-time employees. The Refuge also hires 4–6 interns, and 3–4 individuals volunteer their time to conduct work each year (Chapter 5, Table 5-1 identifies existing Refuge staff). The annual operations and maintenance budget was $1,174,394 in 2010.

Volunteer Program

The volunteer program is a vital part of daily Refuge operations. Volunteers accomplish numerous work projects within all aspects of Refuge management, including biological, maintenance, and administrative tasks. Both resident and local commuting volunteers contribute thousands of hours of labor each year to support Refuge programs.

Youth Conservation Corps Program

The Youth Conservation Corps (YCC) is a well-balanced work/learn program for high school students during the summer months that helps youth develop an understanding and appreciation of the environment.

YCC crews work on multiple projects throughout the Refuge, including construction and/or take-down of APC acclimation pens, litter clean-up, invasive plant removal, and fence maintenance.

YCC crew picking up nest fence. CREDIT: USFWS

Student Conservation Association

The Student Conservation Association (SCA) is a non-profit organization that has been recruiting, training, and fielding volunteers to assist land and resource managers since 1957. Volunteer interns are provided a small stipend and living quarters on the Refuge. In return, interns receive valuable on-the-job experience.

Interns serve for one-year, three-month, and six-month terms. Major duties consist of tracking APCs with telemetry equipment, assisting with invasive species management and research, assisting with prescribed burns (after receiving the necessary training and meeting the necessary qualifications), and helping with general biological tasks.

Friends Program

Refuge Friends groups are private, non-profit organizations that partner with their respective Refuge to advocate for Refuge program needs. The Friends of Attwater Prairie Chicken Refuge was organized in 2011. This newly established support group will contribute to Refuge and APC recovery advocacy, outreach, environmental education, and interpretive programs.

3.6.1.2 Administrative Facilities

Infrastructure

The current administrative complex at APCNWR consists of three modular buildings (connected by a breezeway) comprising the Refuge headquarters and Visitor Contact Station; shop and maintenance buildings; and two residences (a house and a mobile home) (Table 3-4). A small travel trailer is also used by researchers and temporary volunteers. A large barn located in the southern end of the Renz Tract is used to store acclimation pen materials and other necessary APC recovery supplies. The administrative complex is served by two water wells. Each group of buildings is served by a separate septic system.

Roads

The Refuge maintains approximately 37 miles of Service roads used by Refuge staff and volunteers. The more commonly used service roads are generally graded 3–4 times a year by Refuge maintenance staff.

Utilities and Rights-of-Way

A number of utilities and rights-of-way exist within the Refuge for other entities to maintain irrigation delivery systems, oil and gas operations, and electrical utilities. There is an underground electrical line for San Bernard Electric Coop. There is an overhead electrical line running from FM3013 to the Enterprise Pipeline Company inholding on the Refuge. The entrance road to the Refuge is owned by Colorado County and has a half-mile overhead powerline along the entrance road owned by Centerpoint/Reliant. The Lakeside Irrigation Company (now owned by LCRA) holds easements for ditches, canals, and rights-of-way within the Refuge. There are four oil and gas pipelines on the southern end of the Refuge with associated rights-of-way.

Table 3-4. Refuge Facilities

Refuge Building	Description
Headquarters and Visitor Contact Station	3 buildings, modular
Shop	Includes wood shop, metal shop, vehicle lift, office space, herbicide storage, shop water well
Large Equipment Storage Building	Heavy equipment storage
Butler Building	Storage for recyclables, biological supplies
Equipment Storage Shed	Store equipment and vehicles
Residence	Houses SCA interns, 3 bedrooms, residence water well
Mobile Home	Houses SCA interns, 3 bedrooms
Unleaded/Diesel Tanks	1,000 gallons each
Travel Trailer	Used by researchers, temporary volunteers
Oil/Paint Shed	Store paints, oils, etc.
Radio Tower Building and antenna	Houses two-way radio components
Renz Storage Barn	Store APC recovery supplies

3.6.1.3 Oil and Gas Operations and Management

Oil and gas exploration and production is prevalent in the area. On APCNWR, eight active oil and/or gas wells (owned by JAMEX, Inc.) and four active pipelines are operating on the southernmost 1,250 acres of the Refuge near FM 3013 (Anderson, Becker, Cranz Units). In addition, there is an eight-acre private inholding in this area where a headquarters facility for Enterprise Pipeline Company is located. The Refuge also has five wells that have been either abandoned or are outdated. Well pads range in size from less than one acre to about 1.5 acres.

Although the Refuge does not own mineral rights and cannot deny access for oil and gas development, various laws, regulations, and administrative procedures must be adhered to before access is granted. Refuge personnel work closely with those companies who oversee oil and gas development and have a good working relationship with the operators and their employees. Refuge staff works with each operator to carefully consider and mitigate affects of oil and gas operations on wildlife or Refuge visitors. The potential for future oil/gas exploration and production on the Refuge is possible depending on economic stability of the industry.

3.6.1.4 Partnerships

The staff of APCNWR has a strong history of working with partners to implement Service policy, projects, and the APC Recovery Program.

Attwater's prairie-chicken Recovery Partners

- Sam Houston Resource and Conservation District
- Grazing Lands Conservation Initiative
- National Aeronautics and Space Administration (NASA)
- Tom Waddell Outdoor Nature Club
- Private Landowners (20+)
- Texas AgriLife Extension Service
- Texas A&M University
- Mazuri Feed
- Society of Tympanuchus Cupido Pinnatus
- Sutton Avian Research Center
- Texas Parks and Wildlife Department
- Natural Resources Conservation Service
- Central Life Sciences
- University of North Texas

- APC Captive breeding facilities (6)
  - Abilene Zoo
  - Caldwell Zoo
  - Fossil Rim Wildlife Center
  - Houston Zoo
  - San Antonio Zoo
  - Sea World of Texas
- National Fish and Wildlife Foundation
- American Zoological Association
- The Nature Conservancy
- Student Conservation Association

3.6.1.5 Memorandums of Understanding and Other Agreements

Attwater Prairie Chicken NWR has a Memorandum of Understanding (MOU) between Balcones Canyonlands NWR and the Sealy Volunteer Fire Department "...for the mutual aid assistance during the suppression of wildfires and the need for mutual aid during other emergency situations..." (effective July 2009–June 2014).

APCNWR has a MOU between Balcones Canyonlands NWR and the Eagle Lake Volunteer Fire Department "...for the mutual aid assistance during the suppression of wildfires and the need for mutual aid during other emergency situations..." (effective July 2009–June 2014).

APCNWR has a challenge cost-share agreement with Houston Zoo, Inc. (June 2010–September 2015), Earth Promise (dba Fossil Rim Wildlife Center) (June 2010–September 2015), San Antonio Zoological Gardens and Aquarium (August 2009–September 2014), and Abilene Zoo (June 2011–September 2016) [4 separate agreements] "...to successfully breed and raise endangered Attwater's prairie chickens..."

APCNWR has a cooperative agreement with Texas AgriLife Research (September 2009–September 2012) "...to determine the impacts of the red imported fire ant (*Solenopsis invicta*) on insect populations at the Attwater Prairie Chicken National Wildlife Refuge…"

APCNWR has a grant agreement with the University of North Texas (September 2009–September 2012) "...to determine the taxonomic distinctiveness of the critically endangered Attwater's prairie chicken (*Tympanuchus cupido attwateri)* to other *Tympanuchus* grouse..."

The Service has a five-year cooperative agreement with the Student Conservation Association to provide the Service with conservation interns, conservation intern teams, high school conservation crews, and high school crew leaders.

3.6.1.6 Law Enforcement and Resource Protection

Refuge staff recognizes the obligation that has been entrusted to them—the care of valuable natural and cultural resources—and they take this responsibility very seriously.

Law enforcement on the Refuge is used both for protection and for prevention. Used for prevention, law enforcement safeguards the visiting public, staff, facilities, and natural and cultural resources from criminal action, accidents, vandalism, and negligence. Law enforcement inhibits incidents from occurring by providing a law enforcement presence. Currently, a zone law enforcement officer provides law enforcement on the Refuge.

3.6.1.7 Safety

Safety is important for both Refuge staff and visitors. Monthly staff safety meetings are held at the Refuge headquarters, and there are occasional videos and discussions at staff meetings. The intent of the safety meetings is to update and train personnel, as well as to resolve any safety concerns that arise. Sample topics include heavy equipment safety, hazardous materials, first aid, and heat stress.

The Refuge has a Safety Plan, which is updated annually, that describes the safety program and the responsibilities of the Refuge staff and volunteers.

3.6.2 Habitat Management

Prairie Restoration

The Refuge uses cleaned, de-bearded native prairie seed and hay bales with native grass seed to restore cultivated areas. Seeds are harvested on Refuge lands through an agreement with a seed contractor. The seed harvest generally occurs during a three- to four-week period, beginning in early November. Modified combines are used to cut seed off the top of grassheads as high off the ground as possible (generally no lower than 10 inches). The Refuge also harvests hay containing grass seed during this period in cooperation with grazing tenants or local farmers. The availability of seed is often limited, as weather conditions highly affect seed production and harvest operations. Field preparation includes removal of levees and other hydrological hindrances before planting. During some years, harvest is not attempted because conditions are too wet and some years' harvest activities are carried out for the entire 3–4 week period.

Grazing Management

Grazing is one of the major habitat management tools used on the Refuge to achieve optimum habitat for Attwater's prairie-chickens (USFWS 2010). If grazing were not used, the accumulation of dense litter would make habitat conditions unsuitable for APCs.

Up to 450 cattle are grazed in designated areas on approximately 7,062 acres of the Refuge in Colorado County. A year-long cow-calf operation is used to achieve APC habitat management objectives. Pastures are stocked at light to moderate levels based on recommendations published in the U.S. Natural Resources Conservation Service ecological site descriptions for the area and principles of adaptive management. Responses of vegetation are monitored and stocking rates evaluated by the Refuge biologist on a constant basis. Livestock are deferred as necessary to meet management objectives. Current stocking rates range from 9–40 acres/animal unit-year (AUY) and average 18.2 acres/AUY. Up to 40 American bison graze on the 763-acre Lafitte Unit located within the auto tour route near the Refuge headquarters.

Native grass seed planting. CREDIT: USFWS

Mowing

High-top mowing of prairie habitat has been used in the past at APCNWR. Although, this management tool has not been used in recent years, it may be used in the future during wet years when vegetation becomes extremely thick. Mowing opens thick grass stands to provide more optimum habitat structure for APCs (USFWS 2010).

Fire Management

Prescribed burning plays an integral role in the Refuge's grassland management. It eliminates litter accumulation, suppresses brush encroachment, and creates a greater diversity of habitats (USFWS 2010).

The Refuge burns 2,000–3,000 acres (approximately 25 percent of the Refuge) annually, mainly during the winter months of December-January and no later than March 1. Summer burning occurs after July 4th when necessary to meet management objectives. The Refuge integrates grazing and prescribed fire using patch burning (Fuhlendorf and Engle 2001, Bidwell et al. 2003, Fuhlendorf et al. 2006). The premise of patch burning with regard to prairie management is that the interaction of burning and grazing creates a diversity of habitat pattern, structure, and plant composition that meet the

life requisites of prairie-chickens and other grassland species (Bidwell et al. 2003). As applied on this Refuge, pastures have been divided into 4–16 patches, with 25 percent burned each year on a 4-year rotation. Continuous grazing within pastures results in preferential selection of more recent burns for grazing and avoidance of older burns. This fire-grazing interaction has led to the patch burning system also referred to as rotational grazing without fences (Bidwell et al. 2003).

Invasive Species Management (Flora)

Preventing the introduction and spread of invasive species is an ongoing and serious threat to native grasslands. The Refuge concentrates its efforts on controlling Macartney rose, deep-rooted sedge, Chinese tallow, and other invasive species on a case-by-case basis to preserve the integrity of the coastal prairie ecosystem through implementation of integrated pest management practices. Prescribed fire and chemical treatments are the primary tools used to implement this management direction; mechanical treatments are used on a limited basis. Prescribed fire is the preferred technique for dealing with invasion of woody species. However, in situations where woody species become too large to be effectively controlled by fire, or in areas where fuels are not conducive to achieving brush management objectives (e.g., areas that are wet during burn season, areas where brush canopy prevents build-up of fine fuels, etc.), mechanical or chemical treatments are necessary. Chemical treatment is used on an average 500–600 acres annually. All chemicals used to treat invasive species are approved through the Pesticide Use Proposal process prior to application. Macartney rose treatment (combination of prescribed fire and approved herbicides) in a particular area is necessary every 3–4 years. Chinese tallow is treated mostly by cut stump/spray method. Herbicides are used for deep-rooted sedge control. The Refuge occasionally uses aerial spraying to control invasives. Treatment is focused on problem areas. Timing of management actions is dependent on the species being treated and efforts to limit disturbance to protected species.

Using fire to control invasive species. CREDIT: USFWS

Wildlife Food Plot Management

The Refuge provides three wildlife food plots for use by APCs. The units (Renz, Corman, and Krueger Exclosure) are managed by Refuge staff and total approximately 150 acres (Map 3-4). The Refuge attempts to plant as much of the 150 acres as possible, but conditions are not always favorable. On average, 85 acres are planted annually to provide additional nutrition for APC during the winter months. Other wildlife also use these food plots. The Refuge plants milo, soybeans, sunflowers, and millet. Preparation of food plots begins during mid- to late February and includes plowing and disking, bedding rows, and planting. The process may take anywhere from one to three months depending on weather conditions. Rainy conditions can slow down the process because heavy equipment cannot be used on wet soils. Currently, wildlife food plots are not irrigated. Herbicides, pesticides, and genetically modified crops are not used for management of these food plots. Fertilizer is applied based on soil testing, the type of crop, and available funding. Invasive species control does not take place in Refuge food plots because invasive species have not been an issue in these areas to date.

APC chick. CREDIT: USFWS

3.6.3 Wildlife Management

Attwater's Prairie-Chicken Recovery Program

APCNWR was designated the lead for Attwater's prairie-chicken recovery in 1988. Since then, recovery of this imperiled species has gone well beyond the Refuge's boundaries. Three major strategies have been identified for APC recovery: 1) habitat management, 2) population management, and 3) public outreach.

Most day-to-day Refuge activities focus on APC recovery in some way. As one of the largest contiguous examples of coastal prairie habitat remaining in southeast Texas and home to one of three APC populations, it is imperative that this Refuge's prairie habitat be actively managed (through prescribed burning, grazing, controlling invasive species, etc.) to optimize and attain APC recovery goals set forth in the 2010 APC Recovery Plan (USFWS 2010).

Overseeing the APC captive breeding program at six different facilities and being directly involved with annual releases of captive-bred birds at multiple release sites throughout the State requires substantial resources provided by APCNWR and Refuge personnel. In addition, APCNWR serves as a consistent site to research and determine limiting factors affecting APC populations.

For a more detailed discussion about APC recovery, including the 2010 Attwater's Prairie-Chicken Recovery Plan, Second Revision, please refer to the endangered species database found at: http://www.fws.gov/endangered/ and search for Attwater's prairie-chicken in the species search field. This website provides information on all listed species.

Opossum. CREDIT: Noppadol Paothong

Predator Management

Predation is a major factor contributing to APC mortality. While predator management is not a cure-all for the problems affecting the APC, it is a valuable tool that is critical to its recovery.

The Refuge controls small mammal populations prior to and during the APC nesting season. Target species on the Refuge include but are not limited to striped skunks, opossums, raccoons, and feral dogs and cats. Coyotes and bobcats are only removed if individuals become a nuisance. All of these are documented predators of prairie-chicken nests, young, or adults (Lehmann 1941, Jurries 1979, Morrow 1986, Attwater Prairie Chicken NWR

unpubl. data). Means of control include trapping and shooting (lethal predator removal) through a partnership with U.S. Department of Agriculture (USDA) Wildlife Services.

The Refuge also places predator deterrent fences around APC nests and perch deterrents on fence posts throughout the Refuge, focused mostly in the APC core use area.

Invasive Species Management (Fauna)

Management of non-native invasive species is focused on three species: feral hogs, nutria, and red imported fire ants. Feral hogs are removed based on sightings and/or documented damage. Nutria are removed as they become relatively abundant. RIFA have been documented to negatively affect newly hatched APCs, chicks, and adult APCs. The Refuge treats areas around APC nest sites with approved fire ant pesticides. Research investigating RIFA impacts on insect communities used by APC broods for food is currently being conducted on the Refuge and at other locations within the APC's historic range.

Refuge entrance sign. CREDIT: USFWS

3.6.4 Visitor Services and Infrastructure

The National Wildlife Refuge System Improvement Act of 1997 recognizes six wildlife-dependent public uses (hunting, fishing, wildlife observation, photography, environmental education, and interpretation) that are to be given priority on refuges when determined to be compatible. Except where otherwise mandated by law, the Service must determine whether a particular use is compatible with refuge resources before permitting it (See Appendix D). The Refuge offers four of the six wildlife-dependent public uses: wildlife observation, wildlife photography, environmental education, and interpretation. The Refuge provides public use opportunities consistent with a national wildlife refuge of its size and staffing level. About 4,000 people visit the Refuge annually. More than a fourth of the visitors come during the spring season (March–April) to view prairie-chickens and enjoy the coastal prairie habitat when a variety of flowering plants are blooming.

3.6.4.1 Wildlife-Dependent Recreation Opportunities

Wildlife Observation and Wildlife Photography

Refuge visitors enjoy observing grassland bird species, wintering waterfowl, and American bison from the auto tour route or walking trails. During the spring months, the Refuge is transformed into a palette of colors as flowering plants bloom, providing visitors with extraordinary photo opportunities. Waterfowl watching can be exciting from the auto tour route in the fall and winter. Spectacular sunrises and sunsets grace the prairie throughout the year. The auto tour route is open daily from sunrise to sunset.

With APC numbers so close to extinction, it is imperative that disturbance of the birds, especially during their breeding season, be tightly monitored and minimized as much as possible. However, Refuge personnel also realize the importance of creating a constituency that is supportive of Service, Refuge, and APC recovery efforts and programs. People tend to be more supportive of a cause when they can actually see and interact with the subject.

Environmental Education

Due to limited staff, the Refuge does not currently have a formal environmental education

(EE) program. The Refuge does provide EE when requested.

School group tours, youth groups, and youth scouting programs are an essential part of ongoing environmental education efforts at Attwater Prairie NWR. Refuge personnel give a variety of talks, presentations, and demonstrations throughout the year to local civic organizations, school groups, and other interested organizations.

APC Festival tours. CREDIT: USFWS

Interpretation

The Refuge holds an annual Attwater's Prairie-Chicken Festival every second weekend in April. This is a two-day event that offers a number of tours. These tours allow visitors to experience the beauty of the Refuge, including a tour to view the courtship dance of the Attwater's prairie-chicken, a tour of virgin coastal prairie habitat, and an opportunity to get up close to native grasses and flowering plants. There are also several interpretive panels at the Sycamore Trail Kiosk. These panels describe the life history of the APC, why the species is on the brink of extinction, and what is being done to help this species recover. The Visitor Contact Station provides visitors the opportunity to sharpen their birding skills by viewing over 100 taxidermy bird mounts. The Visitor Contact Station also provides a wildflower identification guide and a video about the endangered Attwater's prairie-chicken.

3.6.4.2 Public Use Areas

A portion of the Refuge is open to public use as depicted in Map 3-5, Refuge Facilities Map.

3.6.4.3 Public Use Access

Roads and Trails

The Refuge's entrance road off of FM 3013 is a poorly maintained county road that leads to the Refuge auto tour route. This road serves as the only way in and out of the Refuge for visitors. During inclement weather, the condition of the gravel auto tour route is poor and is often closed to prevent damage to the road and for visitor safety.

Two hiking trails, Pipit Trail and Sycamore Trail, traverse the prairie and provide a glimpse of riparian areas. The auto tour route loop can also serve as a hiking trail. Pipit Trail is 1.5 miles long and Sycamore Trail is 1 mile. Access to the San Bernard River is only by foot through the Sycamore Trail.

3.6.4.4 Public Use Facilities

The Refuge offers a five-mile auto tour route that provides visitors the opportunity to view and photograph wildlife, including a small herd of American bison. Two hiking trails (Pipit and Sycamore) also provide visitors with opportunities to experience coastal prairie and riparian habitat more closely. A Visitor Contact Station with interpretive panels about the coastal prairie ecosystem, APC videos, and more than 100 avian mounts further help to explain the values of prairie wildlife and habitat. Two interpretive kiosks, located at either end of the Sycamore Trail, provide visitors with information about the Service, APCNWR, APC recovery strategies, and habitat management techniques used on the Refuge. In addition, the booming sounds of the APC can be heard at one of these interpretive kiosks. Refer to Map 3-5 for Public Use Facilities. There are no public use facilities located in east portion of the Refuge located in Austin County.

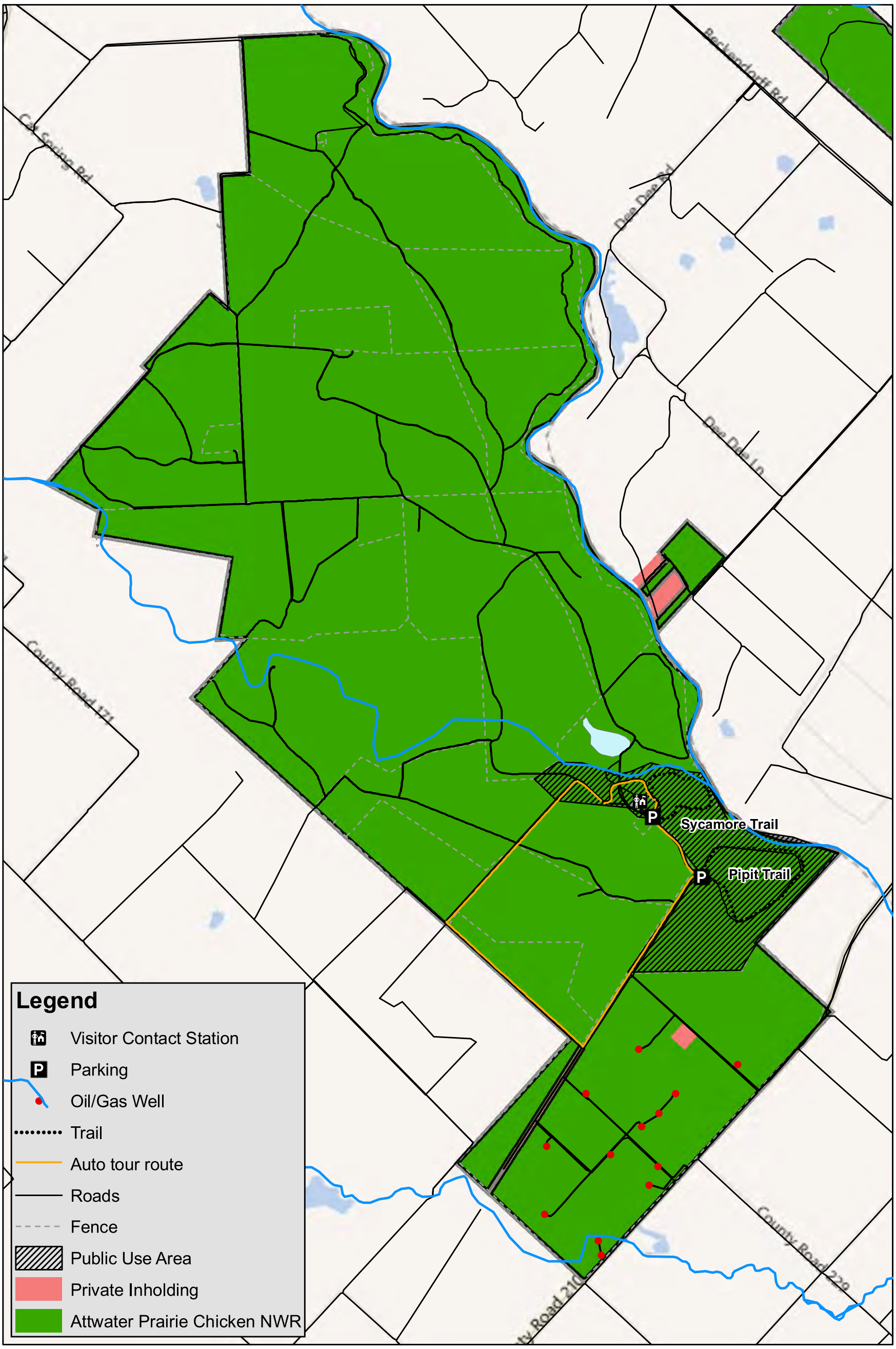
[This page intentionally left blank.]

U.S. Fish & Wildlife Service

Attwater Prairie Chicken National Wildlife Refuge

Austin/Colorado County, Texas

Map 3-5. Refuge Facilities Map



PRODUCED IN THE DIVISION OF REFUGE PLANNING
ALBUQUERQUE, NEW MEXICO
LAND STATUS CURRENT TO: 5/31/09
MAP DATE: March 2012
BASEMAP: N/A
MERIDIAN: N/A
FILE: atw_facilities_west_3_21_12sk

0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

UTM ZONE 14
NAD 83

[This page intentionally left blank.]

3.6.5 Special Management Areas

This section identifies special management areas designated within Attwater Prairie Chicken National Wildlife Refuge. In addition to Refuge status, the "special" status of lands within individual refuges may be recognized by additional designations (i.e., legislative or administrative). Special designations may also occur through the actions of other agencies or organizations. The influence that special designations may have on the management of lands and waters within refuges may vary considerably.

3.6.5.1 Wilderness Areas

The 1964 Wilderness Act recognized wilderness as a resource in and of itself and also established a mechanism for preserving that resource in a national system of lands and waters. The definition of wilderness found in the act provides a framework for identifying and describing wilderness values. According to the act, the fundamental qualities of wilderness are: undeveloped, untrammeled, natural, and outstanding opportunities for solitude, or a primitive and unconfined type of recreation. In addition, the act states that wilderness "may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value."

There are no designated wilderness areas on Attwater Prairie Chicken NWR.

Refuge planning policy 610 FW 4 requires a Wilderness Review as part of the comprehensive conservation planning process. After completing the inventory phase of the Wilderness Review, the team determined that Attwater Prairie Chicken NWR does not have any inventory units that meet the minimum criteria for a Wilderness Study Area. Therefore, the team does not recommend any land areas as designated Wilderness. The Refuge's Wilderness Review is provided in Appendix E.

3.6.5.2 Research Natural Areas

Research Natural Areas (RNAs) on National Wildlife Refuges are part of a national network of research areas under various ownerships. RNAs are areas where natural processes are allowed to dominate without human intervention. However, under certain circumstances, deliberate manipulation is used to maintain unique features that the RNA was established to protect.

The Service administers 210 RNAs on refuges nationwide comprising a total of 1,955,762 acres. The Service's Southwest Region administers 27 RNAs totaling 59,940 acres on 14 national wildlife refuges.

Attwater Prairie Chicken NWR does not administer any RNAs at this time.

Dickcissel. CREDIT: USFWS

3.6.5.3 Other Special Management Areas

National Natural Landmarks Program

The National Natural Landmarks Program recognizes and encourages the conservation of outstanding examples of our country's natural history. It is the only natural areas program of national scope that identifies and recognizes the best examples of biological and geological features in both public and private ownership. National Natural Landmarks (NNLs) are designated by the Secretary of the Interior, with the owner's concurrence. To date, fewer than 600 sites have been designated. The National Park Service administers the NNL Program and, if requested, assists NNL owners and managers with the conservation of these important sites. The Attwater Prairie-Chicken Preserve is a NNL located within the Attwater Prairie Chicken NWR (totaling approximately 3,500 acres). This area contains a significant segment of gulf coastal prairie.

Globally Important Bird Area

The Refuge was also designated a Globally Important Bird Area by the American Bird Conservancy during the late 1990s.

Photo of Designation. CREDIT: USFWS

3.6.5.4 Concerns Regarding Special Management Areas

The introduction of exotic invasive plants and animals has affected the Refuge's National Natural Landmark acreage. Most notable of these invasive species include Macartney rose, deep-rooted sedge, Chinese tallow, feral hogs, and red imported fire ants. Unfortunately, total eradication of most of these may be cost prohibitive and time consuming. Ongoing control and containment is often the mode of operation to combat these exotic species.

Increased urbanization surrounding the Refuge has the potential to dramatically reduce or inhibit Refuge habitat management activities that occur on the NNL area such as prescribed burning. As more homes surround the Refuge, prescribed burning, used to attain and maintain high quality prairie habitat, becomes more expensive and more difficult to conduct safely. As a result, the quality and quantity of coastal prairie habitat degrades further, adding to the loss of this unique habitat.

3.6.6 Land Protection and Acquisition

In an effort to provide additional protected coastal prairie habitat for the Attwater's prairie-chicken and other prairie-dependent species, a land-protection and acquisition program involving willing sellers only was initiated in 1998. The Service published a Final Land Protection Compliance Document and Conceptual Management Plan in September 1998. This document proposed to acquire an additional 22,000 acres to grow the Refuge to 30,000 acres to provide an area of coastal prairie habitat large enough to maintain a viable, self-sustaining APC population by fee title and conservation easement. Since 1998, more than 2,500 acres have been added to the Refuge. To date, the Refuge has acquired 10,541 acres (Map 1-2).

3.6.7 Cultural Resource Management

Cultural resources (archaeological sites, historic structures, and Native American traditional cultural properties) are important parts of the nation's heritage.

The Service strives to preserve evidence of these human occupations, which can provide valuable information regarding not only human interactions with each other, but also with the natural environment. Protection of cultural resources is accomplished in conjunction with the Service's mandate to protect fish, wildlife, and plant resources.

The Service is charged with the responsibility, under Section 106 of the National Historic Preservation Act of 1966 (NHPA), of identifying historic properties (cultural resources that are potentially eligible for listing on the National Register of Historic Places) that may be affected by our actions.

The Service is also required to coordinate these actions with the State Historic Preservation Office, Native American tribal governments, local governments, and other interested parties. Cultural resource management in the Service is the responsibility of the Regional Director and is not delegated for the Section 106 process when historic properties could be affected by Service undertakings, for issuing archaeological permits, and for Indian tribal involvement.

The Archaeological Resources Protection Act of 1979 (ARPA) Section 14 requires plans to survey lands and a schedule for surveying lands with "the most scientifically valuable archaeological resources." This act also affords protection to all archeological and historic sites more than 100 years old (not just sites meeting the criteria for the National Register) on Federal land and requires archeological investigations on Federal land be performed in the public interest by qualified persons.

The Regional Historic Preservation Officer (RHPO) advises the Regional Director about procedures, compliance, and implementation of these and other cultural resource laws. The actual determinations relating to cultural resources are to be made by the RHPO for undertakings on Service fee title lands and for undertakings funded in whole or in part under the direct or indirect jurisdiction of the Service, including those carried out by or on behalf of the Service; those carried out with Federal financial assistance; and those requiring a Federal permit, license, or approval.

The responsibility of the Refuge Manager is to identify undertakings that could affect cultural resources and coordinate the subsequent review process as early as possible with the RHPO and State, tribal, and local officials. Also, the Refuge Manager assists the RHPO by protecting archeological sites and historic properties on Service managed and administered lands, by monitoring archaeological investigations by contractors and permittees, and by reporting ARPA violations.

[This page intentionally left blank.]