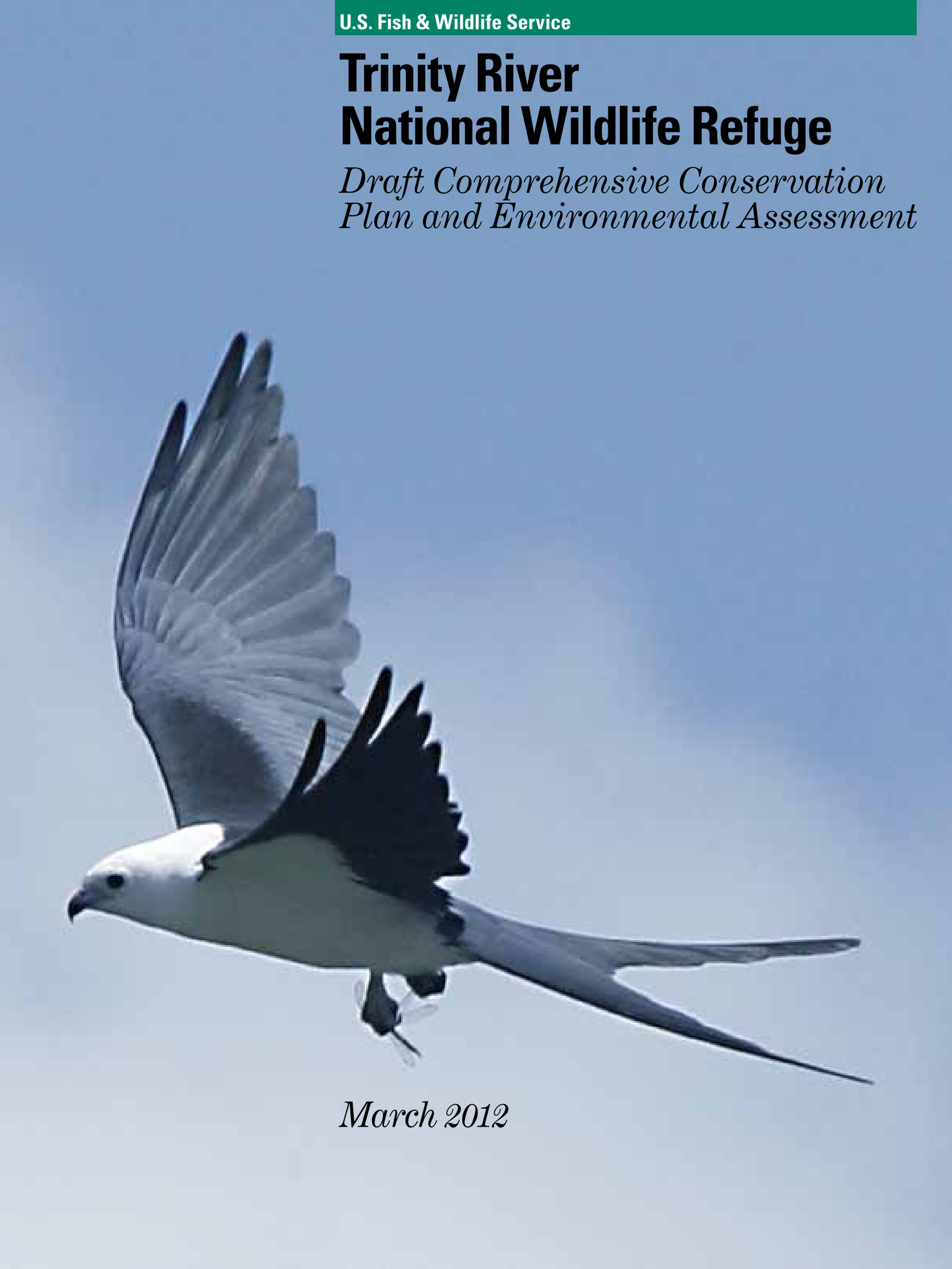
U.S. Fish & Wildlife Service

Trinity River National Wildlife Refuge

Draft Comprehensive Conservation Plan and Environmental Assessment



March 2012

U.S. Fish and Wildlife Service Mission Statement
The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people.

National Wildlife Refuge System Mission Statement
The mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management, and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

-National Wildlife Refuge System Improvement Act of 1997

Comprehensive conservation plans provide long-term guidance for management decisions and set forth goals, objectives, and strategies needed to accomplish refuge purposes and identify the Service's best estimate of future needs. These plans detail program planning levels that are sometimes substantially above current budget allocations and, as such, are primarily for Service strategic planning and program prioritization purposes. The plans do not constitute a commitment for staffing increases, operational and maintenance increases, or funding for future land acquisition.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
P.O. Box 1306
Albuquerque, New Mexico 87103

Dear Reader:

Enclosed is the Draft Comprehensive Conservation Plan and Environmental Assessment (CCP) for the Trinity River National Wildlife Refuge. The CCP identifies the role that this refuge will play in support of the mission of the National Wildlife Refuge System. The final version of this CCP will guide management of the Refuge for the next 15 years.

The CCP has been sent to you because public involvement in the planning process is essential for development of an effective plan. Please review and provide comment on the CCP's contents by **May 4, 2012**. Comments should be specific, addressing merits of the alternatives and adequacy of the environmental analysis. We will consider your comments as we prepare the Final CCP.

All public comments received, including respondent names and addresses will be included in the planning record which will be available for public review. If you, as an individual, wish us to withhold your name or address, state this prominently at the beginning of your comments. We will honor your request to the extent allowed by law. All comments from organizations, businesses, and from individuals identifying themselves as representative or officials of organizations and businesses, will be available for public inspection. Anonymous comments will not be considered.

Comments should be mailed, e-mailed, by **May 4, 2012** to:

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Additionally, a public meeting will be held at the new refuge headquarters at 601 FM 1011 in Liberty, Texas on April 10, 2012 at 6:30pm. During this meeting, all public comments on the draft CCP/EA will be considered for the formulation of the final CCP.

Thank you for your participation in our planning process. Your comments will help us prepare a better plan for the future of the Refuge.

Sincerely,

Jose Viramontes
Chief, Division of Planning

Trinity River National Wildlife Refuge

Draft

Comprehensive Conservation Plan

and

Environmental Assessment

March 2012

Prepared by:

Trinity River National Wildlife Refuge
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1. Introduction

The 25,000-acre Trinity River National Wildlife Refuge (refuge, Trinity River NWR) is remnant of what was once a much larger, frequently flooded, bottomland hardwood forest. The primary purpose of the refuge is to protect a remnant of the bottomland hardwood forest ecosystem along the Trinity River. It is one of only 14 priority one bottomland sites identified for protection in the Texas Bottomland Hardwood Preservation Program (USFWS 1985b). Although not fully surveyed, the refuge contains more than 635 plant species and another 350 vertebrate species, including more than 200 birds, 60 fish, 40 mammals, and 50 reptiles and amphibians. The refuge still consists of a broad, flat floodplain, numerous sloughs, oxbows, artesian wells, and tributaries.

This document is a Draft Comprehensive Conservation Plan (CCP) designed to guide management of the refuge for the next 15 years. The CCP provides a description of the desired future conditions and long-range guidance to accomplish the purposes for which the refuge was established. The CCP and accompanying Environmental Assessment (EA) address U.S. Fish and Wildlife Service (Service) legal mandates, policies, goals, and National Environmental Policy Act (NEPA) compliance. The EA (Appendix C) presents a range of alternatives for habitat and wildlife management, visitor services, and facilities management that consider issues and opportunities on the refuge. It also identifies, describes, and compares the consequences (or impacts) of implementing three management alternatives (including current management) on the physical, biological, and human environments described in the CCP. The final CCP will be developed through modifications made after the public review process and will replace current management direction when it is finalized.

The CCP is divided into five chapters. Chapter 1, Introduction, provides information about why the Service is developing this CCP, and an overview of the refuge, including the history of establishment and management, authorizing legislation, description of its purposes, and information on the National Wildlife Refuge System (Refuge System) and the laws, policies, and guidance that set the stage for management direction. Chapter 2, The Planning Process, explains the process used to develop the CCP consistent with planning requirements. Chapter 3, Refuge Resources and Current Management, explains the landscape setting; physical, biological, and socio-economic environment; and the current management programs on the refuge. Chapter 4, Management Direction, describes the goals, objectives, and strategies for the Service's preferred alternative (Alternative C). Finally, Chapter 5, Plan Implementation and Monitoring, describes the various tools the refuge will use to implement the management direction presented in this CCP.

1.1 Purpose and Need for the CCP

The purpose of comprehensive conservation planning is to provide long-range guidance for the management of national wildlife refuges, as mandated by the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act).

This CCP provides a vision for the refuge and offers management direction for conducting scientific research, habitat restoration, maintenance, and management of compatible public uses of refuge resources for the next 15 years.

The CCP will enhance the management of the refuge by:

- Providing a clear statement of direction for the future management of the refuge.
- Providing long-term continuity in refuge management throughout the refuge.
- Communicating the Service's management priorities for the refuge to their partners, neighbors, visitors, and the general public.
- Providing an opportunity for the public to help shape the future management of the refuge.
- Ensuring that management programs on the refuge are consistent with the mandates of the Refuge System and the purposes for which the refuge was established.
- Ensuring that the management of the refuge is consistent with Federal, State, and local plans.
- Providing a basis for budget requests to support the refuge's needs for staffing, operations, maintenance, and capital improvements.

The CCP is needed to provide guidance and rationale for management actions and will be used by the Refuge Manager and refuge staff as a reference document when developing work plans and step-down plans, and making management decisions. Through the development of goals, objectives, and strategies, this CCP describes how the refuge contributes to the overall mission of the Refuge System, fulfills the purposes designated for the refuge, and uses the best available science for adaptive management.

The goals established for the refuge include the following:

To contribute to conservation efforts and to foster the ecological integrity of the Gulf Coast Prairies and Marshes, West Gulf Coastal Plain and Upper West Gulf Coastal Plain ecoregions*:*

- Through proven and innovative management practices across the refuge.
- To conserve, restore, enhance, and protect refuge habitats by implementing appropriate management programs to benefit native flora and fauna, including threatened and endangered species and other species of concern.
- To protect, maintain, and enhance populations of migratory birds and resident fish and wildlife, including Federal and State threatened and endangered species.
- To develop and implement quality wildlife-dependent recreation programs that are compatible with the refuge's purposes and foster enjoyment and understanding of the refuge's unique wildlife and plant communities.
- To provide high quality, safe, environmentally responsible facilities needed to support refuge operations and enhance visitor experiences.

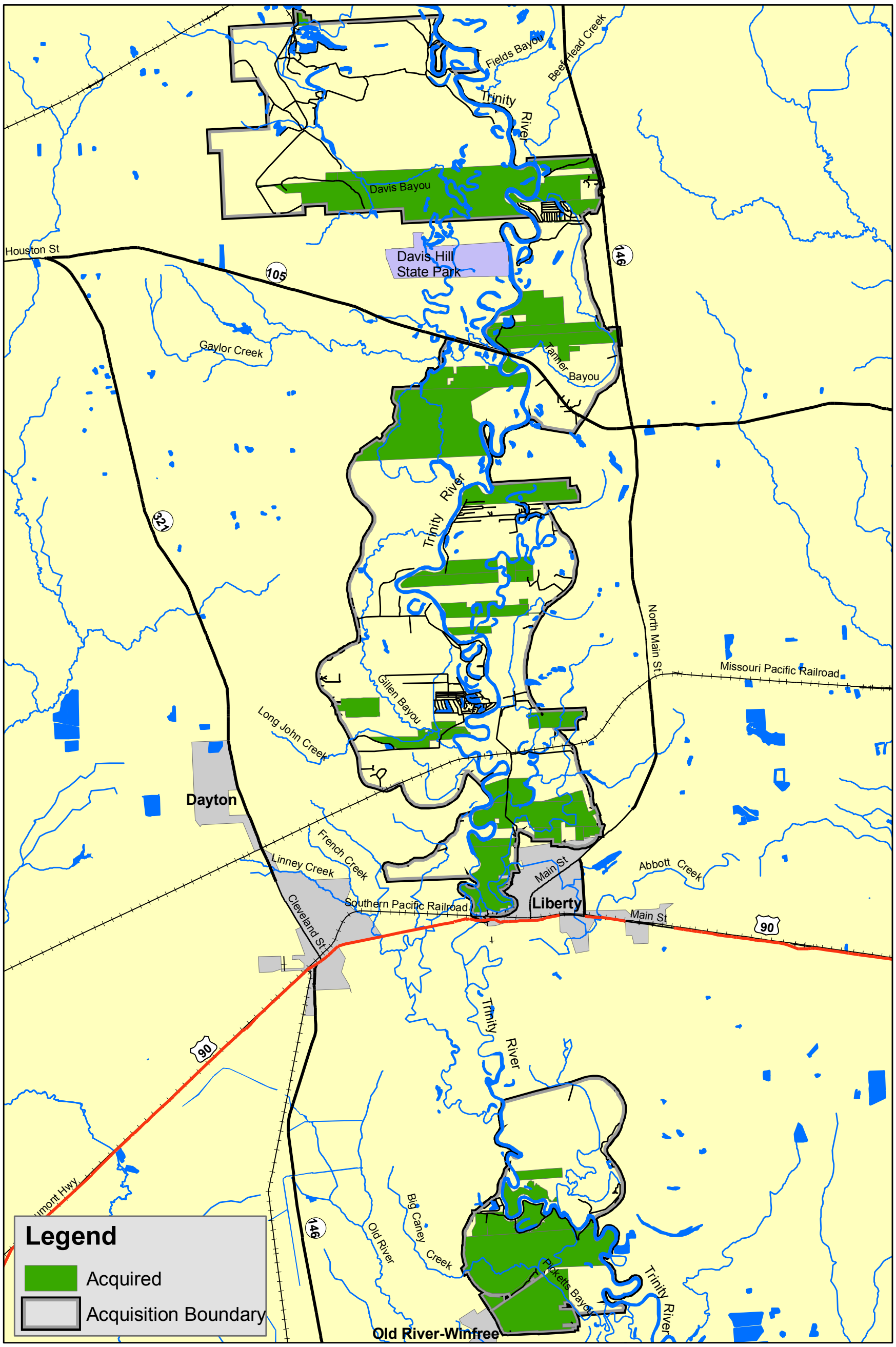
By preparing this CCP, documenting our goals and objectives, and involving our partners and the public in the process, we can gain a better understanding of the issues. Sustaining the nation's fish and wildlife resources is a task that can be accomplished only through the combined efforts of governments, partners, and private citizens. This CCP will help explain how the refuge fits into the larger landscape and our role in protecting our natural resources for present and future generations.

U.S. Fish & Wildlife Service

Trinity River National Wildlife Refuge

Liberty County, Texas

Refuge Location



PRODUCED IN THE DIVISION OF REFUGE PLANNING
ALBUQUERQUE, NEW MEXICO
LAND STATUS CURRENT TO: 5/31/09
MAP DATE: November, 2010
BASEMAP: N/A
MERIDIAN: N/A
FILE: trn_general_11.3.10_shl

0 1.5 3 6 Miles

0 1.5 3 6 Kilometers

UTM ZONE 15
NAD 83

1.2 Refuge Overview: History of Establishment, Acquisition, and Management

The Trinity River NWR is located in the floodplain of the lower Trinity River in Liberty County, Texas, consisting of over 51 tracts. It continues to emphasize acquisition opportunities throughout the floodplain of the Trinity River. The refuge is approximately 50 miles northeast of Houston and 40 miles west of Beaumont in southeast Texas (Map 1-1. Refuge Location). Although located in a rural setting, it is within 65 miles of over 5,000,000 people.

The refuge was established to protect bottomland hardwood forest habitat in southeastern Texas. The Service's intent of developing a refuge was to protect a remnant of the threatened bottomland hardwood forest ecosystem of Texas where wetland loss has been well documented since the 1950s. Wetland habitat in eastern Texas was ranked by type, and rates of loss were determined in the mid 1950s and continued through the mid 1970s. The bottomland hardwood forests were considered palustrine forested wetlands and were shown to experience the greatest loss of all wetland types during the 20-year period; this was identified as the highest priority for protection under the Emergency Wetlands Resources Act of 1986.

Efforts to preserve bottomland hardwood forests began with the initiation of the Texas Unique Ecosystem Program in 1978. A meeting was held in Nacogdoches, Texas, to solicit public comments and to seek recommendations for important wildlife sites. The Wildlife Ecosystem Concept Plan (USFWS 1979) was established by the Service in response to the Texas Unique Ecosystem Program. Further interagency coordination resulted in the Land Protection Plan: Bottomland Hardwoods Category 3 for Texas and Oklahoma (USFWS 1985a). The plan for Texas bottomland hardwoods was outlined in more detail in the Texas Bottomland Hardwood Preservation Program Category 3 (USFWS 1985b). This plan identified areas (that are currently part of the refuge) as two of 14 priority one bottomland hardwood sites identified for protection.

The Service also developed a Regional Wetlands Concept Plan (USFWS 1991) and identified the Wirt Davis Estate area as one of 32 priority wetland sites in Texas. This original proposal was consistent with the wetland habitat/waterfowl related goals of the North Americans Waterfowl Management Plan (USFWS 1986) and the North American Wetlands Conservation Act of 1989.

In 1989, the Service developed the Texas Bottomland Hardwood Initiative (TBHI) to help meet the objectives of the North American Waterfowl Management Plan, a joint effort between the U.S. and Canada. The TBHI was designed to protect important wintering, migrating, and breeding habitat for migratory waterfowl in the central flyway. Bottomland hardwood forests of eastern Texas and southeastern Oklahoma represent one of the most important wintering areas for mallards and comprise the principal breeding habitat for wood ducks in the central flyway. Preservation of the area that is currently part of the refuge was one of several proposals outlined in the TBHI.

The forested wetlands of the bottomland hardwood forest provide important wintering and breeding habitat for a variety of resident and migratory wildlife species and several species of concern.

1.2.1 Establishment of Trinity River National Wildlife Refuge

The Trinity River NWR was established by the Emergency Wetlands Resources Act of 1986 on January 4, 1994, for "*…the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory birds treaties and conventions….*" The Trinity River National Wildlife Refuge was established with an initial purchase of 4,400 acres. Since that time, the refuge has acquired additional acreage, which now totals approximately 25,000 acres.

1.2.1.1 Authorizing Legislation and Refuge Purpose(s)

National wildlife refuges are established under a variety of legislative acts and administrative orders and authorities. These orders and authorities include one or more specific purposes for which the refuge lands are acquired. The purposes are of key importance in refuge planning and are the foundation for management decisions. The purposes of a refuge are specified in, or derived from law, proclamation, Executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit.

By law, refuges are to be managed to achieve their purposes, and unless otherwise indicated by the establishing document, the following rules apply:

- Purposes dealing with the conservation, management, and restoration of fish, wildlife, and plants, and their habitats take precedence over other management and administration purposes.
- When in conflict, the purpose of an individual refuge may supersede the Refuge System mission.
- Where a refuge has multiple purposes related to fish, wildlife, and plant conservation, the more specific purpose will take precedence in instances of conflict.
- When an additional unit is acquired under a different authority than that used to establish the original unit, the addition takes on the purpose(s) of the original unit, but the original unit does not take on the purpose(s) of the addition.

The purpose of Trinity River National Wildlife Refuge is as follows:

for "*…the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory birds treaties and conventions…*"

"*…for use as an inviolate sanctuary, or for any other management purposes, for migratory birds.*" 16 U.S.C. 715d (Migratory Bird Conservation Act).

"*…to conserve (A) fish or wildlife which are listed as endangered species or threatened species…or (B) plants which are listed as endangered species or threatened species…*" 16 U.S.C. subsection 1534, as amended Endangered Species Act of 1973.

1.3 Planning Context

The Trinity River NWR is part of a national system of more than 551 refuges. The Service manages individual refuges in a manner that reflects each refuge's purpose(s) while supporting the mission of the National Wildlife Refuge System.

Figure 1-1. The National Wildlife Refuge System

1.3.1 The U.S. Fish and Wildlife Service

The Service is the principal Federal agency responsible for conserving, protecting, and enhancing fish and wildlife and their habitats for the continuing benefit of the American people. The Service has a primary responsibility to manage and protect Federal trust species, which includes migratory birds, threatened and endangered species, inter-jurisdictional fish, marine mammals, and other species of concern. In addition to the Refuge System, the Service also operates national fish hatcheries, fishery resource office, and Ecological Services field stations. The Service enforces Federal wildlife laws, manages migratory bird populations, restores nationally significant fisheries, administers the Endangered Species Act (ESA), conserves and restores wildlife habitat such as wetlands, and helps Native American tribal governments and foreign governments with their conservation efforts. It also oversees the Federal Assistance Program, which distributes hundreds of millions of dollars in excise taxes on fishing and hunting equipment to state fish and wildlife agencies.

The mission of the U.S. Fish and Wildlife Service is:

> *"working with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people"*

1.3.2 The National Wildlife Refuge System

The Refuge System is the only existing system of federally-owned lands managed chiefly for the conservation of wildlife. Founded in 1903 by President Theodore Roosevelt with the designation of Pelican Island as a refuge for brown pelicans, the Refuge System consists of over 150 million acres in over 551 refuges and 38 wetland management districts in all 50 states and U.S. territories. National wildlife refuges host a tremendous variety of plants and animals supported by a variety of habitats from arctic tundra and prairie grasslands to subtropical estuaries. Most national wildlife refuges are strategically located along major bird migration corridors ensuring that ducks, geese, and songbirds have rest stops on their annual migrations. Many refuges are integral to the protection and survival of plant and animal species listed as endangered. The Refuge System is the world's largest collection of lands and waters set aside specifically for the conservation of wildlife and ecosystem protection.

The mission of the Refuge System is:

> *"…to administer a national network of lands and waters for the conservation, management and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans"* (National Wildlife Refuge System Improvement Act of 1997, Public Law 105-57).

The goals of the Refuge System are to:

- *Conserve a diversity of fish, wildlife, and plants and their habitats, including species that are endangered or threatened with becoming endangered.*
- *Develop and maintain a network of habitats for migratory birds, anadromous and inter-jurisdictional fish, and marine mammal populations that is strategically distributed and carefully managed to meet important life history needs of these species across their ranges.*
- *Conserve those ecosystems, plant communities, wetlands of national or international significance, and landscapes and seascapes that are unique, rare, declining, or underrepresented in existing protection efforts.*
- *Provide and enhance opportunities to participate in compatible wildlife-dependent recreation (hunting, fishing, wildlife observation and photography, and environmental education and interpretation.*
- *Foster understanding and instill appreciation of the diversity and interconnectedness of fish, wildlife, and plants and their habitats.*

1.3.2.1 Legal and Policy Guidance

Refuge management and administrative activities are dictated, in large part, by the legislation that created the unit and its purposes and goals. However, other laws, regulations, and policies also guide management. The mission and goals of the Refuge System, Service policy, Federal laws and Executive orders, and international treaties guide the refuge. Appendix B provides a

complete list of the laws, policies, treaties, and Executive orders that pertain to the conservation and protection of natural and cultural resources. Key laws and policies related directly to comprehensive conservation planning are discussed in the following section.

National Wildlife Refuge System Improvement Act of 1997

The National Wildlife Refuge System Administration Act of 1966, as amended, states that each refuge shall be managed to fulfill both the mission of the Refuge System and the purposes for which the individual refuge was established. It also requires that any use of a refuge be a compatible use, a use that will not materially interfere with nor detract from, in the sound professional judgment of the Refuge Manager, fulfillment of the mission of the System or the purposes of the refuge.

The 1997 amendments to the National Wildlife Refuge System Administration Act of 1966 identified a number of principles to guide management of the Refuge System. They include the following:

- Conserve fish, wildlife, and plants, and their habitats within the Refuge System.
- Maintain the biological integrity, diversity, and environmental health of the Refuge System.
- Coordinate, interact, and cooperate with adjacent landowners and State fish and wildlife agencies.
- Maintain adequate water quantity and quality to meet refuge and Refuge System purposes and acquire necessary water rights.
- Maintain hunting, fishing, wildlife observation, wildlife photography, interpretation, and environmental education as the priority general public uses of the Refuge System.
- Provide opportunities for compatible priority wildlife-dependent public uses with the Refuge System.
- Provide enhanced consideration for priority wildlife-dependent public uses over other general public uses in planning and management.
- Provide increased opportunities for families to experience priority general public uses, especially traditional outdoor activities such as fishing and hunting.
- Monitor the status and trends of fish, wildlife, and plants in each refuge.

The Improvement Act establishes the responsibilities of the Secretary of the Interior for managing and protecting the Refuge System. It requires a CCP for each refuge by the year 2012. The CCP provides guidelines and directives for the administration and management of all areas in the Refuge System, including wildlife refuges, areas for the protection and conservation of fish and wildlife threatened with extinction, wildlife ranges, game ranges, wildlife management areas, and waterfowl production areas.

To maintain the health of individual refuges and the National Wildlife Refuge System as a whole, managers must anticipate future conditions. Managers must endeavor to avoid adverse impacts and take positive actions to conserve and protect refuge resources. Effective management also depends on acknowledging resource relationships and acknowledging that refuges are parts of larger ecosystems. Refuge Managers work together with partners, including other refuges, Federal and state agencies, tribal and other governments, and nongovernmental organizations and groups to protect, conserve, enhance, or restore all native fish, wildlife (including invertebrates), and plants, and their habitats.

Appropriate Use Policy

This policy describes the initial decision process the Refuge Manager follows when first considering whether to allow a proposed use on a refuge. The Refuge Manager must find a use appropriate before undertaking a compatibility review of the use. An appropriate use as defined by the Appropriate Use Policy (603 FW 1 of the Service Manual) is a proposed or existing use on a refuge that meets at least one of the following four conditions:

- The use is a wildlife-dependant recreational use as identified in the Improvement Act.
- The use contributes to the fulfilling of the refuge purpose(s), the Refuge System mission, or goals or objectives described in a refuge management plan approved after October 9, 1997, the date the Improvement Act was signed into law.
- The use involves the take of fish and wildlife under state regulations.
- The use has been found to be appropriate as specified in Section 1.11 (603 FW 1 of the Service Manual).

Chapter 5 of this CCP includes additional information on appropriateness of refuge uses.

Compatibility Policy

Lands within the Refuge System are different from other multiple use public lands in that they are closed to all public uses unless specifically and legally opened. The Improvement Act states, "…the Secretary shall not initiate or permit a new use of a refuge or expand, renew, or extend an existing use of a refuge, unless the Secretary has determined that the use is a compatible use and that the use is not inconsistent with public safety."

In accordance with the Improvement Act, the Service has adopted a Compatibility Policy (603 FW 2 of the Service Manual) that includes guidelines for determining if a use proposed on a national wildlife refuge is compatible with the purposes for which the refuge was established. A compatible use is defined in the policy as a proposed or existing wildlife-dependent recreational use or any other use of a national wildlife refuge that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the Refuge System mission or the purposes of the refuge. Sound professional judgment is defined as a finding, determination, or decision that is consistent with the principles of sound fish and wildlife management and administration, available science and resources (funding, personnel, facilities, and other infrastructure), and applicable laws.

The Service strives to provide priority public uses when they are compatible. If financial resources are not available to design, operate, and maintain a priority use, the Refuge Manager will take reasonable steps to obtain outside assistance from the state and other conservation interests.

Additional information regarding compatibility determinations (CDs) is provided in Chapter 5 and the CDs prepared in association with this CCP are provided in Appendix D.

Biological Integrity, Diversity, and Environmental Health Policy

The Improvement Act directs the Service to "ensure that the biological integrity, diversity, and environmental health of the Refuge System are maintained for the benefit of present and future generations of Americans…." To implement this directive, the Service has issued the Biological Integrity, Diversity, and Environmental Health Policy (601 FW 3 of the Service

Manual), which provides policy for maintaining and restoring, where appropriate, the biological integrity, diversity, and environmental health of the Refuge System. The policy is an additional directive for Refuge Managers to follow while achieving the refuge purpose(s) and Refuge System mission. It provides for the consideration and protection of the broad spectrum of fish, wildlife, and habitat resources found on refuge and associated ecosystems. Further, it provides Refuge Managers with an evaluation process to analyze their refuge and recommend the best management direction to prevent further degradation of environmental conditions and restore lost or severely degraded components where appropriate and in concert with refuge purposes and the Refuge System mission. When evaluating the appropriate management direction for refuges, Refuge Managers will use sound professional judgment to determine their refuges' contribution to biological integrity, diversity, and environmental health at multiple landscape scales.

1.3.3 Setting the Stage for Planning: Identifying the Landscape Context

1.3.3.1 Climate Change

Department of the Interior Secretarial Order 3226, signed on January 19, 2001, and reinstated on February 22, 2010, by Secretarial Order 3289 Amendment No. 1, states that "there is a consensus in the international community that global climate change is occurring and that it should be addressed in governmental decision making… This Order ensures that climate change impacts are taken into account in connection with Departmental planning decision making." Additionally, it calls for the incorporation of climate change into long-term planning documents such as this CCP.

The U.N. Intergovernmental Panel on Climate Change (IPCC) reports that direct temperature measurements at weather stations world-wide suggest that the surface of Earth has warmed, on average, 1.0 °C (1.8 °F) in the last 100 years (IPCC 2007). Data for the Southwest show an increase in temperature from 1.1 °C to 1.7 °C (34 °F to 35 °F) during the past century and project an increase in temperature of 4.5 °C to 6.1 °C (40.1 °F to 43 °F) in the future. The last 10 years was the warmest decade on record, during which global sea level rose about 20 centimeters (8 inches). The increase of carbon dioxide (CO_2) within the Earth's atmosphere has been linked to the gradual rise in surface temperature commonly referred to as global warming. The IPCC also concludes that substantial increases in global average temperatures will cause major changes in ecosystem structure and function, species' ecological interactions, and species' geographical ranges. These projected changes have enormous implications for management of fish, wildlife, and their habitats around the world.

The U.S. Department of Energy's *"Carbon Sequestration Research and Development"* defines carbon sequestration as "…the capture and secure storage of carbon that would otherwise be emitted to or remain in the atmosphere" (Reichle et al. 1999). Conserving natural habitat for wildlife is the heart of any long-range plan for national wildlife refuges. The actions proposed in this plan would conserve or restore land and habitat, and would thus retain existing carbon sequestration on the refuge. This in turn contributes positively to efforts to mitigate human-induced global climate change. Vegetated land is a tremendous factor in carbon sequestration. Terrestrial biomes of all sorts, including grasslands, forests, wetlands, tundra, and desert, are effective both in preventing carbon emission and acting as a biological "scrubber" of atmospheric CO_2. The Department of Energy report concludes that ecosystem protection is important to carbon sequestration and may reduce or prevent loss of carbon currently stored

in the terrestrial biosphere (Reichle et al. 1999). One Service activity in particular, prescribed burning, releases CO_2 directly into the atmosphere from the biomass consumed during combustion. However, there is actually no net loss of carbon, since new vegetation quickly germinates and sprouts to replace the burned-up biomass and sequesters or assimilates an approximately equal amount of carbon as was lost to the air (Boutton et al. 2006).

The Service's strategic approach to climate change will emphasize three strategies that are often used to describe responses to climate change: Adaptation, Mitigation, and Education. *Adaptation* is an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. It refers to the management actions we take to reduce the impacts of climate change—reactive and anticipatory. *Mitigation* is human intervention to reduce the sources or enhance the sinks of greenhouse gases. It involves reducing our agency's "carbon footprint" by using less energy, consuming fewer materials, and altering land management practices, such as water pumping and wildlife food production. Mitigation is also achieved through terrestrial carbon sequestration. *Education* is helping people learn and discover, thereby creating awareness and empathy, and ultimately leading to changes in human behavior. It is a fundamental conservation tool and a public service responsibility. In the context of climate change, education means helping Service employees, our national and international partner, and constituencies (e.g., the public, Congress) understand that climate change is real and happening now; it threatens fish and wildlife resources we have come to value; and each of us can do something meaningful to reduce the threats.

Climate change may accelerate and intensify existing stressors (pollution, invasive species, development, habitat fragmentation, loss and degradation, etc.), which could have possible effects on the refuge in addition to a general temperature increase, including: reduced rainfall and surface water supplies, deterioration of water quality, decreased habitat availability for many species, changes in vegetation communities, modification of migratory bird patterns, loss of breeding habitat for migratory forest dwelling land birds and resident wildlife species, loss of some species along with the introduction of new species, and significantly increased energy costs. Possible effects were a substantive consideration in the development of the objectives and strategies in this CCP. Implementation of all the strategies for monitoring and surveys will emphasize identification and analysis of the effects of climate change on the various habitats and species. Implementation of all strategies will emphasize energy conservation and/or use of alternative energy source when feasible. Chapter 3 contains additional information on possible climate change impacts to the refuge.

1.3.3.2 National Conservation Plans and Initiatives

USFWS Rising to the Urgent Challenge: Strategic Plan for Responding to Accelerating Climate Change (2010a)

In administering the Refuge System, the Service will ensure that the CCP complements national and international efforts to conserve fish, wildlife, and their habitats, and increases support for the Refuge System and participation from conservation partners and the public.

The Service climate change strategy establishes a basic framework that will work as part of the larger conservation community to help ensure the sustainability of fish, wildlife, plants, and habitats in the face of accelerating climate change. It begins with a dynamic action plan that details specific steps the Service will take during the next five years to implement. It

focuses on three key strategies addressing climate change: Adaptation, Mitigation, and Engagement. For the Service, adaptation is planned, science-based management actions that we take to help reduce the impacts of climate change on fish, wildlife, and their habitats. Mitigation involves reducing our "carbon footprint" by using less energy, consuming fewer materials, and appropriately altering our land management practices. Mitigation is also achieved through biological carbon sequestration, the process in which CO_2 from the atmosphere is taken up by plants through photosynthesis and stored as carbon in tree trunks, branches, and roots. Engagement involves reaching out to Service employees; local, national, and international partners in the public and private sectors; key constituencies and stakeholders; and citizens to join forces and seek solutions to the challenges to fish and wildlife conservation posed by climate change.

Our goal is to achieve carbon neutrality as an organization by 2020 (USFWS 2010a). By building knowledge and sharing information in a comprehensive and integrated method, the Service, its partners, and stakeholders will increase our understanding of global climate change impacts and use our combined expertise and creativity to help wildlife resources adapt in a climate changed world.

USFWS Migratory Bird Program Strategic Plan 2004–2014
"A Blueprint for the Future of Migratory Birds"
This plan was developed by the Service's Migratory Bird Program with the main goal "…to increase the percent of species of migratory birds that are at healthy and sustainable levels." The plan identifies "focal species" that are considered to be of a priority emphasis in the overall context of landscape-scale integrated bird conservation. These species share a high conservation need and are representative of larger groups of birds that share similar or the same conservation needs. The plan also calls for partnerships inside and outside the Service essential to the implementation of action plans.

Partners in Flight (PIF) North American Landbird Conservation Plan (2004)
The PIF North American Landbird Conservation Plan (NALCP) provides a continental synthesis of priorities and objectives that guide landbird conservation actions at the national and international scales. When combined with plans written for shorebirds, waterbirds, waterfowl, and other game birds, it can serve as a blueprint for continental habitat conservation under the North American Bird Conservation Initiative (NABCI). The NALCP summarizes the conservation status of 448 native landbirds that breed in the U.S. and Canada, illustrating broad patterns based on comprehensive, biologically-based species assessment.

Trinity River NWR occurs within two Partners in Flight (PIF) physiographic areas. Most of the refuge is in Area 42, the West Gulf Coast Plain, with a smaller portion in Area 06, the Coastal Prairies.

The West Gulf Coastal Plain (15,025,888 hectares) (37,129,778 acres) covers northwest Louisiana, southwest Arkansas, easternmost Texas, and the southeast corner of Oklahoma. In general, pines dominate uplands, and hardwood forests dominate bottomlands. The pine is originally longleaf in the southern portion and shortleaf with a significant hardwood element in the northern portion. The southern edge of the physiographic area occurs where trees become less dominant and the grasslands of the Coastal Prairies begin. The West Gulf Coastal Plain extends east to the Mississippi Alluvial Valley and north to edge of the Ouachita highlands.

Drier climate and changing soils to the west mark the edge of the distribution of pine in eastern Texas and the beginnings of the Oaks and Prairies physiographic area.

Pine habitat here, as in the rest of the Southeast, has undergone dramatic changes this century, even though some type of pine still dominates most of the landscape. The area was originally longleaf in the southern portion, with some loblolly in drainages protected from fire, grading into shortleaf pine with some intermixed hardwood to the north. All of this was fire maintained. Virtually all of it was cut in the early 1900s, which in itself would not have been a grave problem. However, fire suppression and either intentional or neglectful regeneration practices have resulted in replacement of the native on-site species with loblolly or introduced slash pine. More recently, these have been planted in short-rotation plantations. This has been particularly harmful to the red-cockaded woodpecker, which shows a strong preference for old longleaf stands, but has also had a negative effect on other pine birds that thrive best under native pine savanna conditions. Young pine plantations do support many birds, including species normally associated with mature hardwoods such as worm-eating warbler, as well as some birds more typical of early successional conditions like the white-eyed vireo and prairie warbler.

Maintenance of older growth fire-maintained longleaf stands must be a high priority for public and perhaps some private lands in the southern half of this physiographic area. Keeping as much of the region as possible in forest, even if short-rotation loblolly, is better for birds than conversion to pasture or other uses.

Meanwhile, bottomland hardwood habitat has been fragmented and also reduced in extent. This is due to typical conversion to agriculture and other uses and to inundation by the numerous reservoirs, particularly in eastern Texas. Bottomland hardwoods are not only important for many high priority, area-sensitive breeding birds, but are also becoming known as being potentially of absolute necessity to spring migrants. Radar shows huge numbers of these birds descending into bottomland hardwoods relatively close to the coast upon completion of their Gulf of Mexico crossing. Maintenance of these forests may have conservation implications that extend well beyond the West Gulf Coastal Plain.

The Coastal Prairies cover approximately 547 miles of coastal shoreline from the Atchafalaya Basin, Louisiana, to Baffin Bay, Texas. The area consists of grasslands, bottomland hardwood forests, cheniers, and scrub-shrub habitats. The inland boundary of this area ranges from 24 to 240 miles from the coast, capturing a complex of marshes, upland grassland, coastal woodlands, and a small amount of forested habitat. Nearly all grassland habitats have been converted to agricultural use, primarily pasture lands and rice farms. Forested areas include bottomland hardwood forests, which are found along the major river systems that drain the Coastal Prairies range. The portion of the refuge that falls within the Coastal Prairies physiographic area is strictly bottomland hardwood forest. Priority bird populations in this physiographic area in the bottomland hardwood forest that also occur on the refuge include the swallow tailed kite, Swainson's warbler, prothonotary warbler, and American woodcock. These species are indicators of the condition of the natural communities of the bottomland hardwood forests. Their populations have been emphasized as a priority for monitoring due to the tremendous alteration within this physiographic area.

Most of the natural communities of the Coastal Prairies physiographic area have experienced tremendous alteration. Marsh habitats have been lost or changed because of saltwater intrusion caused by oil and gas development, dredging, channelization, impoundments, land

subsidence, and other factors. As much as 99 percent of the original prairies and grasslands have been converted to agriculture. Cattle are commonly grazed in marsh, grassland, and wooded habitats, further degrading bird habitat. Invasion by non-native plants, such as Chinese tallow, has changed diverse natural habitats to monotypic stands covering hundreds of hectares. Continuing human development of higher ground is likely as human population pressures increase.

North American Waterfowl Management Plan (2004)

The North American Waterfowl Management Plan (NAWMP) is an international plan to conserve waterfowl and migratory birds in North America. It was established in 1986 by Canada and the United States, and expanded to include Mexico in 1994. The NAWMP was updated in 1998 and again in 2004 and is scheduled for revision in 2012. The essence of the original plan was that waterfowl populations could only recover through habitat conservation at a continental scale. The NAWMP identified general objectives for habitat conservation in five key priority regions, with the acknowledgement that each region would convert the objectives into local action plans. Regional partnerships, called joint ventures (JVs), are the implementing mechanisms of the NAWMP. A JV is a collaborative, regional partnership of government agencies, non-profit organizations, corporations, tribes, and individuals that conserves habitat for priority bird species, other wildlife, and people. There are 18 habitat-based and three species-based JV's in the U.S. today. Cumulatively, they have conserved 17.3 million acres of habitat for waterfowl and migratory birds. Within the Gulf Coast Joint Venture are six initiative areas. Trinity River NWR occurs in the Chenier Plain Initiative Area. This area is a rich and complex mixture of wetlands, uplands, and open water that extends roughly 200 miles from Vermilion Bay, Louisiana, to Galveston Bay, Texas. It runs from the expansive coastal marshes bordering the Gulf of Mexico shore, inland for 40 to 70 miles through the coastal prairie into areas of intensive rice cultivation. Geographically, it includes the Louisiana parishes of Cameron, Calcasieu, Vermilion, Acadia, Jefferson Davis, Allen, and Evangeline, and the Texas counties of Chambers, Jefferson, Orange, and Liberty. Very small portions of Galveston and Harris Counties are also included at the western edge of the Texas segment. Paralleling the coastline are old beach ridges known as cheniers that are characteristic of the area and form natural levees, bordering an immense marsh. Lying within this marsh zone are great estuarine lakes such as White, Grand, Calcasieu, and Sabine. The entire Chenier Plain Initiative Area covers well over 10,000 square miles or approximately 6.5 million acres.

Waterbird Conservation for the Americas: the North American Waterbird Conservation Plan (2002)

The North American Waterbird Conservation Plan (NAWCP) provides a continental-scale framework for the conservation and management of 210 species (23 families). These include sea-birds, coastal waterbirds, wading-birds, and marsh-birds. They utilize aquatic habitats in 29 nations throughout North America, Central America, the islands and pelagic waters of the Caribbean Sea and western Atlantic, the U.S.-associated Pacific Islands, and pelagic waters of the Pacific. Eighty percent of the species identified in the plan are colonial nesters congregating at breeding sites in numbers ranging from many to hundreds of thousands of birds. The NAWCP considers one-third of these species to be at risk of serious population loss. Additional information on the NACWCP can be found at http://www.waterbirdconservation.org/nawcp.html.

U. S. Shorebird Conservation Plan (2001)
The U.S. Shorebird Conservation Plan (SCP) is designed to complement the existing landscape-scale conservation efforts of the NAWMP, PIF, and NAWCP. It seeks to stabilize populations of all shorebirds that are in decline because of factors affecting habitat in the U.S. At a regional level, the plan's goal is to ensure that shorebird habitat is available in adequate quantity and quality to support shorebird populations in each region. At the national scale, its goal is to stabilize populations of all shorebird species known or suspected of being in decline due to limiting factors occurring within the U.S. while ensuring that common species are also protected from future threats. Ultimately, the goal of the SCP is to restore and maintain shorebird populations throughout the western hemisphere through an international partnership. The SCP considers 53 species of shorebirds, of which 17 occur within the refuge (Table 1-1). Additional information on this plan can be found at http://shorebirdplan.fws.gov. Table 1-1 identifies shorebird species at risk listed in the SCP that occur on the refuge.

Table 1-1. Shorebirds of Special Concern Documented on Trinity River NWR

Family (Common)	Species (Common)		
Sandpipers, Phalaropes and Allies	Spotted sandpiper	Upland sandpiper	Long-billed dowitcher
	Greater yellowlegs	Least sandpiper	Wilson's snipe
	Lesser yellowlegs	Baird's sandpiper	American woodcock
Gulls and Terns	Bonaparte's gull	Ring-billed gull	Least tern
	Caspian tern	Foster's tern	Royal tern
Stilts	Black-necked stilt		
Lapwings and Plovers	Killdeer		

1.3.3.3 Regional Plans and Initiatives

North American Bird Conservation Initiative: Bird Conservation Region Descriptions (2000)
The purpose of the NABCI is to ensure the long-term health of North America's native bird populations by increasing the effectiveness of existing and new bird conservation initiatives, enhancing coordination among the initiatives, and fostering greater cooperation among the continent's three national governments and their people. All of this will be done with appreciation of the cultural and biological differences that make each country unique.

This conservation approach is expressed through NABCI's goal of delivering the full spectrum of bird conservation through regionally-based, biologically-driven, landscape-oriented partnerships. "Regionally-based" partnerships involve all stakeholders across ecoregions and are the proven means of effectively delivering bird conservation. "Biologically-driven" means that there must be explicit linkages among population objectives, habitat goals, and conservation actions. It also means that evaluation and adaptability are critical components of successful conservation efforts. "Landscape-oriented" recognizes the response of bird populations to habitat conditions across broad ecoregions and the need for conservation to operate at multiple geographic scales.

The NABCI vision is one of habitat partnerships, based upon the NAWMP's joint venture model, covering the continent coast-to-coast. It is hoped that each existing and new partnership will consider delivering conservation to all birds in all habitats and that these partnerships eventually move toward conservation of biological diversity using bird conservation regions (BCRs) as the ecological unit in which to achieve their goals.

The refuge is located primarily within the West Gulf Coastal Plain/Ouachita (BCR #25) with a small portion located in the Gulf Coastal Prairie (BCR #37).

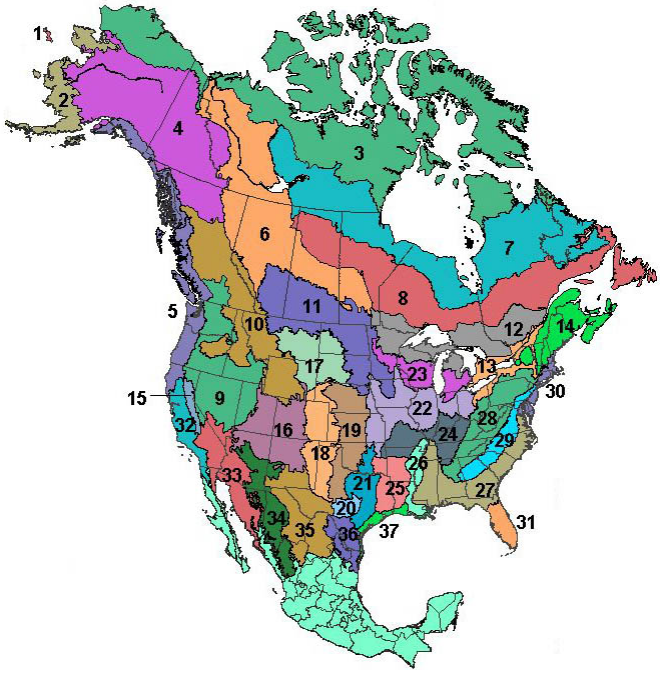


Figure 1-2. Bird Conservation Regions (http://www.nabci-us.org/map.html accessed 6/28/2011)

BCRs (see Figure 1-2) are part of the North American Bird Conservation Initiative. BCRs are ecologically defined units that provide a consistent spatial framework for bird conservation across North American landscapes. They are the fundamental biological units through which NABCI will deliver landscape-scale bird conservation, including evaluation, planning, and in many instances, implementation.

Most of the Refuge is located in the West Gulf Coastal Plains/Ouachitas (BCR #25). Pines dominate this area, largely shortleaf pine (*Pinus echinata*) in the north, including the Ouachita Mountains, and longleaf pine (*Pinus palustris*) in the south. This westernmost part of the eastern United States forest also includes hardwood dominated bottomlands along the Arkansas River and other drainages. Red-cockaded woodpecker is the highest priority bird in pine habitat, which is also inhabited by Bachman's sparrow and brown-headed nuthatch. Conversion of the native pine forests to industrial loblolly pine (*Pinus taeda*) plantations provides some bird habitat but is less useful for the highest priority species. The river and stream bottoms provide habitat used by Swainson's warbler and large numbers of nesting herons and egrets. Bottomland hardwoods and associated wetlands support substantial wintering populations of waterfowl species, principally mallards, and breeding and wintering wood ducks, and are a primary migration corridor for significant numbers of other dabbling ducks. The principal threats to bottomland hardwood wetlands in the region are from reservoirs, timber harvest, and subsequent conversion to pine plantation, pasture, or other land uses (American Bird Conservancy 2007).

The smaller refuge portion in BCR 37 has flat grasslands and marshes that hug the coast of the Gulf of Mexico from northern Tamaulipas across the mouth of the Río Grande, up into the

rice country of southeastern Texas and southwestern Louisiana, and across the great Louisiana marshlands at the mouth of the Mississippi River. Approximately 318 species of birds regularly occur in this BCR, and at least 45 more migrate through the region. This BCR features one of the greatest concentrations of colonial waterbirds in the world, with breeding reddish egret, roseate spoonbill, brown pelican, and large numbers of herons, egrets, ibis, terns, and skimmers. The region provides critical in-transit habitat for migrating shorebirds, including buffbreasted sandpiper and Hudsonian godwit, and for most of the Neotropical migrant forest birds of eastern North America. Mottled duck, fulvous whistling-duck, and purple gallinule also breed in wetlands, and winter numbers of waterfowl are among the highest on the continent. The primary threats to this BCR are loss and degradation of wetland habitats due to subsidence, sea level rise, shoreline erosion, freshwater and sediment deprivation, salt water intrusion, oil and gas canals, and navigation channels and associated maintenance dredging (American Bird Conservancy 2007).

The national geographic framework consists of 22 areas that were developed by aggregating Joint Venture's BCRs (biologically based units representing long-standing partnerships that facilitate conservation planning and design at the landscape scale), the Freshwater Ecoregions of the North America (as a standard unit for aquatic species considerations; Abell et al. 2000), and Omernick's ecological units (Omernik 1987). BCRs are part of the NABCI and are biologically-based, geographic delineations that represent long-standing partnerships to deliver avian conservation planning and design at the landscape-scale. Sixty-seven BCRs have been identified, 35 of which fall entirely or partially within the United States. Similarly, Freshwater Ecoregions of the World are biologically-based units for aquatic species, and Omernick's ecological units integrate diverse non-avian, terrestrial species needs.

Gulf Coastal Plains and Ozarks/Gulf Coast Prairie Landscape Conservation Cooperative Development and Operations Plan (September 2009)

Department of the Interior (DOI) Secretarial Order 3289, Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources, committed the resources of the agency to help the conservation community develop a collaborative response to climate change. In fiscal year (FY) 2010, Congress appropriated funds to support DOI's vision of establishing a national network of Landscape Conservation Cooperatives (LCCs). LCCs are envisioned as conservation science alliances where the private, state, and Federal community operates as a networked, leveraged system in a non-regulatory forum to effectively pursue socio-viable solutions in support of the Nation's interest in sustaining endemic fish and wildlife populations and ecological functions and processes on which they depend.

The refuge is located in parts of two LCCs: The Gulf Coastal Plains and Ozarks LCC and a small portion of the Gulf Coast Prairie LCC. These are two of 22 LCCs identified by the DOI. This CCP identifies and describes the LCC's geographic setting, priority species and habitats, conservation challenges, and conservation opportunities in Chapter 3.

The Nature Conservancy Ecoregional Conservation Plans: Gulf Coast Prairies and Marshes (2002); West Gulf Coastal Plain Ecoregional Plan (2002a); Upper West Gulf Coastal Plain Ecoregional Plan (2002b)

The Nature Conservancy (TNC) developed an ecoregional approach to conservation in 1996 that stated biodiversity conservation required working at larger scales and along ecological instead of geopolitical lines. The goal of ecoregion-based conservation is the design and

conservation of portfolios of conservation areas that will collectively ensure the long-term survival of the ecoregion's biodiversity.

The refuge is located in parts of three TNC ecoregions: Gulf Coast Prairies and Marshes, West Gulf Coastal Plain Ecoregional Plan, and Upper West Gulf Coastal Plain Ecoregional Plan. These are three of 64 ecoregions identified by TNC. This CCP identifies and describes the ecoregion's in further detail in Chapter 3.

1.3.3.4 State and Local Plans and Initiatives

In administering the Refuge System, the Service will ensure that the CCP complements State efforts to conserve fish and wildlife and their habitats, and to increase support for the Refuge System and participation from conservation partners and the public. During the development of the CCP, the Service is required to consult and coordinate with affected State conservation agencies, as well as adjoining Federal, local, and private landowners. The Service is required to ensure effective coordination, interaction, and cooperation in a timely and effective manner with the State during the course of acquiring and managing refuges. Under the Refuge Administration Act of 1966 and 43 CFR 24, the Director and the Secretary's designee is required to ensure the Refuge System regulations and management plans are, to the extent practicable, consistent with State laws, regulations, and management plans.

Texas Comprehensive Wildlife Conservation Strategy (2005b)
As part of the State Wildlife Grant Program, the Texas Wildlife Conservation Strategy (Texas Wildlife Action Plan 2005a) was completed by Texas Parks and Wildlife Department (TPWD) in 2005 but is currently being updated. The primary objective is to assist the agency and its conservation partners with the development of non-game initiatives and goals to address the needs of wildlife and habitats. The State plan provides detailed species and habitat information on 10 major ecoregions in Texas. Parts of Trinity River NWR occur within two of the 10 ecoregions of Texas, including the Pineywoods and the Gulf Coast Prairies and Marshes.

A major focus of the action plan is to provide species and habitat assessments along with conservation strategies. The plan indicates that since Texas is more than 94 percent privately owned, "a strong education program" is also needed to "gain support for general conservation as well as specific projects." High priority conservation actions include vegetation and habitat mapping, biological inventories, data collection and database management, land protection, support of joint ventures, land and water monitoring, developing conservation partnerships, and education and outreach activities. Species-specific conservation actions are also included in the plan. Relevant strategies of this CCP and associated step-down management plans will take into account many of the specific conservation actions identified in the State's plan.

Land and Water Resources Conservation and Recreation Plan (TPWD 2010)
The Land and Water Resources Conservation and Recreation Plan (LWRCRP) was written in 2005 to guide TPWD in conserving the State's natural and historic heritage and in providing public access to the outdoors. The plan was updated in 2010 and consolidated into four major goals:

1. Practice, encourage, and enable science-based stewardship of natural and cultural resources.
2. Increase access to and participation in the outdoors.
3. Educate, inform, and engage Texas citizens in support of conservation and recreation.

4. Employ efficient, sustainable, and sound business practices.

The goals and objectives are intended to promote stewardship on public and private lands and waters; protect our unique natural and cultural resources; encourage partnerships with all stakeholders; utilize science as the backbone of decision-making; promote participation in the outdoors; instill appreciation of nature in our citizens, young and old; and promote business approaches that leverage industry standards and best management practices to support our mission.

According to the LWRCRP, "…the high population growth and associated development along the coast have fragmented land, converted prairies, changed river flows, decreased water quality, and increased sediment loads and pollutants on marshes and estuaries. Projections indicate continued high growth and increasing fragmentation in most parts of this ecoregion." The Plan recommends that "…many beach areas and mud flats need additional protection." This plan incorporates many relevant strategies, such as monitoring species status and trends, restoring coastal prairie, providing public outreach, protecting cultural and historical resources, maintaining and developing new partnerships, and managing invasive species.

Texas Wetlands Conservation Plan (1997)
The goal of the Texas Wetlands Conservation Plan (TWCP) is consistent with the wetlands conservation goals of the refuge and is to "*…enhance our wetland resources with respect to function and value through voluntary conservation and restoration of the quality, quantity, and diversity of Texas wetlands.*" The TWCP focuses on a non-regulatory, incentive-based approach to wetlands management and conservation aimed mainly at private landowners. The TWCP also focuses on:

1. Enhancing the landowner's ability to use existing incentive programs and other land use options through outreach and technical assistance;
2. Developing and encouraging land management options that provide an economic incentive for conserving existing wetlands or restoring former ones; and,
3. Coordinating regional wetlands conservation efforts.

1.3.3.5 Species-Specific Plans

Species-specific recovery plans identify site-specific management actions that, if completed, could lead to reclassification of a species to a less critical status or help them recover to the point they can be removed from Endangered Species Act protection. Table 1-2 identifies recovery plans that have been drafted for species that could potentially occur on the Trinity River NWR.

Table 1-2. Endangered Species Potentially Occurring on Trinity River NWR

Species (Common Name)	Species (Scientific Name)	Document	Current Status / Year Listed
Houston toad	*Bufo houstonensis*	Recovery Plan 1984	Endangered/1970
Piping plover	*Charadrius melodus*	Recovery Plan 2003	Threatened/1985
Red-cockaded woodpecker	*Picoides borealis*	Recovery Plan 2003	Endangered/1970
Interior least tern	*Sterna antillarum athalassos*	Recovery Plan 1990	Endangered/1985
Louisiana black bear	*Ursus americanus luteolus*	Recovery Plan 1992	Threatened/1992
Red wolf	*Canis rufus*	Recovery Plan 2007	Endangered/1967
American alligator	*Alligator mississipiensis*	Recovery Plan 1987	Threatened/SA*/1979

* Threatened by Similarity in Appearance

1.3.4 Coordination with the State of Texas and Other Entities

The Service will ensure this CCP complements the State of Texas efforts to conserve fish, wildlife, and their habitats, and to increase support for the Refuge System and participation from conservation partners and the public.

The refuge has a current Memorandum of Understanding (MOU) for law enforcement radio frequencies with the Liberty County Sheriff's Department and the TPWD.

This CCP recognizes that both the Service and TPWD have authorities and responsibilities for management of fish and wildlife species on the refuge. Under the Refuge Administration Act of 1966 and 43 CFR 24, the Director and the Secretaries designee are required to ensure Refuge System regulations and management plans are, to the extent practicable, consistent with State laws, regulations, and management plans. The State's participation and contribution throughout this planning process has provided for ongoing opportunities and open dialogue to improve the ecological conservation of fish and wildlife species and their habitats.

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2. The Planning Process

2.1 Description of the Planning Process

This CCP complies with the requirements of the Improvement Act and NEPA. Refuge planning policy also guided the process and development of the CCP, as outlined in Part 602, Chapters 1, 3, and 4 of the Service Manual. Service policy, the Improvement Act, and NEPA provide specific guidance for the planning process, such as seeking public involvement in the preparation of the EA. The development and analysis of "reasonable" management alternatives within the EA include a "no action" alternative that reflects current conditions and management strategies on the refuge. Figure 2-1 outlines the steps in the CCP planning process.

Figure 2-1. The Planning Process

2.1.1 Preplanning

The Service completed the following preplanning tasks prior to formally initiating the development of this CCP in order to support planning activities:

- Established an interdisciplinary interagency planning team.
- Identified refuge purpose, history, and establishing authority.
- Identified all relevant laws, regulations, and policies that would have to be considered during the development of the CCP.
- Identified purpose and need for the CCP to make sure all issues are adequately addressed.
- Identified planning area and resource data needs.

2.1.2 Initiate Public Involvement and Scoping

The formal planning process begins with the scoping period, which involves soliciting public involvement and results in a thorough assessment of issues, concerns, opinions, thoughts, ideas, concepts, and visions for the refuge. Formal scoping began with publication of a notice of intent to prepare an Environmental Assessment (EA), which was published in the *Federal Register* on August 10, 2007 (Volume 72, Number 154, pp. 45059-45060).

Three public open house meetings were held in 2009 (Table 2-1).

Table 2-1. Location, Attendance, and Dates of Public Meetings

Community	Attendance	Meeting Date
Liberty, TX	18	November 30, 2009
Beaumont, TX	5	December 1, 2009
Houston, TX	14	December 2, 2009

When the notice of intent was published, the team distributed a Planning Update requesting public feedback and informing community members of upcoming public scoping meetings. Notices of these meetings were also published in the local newspaper and announced on local radio.

The first meeting was held in Liberty, Texas, on November 30, 2009, at the Jean and Price Daniel House; the second meeting was held in Beaumont, on December 1, 2009, at the Rogers Park Center; and the third meeting was held in Houston on December 2, 2009, at the United Way of greater Houston. The refuge, with regional office representatives, provided presentation on both the CCP's process as well as the existing condition of the refuge in an attempt to inform the public and to solicit input into the planning process. These presentations were also designed to solicit input on refuge-specific issues that the public felt should be addressed in the CCP.

In addition to three open house public meetings, the refuge hosted a government-to-government meeting and invited regional representatives from both State and Federal government agencies on February 4, 2010. The meeting was held at the Liberty/Dayton Area Chamber of Commerce in Trinity, Texas, with representatives from the refuge, U.S. Fish and Wildlife Service Ecological Services Field Office in Houston, the National Park Service, and the Texas Parks and Wildlife Department.

In addition to these public and interagency meetings, a representative from the refuge attended an Ecoregional Meeting at the Texas Mid-coast National Wildlife Refuge Complex where land management agencies in the Gulf Coast Prairies and Marshes met to discuss ecoregional concerns. The meeting was intended to discuss the refuge's role in addressing issues affecting fish, wildlife, and their habitats within the larger landscape. Seventeen people attended this meeting representing a variety of land management groups and agencies. Table 2-2 lists agencies and organizations that attended the ecoregion coordination meeting.

Table 2-2. Agencies and Organizations Attending the Gulf Coast Prairies and Marshes Ecoregional Coordination Meeting

Agencies	Organizations
Trinity River NWR	US Fish and Wildlife Service
Texas Mid-coast NWR Complex	US Fish and Wildlife Service
Gulf Coast Joint Venture	Gulf Coast Prairies and Marshes Ecoregion
The Nature Conservancy	Gulf Coast Prairies and Marshes Ecoregion
FWS Ecological Services	US Fish and Wildlife Service
Texas Parks and Wildlife Department	State of Texas
Texas Chenier Plains NWR Complex	US Fish and Wildlife Service
Bosque del Apache NWR	US Fish and Wildlife Service
Attwater Prairie Chicken NWR	US Fish and Wildlife Service

The feedback received at the conclusion of the public involvement period indentified numerous concerns for a variety of stakeholders. Table 2-3 thru 2-5 list these concerns and specifies which stakeholder group voiced them.

Table 2-3. Concerns Regarding Habitat

Concern	General Public	State of Texas	Federal Agencies	USFWS
Threatened and Endangered Species	X		X	X
Land Acquisition	X			X
Instream Flows	X			
Invasive Flora/Fauna Management	X	X	X	X
Native Flora/Fauna Conservation	X			X
Wetland Management	X			X
Climate Change	X		X	X
Oil and Gas Development	X			X

Table 2-4. Concerns Regarding Public Use Opportunities

Concern	General Public	State of Texas	Federal Agencies	USFWS
Interpretation	X			X
Environmental Education	X	X	X	
Hunting	X	X		X
Fishing	X			
Wildlife Observation	X			
Wildlife Photography	X			
Law Enforcement	X	X	X	X
Land Acquisition	X			X

Table 2-5. Concerns Regarding Facilities

Concern	General Public	State of Texas	Federal Agencies	USFWS
Public Use Access	X	X	X	X
Visitor Office/ Environmental Center	X			X
Other Visitor Facilities	X			
Cultural Resources	X			
Climate Change	X	X	X	X

2.1.3 Determine Issues

To determine the planning issues to be addressed in the CCP, the planning team reviewed the concerns identified by the public along with management concerns identified by refuge staff and those submitted by other Federal agencies and the State of Texas. Planning issues are those issues for which multiple approaches to resolving the issue will be evaluated as part of the planning process. Section 2.2 provides more detail on the process used to identify the issues, as well as what those issues are.

2.1.4 Develop and Analyze Alternatives

The practice of developing management alternatives as a part of the planning process is derived from the NEPA. This act requires Federal agencies to consider the impacts of proposed actions and to develop a reasonable range of alternatives to those actions. Alternatives are "different sets of objectives and strategies or means of achieving refuge purposes and goals, helping to fulfill the Refuge System mission, and resolving issues" (602 FW 1 of the Service Manual). The planning team developed a range of alternatives that respond to the significant planning issues and eliminated alternatives that did not meet refuge purposes or that were outside the Service's ability to implement. The environmental effects of the alternatives were analyzed, and the results are presented in Chapter 4 of the EA found in Appendix C.

2.1.5 Prepare Draft Plan and EA

The draft CCP and EA were concurrently prepared. The draft CCP and EA were then submitted for internal review, submitted to TPWD for review, then released to the public for a 30-day review period. The public was informed of the release with a notice in the *Federal Register* as well as through local media outlets.

2.1.6 Prepare and Adopt Final Plan

Comments received on this draft CCP/EA will be incorporated where appropriate and perhaps result in modifications to the proposed action or selection of one of the other alternatives. The alternative that is ultimately selected will be the basis for the final CCP. The final CCP will provide an appendix with the response to comments received during public review and will replace current management direction after the decision document is signed (see Section 1.6, Decision to be Made, of Appendix C, Environmental Assessment).

2.1.7 Implement Plan, Monitor, and Evaluate

The final CCP will guide management of the refuge over the coming 15-year period. It will guide the development of more detailed step-down management plans for specific resource areas and will be the basis for the annual budgeting process for refuge operations and maintenance (Chapter 5). Most importantly, it lays out the general approach to managing habitat, wildlife, and people at the refuge that will direct day-to-day decision-making and actions.

A critical component of management is monitoring and measuring resources and social conditions to make sure that progress is being made toward meeting goals. Monitoring also detects new problems, issues, or opportunities that should be addressed. The refuge is using an adaptive management approach, which means that information gained from monitoring is used to evaluate and, as needed, to modify refuge objectives.

2.1.8 Review and Revise Plan

Agency policy directs that the CCP be reviewed annually to assess the need for changes. The CCP will be revised when significant new information becomes available, ecological conditions change, or the need to do so is identified during the annual review. If major changes are proposed, public meetings may be held, or new environmental assessments and environmental impact statements may be necessary. Consultation with appropriate State agencies would occur at least every 15 years.

2.2 Issues

Refuge planning policy defines an issue as any unsettled matter that requires a management decision: an initiative, opportunity, resource management problem, threat to refuge resources, conflict in uses, public concern, or presence of an undesirable resource condition (602 FW 1.6I). Public responses obtained through newsletters and public open house meetings, in addition to management concerns identified by refuge staff and State and Federal natural resource agencies, were used to identify issues addressed in the CCP/EA.

Three planning issues were identified for consideration during the development of this draft CCP. These issues reflect problems, opportunities, or points of discussion that the draft CCP addresses in a variety of ways. The EA (Appendix C) displays the potential consequences of implementing the alternatives on refuge resources.

The complete set of written comments received is available from the U.S. Fish and Wildlife Service Southwest Regional Office in Albuquerque, New Mexico.

2.2.1 Issue 1: How will the refuge address wildlife and habitat management issues to ensure the conservation, diversity, and enhancement of the bottomland hardwood forests?

2.2.1.1 Summary of Comments

Members of the public, representatives at the Ecoregional Meeting, and the planning team were concerned about the conservation of the bottomland hardwood forests. Restoration of previously drained wetlands is needed in this area. Invasive species control, both plants and animals, is critical to protect native plants and animals. The public also raised concerns about habitat loss and opportunities to acquire additional lands. The public would also like to see continued habitat restoration efforts on the refuge and management of threatened and endangered species. There is also concern about how the refuge will address climate change.

Members of the general public, TPWD, other Federal agencies, the general public, and the planning team expressed concern on how the refuge will manage to ensure the conservation, diversity, and enhancement of the bottomland hardwood forests, native flora/fauna conservation, invasive flora/fauna management, wetland management, land acquisition, climate change, and resource protection.

Conservation/Enhancement of Bottomland Hardwood Forests

The majority of comments received on habitat and wildlife management issues were based on an aggressive acquisition program to expand the refuge with continuous units of land from willing sellers and land donors. Comments from all stakeholder groups on habitat management were based on preservation and reversing the trends of fragmentation and development. Many groups, including the refuge, had concerns over the increased spread of invasive and non-native flora throughout the refuge, as well as preserving existing units to allow them to develop and mature into old growth forests.

Native Flora/Fauna Conservation

Members of the public commented on numerous concerns, including the priority for managing wildlife first and then initiating management actions for public use opportunities. Concerns were expressed on restoring native flora, as well as impacts of invasive species and damage initiated from feral hog rooting activities.

Invasive Flora/Fauna Management

Invasive, exotic, and nuisance species issues were raised by the public, State, and the refuge. All comments indicated that the refuge needs to continue to treat invasive flora. The refuge also identified concerns of the red imported fire ant and the potential impacts to native wildlife.

Wetland Management

The refuge identified issues with existing water control structures and the need to maintain and improve existing levees, as well as developing a consistent program to conduct water sampling and fish surveys as indicators of quality wetlands.

Land Acquisition

Acquisition efforts are focused on the floodplain of the Trinity River with special emphasis on bottomland hardwood forests. The bottomland forests of the ecosystem have high wildlife and wetland values and provide quality habitat for a large variety of wildlife species. Many stakeholders identified acquisition efforts as the desired direction to offset the impacts of fragmentation.

Climate Change

Many concerns were bought up during our ecoregional planning meeting held for the Prairies and Marshes Ecoregional meeting on Brazoria National Wildlife Refuge in 2009. Many concerns were focused on the concerns of global climate change and the impacts warmer temperatures would have on the entire ecoregion. Issues included climate change and its potential for alterations to habitat components and wildlife migrations, and habitat fragmentation from the development of sprawling communities or other land use developments. As habitats change, the wildlife species that inhabit those habitats will also change. There is little the refuge can do to affect this issue, but it can realize that is occurring, document these changes through data collection, and adapt management as hydrology and plant communities change. Concerns regarding climate change were focused on initiating baseline data to develop a better understanding of the immediate impacts of climate change and the long-term trends in habitat and wildlife species shifts.

Resource Protection

Many concerns were bought up by the public and the refuge on the increased need for law enforcement patrols to better protect refuge resources.

2.2.2 Issues 2: How will the refuge provide public use opportunities while ensuring the conservation, diversity, and enhancement of the bottomland hardwood forests?

2.2.2.1 Summary of Comments

The refuge receives over 22,000 visitors annually and provides opportunities for the public to hunt waterfowl, big game, and upland game; fish; and observe, photograph, and learn about bottomland hardwood forests. The refuge provides public use opportunities that are appropriate and consistent with other national wildlife refuges of the same size and staffing levels. Members of the general public, the State of Texas, and the planning team expressed a desire for the refuge to increase and enhance its public use programs and quality wildlife-dependent recreation activities. Comments were received indicating that additional wildlife-dependent recreational opportunities are needed on the refuge. Some members of the public would like to see hunting and fishing continued on the refuge. There were concerns of vandalism and littering on the refuge. Some members of the public would like to see more education and interpretation opportunities on the refuge. Some individuals would like to see more opportunities for photography, viewing areas with information about refuge habitats,

and/or additional access points for canoes and kayaks. Other major concerns call for expanding the refuge boundaries. Overall, public comments reflected care in growing the refuge, increasing conservation efforts, and building upon the unique wildlife viewing and extraordinary recreational opportunities.

2.2.3 Issue 3: How will the refuge manage facilities while ensuring the conservation, diversity, and enhancement of the bottomland hardwood forests?

The Trinity River NWR has not only been aggressive in acquisition of additional acreage from willing sellers but has also recently constructed an office facility on refuge land and would like to incorporate a visitor center and additional facilities to support a greater wildlife-dependent public use program. The office for the refuge consists of a single field station administrative headquarters office as well as a storage/maintenance building. The office is approximately 3,200 square feet and includes eight offices, storage space, conference room, kitchenette, and visitor and staff parking areas. The storage/maintenance building encompasses 2,250 square feet and is adjacent to the headquarters.

2.2.3.1 Summary of Comments

Members of the general public and the planning team commented on the need for improved facilities to support refuge operations. The planning team reviewed comments on public use facilities, administrative facilities, and refuge access issues. Members of the public commented on issues such as increasing interpretive signs and kiosks, establishing a visitor center, and creating and improving on “green” infrastructure.

Public Use Access

Members of the public would like to see additional areas of the refuge open for wildlife-dependent recreational opportunities. Some constituents commented on additional maps or web information indicating which areas of the refuge contain public access and the types of activities allowed on certain units.

Public Use Facilities

Members of the general public expressed concern about having additional public use facilities throughout the refuge. Many members of the public requested a new visitor center for the refuge.

Cultural Resources

Cultural resources include archaeological and historic sites and other artifacts. Some comments were received during the public meetings requesting interpretive materials on cultural resources be provided throughout the refuge.

Oil and Gas Operations

Many members of the public would like to see no petroleum development on the refuge, and many would like to see special mitigations incorporated to minimize negative impacts to wildlife.

3. 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 six major sections: Landscape Setting; Physical Environment; Biological Environment; Socioeconomic Environment; Archeological, Cultural, and Historical Resources; and Current Management.

3.1 Landscape Setting

To more effectively achieve the Refuge System mission of conserving fish, wildlife, and their habitats, the Trinity River 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 landscape beyond its boundaries should be taken into consideration to determine its role in the larger conservation effort. This section describes the landscape setting in which the Trinity River NWR is located. These "landscapes" are defined by many different characteristics and zones dependent upon which government or non-government organization (NGO) is delineating them. The different landscapes (Central Flyway, Landscape Conservation Cooperative, Bird Conservation Regions, The Nature Conservancy Ecoregion, and Hydrologic Unit) are discussed in the following text (see Map 3-1).

3.1.1 Central Flyway

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

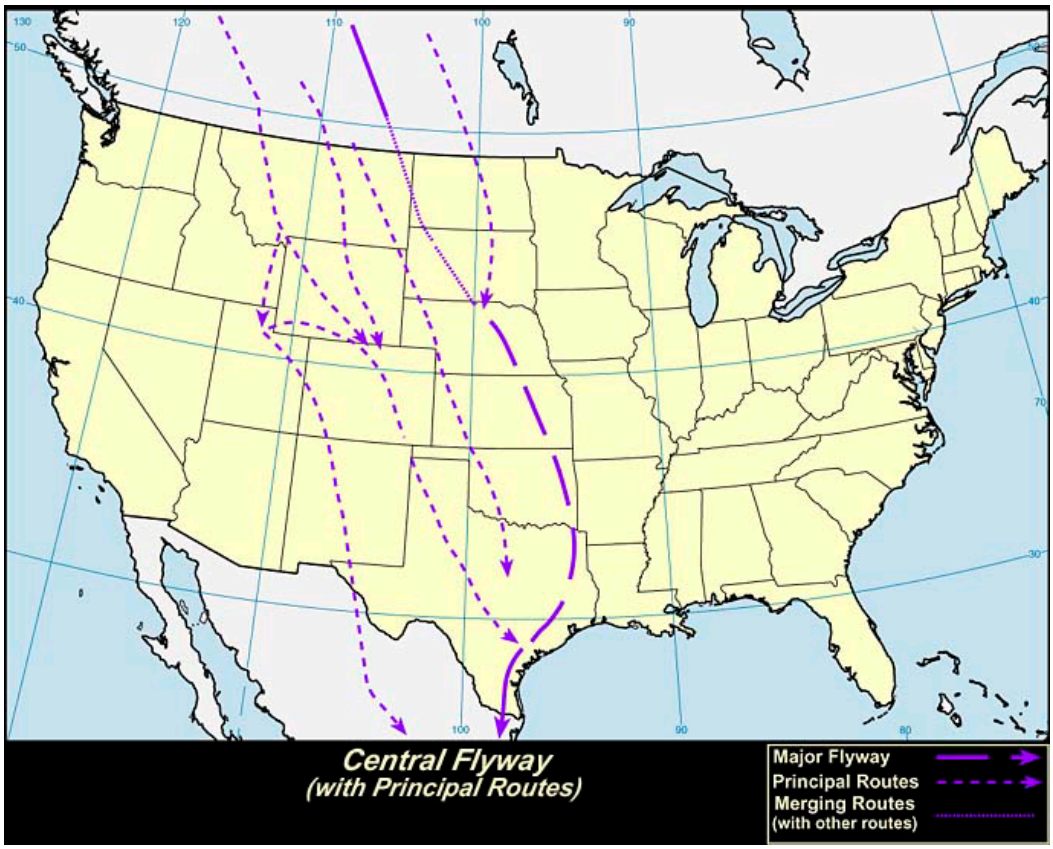
The Central Flyway (See Figure 3-1) spans the Canadian Northwest Territory, two Canadian provinces (Alberta and Saskatchewan), numerous countries in Central America, South America, and 10 U.S. states: Montana, North Dakota, South Dakota, Wyoming, Nebraska, Colorado, Kansas, New Mexico, Oklahoma, and Texas.

This great flyway has its beginnings on the northwest Arctic coast. Further south in Canada, the western boundary of the Central Flyway parallels the eastern base of the Rocky Mountains. In the U.S., the Central Flyway veers toward the east, merging with the Mississippi Flyway. The Central Flyway is bounded on that side by the Missouri River running through western Missouri, Arkansas, and Louisiana, eventually following the Gulf Coast of Mexico southward. In western Montana, however, the Continental Divide is crossed, and the line passes through the Great Salt Lake Valley and then somewhat east of south across the tableland of Mexico. It may be called "the flyway of the Great Plains," as it encompasses the vast region lying between the valley of the Mississippi River and the Rocky Mountains, the principal wheat-growing region of both Canada and the United States.

The western boundary of the Central Flyway is an important breeding area for waterfowl beginning at the northern end of Great Salt Lake, Utah. The Central Flyway is relatively

simple, as the majority of the birds that use it make direct north and south journeys from breeding grounds in the north to winter quarters in the south. Trinity River NWR lies near the southern end of the Central Flyway and is one of 13 refuges located within the State of Texas.

Historically, the area surrounding the refuge has played a key role in sustaining continental waterfowl and migratory Neotropical bird populations within the Central Flyway. Eastern Texas bottomland hardwood forests, including those along the Trinity River, represent the only significant breeding habitat of the wood duck in the Central Flyway, as well as important wintering areas for mallards and several other waterfowl species. This area also provides important breeding, wintering, and stopover habitat for a variety of Neotropical birds. Approximately 273 species of birds are present in the bottomland forests and the associated wetlands in eastern Texas; approximately 100 bird species breed within the Trinity River area. Trinity River NWR provides wintering and foraging habitats for over a dozen species of ducks. Additionally, the refuge provides breeding habitat for wood duck (*Aix sponsa*), black-bellied whistling ducks *(Dendrocygna autumnalis)*, and hooded merganser (*Lophodytes cucullatus*).



(Illustrator: J. Pahountis-Opacic. Nutty Birdwatcher 2009)

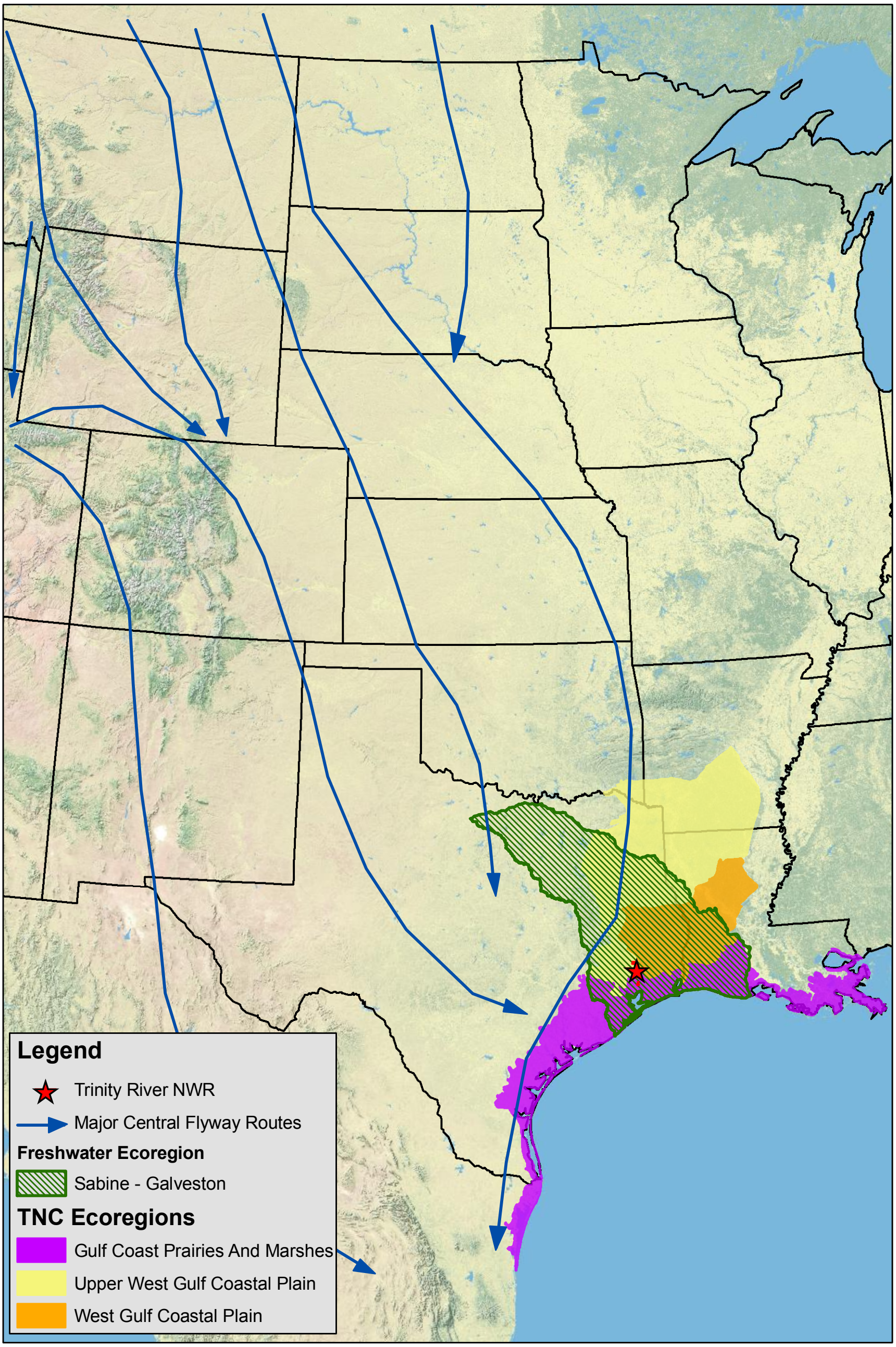
Figure 3-1. Central Flyway. The primary routes taken by migratory birds through Texas and the lower Gulf Coast.

U.S. Fish & Wildlife Service

Trinity River National Wildlife Refuge

Liberty County, Texas

Landscape Scale Conservation



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: trn_flyway_6.8.11_shl

0 100 200 400 Miles

0 100 200 400 Kilometers

N S

UTM ZONE 15
NAD 83

3.1.2 Strategic Habitat Conservation: Gulf Coastal Plains and Ozarks LLC and Gulf Coast Prairie LLC

Strategic Habitat Conservation (SHC) is an adaptive management approach to habitat conservation (USFWS 2006a) that directs 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. *Adaptive management* refers to a management style in which the effectiveness of management actions is monitored and evaluated, and future management is modified as needed based on the results of this evaluation or other relevant information that becomes available. This approach will protect and enhance wildlife populations and ecological functions that sustain them. Additionally, it will direct our limited resources to achieve conservation for priority species.

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)

Some programs within the Service already use the framework of SHC, notably the Joint Venture and the National Fish Habitat Action Plan. Many of our conservation partners, such as The Nature Conservancy, World Wildlife Fund, and State wildlife departments in their State Comprehensive Wildlife Conservation Strategies (Wildlife Action Plans) use a similar approach. This approach provides a framework for setting conservation objectives based on the best available information. The refuge will monitor and test underlying assumptions to improve our knowledge and make any necessary changes to our implementation strategies and techniques.

Landscape Conservation Cooperatives

The Service is using the framework as a base geography to locate the first, as well as future, Landscape Conservation Cooperatives (LCCs; See Figure 3-2). LCCs are conservation-science partnerships between the Service, Federal agencies, states, tribes, NGOs, universities, and other entities. The Service uses LCCs, the fundamental units that function within the geographic framework, to carry out the functional elements of SHC. The geographic framework provides a Service-wide network of scientifically credible analytical units for optimizing conservation efficiency for priority species that can be compared fairly across the network. By providing a visual context for conservation at the landscape scale (the entire range of a priority species or suite of species), the framework helps ensure that resource managers have the information and tools needed to make decisions to conserve natural resources using the most efficient and effective methods possible.

LCCs guide resource management decisions to address landscape-scale stressors, including habitat fragmentation, genetic isolation, spread of invasive species, and water scarcity, all of which are accelerated by climate change. LCCs are developed on the foundation of SHC.

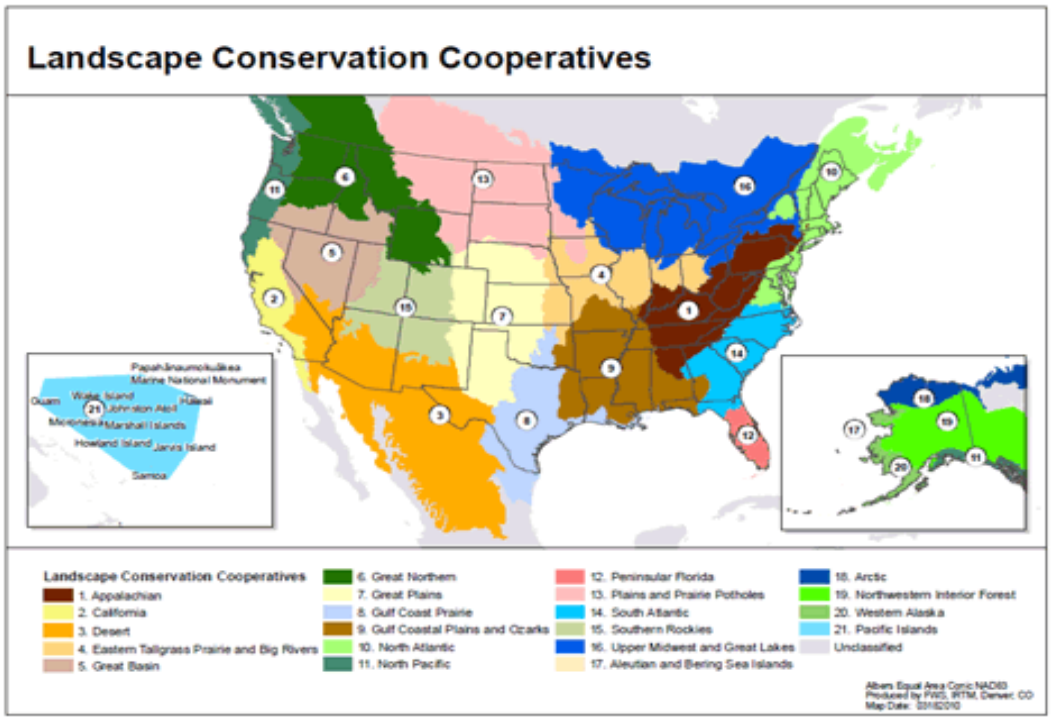


Figure 3-2. Landscape Conservation Cooperatives

The refuge is located in parts of two LCCs: The Gulf Coastal Plains and Ozarks LCC (GCPO LCC), and a small portion of the Gulf Coast Prairie LCC (GCP LCC). These are two of 22 LCCs identified by the DOI; they are described in Chapter 1.

The refuge also falls into two Bird Conservation Regions (BCRs). The majority of the refuge is within the West Gulf Coastal Plain/Ouachita (BCR #25), with a small portion located in the Gulf Coastal Prairie (BCR #37) described in Chapter 1.

Gulf Coastal Plains and Ozarks Landscape Conservation Cooperative

The GCPO LCC will facilitate conservation planning and design across this highly diverse region in southeastern North America that extends from the mountain tops of the Ozark, Boston, and Ouachita ranges to the pine savanna and prairies of the West and East Coastal Plains, down into the swamps, bayous, and alluvial bottomlands of the Mississippi River and its tributaries, and along the beachfronts and shorelines of the northeast Gulf Coast. With accelerating climate change threatening to affect wildlife and fisheries, a capability is being developed to test, implement, and monitor conservation strategies responsive to this dynamic landscape. These strategies are model-based and geographically defined, allowing us to effectively apply our emerging climate knowledge to predict habitat and species changes and to target our conservation action. The Service is collaborating with agencies across the Department of the Interior, State agencies, and NGOs consistent with the Secretarial Order issued in September 2009 (U.S. Secretary of Interior 2009).

The GCPO LLC is home to species found nowhere else in the world. Those include a long list of freshwater mussels, snails, and fish with names like the plicate rocksnail and the Ouachita kidneyshell. Other endemic species include the Louisiana black bear, red-cockaded

woodpecker, cerulean warbler, Mississippi sandhill crane, gopher tortoise, pitcher plant, Fourche Mountain salamander, and Ozark cavefish (USFWS 2011e).

Gulf Coast Prairie Landscape Conservation Cooperative

A small portion of the GCP LCC occurs along the southern portion of the refuge. The LCC 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 may include to include portions of three Mexican states that share similar habitats (Tamaulipas, Nuevo Leon, and Coahuila). The Gulf Coast Prairie region contains several large river systems, including the lower Rio Grande, Guadalupe, Brazos, Trinity, Nueces, Arkansas, Red, San Antonio, and Mississippi Rivers. Each subdivision contains a unique mix of habitats and priority populations of fish and wildlife.

The GCP LCC includes a diverse landscape of prairies, coastal environments, and rangelands. The richness of the area supports a wide variety of habitat for many distinct species of native plants, fish, and wildlife, including many endemic species. The LCC seeks to address critical science needs and gaps in the area and connect them to conservation practices on the ground, building synergies with efforts already underway. This coordination helps ensure efficient use of limited conservation funding and resources.

The GCP region faces many challenges that threaten both nature and wildlife within this diverse landscape. The once extensive grassland system has been impacted by urban and agricultural development. Large river systems struggle to maintain watershed integrity and base flows. Coastal systems fight the effects of reduced freshwater inputs. Unprecedented drought, catastrophic wildfires, and climate-related impacts, as well as threats such as pollution, invasive species, and disease, also put a strain on native species and habitats.

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. By recognizing the spatial differences in the capacities and potentials of ecosystems, ecoregions stratify the environment by their probable response to disturbance. The ecoregions were based on original work by Robert Bailey, U.S.D.A. Forest Service (Bailey et al. 1994) and were modified by TNC in cooperation with the network of Natural Heritage Programs (The Nature Conservancy 1999).

The refuge is located in three TNC Ecoregions (see Figure 3-3) including parts of the West Gulf Coastal Plain, the Upper West Gulf Coastal Plains, and the Gulf Coast Prairies and Marshes Ecoregion (The Nature Conservancy 2002, The Nature Conservancy 2002a, The Nature Conservancy, 2002b).

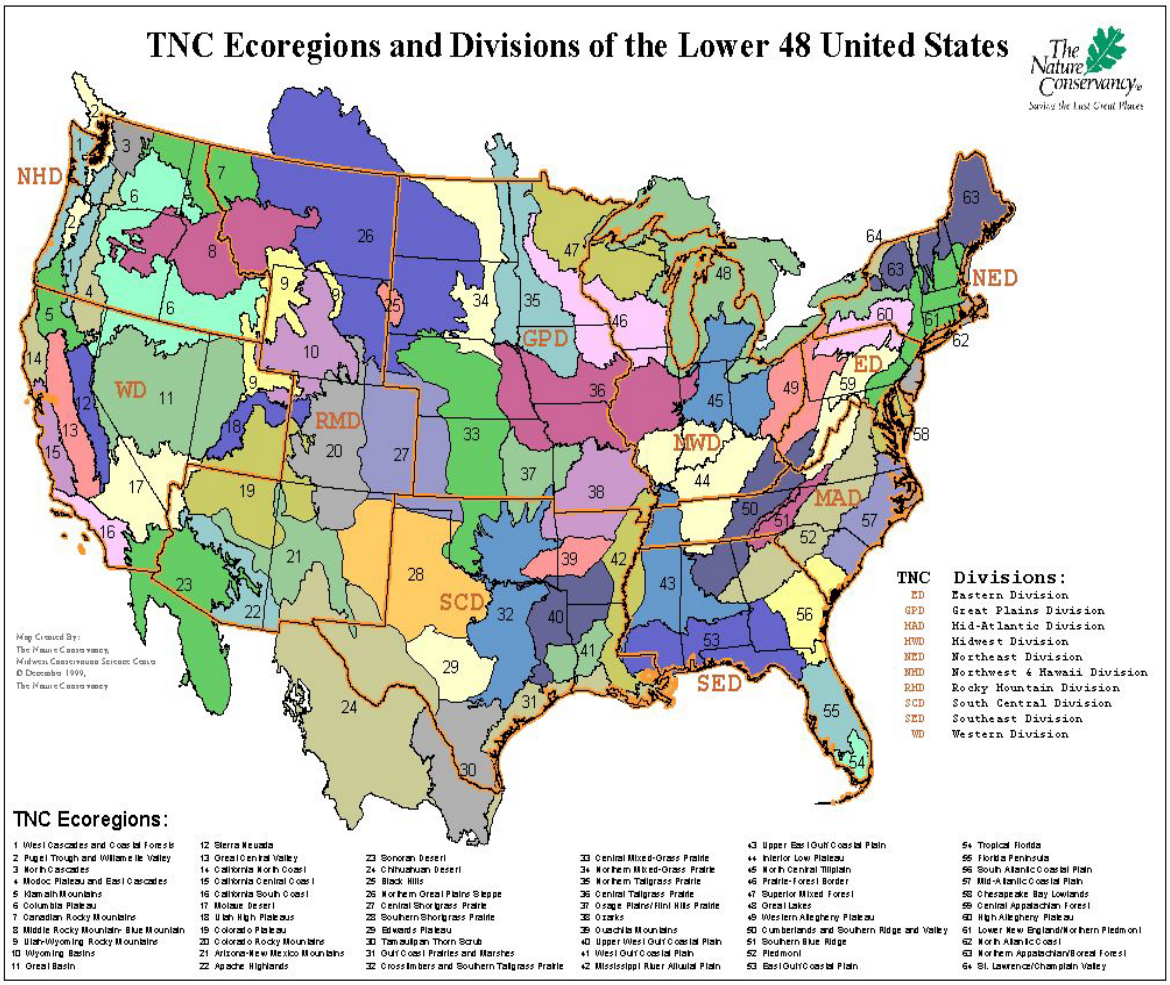


Figure 3-3. The Nature Conservancy Ecoregions and Divisions of the Lower 48 States

The West Gulf Coastal Plain (WGCP) Ecoregion (see Figure 3-3) encompasses approximately 17,469 square miles (11,180,160 acres) in eastern Texas and western Louisiana, extending from the western edge of the Mississippi River floodplain in Louisiana to the Trinity River in Texas, and from the prairies and marshes of the Gulf Coast north to the mixed pine-hardwood dominated rolling hills of northeast Texas and northern Louisiana. It is broadly defined as the area encompassing the natural range of longleaf pine dominated uplands on the coastal plain west of the Mississippi River. The WGCP touches the eastern boundary of the refuge in several locations (see Map 3-2. TNC Ecoregions Overlying Trinity River NWR) but remains the ecoregion with the fewest acres represented on the refuge.

Pre-Settlement Landscape

The pre-settlement landscape of the WGCP was a mosaic of ecosystems, each responding to environmental gradients at various scales, such as regional climate and local patterns of soils, landform, and disturbance regimes. The WGCP landscape was primarily forests and woodlands, with longleaf pine woodlands dominating the frequently burned uplands and bottomland mixed-hardwood forests occupying the floodplains. Within these landscape-scale "matrix" ecosystems were imbedded several smaller ecosystems that responded to local environmental influences. Such "patch" ecosystems included herb-dominated glades, barrens,

and groundwater seeps, xeric and mesic hardwood forests, bald cypress swamps, and marshes. The widespread occurrence of open prairies in the ecoregion is evident by the use of "prairie" in many local place names. Dominating the uplands were longleaf pine woodlands, representing the western limit of a once primeval forest that extended across 92 million acres of the southeastern United States from Texas to Virginia. The ground cover of the longleaf pine woodlands harbored some of the most species-rich plant communities in North America. Likewise, river bottoms were highly diverse, with a mix of species and communities resulting from relatively minor changes in elevation. Although much of the modern landscape on the WGCP remains forested, the pattern of vegetation differs greatly from that of the pre-settlement landscape. For example, less than four percent of the longleaf pine communities that once dominated the uplands of the WGCP remain in the ecoregion.

Humans in the WGCP

It is estimated that humans first appeared on the WGCP approximately 12,000 years ago during the last ice age. These were small bands of hunter-gatherers who followed the migrations of large mammals such as woolly mammoths, ground sloths, and longhorned bison. Some archaeologists believe that hunting pressure from humans contributed to the extinction of these large Pleistocene mammals. The Caddo Indians were the largest indigenous group in the region just prior to European settlement. The Caddo Indians had a village-based, agricultural society. They cleared forests for crops and villages, and set fires on the landscape to improve travel and to drive game (Truett and Lay 1984). Although accurate accounts of the landscape setting during this time are few, the impact of Native Americans on the landscape was probably minimal by modern standards (Martin and Smith 1993).

Alteration of the Landscape

Since Euro-American settlement, most of the ecoregion has been subject to increasing and widespread alteration of the landscape. Today, only approximately three percent of the coastal plain upland landscape remains in entirely natural vegetation (Frost 1993), consisting primarily of longleaf pine dominated natural stands. Many stands are mixed with sand post oak, blue jack oak, black hickory, and shortleaf pine. Ground cover plant species consisting of bullnettle, noseburn, longleaf buckwheat, hairy bush clover, soft greeneyes, spiderwort, Louisiana yucca, and pricklypear cactus are generally drought tolerant and exhibit adaptations to frequent fire regimes.

Logging, agriculture, and herbicide use have been major threats to the ecoregion in the past, which has affected many bottomland hardwood forest dependent wildlife species, such as the red-cockaded woodpecker.

The Upper West Gulf Coastal Plain (UWGCP) Ecoregion (see Figure 3-3) is approximately 26,500,000 acres, or 41,400 square miles, and encompasses parts of four states: Arkansas, Oklahoma, Texas, and Louisiana. The UWGCP extends south approximately from Little Rock, Arkansas, to Shreveport, Louisiana, southwest to Houston and northwest to outside the Dallas/Fort Worth area. Physiographically, it is bordered by the Lower West Gulf Coast Plain to the south, the Gulf Coast Prairies and Marshes to the southeast, the Crosstimbers and Southern Tallgrass Prairie to the West, the Ouachita Mountains to the north, and the Mississippi River Alluvial Plain to the East. The delineation between the Lower West Gulf Coastal Plain and the UWGCP is the northern limit of the longleaf pine terrestrial community.

The vast majority of the refuge occurs in the UWGCP (see Map 3-2. TNC Ecoregions Overlying Trinity River NWR).

Pre-Settlement Landscape

Pre-settlement landscape in the UWGCP consisted of bottomland hardwood forests in various degrees depending on the amount of annual and seasonal flooding. Bottomlands were dominated by hardwood communities consisting primarily of oak species, and more deeply flooded areas frequently consisted of cypress and cypress-tupelo swamps. Upland areas consisted of shortleaf and loblolly pines, mixed pine-hardwood communities, glades, and woodlands. Prairies appear to have been quite common.

Humans in the UWGCP

It is believed that nomadic hunter-gatherers first occupied the UWGCP at the end of the last glacial advance, approximately 14,000 to 10,000 years ago. Approximately 2,500 years ago, Native Americans began to transition from a gathering to an agricultural lifestyle (Peter 1990). European visitors to the UWGCP in the early 1800s reported Native Americans were engaged in limited farming, as well as hunting and gathering. It is believed that the Caddo tribe augmented the natural fire process in the ecoregion to clear areas, enhance crops, and flush game. Though there was a European presence in the area since the 17th century, the 1820s are considered the real beginning of settlement in the ecoregion (Shepherd 1984).

Most Native Americans were relocated from the UWGCP by the 1840s. Relocation coincided with increasing western settlement aided by Federal land grant programs (McInnis 1995). Agriculture became one of the primary land uses in the UWGCP with the rise of several large plantations in the 30 years before the Civil War, with cotton and corn the dominant crops (Peter 1990). The civil war curbed large-scale agricultural development. After the Civil War, property was sold off in smaller tracts so that by 1900, numerous smaller farms and tenants occupied the area. Cattle grazing also became popular in the ecoregion after the Civil War (McInnis 1995).

Cotton farming grew as more lands were cleared from timber harvesting, to the point where cotton farming was attempted in nearly every terrestrial system in the ecoregion. Many of the smaller farms that were abandoned during the Great Depression in the 1920s and 1930s were purchased by the Federal Government and became elements of Kisatchie, Davy Crockett, and Sabine National Forests (Turner 2000).

Timber production has been the other primary land use in the ecoregion. Railroad construction through the UWGCP in the early 1800s facilitated traffic and development into the ecoregion, expanding timber and agriculture markets. Lumber mills followed rail lines into the ecoregion. The timber industry reached its peak in the UWGCP in the 1880s, and by the 1920s, most of the ecoregion had been logged and cut over at least once. By 1925, almost all virgin pine had been cut over. After a decrease in large-scale timber harvesting, the timber industry moved to managed plantation harvesting. Timber harvesting for both sawmill and pulpwood continues to be a major land use in the UWGCP.

Mineral extraction in the UWGCP began in the late 1800s and included coal, lignite, clays, sand, gravel, and metals. Many of these resources continue to be extracted from the ecoregion. Oil and gas extraction began in the 1920s following the decrease of timber production (McInnis 1995).

The Nepheline Syenite formations in the northern part of the ecoregion were mined extensively beginning in the 1930s for bauxite for the aluminum industry. In addition to creating a huge demand for aluminum, World War II was also responsible for the number of munitions plants, depots, and military bases in the ecoregion (Shepherd 1984). As munitions plants and depots were constructed in remote areas with plenty of surrounding land, they provided excellent conservation opportunities owing to their scale and use patterns.

Natural resource-based industries in the UWGCP have expanded this century to include recreation and tourism, though much of the local economy is still based on forestry, agriculture, and traditional resource extraction. Suburban sprawl and development of natural lands continues to increase (Shepherd 1984, U.S. Dept. Census 1998).

Alteration of the Landscape

Generally, land use in the UWGCP has resulted in disturbance of various types and levels throughout the ecoregion. Many areas of biodiversity have experienced some kind of past disturbance, including clearing for timber, agriculture, grazing, or mineral extraction. However, some of these areas have been or are in the process of being returned to a level of pre-settlement state. Following the first round of timber extraction, many cleared areas were converted to pasture or cotton fields. Cleared areas that have failed to grow cotton may have been abandoned to return to a wooded state, and areas that were clearcut for the first time in the 1920s or 1930s are now showing older-growth forest; similarly, areas that have proven unsuccessful at hosting commercial forest are being restored to their natural state. Unfortunately, suppression of the natural fire regime has resulted in stressed or ecologically incomplete landscapes.

Major threats to the ecoregion consist of habitat conversion, habitat fragmentation, and the alteration of natural fire regimes through actions, including but not limited to logging, grazing, residential development, mining, oil and gas extraction, exotic species invasions, and commercial development.

The Gulf Coast Prairies and Marshes (GCP&M) Ecoregion (see Figure 3-3) is a region of contrasts and commonalties. The region encompasses two countries, two states, 22 primary bays, 19 major rivers, and nearly 600 miles of shoreline. A rich and vast ecoregion, consisting of nearly 24 million acres, the GCP&M is characterized by great biodiversity. The number and types of birds in the ecoregion is among the greatest anywhere in the United States or Canada, and it is also renowned for its butterfly and reptile diversity. The region's productive bays and estuaries are virtual factories, producing fishes and shellfish upon which the people of the ecoregion depend economically and which constitute important links in the food chain for many marine organisms. 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). The southern third of the refuge is located within the GCP&M ecoregion (see Map 3-2. TNC Ecoregions Overlying Trinity River NWR).

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, 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 (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, industrial development and distribution, business infrastructure, agricultural production, tourism, and the appeal of a coastal lifestyle with associated recreational and aesthetic attributes fuel the attraction.

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 affect biodiversity. On a somewhat larger scale, the ecoregion supports the world's second largest petrochemical complex and some of the nation's busiest port facilities.

Alteration of the Landscape

The clearing and fragmenting of coastal forests and the reduction of freshwater wetlands by 30 percent transformed the ecoregion dramatically since the early 1900s (Moulton 1997). The chenier woodlands of the upper Texas coast are essentially gone (Gosselink et al. 1979), and less than two percent of the tallgrass coastal prairie remains (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, and channelization). Large landholdings are also becoming less common due to inheritance tax and developmental pressures.

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, the chenier woodlands of the upper Texas coast are essentially gone (Gosselink et al. 1979), and less than two percent of the tallgrass coastal prairie remains (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).

3.1.3.1 Terrestrial Descriptions

Terrestrial systems in this ecosystem include both mesic bottomland and upland dry-mesic and hydric areas. Bottomlands are dominated by hardwood communities, primarily oak species, and more deeply flooded areas frequently have cypress and cypress-tupelo swamp vegetation. Upland areas have shortleaf and loblolly pines, mixed pine-hardwood communities, glades, and woodlands. Prairies occur on blackland sites, depending on fire history and soil depth. Barrens and woodlands occur on saline soil flats. Ancient volcanic intrusions form bauxite deposits that are home to globally rare and endemic Nepheline Syenite communities. Aquatic systems are low slope, medium- to high-order streams and river systems. Streams are sheet, surface, and groundwater fed. Slower, larger rivers that originate in other ecoregions flow through the UWGCP and are home to diverse mussel and fish communities. Substrates range from gravel and sand-gravel to mud and silt. Natural lakes are few and are remnants of river reaches; the most prominent is Caddo Lake on the Texas/Louisiana border. It is the remnant of a pre-settlement "Great Raft," an expansive natural logjam on the Red River that created a series of wetlands and lake areas that covered thousands of acres.

3.1.3.2 Aquatic Description

The Trinity River NWR is located in the Sabine-Galveston freshwater ecoregion of North America. The Sabine-Galveston is an ecoregion of the Mississippi Complex located in the Arctic-Atlantic Bioregion. It covers central and southeastern Texas and western Louisiana and includes the watersheds of the Neches, Trinity, San Jacinto and Calcasieu Rivers (Abell et al. 2000). There are no known endemic fish species in this ecoregion (Connor and Suttkus 1986). The ecoregion is considered vulnerable, meaning that the remaining habitat occurs in blocks or segments, and established exotic species may be controllable (Abell et al. 2000).

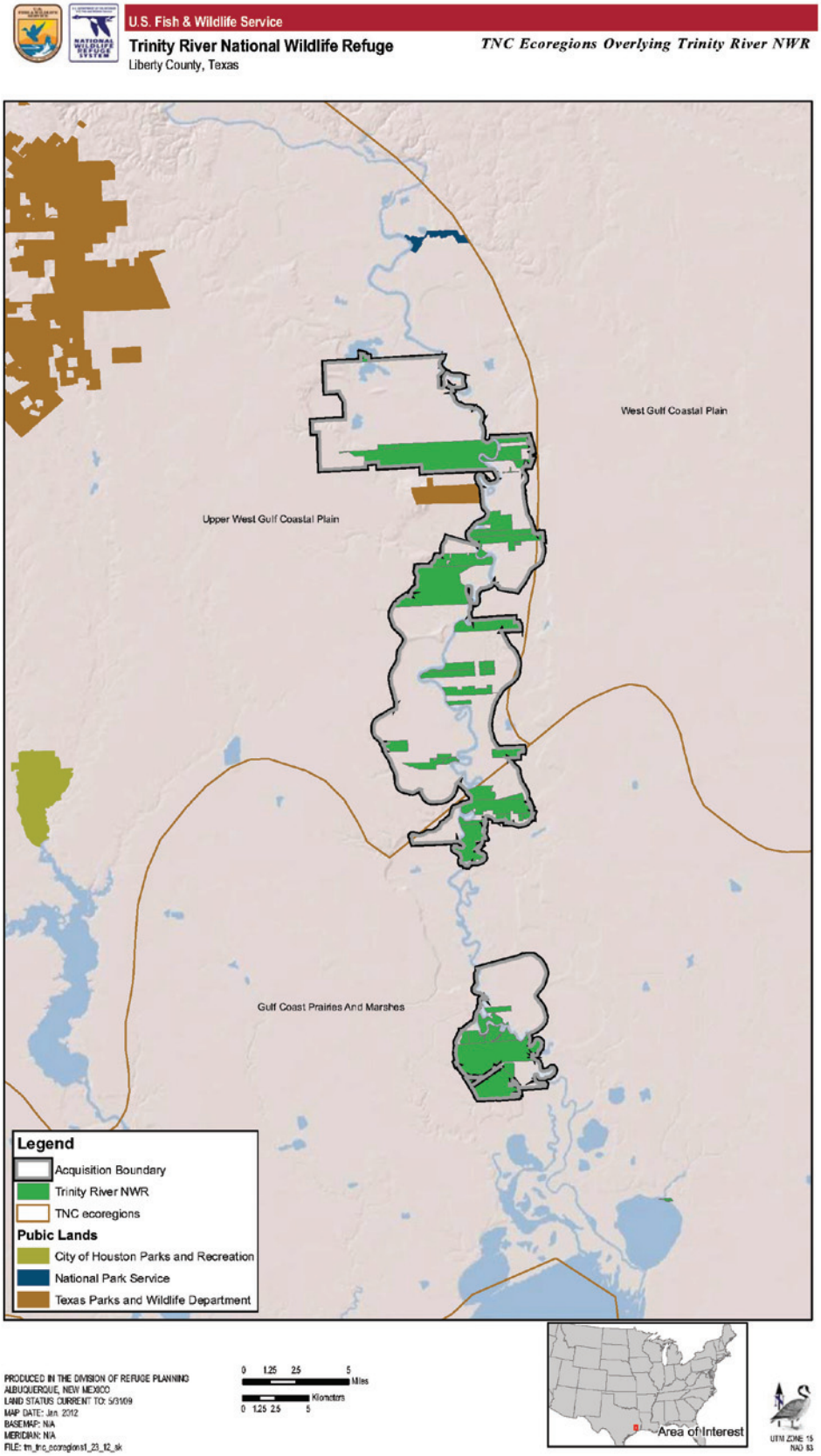
3.1.4 Surrounding Protected Areas

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 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.

Protected areas cover over 13 percent of the Earth's land surface. 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).

There are at least 25 other Federal, State, county, city, and privately managed conservation, wildlife-dependent recreation lands and/or mitigation banks consisting of at least 567,000 acres within the seven counties that surround Liberty County (Harris, Chambers, San Jacinto, Jefferson, Hardin, Polk, and Montgomery) that contribute to wildlife conservation efforts in the area (see Table 3-1). Some of these conservation areas are described in the following text.

Texas Chenier Plains National Wildlife Refuge Complex (98,000 acres) is located in Jefferson and Chambers Counties. It is primarily a fresh and saltwater coastal ecosystem with large expanses of marshes. It is a stopover area for hundreds of thousands of ducks, geese, and various shorebird species. The meandering bayous of the Chenier Plains Refuges cut through ancient floodplains, creating expanses of coastal marsh and prairie bordering Galveston Bay. Prevailing breezes bring in moisture from the Gulf of Mexico, resulting in high humidity and an average annual rainfall of over 51 inches. Coastal marshes act as a huge sponge, holding and siphoning water from tropical storm tides and from flooding upstream. These marshes, combined with the coastal prairie, provide a home for an abundance of wildlife, from migratory birds to alligators.



Map 3-2. TNC Ecoregions Overlying Trinity River NWR

Wallisville Lake Project (U.S. Army Corps of Engineers, 23,000 acres) is located only one mile south of the refuge. The Wallisville Lake Project is a large area of protected wetlands, swamp forest, and bottomland hardwood forest created by the U.S. Army Corps of Engineers for salinity control, navigation, water supply, recreation, and fish and wildlife enhancement. The protection of this land is of vital importance to birds. The Project, which protects the estuary of the Trinity River system, consists of riparian bottomland forests, fresh and brackish water, marshes, cypress swamps, and several natural lakes and rivers, and smaller streams and pools.

Big Thicket Preserve (National Park Service, 105,600 acres) is approximately six miles northeast of the refuge. It is bounded by the Neches and Trinity Rivers to the east and west and by Woodville and Beaumont to the north and south. The southern units of the area are flat and low and drain poorly, while the northern units are hilly with moderate drainage. This area is often referred to as a 'biological crossroad', a transition zone where southeastern swamps, eastern deciduous forest, central plains, pine savannas, and dry sandhills meet and intermingle. This very large ecotone provides habitat for rare species and favors unusual combinations of plants and animals.

Sam Houston National Forest (U.S. Forest Service, 167,000 acres) is approximately 10 miles northwest of the refuge. This area is dominated by several pine species: loblolly, longleaf, and shortleaf. Loblolly pine and shortleaf pine dominate the uplands forest, followed by a mixture of hardwoods trees. Overstory in bottomland hardwood stands include white oak (*Quercus alba*), southern red oak (*Q. falcata*), post oak (*Q. stellata*), sweetgum (*Liquidambar styracuflua*), hickory (*Carya sp.*), and ash (*Fraxinus sp.*). The Sam Houston National Forest is managed under the multiple-use concept. Under this concept, the uses of the forest, such as recreation, fish and wildlife, timber, grazing, soil and water, and minerals, are planned to maintain a balance among the benefits yet provide for public needs. U.S. Forest Service objectives, by law, must consider all resources of the forest, and no single resource can be emphasized to the detriment of others.

Lake Livingston Reservoir (Trinity River Authority, 83,000 acres) was built in 1969 and is owned and operated by Trinity River Authority. Lake Livingston is the largest lake constructed for water supply purposes only that is located entirely within the State of Texas. The Livingston Dam, constructed across the Trinity River approximately 7 miles southwest of the city of Livingston, is 2½ miles in length and has an average height of 55 feet. The average base width of the dam's earthen embankment is 310 feet. The spillway is designed and constructed to pass flows of three times the maximum-recorded flow of the river at this site. Rainfall amounts and current lake levels are of major concern to those who live in close proximity to a large body of water. By design, Lake Livingston has no flood control capabilities/flood storage capabilities, thus flows entering the lake, either from rainfall in the immediate area or from flows coming down the Trinity River, must be passed through the lake as increased flows occur. Spillway operations at Lake Livingston mirror river flows. Within a relatively short period of time, as river flows increase, discharges increase; as river flows decrease, discharges decrease.

Table 3-1. Surrounding Conservation Type Lands within the 8-County Region

Name	Acreage	Management Entity	County
Federal Lands			
Sam Houston National Forest	167,000	U.S. Forest Service	Montgomery, San Jacinto
Big Thicket National Preserve	105,600	National Park Service	Liberty, Chambers, Hardin, Jefferson
Texas Chenier Plains Refuges	98,000	USFWS	Chambers, Jefferson
Addicks and Barker Reservoirs	26,000	Corps of Engineers	Harris
Wallisville Lake Project	23,000	Corps of Engineers	Liberty, Chambers
State Lands			
J. D. Murphree Wildlife Management Area	24,250	TPWD	Chambers
Sea Rim State Park	4,141	TPWD	Jefferson
Village Creek State Park	2,507	TPWD	Hardin
Jones State Forest	1,725	TPWD	Montgomery
Davis Hill State Park	1,700	TPWD	Liberty
Sheldon Lake State Park	1,000	TPWD	Harris
Lake Livingston State Park	635	Texas Forest Service	Montgomery
County/City Lands			
Armand Bayou Nature Center	2,500	Harris County Parks Dept.	Harris
Memorial Park	1,500	Houston Parks and Recreation Department	Harris
Hermann Park	407	Houston Parks and Recreation Department	Harris
Other Lands (e.g., Land Trusts)			
Lake Livingston Reservoir	83,000	Trinity River Authority	Montgomery
Roy E. Larsen Sandyland Sanctuary	5,561	The Nature Conservancy	Hardin
Gulf Coastal Plains Mitigation Bank	1,901	Ecosystem Renewal, LLC	Liberty, Harris, Hardin, Jefferson, Chambers, San Jacinto, Montgomery
Greens Bayou Wetlands Mitigation Bank	1,400	Harris County Flood Control District	Harris
Russell Preserves	726	Texas Land Conservancy	San Jacinto
Big Bear Ranch	517	Texas Land Conservancy	San Jacinto
Katy-Cypress Mitigation Bank	483	Mr. Lieven J. Van Riet	Harris, Chambers, Liberty, Montgomery

Davis Hill State Park (Texas Parks and Wildlife Department, 1,700 acres) is the only State park in Liberty County; however, it is not open to the public and is currently unstaffed. It is within 200 yards of the refuge acquisition boundary. The park is rich with biodiversity, as it is the highest point of the county topping out at 235 feet above mean sea level. The dome is 150 feet from the base to the top of the hill. Davis Hill is one of the last remaining undisturbed salt domes on the upper Texas coast and is home to the State champion Durand oak (*Quercus durandii*) and the uncommon shadow witch orchid (*Ponthieva racemosa*). The great topographical relief contributes to unique habitats in the park, only 30 percent of which is bottomland hardwood forest. The base of the dome begins with a bottomland hardwood cypress-tupelo swamp that transitions to a mixed-oak bottomland hardwood habitat and peaks at a high, open grassy knoll. A steep ravine hides a mysterious and unique gully filled with ferns. The refuge would like to acquire the property if it were donated to the National Wildlife Refuge System. The State of Texas considered selling the park to the Service in 2003, but the matter was never resolved.

3.1.5 Conservation Corridors

Conservation corridors are physical connections between disconnected fragments of plant and animal habitats. 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 them.

The Trinity River NWR location, waterways, and mature forest habitat makes it an ideal corridor for migrating avian species, mostly as stopover habitat.

Woodland corridors are very important for many plant and animal species. These corridors can support a large diversity of species, sometimes the highest in the landscape (Stauffer and Best 1980), and can enrich the ecological opportunities for mammals (Jones et al. 1985) and birds. Songbirds in Canada were twice as likely to move through woodlands than clearings, and the majority of birds selected wooded routes over cutting across a clearing, even though the wooded routes may have been three times as long (Desrochers and Hannon 1997).

Woodland habitats in association with riparian areas may be very important for migratory bat species as they provide tree roosts, an abundance of insect prey, a constant source of water, landmarks to follow during migration (Cryan and Veilleux 2007), and protection from predators. The refuge contains many riparian habitats that are used as migratory corridors for species such as red bats (*Lasiurus borealis*), since this species has been captured during surveys.

In the future, the refuge may provide a conservation corridor to the federally-threatened Louisiana black bear (*Ursus americanus luteolus*). No official sightings of Louisiana black bears have been documented in Liberty County in over 40 years; however, the range of this bear is expanding westward from Louisiana. This species of bear have been reliably sighted in San Jacinto, Polk, and Hardin Counties, three counties that share northern and eastern borders with Liberty County. Two of those counties, San Jacinto and Polk, are juxtaposed to the Trinity River.

3.1.6 Refuge Location

The refuge is located in the floodplain of the lower Trinity River in Liberty County (see Map 3-3). The refuge is approximately 50 miles northeast of Houston and 40 miles west of Beaumont in southeast Texas. Although located in a rural setting, it is within 65 miles of over 5,000,000 people.

3.1.7 Surrounding Land Uses

The conservation land status of Trinity River NWR is just one of a variety of land uses found across the larger landscape. Industrial, urban, suburban, rural development, and agricultural and/or livestock land uses exist that offer an array of threats to fish, wildlife, and their habitats—as do invasive plants, feral animals, crop monocultures, habitat fragmentation, pathogens, and pollutants.

Trinity River NWR exists within a matrix of surrounding land uses, including urbanization, which is expanding from Houston, with a population estimated at 5.9 million people (Texas Comptroller of Public Accounts Office 2009) as well as from Beaumont. The refuge is surrounded mainly by cattle ranches and fragmented forests. Historically, much this area was contained within large ranches or prospected and developed for oil and gas drilling and extraction. Now the trend is toward subdivision of the large ranches for residential development, yet the oil and gas industry still has as strong presence. However, much of the land within the region is still used for agricultural purposes such as grazing, logging, or crop production.

3.2 Physical Environment

This section describes the physical environment in which the Trinity River NWR is found. It includes a description of the climate, geology and soils, aquifers and groundwater, oil and gas occurrences and potential, environmental contaminants, and water and air quality found at the refuge. It concludes with a short discussion about the Service's concerns pertaining to those physical resources.

3.2.1 Climate

According to the United States Department of Agriculture (USDA) National Agriculture Statistics Service, Texas Climate Divisions Map, the refuge is located within the Upper Coast and the East Texas Climate Divisions.

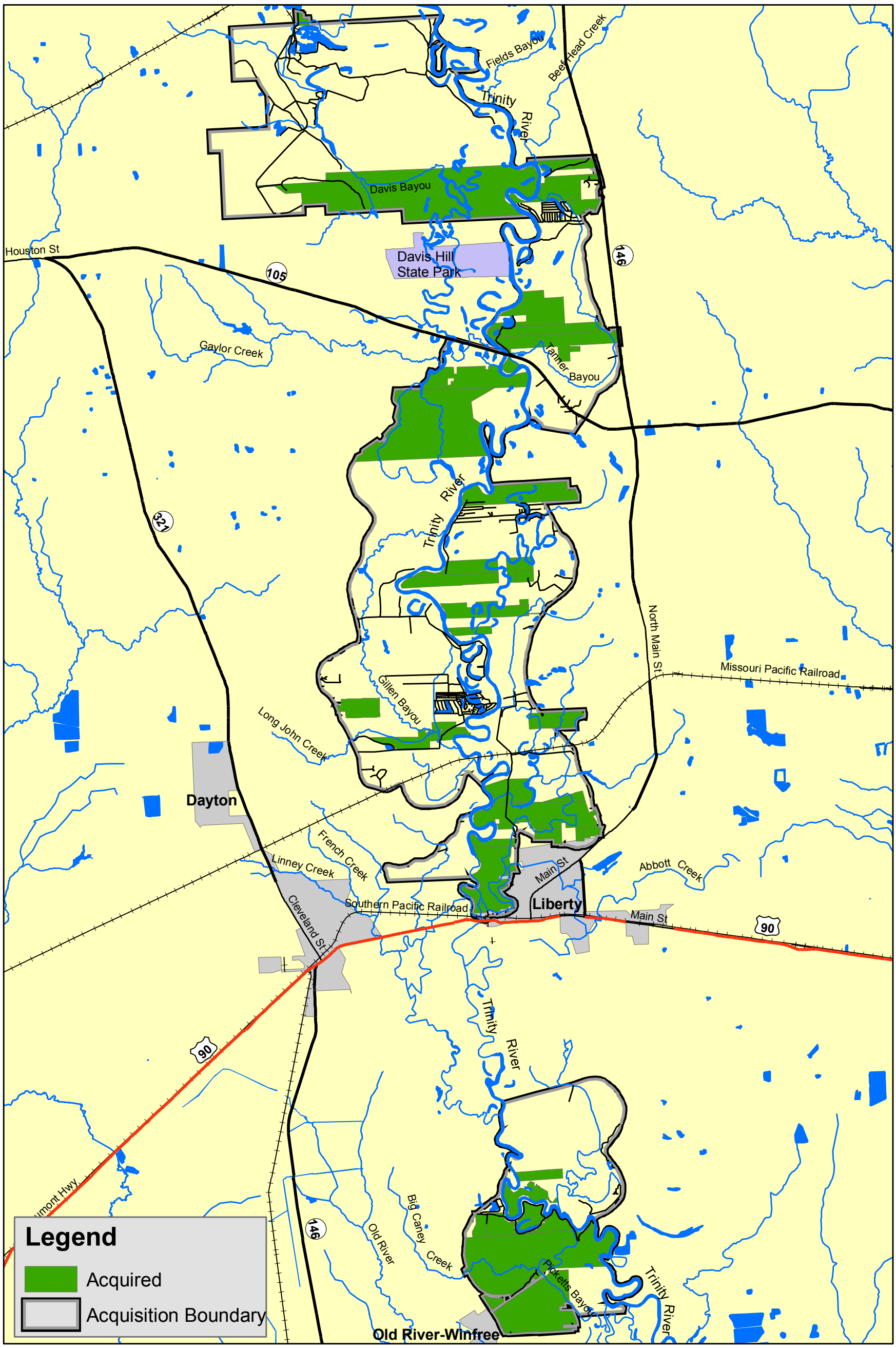
The area is characterized by a modified marine or subtropical climate (Larkin and Bomar 1983), most noted for warm to hot summers and short, mild winters. The primary influence is from the onshore flow of tropical air from the Gulf of Mexico. Annual rainfall in Liberty County over the last 17 years averages 64 inches (see Table 3-2). The monthly precipitation is distributed fairly evenly, varying from 3.5 to 6 inches (Bomar 1995). Overall, the greatest precipitation occurs in the spring and winter seasons. Heavy precipitation during the spring and winter leads to overbank flooding, which is critical to the maintenance and productivity of bottomland ecosystems.

U.S. Fish & Wildlife Service

Trinity River National Wildlife Refuge

Liberty County, Texas

Refuge Location



PRODUCED IN THE DIVISION OF REFUGE PLANNING
ALBUQUERQUE, NEW MEXICO
LAND STATUS CURRENT TO: 5/31/09
MAP DATE: November, 2010
BASEMAP: N/A
MERIDIAN: N/A
FILE: trn_general_11.3.10_shl

0 1.5 3 6 Miles

0 1.5 3 6 Kilometers

UTM ZONE 15
NAD 83

The average temperature for Liberty County is 67° F (Table 3-2). The average annual low temperature is 55° F, and the average annual high temperature is 79° F (Larkin and Bomar 1983, Bomar 1995). The average January minimum is 43° F; the average July maximum is 92° F (Bomar 1995). The growing season in Liberty County averages 261 days. The average number of freezes is 27, and the average number of days 100° F and above is 11. The temperature extremes for Liberty County have ranged from 8° F to 108° F.

Table 3-2. Weather Data from KSHN Radio Station, Official Site in Liberty, TX.

Year	Inches of rain/year	# days rained/year	# days at flood stage (26")/year
1994	80.25	103	50
1995	66.64	101	66
1996	47.89	106	0
1997	64.48	97	30
1998	68.69	78	67
1999	39.08	68	14
2000	63.66	76	0
2001	70.07	99	81
2002	75.76	102	23
2003	53.11	94	22
2004	60.88	98	61
2005	46.84	64	10
2006	87.73	84	0
2007	56.72	111	35
2008	68.26	89	0
2009	64.17	110	18
2010	45.57	97	21

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, with special emphasis on Class I Wilderness Areas (areas in excess of 5,000 acres and formally designated as Wilderness prior to August, 1977). Congress gave the Service the responsibility to protect the air quality and natural resources, including visibility, of the area from manmade 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 Houston area is occupied by over five million people and is a sprawling urban commuter population in one of the largest industrial complexes in the country. The climate is hot and humid with the breeze driven across land and sea by the Gulf of Mexico. Air pollution is

created from pollutants such as carbon monoxide (CO), sulfur dioxide (SO2), oxides of nitrogen (NOx) and highly reactive volatile organic compounds emitted by cars, power plants, refineries, chemical plants, and other sources that react in sunlight. Oxides of nitrogen (NOx) and highly reactive volatile organic compounds and their reaction with sunlight are leading ozone precursors (see Appendix I List of Surrounding Power Plants).

Air quality in Liberty County has not been quantified by the Texas Commission on Environmental Quality (TCEQ). Liberty County is a part of TCEQ Region 12, also known as Houston-Galveston-Brazoria area, which is comprised of Harris County and the seven counties surrounding it. The air quality in Region 12 has been classified according to the National Ambient Air Quality Standard (NAAQS) as severe for both the one-hour ozone NAAQS and the 1997 eight-hour ozone NAAQS. The region's air quality is monitored hourly by 141 air pollution monitors and sampler instruments owned by the TCEQ, private industry, and local governments. These monitors screen for 138 chemical compounds, including ozone precursors and toxic air pollutants. TCEQ compiles data from 51 air pollution monitoring stations in Harris County (TCEQ 2010). No air quality monitoring stations exist in Liberty County. The closest station is in Harris County, 30 miles southwest from the City of Liberty, the county seat of Liberty County.

3.2.3 Water Resources

Watershed

The refuge was acquired on the premise of protecting the Trinity River bottomland hardwood forest that lies in the Trinity River floodplain. The deposition of alluvium through time has produced the present day substrate on which the southeastern bottomland forest grows. The dynamic fluctuations of rivers and streams in the southeast relate directly to high flows from winter and spring rains to low flows with high evapotranspiration rates in late summer and fall (Wharton and Brison 1979). One of the major benefits of intact bottomland systems is the amelioration of downstream flooding and acting as a site for the deposition of sediments, which in turn increases the productivity of the system.

The Trinity River is an alluvial river that originates to the northwest of the refuge in north central Texas at an elevation of 1,200 feet and combines with the East Fork, the Elm Fork, the West Fork, and Clear Fork of the Trinity and with Denton, Mountain, and Village Creeks to form the Trinity River Basin drainage system. Presently, surface runoff is the major water source for the Trinity River Basin. The Trinity River drainage basin, at the gauging station 1.9 miles south of Romayor, Texas, is 17,186 square miles. The Trinity River eventually drains into Trinity Bay, Galveston Bay, and then into the Gulf of Mexico (Texas Department of Water Resources 1984, Texas Water Development Board 1990).

Hydrological data for the Romayor gauging station on the downstream side of State Highway 787 recorded an average discharge of 7,155 cubic feet per second over a 44-year period from 1925 to 1968. The average regulated discharge since the construction of the Livingston Reservoir (1969–1989 is 7,389 cubic feet per second. Extremes for the 65-year period of records include a maximum of 111,000 feet per second and a minimum of 102 feet per second (U.S. Geologic Survey 1990).

Hydrologic Unit

The refuge area is underlain by the Gulf Coast aquifer, a major aquifer extending nearly 100 miles inland from the Gulf Coast, that supplies water to municipalities throughout the lower Trinity River Basin (Texas Department of Water Resources 1984, Texas Water Development Board 1990). An aquifer is a geologic formation, group of formations, or a part of a formation that is water bearing. An aquiclude is an impermeable or relatively impermeable rock that may contain water but is incapable of transmitting an appreciable quantity. The hydrologic units in Liberty County are the Jasper aquifer, Burkeville aquiclude, Evangeline aquifer, and Chicot aquifer. This classification follows the one used by Wesselman (1967) in his report on the groundwater resources of Jasper and Newton Counties (Anders et al. 1968).

Source and Occurrence of Groundwater

The source of groundwater in Liberty County is precipitation on the land surface of the county and adjoining areas to the north. Most of the precipitation runs off or is consumed by evapotranspiration; only a small part migrates downwards until it reaches the zone of saturation. The upper surface of the zone of saturation is the water table, below which water is contained in the interstices or pore space between the rock particles of the table.

Recharge, Movement, and Discharge of Groundwater

Recharge is the addition of water to an aquifer, either by natural of artificial processes. Natural recharge results from the infiltration of precipitation. The greater part of the natural recharge to the aquifers in Liberty County takes place in the northern part of the county and in southern parts of San Jacinto and Polk Counties; the remainder takes place in the southern part of Liberty County.

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, climate, and 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).

The Clean Water Act of 1977 requires states to identify and prioritize waters that do not currently support designated uses. Water-bodies 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 water-body from a distinct localized source, such as a chemical plant or equipment exhaust. Non-point source pollution occurs when contaminants enter the water-body from indirect sources, such as residential development or agricultural practices.

During the past century, the waters of the Trinity River have become increasingly polluted. Runoff containing pesticides and herbicides and dumping of industrial and human waste, particularly in the Dallas-Fort Worth metro-plex have combined to cause serious deterioration of water quality (Trinity River Authority 2010). The most severely affected area is the 250-mile-long stretch that extends from Dallas-Fort Worth to the headwaters of Lake Livingston. By the early 1960s, the river below Dallas for 100 miles was so polluted that the United States

Public Health Service described it as "septic." Since that time, efforts have been made to clean up the river. A water quality management plan was adopted in the 1970s (Texas Department of Water Resources 1984, Gard 2010), but pollution problems continued (Trinity River Authority 2010). Pollutants have been banned for decades, yet legacy pollutants are still found in the environment in concentrations deemed detrimental for humans. The sources of these are typically unknown or contaminated sediment that, were it to be removed, could cause greater harm. Furthermore, bacterial contaminant samples continue to show high levels in highly urbanized portions of the basin (Trinity River Authority 2010).

Chemical Quality of Groundwater in the Hydrologic Units

Groundwater is successfully used in irrigation of crops in Liberty County. However, chemical quality of groundwater in some parts due to excessive residual sodium carbonate, boron, and high salinity can be a problem in certain parts of the county, causing wells to be abandoned.

Samples from wells in the Evangeline aquifer in the northern half of the county are fresh water of the calcium bicarbonate type. The water is low in chloride and sulfate, ranges from soft to very hard, and is suitable for public supply and irrigation uses. The sodium-adsorption ratio value (a measure of sodium hazard) ranged from 0.2 to 2.3, and the residual soil carbon (excessive values cause hazardous increases in alkalinity of soil) values ranged from 0.00 to 1.34 equivalents per million.

Samples of wells tested in the Chicot aquifer range from fresh to slightly saline water and may be classified into three groups: the calcium bicarbonate type, mixtures of the calcium bicarbonate and sodium chloride types, and mixtures of the sodium chloride and sodium bicarbonate types. The water samples ranged from soft to very hard, the sulfate contents are small, but the chloride contents range from 8 to 660 ppm. The sodium-adsorption ratio values ranged from 0.1 to 16, and the residual soil carbon values range up to 5.08 ppm. The samples indicate that most of the water is suitable for public supply and irrigation uses.

Water quality is considered good in the Gulf Coast aquifer, with total dissolved solids generally less than 500 mg/l. Although water from the aquifer is suitable for most purposes, some treatment may be required to reduce total dissolved solids and to reduce the iron concentration where it exceeds 0.3 ppm. Within the refuge area, most (if not all) water quality parameters appear to be within State standards. The area is rated acceptable for contact recreational use and is considered high quality aquatic habitat. Groundwater in the aquifer passing under confined layers is under artesian pressure (Peckham et al. 1963). Several artesian wells currently exist on the Gulf Coast aquifer and provide water for various uses.

3.2.4 Geology and Soils

Geology

The geologic substrate of the refuge and the surrounding area is formed by five different groups: 1) the superficial, recent alluvium (Holocene Age); 2) the Deweyville Terraces (Late Pleistocene Age); 3) the Beaumont Formation (Pleistocene Age); 4) the Bentley and Montgomery Formations (Lissie Formation; Pleistocene Age) and Fleming and Willis Formations (Pliocene and Plio-Pleistocene Age).

The recent alluvial materials of the Trinity River and major tributary creeks are primarily clay, silt, sand, and locally abundant organic matter. Alluvial deposits are concentrated in the

floodplain of the Trinity River, with the northern extent beginning at Hannah's Bend Ranch and Cypress Lake Estates then flowing south to Trinity Bay. This Holocene alluvium is less than 10,000 years in age.

The Deweyville terraces occur in the central portion of the area, mainly along the margins of the Trinity River in the central part of the county, and is the major geologic formation. They date back to the late Pleistocene age. The Deweyville terraces are the first terraces below the uplands and terraces of the Beaumont Formation. The Deweyville terraces are approximately 50 feet thick and are composed primarily of sand, silt, clay, and some gravel.

The Beaumont Formation is the youngest and most extensive of the formations of the Pleistocene Age. The Beaumont Formation is approximately 100 feet thick and is composed primarily of clay, silt, and sand. All coast prairie soils discussed in the next section are in areas of the Beaumont Formation. North of Luce Bayou on the west side of the Trinity River, the Beaumont Formation occurs only as high-level stream terraces that are just below where the Bentley and Montgomery Formations crop out. This formation may be up to approximately 30,000 years in age.

The Lissie formation is separated into two formations: Bentley and Montgomery. The Bentley Formation occurs in the extreme northwestern portion of the area. The Bentley Formation is approximately 100 feet thick and is composed primarily of clay, silt, sand, and a minor amount of gravel. The Montgomery Formation is approximately 100 feet thick and is composed primarily of clay, silt, sand, and gravel of granule and pebble sizes. The Bentley and Montgomery Formations are separated from each other and the younger Beaumont Formation by low, poorly defined scarps or slope breaks. One of these scarps is Luce Bayou. It separates the Montgomery Formation from the Beaumont Formation.

Soils

The Trinity River NWR acquisition boundary, with isolated tracts located throughout Liberty County, ranges from 10 feet above mean sea level in the southern part to 210 feet above mean sea level in the northern reaches of the refuge. The range sites within the refuge consist of western Gulf Coast flatwoods and Gulf Coast prairie, which occur on clayey marine sediments.

Generally, the Trinity River borders the refuge with a water flow from north to south. The soils (see Maps 3-4 and 3-5) are mainly clay and are derived primarily from alluvium eroded from the Blackland Prairie. These very dark grey, poorly drained soils are level or nearly level and frequently to occasionally flood. Loamy or sandy soils are rare. Water-tolerant hardwoods cover most of the area. A few small areas have been cleared for pipelines, pastures, and ponds. The area is drained by Nevill Bayou, Coon Slough, Board Slough, Davis Slough, Davis Bayou, and several smaller drainages. The refuge is ultimately drained by the Trinity River. Information in the section above was derived from Soil Survey of Liberty County, Texas (Griffith 1996).

3.2.5 Mineral Resources

Oil and Gas Occurrence and Potential

The refuge does not own any oil or gas mineral rights to any of the properties currently owned by the Service. Exploration and/or extraction of oil and gas are possible on every unit. Active wells are not present on refuge property at this time. Numerous units have active pipeline right-

of-ways totaling approximately 22 miles of buried pipe and carrying many types of petrochemical products on various units. See Section 3.6 for more information about oil and gas management on the refuge.

Owners of these mineral rights have the right to develop, produce, and transport the oil and gas resources located within a refuge (USGAO 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 to 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. A variety of 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.

3.2.6 Concerns Regarding the Physical Environment

As experienced during the past decade, the refuge is generally near the extremes of the rainfall charts, either suffering extreme drought or excess rains. Rarely does annual rainfall occur near the annual average. Managing the refuge at climatic extremes is difficult.

Effects of severe droughts and floods affect carbon sequestration efforts. Extreme drought and extreme flooding can reduce the survivability of newly planted native hardwood seedlings.

A concern for the refuge is increased intensity and frequency of hurricanes. These hurricanes can stress old-growth forests, changing the successional stage of a given community and increasing the potential of non-native invasive species.

Population increases and urbanization may contribute to additional water removed from the Trinity River. Decreased water flows may increase salinity levels altering species composition and survivability.

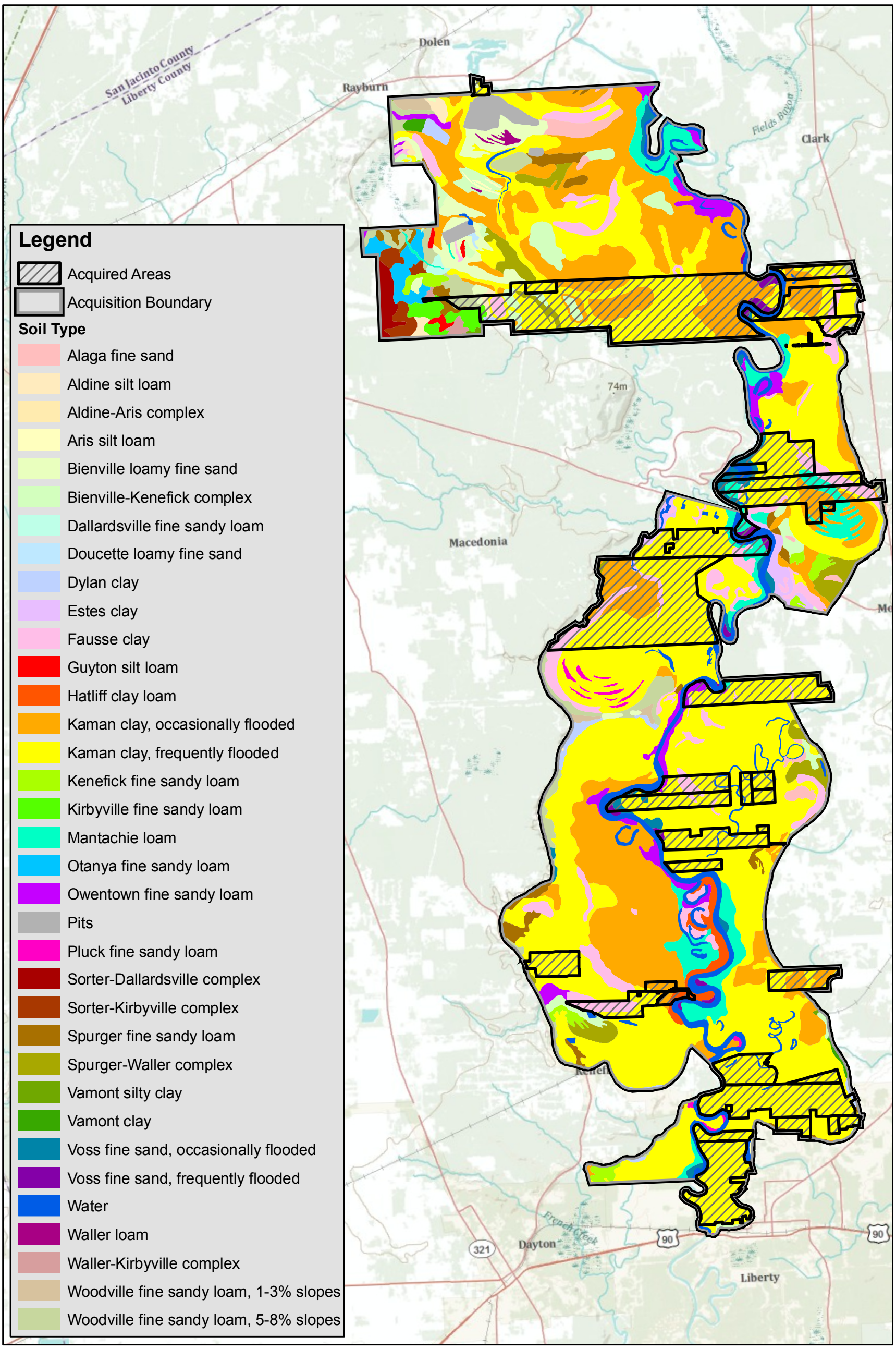
The refuge acts as a filtering system and water storage to support groundwater recharge. During major flood events, the refuge captures excess water in the floodplain, reducing the effects to developed areas.

U.S. Fish & Wildlife Service

Trinity River National Wildlife Refuge

Liberty County, Texas

Soil Map, North Section



PRODUCED IN THE DIVISION OF REFUGE PLANNING
ALBUQUERQUE, NEW MEXICO
LAND STATUS CURRENT TO: 5/31/09
MAP DATE: October, 2010
BASEMAP: N/A
MERIDIAN: N/A
FILE: trn_soil_north_10.12.10_shl

0 1.5 3 6 Miles

0 1.5 3 6 Kilometers

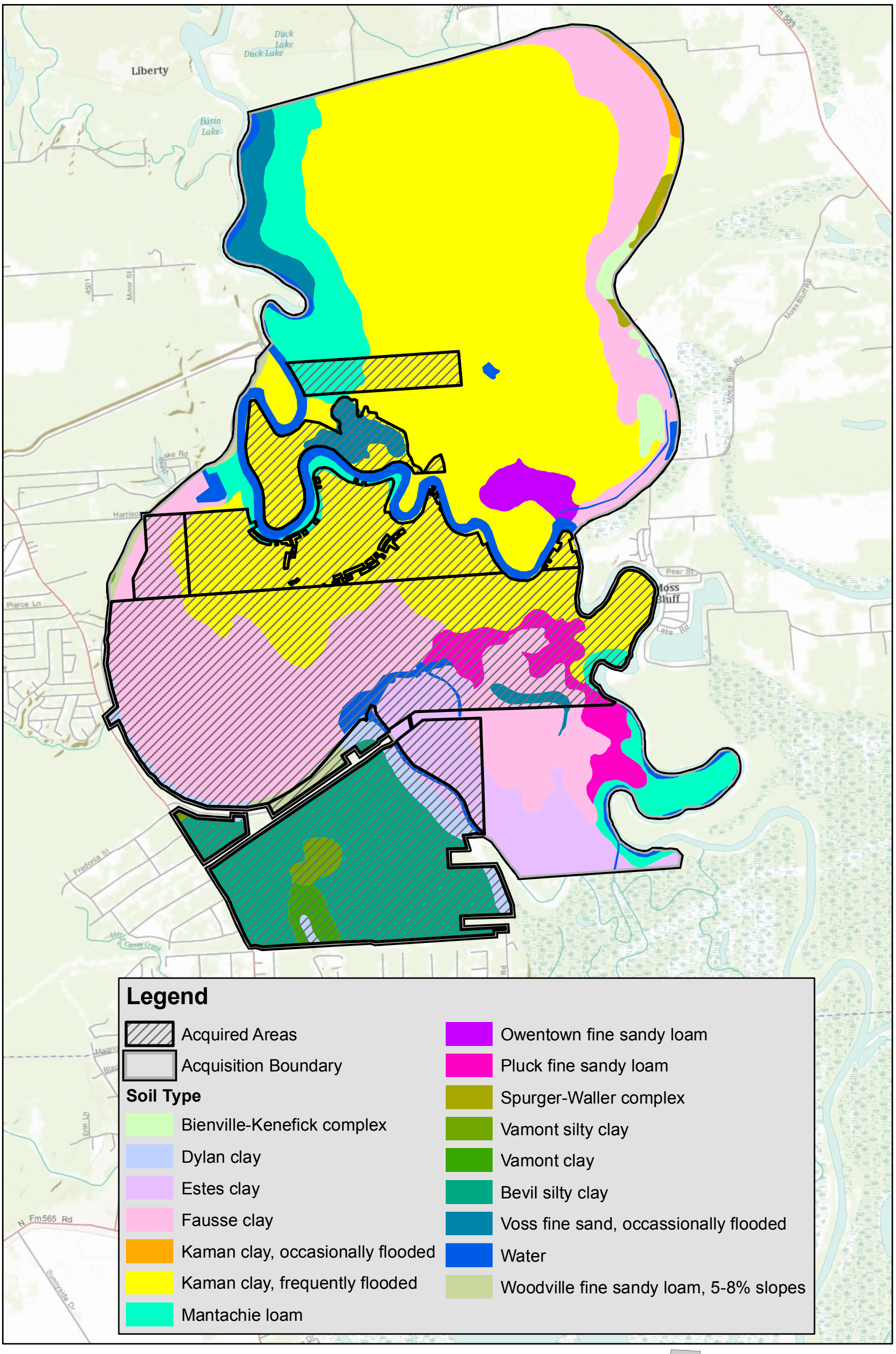
UTM ZONE 15
NAD 83

U.S. Fish & Wildlife Service

Trinity River National Wildlife Refuge

Liberty County, Texas

Soil Map, South Section



PRODUCED IN THE DIVISION OF REFUGE PLANNING
ALBUQUERQUE, NEW MEXICO
LAND STATUS CURRENT TO: 5/31/09
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BASEMAP: N/A
MERIDIAN: N/A
FILE: trn_soil_south_10.12.10_shl

0 0.5 1 2 Miles

0 0.5 1 2 Kilometers

UTM ZONE 15
NAD 83

Environmental Contaminants

This section describes existing and potential sites of environmental contaminants as identified from the Service's Contaminant Assessment Process (CAP) reports. A CAP is an information gathering process and initial assessment of environmental contaminants found on national wildlife refuges. Each CAP analyzes particular contaminants of concern to fish, wildlife, and other resources on the refuge. A CAP was conducted for the refuge on September 30, 2010, by the Clear Lake Ecological Services Field Office and is summarized in the following text.

Farm practices also lead to the introduction of non-native domestic animal species. The cattle industry was introduced in 1840 starting with 14,058 head. Cattle production was still quite popular a century later. The practice of grazing cattle in the bottomland forest has contributed to the spread of invasive flora species and possible changes in understory forest composition. Liberty County was the swine production capital of the State in the 1930s. Ironically, feral hogs (*Sus scrofa*) are a leading invasive species in Liberty County in the present era. By the 1980s, 52 percent of land in Liberty County was in farms and ranches, and 36 percent was under cultivation (Kleiner 2010).

The forest and forest soils were seen as major marketable commodities that were not in short supply. Logging severely altered the bottomlands by the 1900s (Bray 1906). The cypress swamps were modified the most severely. Minimal old-growth forest was left in the county, as it had mostly been harvested. Areas in the uplands were planted with loblolly pine, a more desired pine species. Most of the older growth hardwoods could be found in the bottoms where the soil was too moist for equipment to enter. However, during dry periods, even this timber became vulnerable and was eventually harvested. Most of the major swamps were logged by 1915 (Tanner 1942). In 1980, the county continued to be known for forest products.

Prospecting for oil began in 1901. Oil fields were placed around much of the southern half of the county. Oil and natural gas pipelines were installed to move the vast amounts of products through the county (Kleiner 2010). Disturbances from oil and natural gas productions may have included pollution, seismic surveys affecting ground integrity, and the creation of roads and oil well pads.

The Port of Liberty shipped commodities to the Gulf Coast via steamboat along the Trinity River from 1838–1940. Portions of the Trinity River were channeled and dredged, which may have had an impact on hydrology in the area. Railroad construction led to the first railroad being completed in the county by 1860, with other railroads being built in the 1900s (Kleiner 2010). This may have been the first of modern right-of-way in the county.

In the 1940s, mining became an important industry, a result of World War II. Sulfur was mined in the southern part of the county. As many as 52 firms opened during the decade, further affecting soil and hydrology to the area. By 1958, 40 manufacturing plants operated, along with 165 mineral companies, resulting in further impacts to soil and hydrology. The resulting pollution of these industries to the environment may not have ever been measured in impacted areas.

Today, much of the forest has been altered by many human-related activities. Agriculture has affected the relatively non-fragmented forest by the creation of open spaces to cultivate, introduction of seeds, alteration of soil properties, and changes in hydrology. Grazing of livestock has affected flora and fauna species in the understory of the forests, the creation of open pastures, and introduction of feral hogs. The timber industry drove the harvest of native trees and the introduction of loblolly pine trees, while also influencing stand ages of trees and

affecting flora and fauna species that depend upon a mature forest. Mining practices and industrial facilities greatly affected the soils and hydrology in areas where mining minerals were located, further creating possible pollution issues. Oil and gas pipelines, railroads, human transportation, and even the introduction of electricity via power lines all contributed to right-of-ways that have further affected the continuity of the relatively non-fragmented Big Thicket forest prior to Antebellum Liberty County (Cozine 2004, Abernethy 2010).

Although there are few sources of contamination within the current boundaries of the refuge, the waters of the Trinity River can transport potential pollutants and therefore is considered a major source of contamination to lands occurring within its floodplain. The river is subject to runoff from agricultural lands; farms, ranches, and feedlots; storm water runoff from rural areas; discharges from waste water treatment plants; urban runoff from major cities such as Dallas; industrial waste water; and oil and chemicals spills. The southernmost unit of the refuge, Champion Lake, is connected to the Trinity River, and tidal influences can carry contaminants into this portion of the refuge from downstream sources. Many named and unnamed tributaries occur on or near the refuge, and storm water runoff from rural areas and municipalities can be a concern. Many of these waterways have oil, gas, and chemical pipeline crossings that could transport pollutants and affect refuge property if a rupture occurs. Area industry contributes to the air quality, and pollutants from air discharges can have an impact on refuge property.

3.3 Biological Environment

This section describes the biological environment in which the refuge is found. It includes a description of the present, historical, and potential future condition of terrestrial and aquatic habitat types found on the refuge and the natural processes that influence them. It identifies priority wildlife species and focal species used for monitoring purposes and includes a discussion of various wildlife types found on the refuge. The section includes a short discussion about the Service's concerns pertaining to the biological environment.

Habitat Types

The Trinity River floodplain contains a diversity of wetland habitats, including bottomland hardwood forests, forested swamps, shrubs swamps, emergent beds, aquatic beds, open water, and wet pastures. Upland areas outside the floodplain contain cultivated pastures, natural pine forests, pine plantations, and mixed-pine hardwood forests.

Other wetland types within the Trinity River floodplain in the refuge include emergent aquatic beds, floating aquatic beds, and emergent freshwater marshes, on and adjacent to oxbows and sloughs. Important species in these wetland types are smartweed (*Polygonum* spp.), beak rush (*Rynchospora* spp.), spike rush (*Eleocharis* spp.), lizard's tail (*Saururus cernuus*), sedge (*Carex* spp.), water primrose (*Ludwigia* spp.), arrowhead (*Syngonium podophyllum*), cattail (*Typha latifolia*), and duckweed (*Lemna aequinoctialis*).

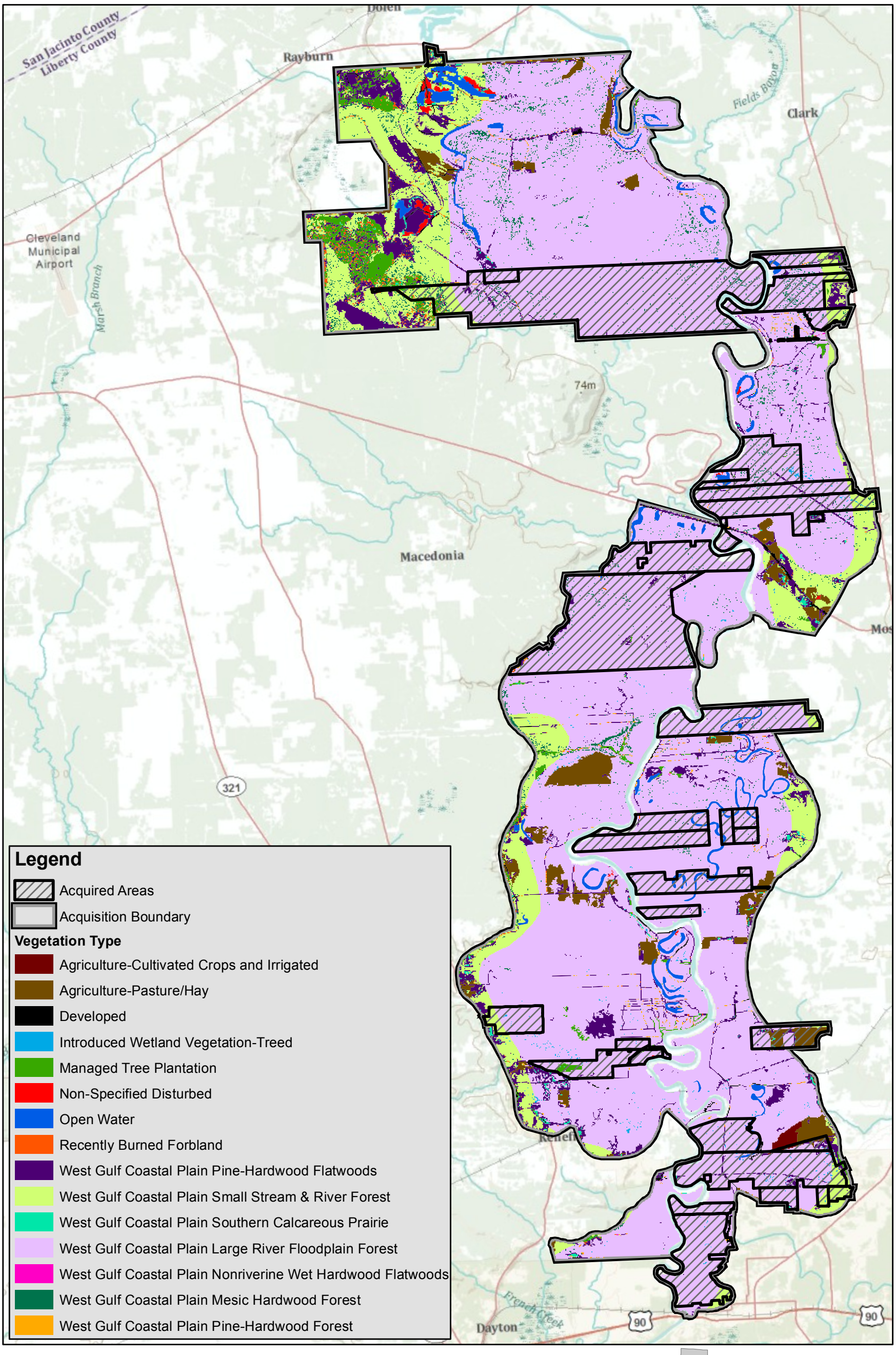
For this document, the refuge used the National Vegetation Classification System (NVCS) to describe habitat types at the ecological system level (Map 3-6 and Map 3-7). Note: The National Land Cover Data map for Trinity River NWR has been altered substantially to more accurately reflect the actual vegetation 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.

U.S. Fish & Wildlife Service

Trinity River National Wildlife Refuge

Liberty County, Texas

Vegetation Map, North Section



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: trn_veg_north_6.13.11_shl

0 1.25 2.5 5 Miles

0 1.25 2.5 5 Kilometers

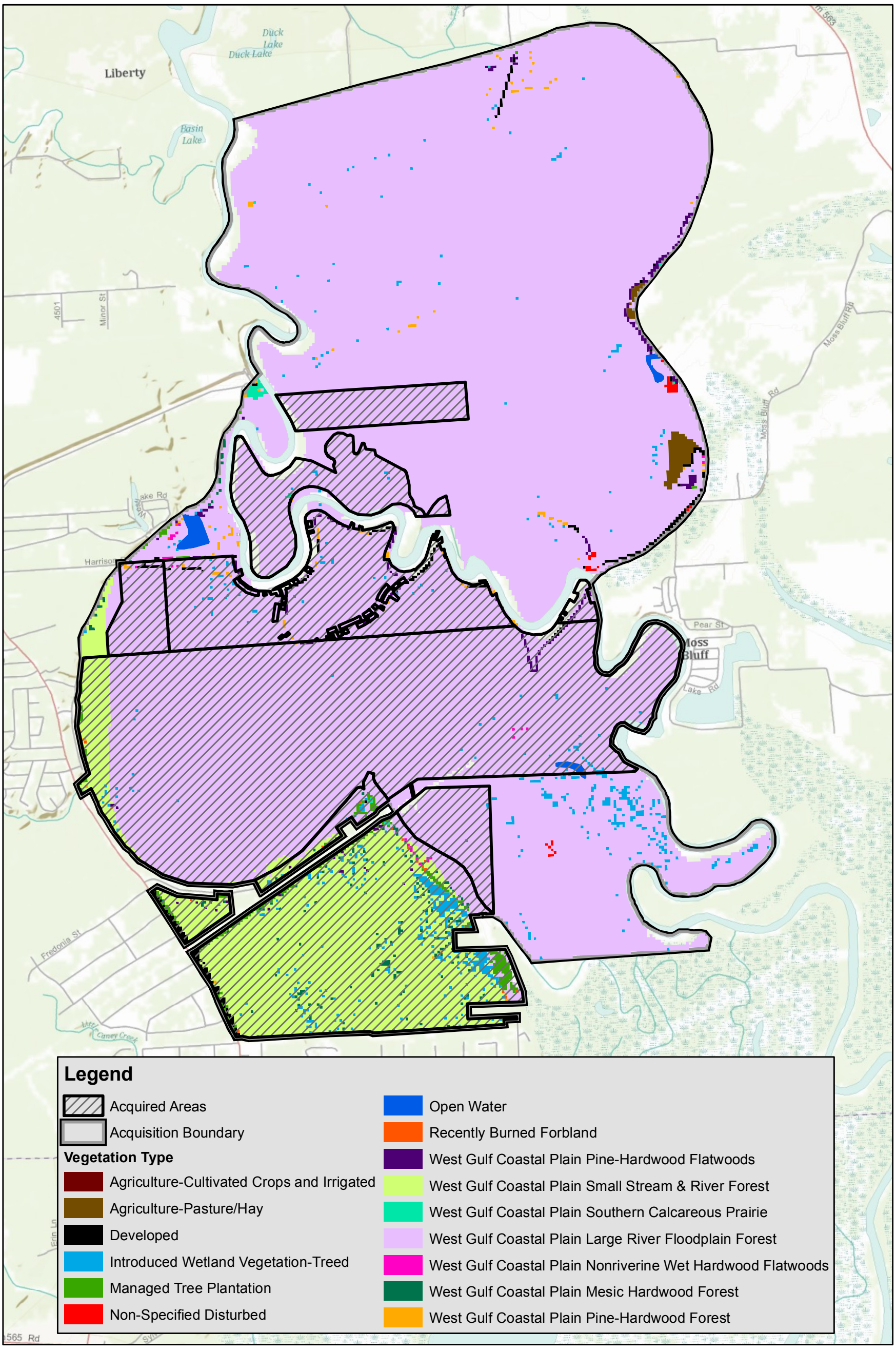
UTM ZONE 15
NAD 83

U.S. Fish & Wildlife Service

Trinity River National Wildlife Refuge

Liberty County, Texas

Vegetation Map, South Section



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: trn_veg_south_6.13.11_shl

0 0.375 0.75 1.5 Miles

0 0.375 0.75 1.5 Kilometers

UTM ZONE 15
NAD 83

3.3.1.1 Terrestrial Vegetation Classes

Agricuture – Cultivated Crops and Irrigated Pastures

All cultivated crops and irrigated pastures occur outside current refuge boundaries. There is no farming or irrigation occurring on the refuge.

Agriculture – Pasture/Hay

All pasture and hay production occurs outside current refuge boundary. The refuge does not produce and hay or pastureland for livestock grazing.

Developed

Developed areas occur outside current refuge boundary and include areas such as housing, roads, subdivisions, etc.

Introduced Wetland Vegetation – Treed

Consists of wetland vegetation primarily along canals, drainages, irrigation ditches, rivers, and streams. Many of these areas are vulnerable to exotic flora invasions such as Chinese tallow *(Sapium sebiferum)*, MaCartney rose *(Rosa bracteata)*, and chinaberry *(Melia azedarach),* along with native species such as willows, oak, and ash.

Managed Tree Plantation

Managed tree plantations occur outside current refuge boundary. The refuge has no managed tree plantations.

Open Water

Seasonal open water occurring in wetlands, ponds, lakes, and rivers.

Recently Burned Forbland

All recently burned forblands occur outside the refuge boundary.

West Gulf Coastal Plain Pine-Hardwood Flatwoods

This ecological system represents predominantly mesic to dry flatwoods of limited areas of inland portions of the West Gulf Coastal Plain. These areas are usually found on Pleistocene high terraces that are located above current floodplains. Hydrology is controlled by local rainfall events and not overbank flooding. Soils are fine-textured, and hardpans may be present in the subsurface. The limited permeability of these soils contributes to shallowly perched water tables during portions of the year when precipitation is greatest and evapotranspiration is lowest. Soil moisture fluctuates widely throughout the growing season, from saturated to very dry, a condition sometimes referred to elsewhere as xerohydric. Saturation occurs not from overbank flooding but typically whenever precipitation events occur. Local topography is a complex of ridges and swales, often in close proximity to one another. Ridges tend to be much drier than swales, which may hold water for varying periods of time. Within both ridges and swales, there is vegetation variability relating to soil texture and moisture and disturbance history. The driest ridges support loblolly pine and post oak; more mesic ridges have loblolly pine with white oak and species such as common sweetleaf (*Symplocos tinctoria)* and southern arrow-weed (*Viburnum dentatum)* (see Map 3-6 and Map 3-7).

West Gulf Coastal Plain Small Stream and River Forest

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 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 vegetation zoning. 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 (see Map 3-6 and Map 3-7).

West Gulf Coastal Plain Southern Calcareous Prairie

This is one of two described calcareous prairie ecological systems occurring within the pine-dominated portions of the coastal plain west of the Mississippi River. This type is the more southerly ranging of the two (compare against West Gulf Coastal Plain Northern Calcareous Prairie). Examples include natural grassland vegetation and adjacent wooded vegetation in a relatively small natural region of Louisiana and Texas. Although most examples are typically upland, some include small stream bottoms or riparian areas that bisect the prairies. This system is found primarily within the historical range of longleaf pine, or TNC Ecoregion 41, but it extends somewhat beyond this area to the north. In addition, examples occurring west to the eastern edge of the post oak savanna region of eastern Texas are also included here. Plant communities in this system occur over relatively deep soils with circumneutral surface soil pH. These conditions are unusual in the local landscape, which is predominantly one of acidic, generally forested soils. In most cases, individual prairie openings are small and isolated from one another. Although they were formerly more extensive prior to European settlement, they apparently were much smaller than examples of West Gulf Coastal Plain (see Map 3-6 and Map 3-7).

West Gulf Coastal Plain Large River Floodplain Forest

This system represents a geographic subset of Kuchler's (1964) Southern Floodplain Forest found west of the Mississippi River. Examples may be found along large rivers of the West Gulf Coastal Plain and Upper West Gulf Coastal Plain, especially the Trinity, Neches, Sabine, and others. Several distinct plant communities can be recognized within this system that may be related to the array of different geomorphic features present within the floodplain. Some of the major geomorphic features associated with different community types include natural levees, point bars, meander scrolls, oxbows, and sloughs (Sharitz and Mitsch 1993). Vegetation generally includes forests dominated by bottomland hardwood species and other trees tolerant of flooding, including bald cypress (*Taxodium distichum*) and water tupelo (*Nyssa aquatica*). However, herbaceous and shrub vegetation may be present in certain areas as well (see Map 3-6 and Map 3-7).

West Gulf Coastal Plain Nonriverine Wet Hardwood Flatwoods

This ecological system represents predominantly wet hardwood flatwoods of the West Gulf Coastal Plain of southern Arkansas, eastern Texas, and western Louisiana. Examples may be somewhat more common in the inland portions of the region but are also found in the Outer Coastal Plain as well. These areas are usually found on Pleistocene high terraces primarily associated with the Red and Mississippi Rivers that are located above the current floodplain. Hydrology is controlled by local rainfall events and not overbank flooding. Soils are fine-

textured, and hardpans may be present in the subsurface. The limited permeability of these soils contributes to perched water tables during fairly substantial portions of the year (when precipitation is greatest and evapotranspiration is lowest). Saturation occurs not from overbank flooding but typically whenever precipitation events occur. The local landscape is often a complex of ridges and swales, usually occurring in close proximity. There is vegetation variability related to soil texture and moisture and disturbance history. Most examples support hardwood forests or swamps, which are often heavily oak-dominated. Important species are tolerant of inundation. They include swamp oak (*Quercus michauxii),* willow oak *(Quercus phellos),* Swamp laurel oak *(Quercus laurifolia)*, and American sweetgum (*Liquidambar styraciflua)*, with sparse coverage of wetland herbs such as southern waxy sedge (*Carex glaucescens)*. Some swales support unusual pockets of pop ash (*Fraxinus caroliniana)* and *Crataegus* spp. Some examples can contain loblolly pine (*Pinus taeda)* (see Map 3-6 and Map 3-7).

West Gulf Coastal Plain Mesic Hardwood Forest

This ecological system is found in limited upland areas (especially ravines and sideslopes) of the Gulf Coastal Plain west of the Mississippi River. These areas are topographically isolated from historically fire-prone, pine-dominated uplands in eastern Texas, western Louisiana, and southern Arkansas. Sites are often found along slopes above perennial streams in the region. These sites have moderate to high fertility and moisture retention. Soils can be quite variable, ranging from coarse to loamy in surface texture. Most are acidic in surface reactions and less commonly circumneutral. Vegetation indicators are mesic hardwoods such as American beech (*Fagus grandifolia),* white oak, and American holly (*Ilex opaca)*, although scattered, large-diameter pines (most often loblolly pine) are also often present. Spring-blooming herbaceous species are typical in the understory of most examples (see Map 3-6 and Map 3-7).

West Gulf Coastal Plain Pine-Hardwood Forest

This West Gulf Coastal Plain ecological system consists of forests and woodlands dominated by *Pinus taeda* and/or *Pinus echinata* in combination with a host of dry to dry-mesic site hardwood species. This type was the historical matrix (dominant vegetation type) for large portions of the Upper West Gulf Coastal Plain (TNC Ecoregion 40) where it replaced *Pinus palustris*-dominated vegetation. In this region of southern Arkansas, northwestern Louisiana, and parts of eastern Texas, this type was historically present on nearly all uplands in the region except on the most edaphically limited sites (droughty sands, calcareous clays, and shallow soil barrens/rock outcrops). Such sites are underlain by loamy to fine-textured soils of variable depths. These are upland sites on ridgetops and adjacent sideslopes, with moderate fertility and moisture retention. This type was also present in more limited areas of the West Gulf Coastal Plain (TNC Ecoregion 41), where it was confined more typically to sideslopes and other locations not dominated by *Pinus palustris*. There are no known "fidel" herbaceous species or any local endemic or globally rare plant species, and overall this system may have supported relatively low levels of vascular plant species diversity. This system has undergone major transformations since European settlement of the region (see Map 3-6 and Map 3-7).

3.3.1.2 Aquatic Classes

Generally, wetlands are lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soils and on its surface. The water creates sever physiological problems for all plants and wildlife except those adapted for life in water of saturated soils. Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered in shallow water.

Wetlands must have one or more of the following attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominately undrained, saturated hydric soil; and (3) the substrate is a nonsoil and is saturated with water at some time during the growing season of the year. Drained hydric soils are not considered wetlands, as their soils no longer support hydrophytes.

Deepwater habitats are permanently flooded lands lying below the deepwater boundary of wetlands. Deepwater habitats include environments where surface water is permanent and often deep, so that water is the principal medium within which the dominant organisms live, whether or not they are attached to the substrate.

According to Cowardin et al. (1979), the refuge wetlands are classified as a Palustrine System. The refuge can be characterized by the following classes and subclasses of the Palustrine System. The Unconsolidated Bottom Class is divided into the subclasses Sand, Mud, and Organic. The Aquatic Bed Class is divided into the subclasses Rooted Vascular and Floating Vascular. The Emergent Wetlands Class is divided into the subclasses Persistent and Nonpersistent. The Scrub-Shrub Wetland Class is divided into the subclasses Broad-leaved Deciduous, Needle-leaved Deciduous, Broad-leaved Evergreen, Needle-leaved Evergreen, and Dead. Forested wetland is divided into the subclasses Broad-leaved Deciduous, Needle-leaved Deciduous, Broad-leaved Evergreen, Needle-leaved Evergreen, and Dead.

Estimated percentages of the entire 80,000-acre approved acquisition boundary by habitat are as follows: 90 percent bottomland hardwood forest, primarily consisting of oak (*Quercus* spp.), hickory *(Carya* spp.*)*, elm *(Ulmus* spp.*)*, sweetgum, and ash *(Fraxinus* spp.*)*; 6 percent permanently flooded forest, primarily consisting of bald cypress, water tupelo, buttonbush *(Cephalanthus occidentalis)*, black willow *(Salix nigra)*, and open water areas; 2 percent upland pine flatwoods, primarily consisting of loblolly pine and yaupon *(Ilex* spp.*)*; and 1 percent other habitat primarily consisting of open fields, pipeline right-of-ways, roads, and trails.

3.3.1.3 Natural Disturbance Processes

In 1994, southeast Texas experienced a 500-year flood episode. The river gauge in Liberty reached nearly 31 feet, some 7 feet above flood stage. That was the highest recorded flood in over 70 years. Although only one 4,400-acre unit was under refuge ownership at that time, Refuge Manager Stuart Marcus was able to get a firsthand look at the expanse of floodwaters throughout Liberty County during rescue operations. Significant erosion occurred to various parts of river embankments, but most other natural sites held firm. The same could not be said for homes, trailers, and roads that were inundated for weeks.

Hurricanes Rita (September 2005) and Ike (September 2008) created substantial damage to the refuge. Structural damage due to the arrivals of these hurricanes was limited to fences, trails, roads, radio towers, pole sheds, and historic buildings, but damage totaled approximately $1,000,000 each time. Although the office facility had a fair amount of damage, it is a General Services Administration rental, thus was taken care of by the landlord within a week of the storm after each hurricane. Portions of the cleanup effort were completed by fire staff crews brought in immediately following the storm while other cleanup efforts were still being completed by refuge staff. Many trees were downed by the hurricanes; however, this was seen as a natural process and not counted as damage.

Historical Habitat Description

Historically, east Texas was much cooler and wetter than it is today, as was the case for much of the southeastern United States. The fluctuating water regime, which has produced the modern dynamic floodplain ecosystem, is relatively recent (geologically), possibly originating about 18,000 years ago in the late Pleistocene age, when the change towards a strong seasonal climate originated (Martin 1980). Many floodplain species can be traced to early Tertiary or Mesozoic, 60 to 120 million years ago (Wharton et al. 1982). As is the case today, rivers and floodplains have historically served as a refuge for numerous species.

The floodplain of the refuge has experienced many changes throughout history. The meandering of the Trinity River has left a 100-year floodplain as thin as 1.6 miles in few areas to as wide as 8.0 miles in the most northern portion of the refuge acquisition boundaries. The average length across the floodplain in Liberty County, west to east, is over 4 miles.

In recent historic times, the bottomlands and most of extreme east Texas were forested. To the west, the area was principally a grassland ecosystem. Even in “deep east Texas” there were, and in a few cases still are, areas of deep sand that supported longleaf pine savanna maintained by fire (Watson 1979, Streng and Harcombe 1982) and isolated patches of clay soil “prairie-like” communities (Bray 1906, Marietta and Nixon 1984) that interrupted the continuous surface.

3.3.1.4 Estimated Future Habitat 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 (Neilsen-Gammon 2008). Texas lies within the 30°N latitude band where precipitation should have decreased consistent with global trends, but Texas has observed increased precipitation (Neilsen-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 (Neilson-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).

The Texas climate has always been variable and sometimes extreme, and climate change may intensify this historical pattern. Average State temperatures have varied substantially over the past century, with a warming trend since the late 1960s. Average rainfall has increased slightly; both in the summer and winter, and extreme rainfall events have become more frequent. Sea level from Brownsville to Port Arthur has risen steadily, increasing eight inches over the past 100 years due to a combination of globally rising seas and substantial local sinking of the land (subsidence). However, the rate of sea-level rise varies locally with the rate of land subsidence (Union of Concerned Scientists 2009).

Texas is predicted to have warmer temperatures, with a 3–10 °F rise in winter lows and a 3–7 °F rise in summer highs. Also expected are more frequent intense rainfall events with longer drier periods in between, an increased hurricane intensity, and sea level rise along the Texas coasts, Union of Concerned Scientists 2009).

The refuge is concerned that if these trends continue, it could eventually lead to changes in vegetative communities and associated species shifts, as well as accelerating and intensifying existing stressors as discussed in Chapter 1 of the Plan. Chapter 4, Goal 1, Habitat Conservation (Protection and Restoration), Objective 6 (Climate Change Monitoring), identifies six strategies that summarize the vision the refuge has in identifying management challenges associated with a changing climate. In summary, the refuge will initiate baseline monitoring that could potentially identify shifts in vegetative communities and wildlife species and utilize best available science and adaptive management techniques to address the challenges to target species most affected by these changes.

Concerns Regarding Refuge Habitats

Historical land use of the county can be assessed as far back as 1938 using historical aerial photography from the USDA Natural Resources Conservation Services office in Liberty County. Historical aerial photography from 1938, 1952, 1964, 1972, 1988, 1995, 2004, and 2009 were digitized and geo-referenced by the Habitat and Population Evaluation Team Division in Region 2 so that the photos could be displayed and studied using ArcGIS software. The results of the project have been used to determine the changes in historical habitat within the Trinity River floodplain from the 1930s to the present.

The most critical change to the Trinity River in Liberty County occurred when the Lake Livingston Dam was completed in 1969. The dam was built to supply water to the city of Houston. The lake covers more than 90,000 acres. The flow of the dam is based on the flow of the Trinity River; however, a hydrograph produced by Service exhibited obvious changes in the seasonality of the flood pulses. The lower intensity of the flooding allowed for the infiltration of roads, more levees, subdivision development, pollution, and invasive flora. More areas were accessible for timber harvest, natural resource exploration, and enterprises in agriculture. Agriculture, such as rice fields and hayfields in the area, were a bust.

Hydrology

The unforeseen changes cascaded across the floodplain with the construction of the dam. The natural flooding pulses were altered. Prior to the dam being built, the wetlands dried out naturally in the late summer and then flooded strongly in late spring. Post-dam, the wetlands did not dry out as much in the late summer as they had in the past and the floods came earlier in

late winter and were weaker (See Figure 3-4). Peak flows have been reduced and shifted to late winter-early spring, and low flows are roughly 50 percent higher.

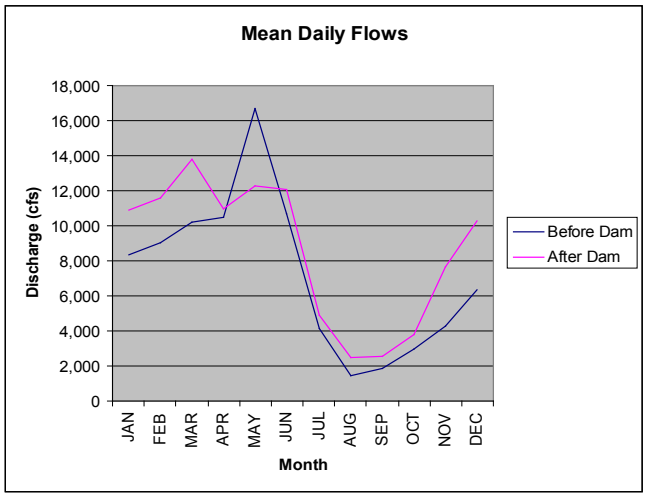


Figure 3-4. Mean Daily Flows of the Trinity River from 1970 to 2009

Land Acquisition

With the change in hydrology, landowners were lured to subdivisions in low-lying areas that were dry and surrounded by picturesque oxbows, not realizing that the area was prone to flooding. Those who bought property in areas during a dry period later found themselves flooded in their homes or not able to leave or access their property due to the flooding of waterways crossing under, on, or near roads. Large subdivided tracts of land were left by insurmountable numbers of landowners, making acquisition of these low-lying subdivisions by the Service virtually impossible. Therefore, large tracts of land with prime habitat within the Trinity River floodplain may never be acquired by the Service.

Pollution

The refuge has acquired several lots in which previous landowners abandoned houses and lots, leaving incredible amounts of pollution such as propane tanks, well systems, asbestos, glass, metal, and plastic in the decaying homes. It is very common to find dumped trash on the side of the road or in parking lots of current refuge properties. It is also common to find trash that has floated onto refuge properties during floods. Industrial pollution has not been an issue so far for the refuge. Oil spills have occurred in Liberty County but not on refuge property.

Invasive Terrestrial Species

Chinese tallow is the primary invasive flora species in Liberty County. It flourishes in deforested areas or in soil that has been disturbed. Feral hogs, the primary invasive fauna species, contribute to the Chinese tallow issue while performing their natural “rooting” behavior, foraging in forest floors, creating soil disturbance liberating tallow seeds that may have otherwise remained dormant. Feral hogs are also notorious for feeding on ground nests and consuming any vulnerable small fauna. Invasive species are managed when possible.

Invasive Aquatic Species

The change in hydrology has also assisted in the persistence of invasive aquatic fauna. Water hyacinth (*Eichornia crassipes*), giant salvinia (*Salvinia molesta*), and alligatorweed (*Alternathera phileroxoides*), along with other invasive aquatic flora seem to be a constant reminder of the unnatural hydrologic system. Wetlands now stay wetter during the late summer and have weaker floods in late winter. The result is nuisance flora that does not desiccate and does not flush out of the wetlands but remains prosperous the next year.

Native Forested Wetland Species

The change in hydrology may have influenced the composition of trees in the wetter parts of the forest. The constant flooding and drying that occurred during the pre-dam flood pulses maintained the cypress, tupelo, and other hardwood trees, as seen in aerial imagery. However, the stress of peak flows being reduced and shifted to late winter-early spring and low flows being 50 percent higher may have impacted the trees by altering soil and water regime conditions for some of the trees, similar to the effects of taking a section of land and impounding it to hold water. Some trees species survive and others may not.

Floodplain Hardwood Conservation/Fragmentation

Trinity River NWR was created to assist in the conservation of forested wetlands. The forested wetlands in Liberty County are relatively young. Mature tree stands are difficult to locate and acquire. The refuge is actively acquiring lands from willing landowners in attempts to create a contiguous refuge corridor. A more valuable piece of land is one with many mature native trees. Many of the properties private landowners attempt to sell to the refuge have recently been timbered or they are pasturelands, leaving them vulnerable to encroachment by Chinese tallow. For these reasons, it is most critical to acquire new refuge properties as quickly as possible. Planting trees is a management tool utilized by refuge staff when possible in attempt to control exotic species while also sequestering carbon and mitigating for properties devoid of trees because of prior agricultural uses. Since 1995, over 63,000 oak, ash and cypress, seedlings have been planted throughout the refuge.

Fire Management

There are no historical records of fire in the refuge “bottoms,” but there is limited evidence of a past fire in two parcels of planted pines adjacent to a power line right-of-way. Trinity River NWR has not used prescribed fire as a management tool in the past. Fire, prescribed or otherwise, does not play a significant role in sustaining the integrity of the floodplain forest simply because leaf litter does not build up enough to create a fuel load. The small percentage of the refuge with vegetation that may have the capabilities of sustaining limited fire are primarily manmade features (i.e. right-of-ways, old hay fields, and areas of planted pine). Due to this limited fire capability, an abbreviated Fire Management Plan has been developed as discussed in Chapter 5 of this CCP.

Urbanization

Increased urbanization in the area has further increased the loss, fragmentation, and degradation of the bottomland hardwood forest landscape. The population of the State of Texas is expected to double by 2050. Liberty County 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 (litter, noise, air, water, etc.), introduction of non-native invasive plants and animals, and disturbance/competition to 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 refuge lands may increase market pressure on smaller private landowners to sell their property for further development.

3.3.2 Wildlife

The refuge's rich mixture of bottomland hardwood forests, open lakes, wetlands, and upland habitat supports a diversity of wildlife species of eastern Texas. Species from vertebrates to invertebrates are important contributors to the overall biodiversity on the refuge. Conservation of migratory birds is often considered the overall connecting theme of the Refuge System. Approximately 50 species of waterfowl and other migratory gamebirds have been Service priorities since the 1930s. The refuge was established primarily for the conservation of migratory birds, protection of scarce and vulnerable wetland types, and maintenance of natural biological diversity. The refuge has documented 213 species of birds, 44 species of mammals, 35 species of reptiles, 17 species of amphibians, 50 species of fish, and 75 species of butterflies. Management of many of these species remains a collaborative effort with the TPWD.

A full list of all species found on the entire refuge can be viewed in Appendix E or accessed on the refuge's website at http://www.fws.gov/southwest/refuges/texas/trinityriver.

Research on the refuge is conducted for wildlife and the habitats that support them, as well as for other resources such as cultural resources and water quality. Research is conducted by refuge staff, academia, volunteers, and other Federal and State agencies.

3.3.2.1 Priority Species

The refuge provides habitat for a variety of rare or declining species, including several federally proposed, listed (threatened or endangered), and candidate species, and other species of concern. Declines are often related to loss and fragmentation of suitable habitat, loss of food source, increased disturbance, increased pollution, or increased predation. (See Table 3-3).

TPWD has also identified species of greatest conservation need in the Central Great Plains. For a full list of these species visit Texas Conservation Action Plan at: http://www.tpwd.state.tx.us/landwater/land/tcap/.

Table 3-3. Federally Listed Species in Liberty County

Class	Common Name	Scientific Name	Federal Status	State Status	Comment
Amphibian	Houston toad	*Bufo houstonensis*	Endangered	Endangered	Suitable habitat found at Davis Hill State Park but not seen in Liberty Co. in over 50 years
Avian	Piping plover	*Charadrius melodus*	Threatened	Threatened	Migrates along sandy banks of the Trinity River, very rare
Avian	Red-cockaded woodpecker	*Picoides borealis*	Endangered	Endangered	Only found in area north of Refuge acquisition boundaries
Avian	Interior least tern	*Sterna antillarum athalassos*	Endangered	Endangered	May migrate in northern Liberty County along sandy beaches, very rare
Mammal	Black bear	*Ursus americanus*	Threatened/SA	Threatened	Threatened by similarity of appearance, no credible sighting in Liberty County
Mammal	Louisiana black bear	*Ursus americanus luteolus*	Threatened	Threatened	No credible sighting in Liberty County
Mammal	Red wolf	*Canis rufus*	Endangered	Endangered	Extirpated
Reptile	American alligator	*Alligator mississipiensis*	Threatened/ Similarity in appearance	-	Threatened by similarity of appearance, common on refuge

The purpose of the Endangered Species Act (ESA) of 1973 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" (E) or "threatened" (T). Endangered means a species is in danger of extinction throughout all or a significant portion of its range; threatened means a species likely to become endangered within the foreseeable future. Proposed species means any species of fish, wildlife, or plant that is proposed in the *Federal Register* to be listed under Section 4 of the ESA. Several endangered and threatened species have the potential to occur on the refuge and are described in the following text. No federally listed plant species are documented on the refuge.

Houston toad

This medium-sized toad typically associated with pine and/or oak woodland savanna with deep, loose sandy soil. The Houston toad is currently only found in one county in Texas, Bastrop County. Adults are restricted to sandy soils and prefer wooded areas interspersed with open grass. They are historically documented in coastal prairies. Within these habitats, they are never far from water and during the breeding season are located almost exclusively near

ponds and rain pools. Suitable habitat for reintroduction of this toad may be found in Davis Hill State Park, which is juxtaposed to refuge boundaries. However, this State park is currently unmanaged. It is unknown as to whether this toad exists on the State park.

Piping plover

This shorebird is a wintering migrant along the Gulf Coast. It migrates along the Trinity River corridor from July to March. It utilizes the sandy banks found along the river and on riverfront refuge properties and may forage in refuge mudflats.

Red-cockaded woodpecker

This pineywoods woodpecker has not been located on the refuge. It is associated with northern parts of Liberty County, particularly in the pineywoods that belong to Big Thicket National Preserve.

Interior least tern

Federally threatened in Texas when found within 50 miles of the coast and federally endangered when found more than 50 miles away from the coast, this bird may use the sandbars associated with the Trinity River.

Black bear

There have been no credible bear sightings in Liberty County. This bear is categorized as federally "threatened by similarity of appearance" to the Louisiana black bear.

Louisiana black bear

There have been no credible bear sightings in Liberty County, but it has been reliably sighted within 40 miles of refuge borders. If the refuge acquires a habitat corridor large enough to accommodate the Louisiana black bear, the refuge may become a potential reintroduction site.

Red wolf

Red wolves ranged throughout the eastern half of Texas, but their numbers and range quickly declined under pressure of intensive land use in the region. Also, early lumbering and farming practices allowed the coyote to expand its range into east Texas; hybrid offspring of interbreeding red wolves and coyotes (*Canis latrans*) more closely resembled coyotes, and the genetic identity of the red wolf was gradually suppressed. This wolf is considered extirpated.

American alligator

This alligator is quite abundant in Liberty County; however, it is a State-protected game species. It is considered "threatened by similarity in appearance" due to similarity to the American crocodile (*Crocodylus acutus*). There is a hunt season on alligators; however, hunting of alligators on the refuge is not permitted.

Candidate species

Candidate species are those species for which the Service has enough information to warrant proposing them for listing as endangered or threatened, but these species have not yet been proposed for listing due to other higher priority listing activities. See Table 3-4.

Table 3-4. Candidate Species of Liberty County

Class	Common Name	Scientific Name	Federal Status	State Status	Comment
Mammal	Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	Category II Species of concern	Threatened	Found throughout refuge in appropriate habitat
Aves	Sprague's pipit	*Anthus spragueii*	Candidate species	None	Not found on refuge
Reptilia	Alligator snapping turtle	*Macrochelys temmickii*	Category II Species of concern (under review)	Threatened	Found in some deep water areas of refuge but very rare
Reptilia	Louisiana pine snake	*Pituophis ruthenvi*	Category I Candidate	Threatened	Not found on refuge

Rafinesque's big-eared bat

Most Rafinesque's big-eared bats require large hollow trees for roosting. Throughout their range, many such roosts have been lost. The relatively few remaining colonies now survive mostly in lowland tree hollows that are subject to flooding or in abandoned buildings that are prone to human disturbance and structural collapse from decay. Protection of large hollow trees in lowland areas, especially near water sources, is essential to the preservation of this species. Artificial roosts may be required to provide crucial alternatives in areas where hollow trees and abandoned buildings have been removed (Mirowsky and Horner 1997; http://www.tpwd.state.tx.us/huntwild/wild/species/rafinesque/ accessed 4/6/2011).

Sprague's pipit

Sprague's pipits breeds and winters in open grassland with good drainage and no shrubs or trees. Sprague's pipits use grassland habitat almost exclusively throughout the year. During the breeding season, Sprague's pipits favor relatively large grassland patches. The male has a high breeding flight display that can last up to three hours. On the ground, Sprague's pipits have very secretive behavior, landing several meters away from the nest and approaching on foot. The Sprague's pipit both breeds and winters on the North American prairie. The breeding range includes parts of Montana, North Dakota, South Dakota, and Minnesota in the United States. In Canada, Sprague's pipits breed in parts of Alberta, Saskatchewan, and Manitoba, and it is found in Texas only during migration and winter. The species' wintering range includes parts of Arizona, Texas, southern Oklahoma, southern Arkansas, northwest Mississippi, southern Louisiana, and northern Mexico (USFWS 2011b).

Alligator snapping turtle

The alligator snapping turtle is a species of concern in rivers, deep-water sloughs, ponds, and lakes in eastern Texas. The population of this species has been severely reduced in recent years. The alligator snapping turtle was listed as a Category II candidate by the Service, but it currently under review (USFWS 2011d).

Louisiana pine snake

Habitat for this species includes longleaf pine savanna with well-drained sandy soil, substantial herbaceous ground cover, and pocket gophers (USFWS 2011c).

Migratory birds

Migratory waterfowl are not actively managed on the refuge. Indirect management for migratory waterfowl includes monitoring water quality and nest boxes, and providing nesting, winter, and stopover habitat for migratory waterfowl. Nineteen species of migratory waterfowl have been observed on the refuge, including four geese species, five diving duck species, nine dabbling duck species, and one merganser species.

Species of Special Concern

Species of concern are species for which further biological research and field study are needed to resolve their conservation status or that are considered sensitive, rare, or declining on lists maintained by Natural Heritage Programs, State wildlife agencies, other Federal agencies, or professional scientific societies. This includes State listed endangered or threatened species not included in the preceding text. No actions are currently being taken to manage for these species. Table 3-5 contains species of concern that are known to occur and/or that have potential habitat on the refuge.

Table 3-5. Species of Special Concern in Liberty County

Class	Common Name	Scientific Name	State Status	Found on refuge
Aves	American peregrine falcon	*Falco peregrinus anatum*	Threatened	Unknown
Aves	Bachman's sparrow	*Aimophila aestivalis*	Threatened	No
Aves	Bald eagle	*Haliaeetus leucocephalus*	Threatened	Yes
Aves	Henslow's sparrow	*Ammodramus henslowii*	Rare	Yes
Aves	Peregrine falcon	*Falco peregrines*	Threatened	Yes
Aves	Swallow-tailed kite	*Elanoides forticatus*	Threatened	Yes
Aves	White-faced ibis	*Plegadis chihi*	Threatened	Yes
Aves	Wood stork	*Mycteria Americana*	Threatened	Yes
Actinopterygii	American eel	*Anguila rostrata*	Rare	Unknown
Actinopterygii	Paddlefish	*Polyodon spathula*	Threatened	Yes
Insecta	Gulf coast clubtail	*Gomphus modestus*	Rare	Unknown
Mammalia	Southeastern myotis bat	*Myotis austroriparius*	Rare	Yes
Bivalvia	Creeper (squawfoot)	*Strophitus undulates*	Rare	Unknown
Bivalvia	Fawnsfoot	*Truncilla donaciformis*	Rare	Unknown
Bivalvia	Little spectaclecase	*Villosa lienosa*	Rare	Unknown
Bivalvia	Louisiana pigtoe	*Pleurobema riddellii*	Threatened	Unknown
Bivalvia	Sandbank pocketbook	*Lampsilis satura*	Threatened	Unknown
Bivalvia	Texas heelsplitter	*Potamilus amphichaenus*	Threatened	Unknown
Bivalvia	Texas pigtoe	*Fusconaia askewi*	Threatened	Unknown
Bivalvia	Wabash pigtoe	*Fusconaia flava*	Rare	Unknown
Reptilia	Northern scarlet snake	*Cemophora coccinea copei*	Threatened	Unknown
Reptilia	Timber/canebrake rattlesnake	*Crotalus horridus atricaudatus*	Threatened	Yes

3.3.2.2 Focal/Representative Species

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 2009a). Focal species and their associated habitats will be included in the CCP's objectives and strategies to emphasize specific management efforts utilized to promote life history requirements of these species (see Table 3-6).

Table 3-6. Focal Species

Focal Species	Scientific Name	Associated Habitat
Rafinesque's big-eared bat	*Plecotus rafinesquii*	Bottomland hardwood forest
Alligator snapping turtle	*Macrochelys temminckii*	Open water
Swallow-tailed kite	*Elanoides forficatus*	Bottomland hardwood forest
Three-toed amphiuma	*Amphiuma tridactylum*	Aquatic
Alligator gar	*Atractosteus spatula*	Open water
Little blue heron	*Egretta caerulea*	Wetlands

Rafinesque's big-eared bat

This species was described previously as a *Candidate Species*.

Alligator snapping turtle

Alligator snapping turtle habitat tends to be deeper water of large rivers with well-defined channels but can also be found in lakes, ponds, swamps, and bayous, as well as brackish coastal waters (USFWS 2011d). It is the largest freshwater turtle found in the world. They are confined largely to river systems that drain into the Gulf of Mexico. It possesses a pink, fleshy, worm-like projection located on the floor of the mouth. When wriggled, this process acts as a lure to attract fish or other potential prey items. The refuge may serve as a reintroduction site for this turtle in the future.

Swallow-tailed kite

Swallow-tailed kites inhabit mostly woodland and forested wetlands near nesting locations (BirdLife International 2009). Nests are built in trees, usually near water. Both male and female participate in building the nest. Sometimes a high-pitched chirp is emitted, though the birds mostly remain silent. The swallow-tailed kite feeds on small reptiles, large insects, small birds and eggs, and small mammals. It drinks by skimming the surface and collecting water in its beak.

Three-toed amphiuma

This species occurs along the coastal plain from eastern Texas to western Alabama and northward in the Mississippi River alluvial plain to southeastern Missouri (Salthe 1973). Specimen records exist for 26 Texas counties in and east of the Trinity River Basin. They are found in permanent or semi-permanent aquatic habitats with abundant vegetation such as

oxbow lakes, ponds, swamps, sloughs, bayous, sluggish streams, floodplain pools, roadside and irrigation ditches, borrow pits, and freshwater marshes, in clear or muddy water.

Alligator gar

Alligator gar are usually found in slow sluggish waters, although running water seems to be necessary for spawning. Alligator gar are present in the Gulf of Mexico coastal plain from the Econfina River in west Florida west and south to Veracruz, Mexico. The species range extends north in the Mississippi River basin to the lower reaches of the Missouri and Ohio rivers. An isolated population also occurs in Nicaragua. In Texas, alligator gar may be found in coastal rivers and streams from the Red River west to the Rio Grande.

Little Blue Heron

This species feeds in the shallows of marine and freshwater marshes, where water and vegetation meet. Named for its slate blue plumage, the Little Blue Heron blends in well with dark marsh plants. However, these birds are white for their first year, associating with other white egrets that feed in open habitats. The Little Blue Heron's breeding habitat is sub-tropical swamps. It nests in colonies, often with other herons, usually on platforms of sticks in trees or shrubs. The little blue heron eats fish, crustaceans, amphibians, insects, and reptiles. It stands in shallow water and waits for its prey to go by, and then it grabs its prey with its pointed bill.

General Wildlife of the Trinity River National Wildlife Refuge

The following wildlife sections serve as an introduction to the variety of wildlife represented on the refuge. A full list of species documented on the entire refuge can be viewed on Appendix E or on the refuge's website at http://www.fws.gov/southwest/refuges/texas/trinityriver.

3.3.2.3 Birds

Approximately 213 bird species have been recorded using refuge habitats during parts of their life cycles. The refuge provides a wintering area for Central Flyway waterfowl and ideal nesting habitat for colonial waterbird rookeries during the spring. Thousands of shorebirds use the mud flats created along the Trinity River banks and ephemeral lakes that occur during periods of drought.

Waterfowl

Migrating waterfowl use the refuge during the winter months, while resident species such as wood ducks inhabit the refuge throughout the year. The refuge provides habitat for approximately 19 species in one family from one order. Peak numbers of waterfowl occur in December and January on the refuge. Some of the more common duck species that use the refuge include green-winged teal, blue-winged teal, gadwall, American widgeon, northern shoveler, wood duck, and northern pintail. Black-bellied whistling ducks also use the refuge during the fall, spring, and summer months.

Shorebirds and Waterbirds

The refuge has documented 46 species in 13 families from five orders. Shorebird and waterbird use on the refuge during drier months is driven by the ephemeral and permanent waterways. Some of the more common shorebirds and waterbirds seen on the refuge include

great blue heron, great egret, anhinga, cormorant, killdeer, American coot, common moorhen, and purple gallinule. The refuge includes a number of colonial waterbird nesting sites within or adjacent to its boundary. These species are commonly seen utilizing the cypress-tupelo swamps and buttonbush for forming breeding rookeries during the spring.

Raptors and Owls

The refuge has documented 17 raptor species and three owl species from six families in two orders. In recent years, swallow-tailed kites have been commonly observed throughout the refuge from April through August. Examples of wintering raptors include American kestrels, peregrine falcons, and sharp-shinned hawks. Barred owls are also very common throughout the year.

Perching Birds

The refuge has documented approximately 109 species in 23 families in one order. In addition to grassland birds, ground-dwelling birds, waterfowl, shorebirds, waterbirds, and raptors, a number of other perching bird species that use the refuge include prothonotary warbler, red-winged blackbird, northern mockingbirds, and painted buntings.

3.3.2.4 Mammals

The refuge includes habitat suitable for approximately 44 species of mammals representing 17 families from eight orders. All are woodland species found to thrive in undisturbed bottomland hardwood habitats. While some species are tied to wetlands, such as river otter, common muskrat, American beaver, and the invasive nutria, other species are not tied directly to water, such as the Rafinesque's big-eared bat, white-tailed deer, bobcat, and feral hog. Medium-sized mammals include skunks, opossums, foxes, raccoons, and beaver. The largest mammals in the area are white-tailed deer and feral hogs. The top predators are bobcat, coyote, and feral hog. The terrestrial mammals may be found on every unit, whereas the aquatic mammals must have permanent bodies of water on a unit.

3.3.2.5 Reptiles

The refuge includes habitat suitable for approximately 35 species of reptiles representing 14 families from two orders. The smaller species (skinks, lizards, and geckos) can be found on any forest floor or tree; however, the largest species, American alligator, will likely be found anywhere water is found. Twenty species from Order Squamata can also be found on most refuge units, with four being venomous. Seven species of Testidunes (turtles) are found on most units of the refuge. Even though most turtles are thought to be tied specifically to aquatic environments, many frequently venture on land, especially during breeding season.

3.3.2.6 Amphibians

The refuge has documented 17 amphibian species in eight families from two orders. They are associated with the hardwood forests of the Trinity River. With the exception of the four species of the Ranidae family, which are strictly found in areas with saturated soils and standing water, all other species can be found in any habitat. Three species from Order Caudata (salamanders and newts) can be found on the refuge. They are found only in or near water.

The refuge provides habitat for amphibians and has participated with the Clearlake Ecological Services office on a study to identify malformed frogs. Several species of frogs were collected on the refuge, and none of them showed any malformations.

3.3.2.7 Fish

The refuge has documented 50 fish species in 15 families from nine orders. The refuge, in conjunction with Texas A&M University, has conducted fish surveys to develop a species list for the refuge. Fish survey techniques include electroshock, seining, cast netting, and fishing.

Many areas tend to have dissolved oxygen issues and may completely dry out during a drought. Fish from Order Cyprinodontiformes can be found in all size of bodies of water, from leftover flooded puddles to large open bodies of water that do not dry out. Fish from Order Lepisosteiformes (gars) and Amiiformes (bowfins) have shown the most resiliency and survival in the refuge swamps and waterways. They are adapted to survive in low dissolved oxygen conditions. The fish in Order Siluriformes (catfishes) are also quite resilient to low dissolved oxygen conditions, as they can "mouth-breath" when dissolved oxygen conditions become too lethal to other fish, such as those in the Order Perciformes (basses, sunfishes, drums, and mullet).

The refuge directs most fishing activities to Champion Lake. Fish kills commonly occur during the hottest portions of drought seasons. Most fish, with the exception of bowfin and gar species, are asphyxiated as oxygen levels in the water decline to fatally low levels.

3.3.2.8 Invertebrates

A wide variety and number of invertebrates occur on the refuge; however, no formal surveys have been conducted to identify the wide diversity residing throughout the refuge. Informal surveys of moths and butterflies have revealed at least 78 species in seven families, from one order on the refuge. The refuge also maintains a 5,000-square-foot garden featuring host plants for opportunistic butterflies.

3.3.2.9 Concerns Regarding Wildlife Populations

Climate Change

The projected shift in climate change may affect wildlife populations. Projected changes in climate in southeast Texas include warmer winters and warmer summers with more frequent intense rainfall events and longer drier periods in between (Union of Concerned Scientists 2009). Aquatic species may have a loss of habitat suitable for breeding and foraging, while terrestrial species may experience a shift in composition of suitable habitat. Both habitats are at risk for subsequent invasion by exotic species.

Invasive Flora

Concerns of invasive aquatic plant species (e.g., alligatorweed, giant salvinia, and water hyacinth) forming thick layers and completely covering waterways are valid. Nesting success of colonial waterbirds is dependent upon prey availability and habitat structure (Murken and Kadlec 1986, Hoyer and Canfield 1994). Presence of water hyacinth has a few positive influences, as small mats serve as camouflage for ducklings and loafing areas for adults. In comparison to open water, the edge of hyacinth mats have been shown to support greater abundance of diversity of fish and invertebrates, the two main food sources of wading birds such as the great egret, snowy egret, tri-colored heron, and great blue heron (Brendonck et al.

2003, Toft et al. 2003, Villamagna 2009). However, the mats may become the dominant vegetative feature, out-competing other vegetation and creating a monoculture plant community. Dense mats may physically prevent waterbird access to prey or may have a reduced prey base if dissolved oxygen levels are reduced to a point that they cannot support aquatic invertebrate life. Dense mats have also been seen as predator highways. Rodgers (1987) noted raccoons using water hyacinth as bridges to remote islands where they consumed one-third of the colonial waterbird nestlings.

Chinese tallow tree continues to be a formidable pest tree. The refuge has consistently managed for this tree, in particular, for since the inception of this refuge. Refuge staff, volunteers, and contracted laborers have tried various methods of controlling this tree with herbicides with no lasting results.

Invasive Fauna

Feral hogs are omnivorous, consuming both plant and animal matter. They are very opportunistic feeders, and much of their diet is based on seasonal availability. Foods include grasses, forbs, roots and tubers, browse, mast (acorns), fruits, bulbs, and mushrooms. Animal matter includes invertebrates (e.g., insects, snails, earthworms, etc.), reptiles, amphibians, and carrion (dead animals), as well as live mammals and birds if given the opportunity. Feral hogs feed primarily at night and during twilight hours but will also feed during daylight in cold or wet weather. They prefer bottomlands such as rivers, creeks, and drainages when available. Hogs are generally found in dense vegetation cover often associated with water but also do well in drought prone environments. During hot weather, feral hogs enjoy wallowing in wet, muddy areas and are never far from dense protective cover. They will concentrate in areas of food availability, especially where trees producing nuts or agricultural crops are present (Taylor 1991).

Their home range is based mainly on food availability and cover. It is usually less than 5,000 acres but can range up to 70,000 acres. Feral hogs compete directly with livestock, as well as game and non-game wildlife species, for food. However, the main damage caused to livestock and wildlife is indirect destruction of habitat and agriculture commodities. Rooting and trampling activity for food can damage agricultural crops, fields, and livestock feeding and watering facilities. They also destabilize wetland areas, springs, creeks, and tanks by excessive rooting and wallowing. In addition to habitat destruction and alteration, hogs can destroy forestry plantings and damage trees. While not active predators, feral hogs may prey on fawns, young lambs, and kid goats. If the opportunity arises, they may also destroy and consume eggs of ground-nesting birds, such as turkeys and quail. The average life expectancy, under good conditions, in a feral hog population is about four to five years; however, they may live up to eight years (Taylor 1991).

In general, diseases from feral hogs do not pose a significant threat to humans; however, some diseases can be transmitted to livestock and wildlife. Various diseases of feral hogs include pseudorabies, swine brucellosis, tuberculosis, bubonic plague, tularemia, hog cholera, foot and mouth disease, and anthrax. Internal parasites include kidney worms, stomach worms, round worms, and whipworms. Liver flukes and trichinosis are also found in hogs. External parasites include dog ticks, fleas, and hog lice. Swine brucellosis is an infectious, bacterial, reproductive disease that can cause abortion, low conception rates, and other problems (Taylor 1991).

The feral hog has managed to survive, adapt, and increase their numbers despite attempts at population control. While it is possible to keep the population in check with continuous control, it is highly unlikely to eradicate a hog population within an established range (Taylor 1991).

Red imported fire ants (*Solenopsis invicta*) are also detrimental to nearly all species of wildlife. Fire ants will attack anything that moves. They are very aggressive, stinging in mass numbers. The greatest effect these non-native fire ants have on wildlife populations is the depletion of the system's prey base: ground-nesting birds, insects, and small vertebrates. Birds seem to be the most affected by fire ants. Fire ant attacks on hatchlings are often fatal. While foraging, chicks of many species depend on small insects for forage. Fire ants often feed on insects, creating a strong competition for forage against the hatchlings. Many species also rely upon smaller vertebrates as a food source, but areas may become devoid of small reptiles, amphibians, and mammals—either because they deserted the area or they were consumed by the red imported fire ants. Even the young of large mammals, such as deer fawns, are susceptible to attack from fire ants. These ants do not go dormant over the winter, and populations are quite robust against any stochastic event. In the event of a flood, these ants escape from the multi-chambered underground nest, bind together holding one-to-multiple queens, and create a buoyant raft on the water. Upon hitting a structure, which may range from a tree, house, fence pole, etc, the raft explodes onto the structure until the water recedes. The ants will not leave the structure until the water recedes and will feed upon whatever food sources are available. Ants are not as much a problem in the forest due to the dense root systems laid down by trees and shrubs that inhibit their underground movements. Open areas, such as pastures and prairies, where such root systems are not present, fire ants flourish, creating ant mounds 18 inches high and 18 inches wide. Fire ants are very difficult to control. They can be controlled for only short periods of time. Limitations to fire ant control include cost-effectiveness of insecticide and ant baits and the intensity of management that must be exercised to control them.

Refuge staff has documented fire ants on the refuge, but an increase to unmanageable numbers seems unlikely based on their inability to create large underground pathways in forested areas. They are present in the butterfly garden where cleaning and pruning of the garden seems to be the type of open areas they seek.

3.4 Socioeconomic Environment

This section describes the socioeconomic environment of the Trinity River NWR. It includes a discussion of nearby human populations and economies; public use opportunities and access; and public use and Service administrative facilities. It concludes with a short discussion about the Service's concerns pertaining to the socioeconomic environment.

3.4.1 Population

The refuge is located in Liberty County, Texas, and is located 50 miles east of Houston, Texas (Harris County) and 40 miles west of Beaumont, Texas (Jefferson County). As reported by the 2010 Census Data by the U.S. Census Bureau (U.S. Census Bureau 2011a), the estimated population in Liberty County (Table 3-7) was 75,643; Harris County was 4,092,459; and Jefferson County was 252,273. The refuge is within in the Houston-Baytown-Sugarland metropolitan area, the area also known as Greater Houston.

Table 3-7. Liberty County Population Projections, 2010–2040 as estimated in 2008.

Year	Population
2010	75,405
2015	77,914
2020	79,873
2025	81,296
2030	82,323
2035	106,704
2040	110,273

Source: Texas State Data Center and Office of the State Demographer

The Houston-Baytown-Sugarland metropolitan area is comprised of 10 counties: Austin (28,417), Brazoria (313,166), Chambers (35,096), Fort Bend (585,357), Galveston (291,309), Harris (4,092,459), Liberty (75,643), Montgomery (455,746), Waller (43,205), and San Jacinto (26,384). The current population estimate for the entire metropolitan area is 5,684,612 (U.S. Census Bureau 2011a). This area is defined by the Office of Management and Budget and is located in the Gulf Coast Region of Texas.

Trinity River Refuge is located within the Gulf Coast Region, an area comprised of 13 counties surrounding the Houston, Galveston, and Brazoria metropolitan areas. The 13 counties included are Austin (28,417), Brazoria (313,166), Chambers (35,096), Colorado (20,847), Fort Bend (585,357), Galveston (291,309), Harris (4,092,459), Liberty (75,643), Matagorda (36,702), Montgomery (455,746), Walker (67,861), Waller (43,205), and Wharton (41,280). The population estimate for this region is 6,087,088 (U.S. Census Bureau 2011a).

Of the 50 states, Texas is ranked 2nd most populous with a population estimate of 25,145,561 individuals (U.S. Census Bureau 2011a).

3.4.2 Economy

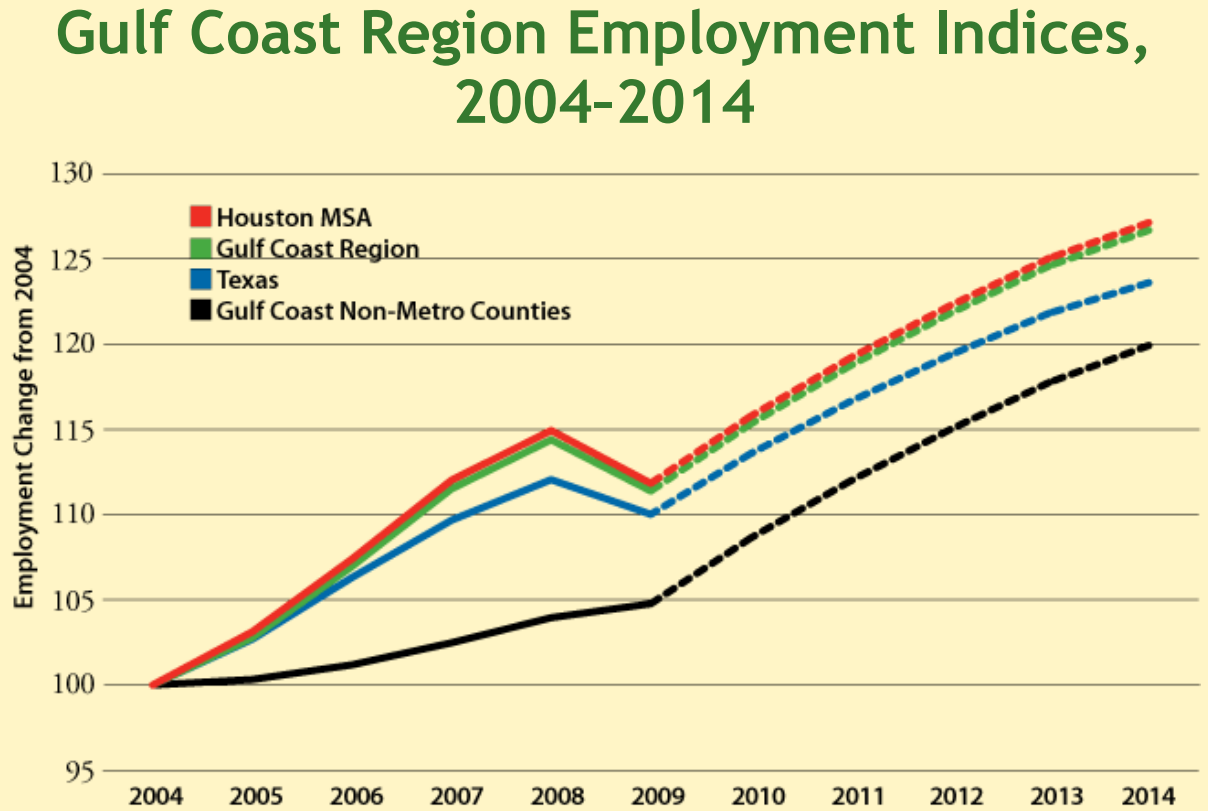
3.4.2.1 Regional Economic Profile

The State of Texas enjoys the world's 11th largest economy; the Texas Comptroller of Public Accounts tracks this economy and provides regional outlooks for 13 different regions throughout Texas. The refuge is located in the Gulf Coast Region (covering a 13-county area surrounding the Houston, Galveston, and Brazoria metropolitan areas).

Based on the comptroller's new 13-region economic model of Texas, employment in the Gulf Coast region of Texas is projected to grow at a 2.6 percent annual rate from 2009–2014, outpacing the 1.6 percent rate predicted for the State as a whole (see Figure 3-5).

Since 1970, the comptroller projected strong economic growth for the region. During the 1990s, employment in the Gulf Coast region had grown at a slightly slower rate than did the State as a whole, and overall growth in this region kept pace with statewide trends of the time. The State's economy had grown in the first five years of the new millennium, though not as rapidly as in the 1990s, and employment in the region grew more slowly as well. Accordingly, the primary challenge for this region was to provide the educational skills needed to train its work force to meet the changing needs of business in an internet economy. Based on the comptroller's new 13-region economic model of Texas, employment in the Gulf Coast region of

Texas was projected to grow at a 1.6 percent annual rate, the same rate as the State as a whole. In 2009, Gulf Coast employers provided 2.6 million jobs. The largest sector (trade, transportation and utilities) provided 21 percent of all employment in the region. Although Hurricane Ike resulted in thousands of lost jobs and employment disruptions, businesses recovered with strong job growth in 2009 (Texas Comptroller of Public Accounts 2010).



Note: Data after September 2009 are projected.
Sources: Economic Modeling Specialists Inc. and Texas Comptroller of Public Accounts.

Figure 3-5. Gulf Coast Employment Indices 2004–2014 (Texas Comptroller of Public Accounts 2010)

Demographics

The following is the most updated information regarding demographics that has been reported by the U.S. Census Bureau as of April 2011 (U.S. Census Bureau 2011b). The U.S. Census Bureau estimated the population of Liberty County to be 75,779 people in 2009. As of 2000, the Bureau counted 23,242 households with 17,756 families residing in the county. The population density was 60 people per square mile (23/km^2). There were 26,359 housing units at an average density of 23 per square mile (9/km^2). The Census Bureau's estimated racial makeup of the county in 2009 was 85.7 percent white, 12.1 percent black or African American, 0.6 percent Native American, 0.5 percent Asian, 0.0 percent Pacific Islander, and 1.1 percent reporting from two or more races.

The 23,242 households, out of which 38.10 percent had children under the age of 18 living with them, 60.50 percent were married couples living together; 11.40 percent had a female householder with no husband present; and 23.60 percent were non-families. Individuals made

up 20.40 percent of all households, while 8.90 percent had someone living alone who was 65 years of age or older.

In 2000, the age of the population of Liberty County was spread out with 27.60 percent under the age of 18; 9.20 percent from 18 to 24; 31.60 percent from 25 to 44; 21.40 percent from 45 to 64, and 10.30 percent who were 65 years of age or older. The median age was 34 years. For every 100 females, there were 95.70 males. For every 100 females age 18 and over, there were 92.40 males.

The median income for a household in the county was $38,361, and the median income for a family was $43,744. Males had a median income of $37,957 versus $22,703 for females. The per capita income for the county was $15,539. About 11.10 percent of families and 14.30 percent of the population were below the poverty line, including 18.30 percent of those under age 18 and 15.00 percent of those 65 or over (U.S. Census Bureau. 2011b).

3.4.2.2 Economic Significance of the Refuge

The socioeconomic impact of Trinity River 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. Refuge visitors add to the benefits of increased tourism benefiting local restaurants, hotels, and businesses. The refuge also contributes to the area's socioeconomic well-being through the salaries of its staff. Annual salaries (FY 2010) totaling more than $445,000 were paid to refuge employees, many of whom own homes and pay taxes in Liberty County.

Land acquired by the Service in fee title is removed from the county tax rolls. To help pay for lost tax revenues, the county received 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 2009, Trinity River NWR's payment to Liberty County was $41,652. Refuge Revenue Sharing payments usually exceeded the property taxes paid by the previous private landowners in cases where agricultural exemptions exist. The payment figure varies due to local land price trends and at what level Congress appropriates additional funds to make up the shortfall. In 2011, Congress discontinued the Revenue Sharing program. Private landowners continue to pay property taxes on lands, which the Service holds under a conservation easement. The refuge does not ask for city or county services. Refuge staff maintains refuge roads, fights fires, and provides law enforcement as needed.

Refuge Revenue Sharing

Land acquired in fee by the Service is removed from the county tax rolls. To help offset lost tax revenues, the county received 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). Monies for these Federal payments to counties came from revenues derived from the nationwide sale of refuge products and privileges. These funds are distributed based on one of the three following formulas that provide the highest return to the county:

- Seventy-five cents per acre, or
- Twenty-five percent of the net revenue received from the operation of the refuge, or
- Three-fourths of one percent of the appraised value of the property, which must be reappraised by the Service every five years. (Usually this formula is the one applied.)

If not enough revenues are available in the fund to make full payments; the Service distributes the funds proportionately nationwide. Congress is authorized to make up the difference. This program was discontinued in 2011. In 2010, refuge revenue paid $29,348.00 to Liberty County.

In addition, the refuge hosts an annual Earth Day event and Free Fishing Day event to provide an opportunity for visitors to experience compatible use activities allowed on the refuge. Additionally, visitors (approximately 22,000) come from local and neighboring counties to hunt, fish, and observe wildlife, thus providing an economic stimulus to local towns through the use of gas stations and restaurants.

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. 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 2007). 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.

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

Liberty County was first inhabited by prehistoric Indians, whose artifacts can be found at various sites including those of Orcoquisac Indian villages. The Jamison and Daniel sites, located opposite each other on the margins of the Trinity about three miles north of Liberty, have revealed mass burials, arrow points, pottery, and other artifacts dating to 1000 B.C. or earlier, as has a site near Dayton. During most of the eighteenth century, the area was contested by French interests seeking to expand from Louisiana to the east and Spanish interests from the west and south. The Spanish crown granted Pánfilo de Narváez the privilege to colonize the lands between the Rio Grande and the cape of Florida in 1526, Karankawa Indians, including Coapites and related groups, were the sole occupants of the future Liberty County until the 1740s. Rumors of French exploration on the Texas coast by

Joseph Blancpain and others prompted the Spanish to send Joaquín de Orobio y Basterra on an exploratory expedition in 1748, and fears of French intrusion continued. The Spanish established Nuestra Señora de la Luz Mission and San Agustín de Ahumada Presidio in 1756; the mission was for the Akokisa and Bidai Indians. Spanish maps in 1757 showed the Atascosito settlement and a Spanish military road known as the Atascosito Road, which crossed the Trinity near the present site of Liberty. Ten years later the Marqués de Rubí included the area in his tour of inspection, but parts of the mission were destroyed by a storm in 1766 and the presidio was abandoned in 1772. According to some sources, a trading-post settlement named Arkokisa or Arkosisa (variants of *Akokisa*) existed from roughly 1770 to 1790 near what later became the town of Liberty.

The Louisiana Purchase altered the balance of power between the Spanish and the French in 1803, and Spanish efforts to discourage American immigration to Texas increased. Nonetheless, the open land attracted numerous immigrants from Louisiana, Mississippi, and the adjoining states. In 1818 Charles F. A. Lallemand and Antoine Rigaud made an unsuccessful attempt to colonize Bonapartist refugees at Champ d'Asile, near the site of present Liberty. Coushatta Indians, who arrived in Texas from Alabama around 1807 and were later placed on an East Texas reservation, inhabited the east bank of the Trinity during this period. After Mexico won her independence from Spain, more American settlers came in response to promised grants of land, and much of what later became Liberty County and adjacent counties soon were part of an empresario grant made to Joseph B. Vehlein in 1826 and transferred to the Galveston Bay and Texas Land Company in 1830. A new Atascosito District developed in Mexican Texas when settlers established an independent colony in 1826. Local administration of the area was conducted at Atascosito until 1831. In the battle for allegiance, some residents of the Liberty area supported the Mexican government and participated in quelling the Fredonian Rebellion. But the Law of April 6, 1830, which prohibited further American immigration, pushed settlers too far. When the Mexican government failed to recognize titles given by the Galveston Bay and Texas Land Company, settlers and squatters in the coastal area petitioned the commander-in-chief of Coahuila and Texas for land titles and organization of a local government.

In 1831 land commissioner José Francisco Madero organized a municipality known as Villa de la Santísima Trinidad de la Libertad, which embraced most of Southeast Texas; it was bounded on the east by the Sabine River, on the west by the San Jacinto, by Nacogdoches Municipality on the north, and by the Gulf of Mexico to the south. Hugh B. Johnston served as alcalde. The new seat of government, called Liberty by the Anglo-Americans, was located about three miles southwest of old Atascosito. In activities that led to the Anahuac disturbances of 1832, John Davis Bradburn, commander of the fort at Anahuac, attempted to annul the act, arrested Madero and the land commissioners who had given titles in the Liberty area, and attempted to dissolve the municipality. Some settlers pledged loyalty to Antonio López de Santa Anna in the Turtle Bayou Resolutions. Nonetheless, the territory between the San Jacinto and Sabine rivers continued to be known thereafter as Liberty and functioned as a municipality.

Antebellum Liberty County was characterized by plantations along the Trinity that raised cotton, sugarcane, tobacco, indigo, grains, and vegetables. Lumber mills were in operation, and Liberty shipped cotton, hides, Indian corn, cattle, and lumber down the Trinity. The county economy received a further boost in 1840 when James Taylor White established the cattle industry with an extensive ranch at Turtle Bayou in what is now Chambers County.

Cattle drives began moving eastward to Louisiana, and some cattlemen sold their animals to a meatpacking plant at Liberty Landing, operated by the English firm Jones and Company.

Early attempts to build a railroad from Liberty to Livingston were interrupted by the Civil War. Efforts to extend the navigable portion of the Trinity began in 1852 and continued spasmodically thereafter. Only the Texas and New Orleans Railroad (later the Southern Pacific) from Houston via Liberty and Beaumont to Orange was in place by 1860.

The Liberty Invincibles, organized in 1861, were later Company F of the Fifth Regiment of Texas Volunteers during the civil war. After the war, many freedmen worked for their former masters or settled in the county and started small farms.

In 1871 steamboat travel resumed when the Trinity River Navigation Company, with headquarters at Liberty, incorporated to run steamboats from that city to Galveston. United States government assistance for making the Trinity more navigable came after 1880, and by 1940 a total of 236 miles of waterway had been constructed. Nonetheless, railroad construction, which began largely after Reconstruction, caused a severe blow to the port of Liberty. The Gulf, Colorado and Santa Fe (later the Atchison, Topeka and Santa Fe) crossed the northern part of the county through Cleveland, Romayor, Fuqua, and other former timber towns by 1900, and by 1907 ten miles of the proposed Trinity Valley and Northern line from Dayton to Cleveland had been completed. The Beaumont, Sour Lake and Western Railway (later the Missouri Pacific) built across the central part of the county through Eastgate, Kenefick, Sandune Station, Hardin, and Hull parallel to the Texas and New Orleans, and Ross S. Sterling's Dayton-Goose Creek line reached Dayton in 1917.

There is only one known archeological site on the refuge. The site was destroyed before Service acquisition. Numerous surface level archeological surveys have been conducted throughout the refuge in the last nine years. The surveys were required before seismic crews could search for oil and gas. No other sites were discovered or are known from previous records. There are currently no sites listed on the National Register of Historic Places on Trinity River NWR.

3.6 Current Management and Administration

3.6.1 Administration

3.6.1.1 Staffing

In FY 2011, Trinity River NWR staff consisted of seven employees, including five permanent full-time, and two part-time on call (1,040-hour appointments). The refuge also had a Student Conservation Association intern, three Youth Conservation Corpsmen; it uses about 15 “regular” volunteers to conduct its work each year (Chapter 5, Table 5-1 identifies existing staff). The annual operations and maintenance budget was $634,859 in 2010.

Volunteer Programs

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 is a well-balanced work/learn program for high school students during the summer months that helps develop an understanding and appreciation of the environment.

Crews work on multiple projects throughout the refuge, including invasive plant removal, litter clean-up, and fence maintenance.

Student Conservation Association

The Student Conservation Association is a nonprofit 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 can serve for a variety of terms (e.g., one-year, three-month, and six-months). Major duties consist of assisting with invasive species management and research and helping with general biological tasks.

Friends of Trinity River Refuge

National Wildlife Refuges have many needs beyond those that can be provided by their traditional funding sources and limited staff. The Friends of Trinity River Refuge (FOTRR) was established in 2000 because volunteers believe in the importance of the refuge—both to wildlife and to the surrounding communities, which are enriched by their presence.

The FOTRR is a non-profit organization dedicated to supporting the refuge. They provide volunteers for many important refuge activities and raise funds for a variety of refuge projects. Funds are raised through donations, grants, and gifts to help fund wildlife refuge projects, educational programs, and other activities. Members of this group are dedicated volunteers who work tirelessly for the benefit of the refuge and the community. Activities provided by the FOTRR include construction of public use facilities, such as the observation/fishing pier, butterfly garden, and parking areas; clean-up efforts; planting trees; hosting annual events; promoting public awareness of our refuge and wildlife; publishing a quarterly news letter; fundraising for refuge projects and programs; and participating in data gathering and bird counts.

FOTRR is a 501(c)(3) non-profit organization governed by an 11-member volunteer board composed of persons who represent those interested in conservation, education, and the natural environment.

3.6.1.2 Administrative Facilities

The refuge office consists of a single field station administrative headquarters office as well as a storage/maintenance building. The office is approximately 3,200 square feet and includes eight offices, storage space, conference room, kitchenette, and visitor and staff parking areas. The storage/maintenance building encompasses 2,250 square feet and is adjacent to the headquarters. The entire footprint of both buildings is approximately 2.5 acres. Other on-refuge facilities are listed in Table 3-8.

Table 3-8. Refuge Facilities

Facility	Description
Headquarters Office	Built in 2011 on refuge unit with 8 offices
Storage/maintenance (adjacent to headquarters)	Built 2011 on refuge unit with 4 bays
Champion Lake – Enclosed Storage Shed	Heavy equipment, ATV, herbicides, tools storage
Champion Lake – Open Storage Shed	Pipe and heavy equipment storage
Champion Lake – Freight Containers	Two, 8' x 40' containers storing equipment
Champion Lake – Mobile Home	Houses interns, 3 bedrooms
Champion Lake – Wooden Storage Building	Houses washer, dryer, and recycling bins
Champion Lake – Septic System	For mobile home and RV pads
Champion Lake – Water Well	For mobile home, RV pads, and butterfly garden
Champion Lake – Above Ground Storage Tanks	1,500 gal diesel and 1,500 gal gas storage
Champion Lake – Stand-by Generator	Diesel – handles all operations for Champion Lake
Champion Lake – Log Cabin (not currently usable)	1950s era log cabin with 2 small rooms
Champion Lake – Lodge (not currently usable)	1940s era large log cabin with 5 large rooms
Die House – Residence	Houses volunteers and researchers, 2 bedrooms
Die House – Butler Building	Enclosed 30' x 30' storage for mowers and tools
Die House – Water Well/Storage Building	Supplies water to the Die House
Die House – Herbicide/Oil/Paint Storage Building	Store various herbicides, paints, oils, etc
Die House – Above Ground Storage Tanks	1,000 gal diesel, 500 gal diesel, and 500 gal gas
Die House – Travel Trailer	Used by researchers, temporary volunteers
Die House – Open Pole Shed	Pipe and heavy equipment storage
Die House – Stand-by Generator	Diesel – handles all operations for diesel
Radio Tower Building (off-refuge)	Houses two-way radio components

Utilities and Right-of-ways

There are a number of right-of-ways that exist within the refuge used for oil, gas, and chemical pipeline transport and electrical utilities. There is a major overhead high voltage electrical line running through Tract 10 for one mile, north of Country Road (CR) 2252, and numerous smaller electrical lines running to various in-holdings and refuge buildings found throughout the refuge. There are at least 20 oil, gas, or chemical companies that have pipelines on approximately 11 tracts of the refuge.

3.6.1.3 Oil and Gas Operations/Management

The refuge does not own any mineral rights. The refuge does not currently have any active oil or gas well sites or production facilities, although the potential exists. There are currently over 16 miles of pipelines located through various refuge units. Except for pipeline construction projects within an existing right-of-way, the remaining pipelines were in place before the inception of the refuge. Although very rare, occasional spills or blow-outs could occur in pipes, causing damage to habitat and wildlife. Mitigation measures will be incorporated into all special use permits allowing any activities relating to oil and gas development and require operators to submit a "Development and Operations Plan" for approval by the refuge manager.

All oil and gas activities conducted on the refuge require the use of "best management practices" as defined in the Operational Plan and/or Special Use Permit. Efforts to minimize environmental

impacts in wetland habitats include special conditions such as timing of activity, types of equipment used, and use of on-site environmental monitors, as well as habitat restoration requirements, if needed. Best management practices and mitigation measures are discussed and agreed upon before the initiation of any seismic, drilling, or production activities.

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 effects of oil and gas operations on wildlife or refuge visitors. The potential for future oil and gas exploration and production on the refuge is always possible.

3.6.1.4 Partnerships

The refuge has a strong history of working with natural resource partners to implement Service policy, projects, and ecoregional goals. The full list of partners can be viewed in Chapter 5.

3.6.1.5 Memorandums of Understandings and Agreements

Trinity River NWR has a Memorandum of Understanding (MOU) between the Liberty County Sheriff's Department and Texas Parks and Wildlife Department for law enforcement use of radio frequencies (effective January 2009–January 2014).

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, refuge facilities, and facilitating the safety of visitors—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, the refuge is limited to one full time law enforcement officer to patrol the entire refuge.

3.6.1.7 Safety

Safety is important for 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 and Wildlife Management

Native Flora/Fauna Conservation

The refuge strives to acquire and conserve units within the approved acquisition boundary. The refuge would continue habitat management activities to restore and reintroduce native flora and fauna. Management tools will continue to be implemented to improve or maintain the integrity of bottomland hardwood forests such as treating non-native flora and planting trees.

Management of native nuisance flora includes limited control by herbicides of cattail and frogbit along various ponds covered in those plants. The use of herbicides would continue at approximately 200 acres per year. The refuge has planted over 12 species of native trees since 1995. Plantings primarily occurred in 1995 and 1996 with 10,000 bare-root seedlings, and over 50,000 seedlings were planted in 2006.

The refuge will initiate a small (approximately 200 acres over the life of the CCP) prescribed fire program to benefit nesting habitat for Henslowe's sparrow and other grassland-dependent species. Small islands of grasslands have been targeted for prescribed burning on four separate units (See Map 3-8. Fire Burn Units). The Refuge completed a Fire Management Plan in 2011 that describes the units, prescriptions, and objectives of prescribed fires on the refuge.

Management of potentially native nuisance fauna includes hunting white-tailed deer and trapping beaver that could potentially affect adjacent landowners.

The refuge would continue to maintain three artificial roosting structures specifically for cavity-roosting bats: one abandoned farmhouse and two cinderblock towers. Artificial bat towers were erected to provide maternity roosts. Surveys of artificial roosting structures over five years have shown that this particular species of bat is increasing. The population has shown a small but steady growth (approximately 10 percent each year) from 2005–2011. Information regarding bat roost selection was collected as a part of a three-year study funded by U.S. Geological Survey (USGS).

The refuge will continue to work with TPWD to establish and record deer browse line surveys to ensure that deer population numbers in and around the refuge are within the unit's carrying capacity.

The refuge will continue to record colonial nesting bird activity in our major rookeries.

Invasive Flora/Fauna Management

Invasive Species (flora):

The refuge treats Chinese tallow, trifoliate orange, McCartney rose, Chinaberry, water hyacinth, alligatorweed, giant salvinia, and other invasive species on a case-by-case basis to preserve the integrity of the bottomland hardwood ecosystem. Herbicidal treatments (Table 3-9) are the primary tools used to implement this management direction, while biological control methods may be used on approved species such as weevils for alligatorweed, salvinia, and water hyacinth. Herbicide treatment occurs on approximately 100–200 acres annually. This average is based on regular annual funding and does not include special circumstances where additional budget allocations have been available in individual years to treat additional acres. Treatments

to date are focused on problem areas that the refuge can achieve, given its limited budget and resources, rather than systematic control.

Table 3-9. Invasive Flora Treatments on the Trinity River NWR

Active Ingredient	Brand Name	Target Species	Application	Purpose
Imazapyr	Habitat, Imazapyr E-pro 2	Chinese tallow, Japanese mimosa, Chinaberry, trifoliate orange, water hyacinth, alligatorweed	Foliar	Eradicate invasive flora in bottomland forest and waterways
Imazamox	Clearcast	Chinese tallow, Japanese mimosa, Chinaberry, trifoliate orange, water hyacinth, alligatorweed	Aerial, Foliar	Eradicate invasive flora in bottomland forest and waterways
Glyphosate	Rodeo, Glyphos Aquatic	Chinese tallow, Japanese mimosa, Chinaberry, trifoliate orange, water hyacinth, alligatorweed	Foliar	Eradicate invasive flora in bottomland forest and waterways
Triclopyr	Garlon 4	Chinese tallow, Japanese mimosa, Chinaberry, trifoliate orange, water hyacinth, alligatorweed	Foliar, basal bark	Eradicate invasive flora in bottomland forest and waterways
Metsulfuron methyl + aminopyralid	Chaparral	McCartney Rose	Foliar	Eradicate invasive flora in bottomland forest and waterways

Faunal Species:

The refuge would place controls on feral hogs and nutria on a continuous basis. Removal of feral hogs is by hunting, removal by staff, and trapping, while nutria removal is by trapping and removal by staff. Current eradication efforts are focused on problem areas rather than systematic control.

Land Acquisition:

The refuge would continue to implement the actions outlined in the 1999 Lower Trinity River Floodplain Habitat Stewardship Program. The refuge continues to acquire lands from willing sellers as they become available. This would be on a case-by-case basis with available funding. Since 2000, yearly acquisition has averaged nearly 1,900 acres.

Climate Change:

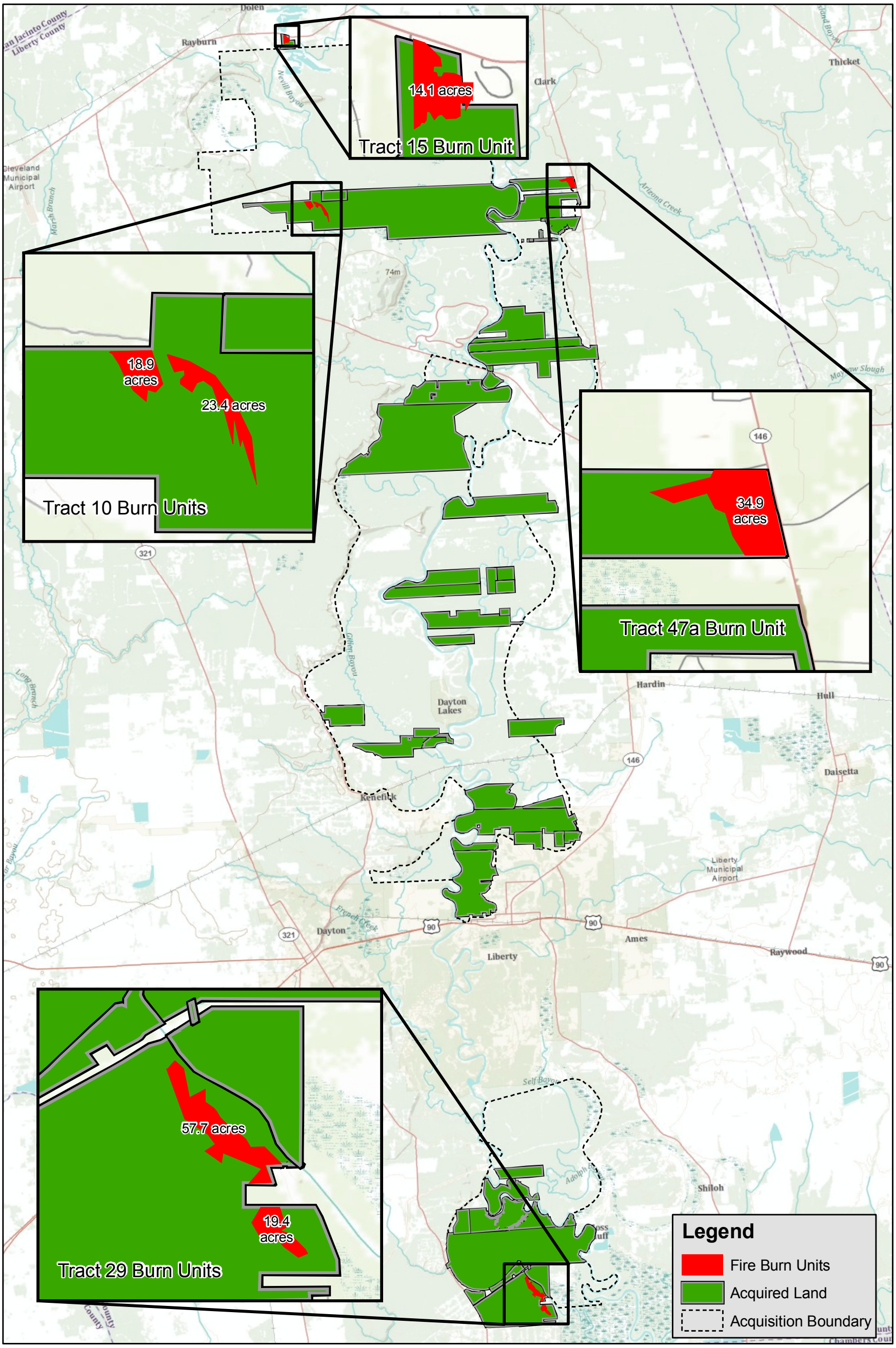
The refuge plants native bare-rooted tree seedlings in an attempt to sequester carbon. As opportunities arise, units that were previously pastureland before Service acquisition may be restored with native tree species. The refuge uses green infrastructure and related technologies when opportunities and funding permit to reduce its carbon footprint and contribution to climate change; the refuge also reduces, reuses, and recycles used materials to the extent possible and maximize “green” technologies. In addition to traditional recycling activities, the refuge participates in local city recycling days for tires and document shredding.

U.S. Fish & Wildlife Service

Trinity River National Wildlife Refuge

Liberty County, Texas

Fire Burn Units



PRODUCED IN THE DIVISION OF REFUGE PLANNING
ALBUQUERQUE, NEW MEXICO
LAND STATUS CURRENT TO: 5/31/09
MAP DATE: January, 2011
BASEMAP: N/A
MERIDIAN: N/A
FILE: trn_burn_1.6.11_shl

0 1.5 3 6 Miles

0 1.5 3 6 Kilometers

UTM ZONE 15
NAD 83

Refuge controlled structures such as trailers and the Die House have converted most incandescent light bulbs to compact fluorescent light bulbs. The 12-volt generator batteries are trickle charged by a solar panel, and the vehicle fleet includes a hybrid Chevy Malibu. The refuge strives to minimize its carbon footprint on a daily basis.

Resource Protection:

Currently, the refuge has one law enforcement officer to cover 25,000 acres on over 50 units, located 45 miles from north to south on two sides of a river. The law enforcement officer averages about four physical arrests, 20 notices of violation, and 50 verbal warnings per year. Most contacts involve illegal fishing and/or boating activities, but there are also considerable trespassing and outstanding warrant violations.

3.6.3 Visitor Services and Infrastructure

Providing recreational opportunities and environmental education, and interpreting the unique natural resources of the refuge for visitors are important elements of the Service's mission and the goals and objectives of the National Wildlife Refuge System. As stated in the Refuge Improvement Act of 1997, six wildlife-dependent recreational uses were determined to be priority public uses on national wildlife refuges. These are hunting, fishing, wildlife observation and wildlife photography, and environmental education and interpretation. These six uses, when compatible with the refuge purposes, are the focus of the refuge's public use activities. Other public uses may be considered to be compatible if they are found to be supportive of the six wildlife-dependent activities. The following describes public use opportunities on Trinity River National Wildlife Refuge.

The Improvement Act also ensures that the public is given an opportunity to participate in the process that determines whether an activity is compatible. Additionally, any management recommendations to discontinue uses found not to be compatible would most likely undergo NEPA compliance, wherein the public is, once again, given the opportunity to participate. If an existing use is legal, compatible, safe, consistent with sound fish and wildlife management principles, and otherwise in the public interest, the Service assesses whether it has the funding and staffing to administer that program. If those resources are insufficient, the new law requires the Service to aggressively seek out partners to assist in implementing that program. For example, assistance from state conservation officers on a refuge in another state enabled that understaffed refuge to have at least a limited hunting program. Only after exhausting all possibilities for assistance from partners can the Service prohibit an otherwise compatible, safe, and sound wildlife-dependent public recreational use.

3.6.3.1 Wildlife-Dependent Recreation Opportunities

The refuge receives over 22,000 visitors annually and provides opportunities for the public to hunt waterfowl, big game, and upland game; fish; and observe, photograph; and learn about bottomland hardwood forests. However, there are currently limited opportunities for visitor education and interpretation.

Hunting

The objective for hunting is to provide safe and high quality waterfowl, upland game, and big game hunting opportunities on the refuge. Hunting is a traditional and very popular outdoor recreational pursuit in the region. Refuges and other public lands in southeast Texas play a key

role in providing hunting opportunities to the public. Of the approximately 22,000 refuge visitor use days a year, about four percent (700) come for an opportunity to hunt on the refuge (see Table 3-10 and Map 3-9).

Table 3-10. Current Hunt Program

Units Currently Open/Acres	Type Of Hunt (Number of Permits Issued)	Species
Page – 2,200	**Big game** ▪ archery (22) ▪ general gun (16)	deer, feral hog
Brierwood – 1,800 (allows ATVs for hunters with disabilities)	**Big game** ▪ general gun (14) ▪ muzzleloader (25) **Upland game** (30)	deer, feral hog squirrel, rabbit
McGuire – 550	**Big game** ▪ general gun (10) ▪ muzzleloader (15) **Upland game** (20)	deer, feral hog squirrel, rabbit
Butler – 250	**Big game** ▪ general gun (8)	deer, feral hog
Hirsch – 890 (allows ATVs for hunters with disabilities)	**Big Game** ▪ archery (14) ▪ general gun (8) ▪ muzzleloader (10)	deer, feral hog
Boar's Den – 2,000	**Big Game** ▪ general gun (18) ▪ muzzleloader (30) **Upland Game** (35)	deer, feral hog squirrel, rabbit
Silver Lake – 260	**Big Game** ▪ general gun (5)	deer, feral hog
Champion Lake – 800	**Waterfowl** (120)	ducks

In 1997, Congress, via the National Wildlife Refuge System Improvement Act, recognized the legitimacy of hunting on the refuge. The Service is dedicated to providing opportunities for hunting and other compatible wildlife-dependent recreation. Hunting is an important wildlife management tool to control populations of some species that might otherwise exceed the carrying capacity of their habitat and threaten the well-being of other wildlife species and, in some instances, that of human health and safety. The guiding principles that the Refuge System uses to manage quality hunting on refuges are: 1) to manage wildlife populations consistent with approved management plans; 2) to promote visitor understanding of and increase visitor appreciation for America's natural resources; 3) to provide opportunities for quality recreational and educational experiences; and, 4) to minimize conflicts with visitors participating in other compatible wildlife-dependent recreational activities.

The current refuge public use program supports hunting, and as such:

- Provides waterfowl hunting opportunities on approximately 1,000 acres of the refuge;
- Provides upland game (squirrel and rabbit) hunting opportunities on approximately 4,350 acres of the refuge;
- Provides big game (deer and hog) hunting opportunities on approximately 7,950 acres of the refuge;
- Requires a fee and refuge hunt permit;
- Maintains existing access facilities that support the hunting program, including roads, boat ramp, parking areas, and waterways; and
- Conducts law enforcement activities to protect public safety and natural resources.

Fishing

The objective for fishing is to provide safe and high quality fishing opportunities on the refuge. The refuge offers good recreational fishing and crabbing opportunities at the Champion Lake/ Pickets Bayou area. Of the approximately 22,000 refuge visitor use days a year, about 85 percent (18,000) come to fish.

The current refuge public use program supports fishing activities, and as such:

- Maintains existing access facilities that support the fishing program, including roads, boat ramps, parking areas, fishing piers, and trails;
- Hosts annual Free Fishing Day event; and
- Conducts law enforcement activities to protect public safety and natural resources.

Anglers can fish on Champion Lake and Pickett's Bayou during daylight hours throughout the year. These anglers are treated to bass, crappie, catfish, and gar. Law enforcement officers (both State and Federal) have stepped up patrols to minimize littering and illegal taking of fish, while educational efforts have been increased to encourage anglers to collect and discard excess and old fishing line, hooks, and sinkers, since wildlife are known to die after ingesting this debris.

No fishing is allowed within 200 yards of any documented colonial waterbird rookeries from March 1 through August 31 to minimize disturbances to nesting birds.

Wildlife Observation

The objective for wildlife observation is to provide safe and high quality opportunities for wildlife observation on the refuge. The refuge provides local, regional, national, and international visitors with a wide range of wildlife observation opportunities, supporting a rapidly growing nature tourism industry in Texas. The refuge is becoming known as a birding and butterfly destination for a few thousand visitors each year. Of the approximately 22,000 refuge visitor use days a year, about five percent (1,000) come to observe wildlife.

The current refuge public use program supports wildlife observation, and as such:

- Maintains existing facilities that support wildlife observation, including the butterfly garden, observation pier, parking areas, trails, levees, kiosks, photography blind, and interpretive signs.
- Conducts law enforcement activities to protect public safety and natural resources.

Wildlife observation opportunities may occur throughout the refuge but visitors are currently directed to eight designated units with parking lots and trails. The Champion Lake Public Use Area has the most to offer with trails, levee, pier, portable toilet, and butterfly garden. Other opportunities to participate in wildlife observation on the refuge are included in Table 3-11.

Table 3-11. Wildlife Observation Trails

Unit Name	Unit #	Acres	Type	Miles of Trails
Butler	10	500	Hiking	0.5
Brierwood	47	2,983	Hiking	7.3
Page	21	877	Hiking	4.5
Hirsch	64	892	Hiking	2.2
McGuire	31	521	Hiking	7.1
Silver Lake	47a	259	Hiking	0.1
Boar's Den	46, 46a, 47	4,471	Hiking	7.5
Champion Lake Public Use Area	27	2,850	Hiking Boating	2.3 7.1

Wildlife Photography

The objective for wildlife photography is to provide safe and high quality opportunities for wildlife photography on the refuge. The refuge provides local, regional, national, and international visitors with a wide range of wildlife photography opportunities, supporting a rapidly growing nature tourism industry in Texas. The refuge is becoming known as a birding and butterfly destination for a few thousand visitors each year. Of the approximately 22,000 refuge visitor use days a year, about one percent (150) come to photograph wildlife.

Wildlife photography opportunities may occur throughout the refuge but visitors are currently directed to the same eight designated units as described under wildlife observation Table 3-11.

The current refuge public use program supports wildlife photography activities, and as such:

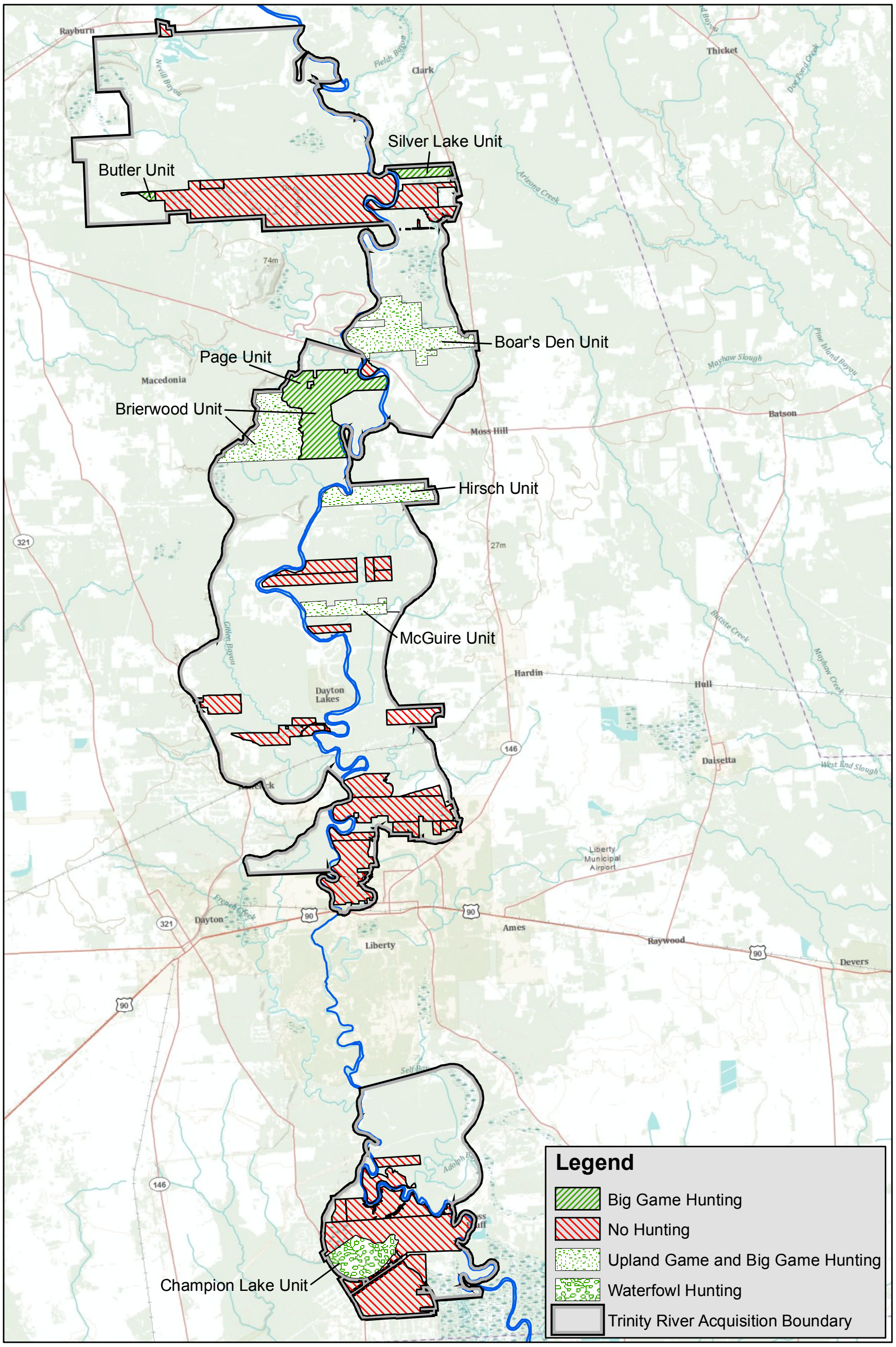
- Maintains existing facilities that support wildlife observation and photography, including the butterfly garden, observation pier, parking areas, trails, levees, kiosks, photography blind, and interpretive signs; and
- Conducts law enforcement activities to protect public safety and natural resources.

U.S. Fish & Wildlife Service

Trinity River National Wildlife Refuge

Liberty County, Texas

Hunt Units



PRODUCED IN THE DIVISION OF REFUGE PLANNING
ALBUQUERQUE, NEW MEXICO
LAND STATUS CURRENT TO: 5/31/09
MAP DATE: December, 2010
BASEMAP: N/A
MERIDIAN: N/A
FILE: trn_hunting_12.3.10_shl

0 1.5 3 6 Miles

0 1.5 3 6 Kilometers

UTM ZONE 15
NAD 83

Interpretation

Refuge interpretive programs provide safe and quality opportunities for both children and adults to learn about the refuge and habitats of southeast Texas. Interpretive programs improve the quality of the visitor's experience while providing them with a better understanding of the benefits, issues, and challenges of natural resource conservation in the bottomland hardwood ecosystem. Of the approximately 22,000 refuge visitor use days a year, about eight percent (1,700) come for interpretive events.

The current refuge public use program supports interpretation activities, and as such:

- Partners with the Friends of Trinity River Refuge and refuge volunteers to provide interpretive programs on and off refuge;
- Maintains existing facilities that support interpretation, including the roads, parking areas, trails, interpretive signs, observation pier, and kiosk;
- Hosts annual off- and on-site interpretive events, including Liberty Jubilee, Earth Day, Christmas Bird Counts, butterfly count, and some guided tours; and
- Conducts law enforcement activities to protect public safety and natural resources.

Outreach efforts consist of staff and volunteers participating in many community activities throughout the area. The refuge provides programs on a per-request basis to schools and local conservation and civic groups. Refuge staff attend Chamber of Commerce and emergency management meetings during hurricane season. The refuge staff and Friends of Trinity River Refuge members regularly staff a refuge exhibit at the Liberty Jubilee Celebration, which reaches over 1,300 people.

Refuge staff and the Friends of Trinity River Refuge host numerous annual special events such as Earth Day, free fishing day, and national Public Lands Day. The Earth Day event includes kayaks, boat tours, dip netting for children, fishing lessons, and a booth to disseminate refuge information to about 175 annual visitors. Free Fishing Day consists of giving 75–100 people (mostly children) an opportunity to fish on the refuge without needing a license. All poles, bait, and fishing lessons are supplied by volunteers. The refuge hosts a beach clean-up for National Public Lands Day. Many school groups participate in the clean-up, averaging over 1,000 pounds of trash removed while separating aluminum cans for recycling. The refuge also hosts the annual Big Sit event where birds are counted all day just by sitting on the refuge fishing pier.

Environmental Education

Environmental education programs on the refuge are extremely limited due to lack of facilities and staff. Most programs are limited to short, on-site visits or off-refuge programs dealing with a large number of students at one time. The refuge does not have a set or certified curricula program.

3.6.3.2 Other Recreational Opportunities

Boating

The refuge provides safe and high quality opportunities for children and adults to learn about the refuge and habitats of southeast Texas through the use of boats with restricted motor size, kayaks, and canoes. Although boating is not identified as one of the six wildlife-dependent recreational uses in the Improvement Act, this activity is directly tied to fishing and hunting and

supports wildlife observation, photography, and interpretation. Boating is allowed only in designated areas during refuge hours. The refuge would continue to provide boating opportunities specifically in support of fishing, waterfowl hunting, wildlife observation, photography, and interpretation. Champion Lake would continue allowing boats having a maximum 10 hp motor, while Pickett's Bayou would continue allowing boats having a maximum 40 hp motor. All other ponds, lakes, or bayous discussed in CCP would only allow non-motorized boats, including no use of electric motors. Of the approximately 22,000 refuge visitor use days a year, about four percent (450) come with a boat.

The current refuge public use program supports boating activities, and as such:

- Maintains existing facilities that support boating activities, including two ramps, boating trails, and parking areas; and
- Conducts law enforcement activities to protect public safety and natural resources.

3.6.3.3 Public Use Areas

The Champion Lake Rookery Site is located on Champion Lake. These areas are administratively closed from March through June to protect herons, egrets, anhingas, and cormorants. Seasonal closures were initiated in 2001.

The Page Unit is located on the west side of the Trinity River, south of Highway 105. Total acres – 2,200. This area was designated in 2004. Open year-round to public uses except during hunt season.

The Brierwood Unit is located west of Gaylor Lake, south of Highway 105. Total acres – 1,800. This area was designated in 2004. Open year-round to public uses except during hunt season.

The McGuire Unit is located on McMurtry Rd (CR 2087). Total acres – 550. This area was designated in 2004. Open year-round to public uses except during hunt season.

The Butler Hunt is located off of Bazzoon Road (CR 2187). Total acres – 250. This area was designated in 2004. Open year-round to public uses except during hunt season.

The Champion Lake Unit is located at the end of CR 417. Total acres 800. This was initiated in 2002. Open year-round to public uses except on weekends from daylight until noon during waterfowl hunt season.

The Hirsch Unit is located at the end of CR 2503. Total acres – 890. This was initiated in 2011. Open year-round to public uses except during hunt season.

The Silver Lake Unit is located at the end of CR 2115. Total acres – 260. This was initiated in 2010. Open year-round to public uses except during hunt season.

The Boar's Den Unit is located on Hwy 105 on the northeast side of the Trinity River. Total acres – 2000. This was initiated in 2011. Open year-round to public uses except during hunt season.

3.6.3.4 Public Use Access

Access on the refuge is provided primarily to facilitate the six priority public uses of the Refuge System (hunting, fishing, wildlife observation, photography, environmental education, and interpretation), when compatible with refuge purposes and the Refuge System mission. Public access is normally only allowed in designated areas and along designated routes of travel (e.g., roads, trails, waterways, and other routes). Designated routes of travel can be public county roads and waterways or refuge dirt roads, trails, and waterways.

Roads

Trinity River NWR only has two miles of dirt roads open to public access. The road to Champion Lake is a gravel road off CR 417. The road to Silver Lake is a gravel road off CR 2115. Both of these roads lead to parking areas. There are no auto tour routes on the refuge.

Trails

The refuge has eight active trails totaling approximately 38 miles throughout the refuge (see Table 3-12).

Table 3-12. Trinity River NWR Trail Summary

Unit Name	Unit #	Acres	Type	Miles of Trails
Butler	10	500	Hiking	0.5
Brierwood	47	2,983	Hiking	7.3
Page	21	877	Hiking	4.5
Hirsch	64	892	Hiking	2.2
McGuire	31	521	Hiking	7.1
Silver Lake	47a	259	Hiking	0.1
Boar's Den	46, 46a, 47	4,471	Hiking	7.5
Champion Lake Public Use Area	27	2,850	Hiking	2.3
			Boating	7.1

Waterways

Champion Lake and Pickett's Bayou are the only navigable waterways on the refuge. These two areas also contain boat ramps. Pickett's Bayou is a deeper waterway that can be used to access the Trinity River during periods of high waters. The refuge owns the first mile of the waterway from the boat ramp, and from that point south, State rules apply. Visitors are allowed to use boat motors of 40 hp or less in this section of Pickett's Bayou. Fishing and crabbing are allowed in these waters. Fishing restrictions include fishing with bows, trotlines, or any sort of nets to take fish or crabs or to harvest frogs or turtles.

3.6.3.5 Facilities

Public Use Facilities

Trinity River NWR has very limited public facilities (Table 3-13 and Map 3-10). Most of the facilities are found at the Champion Lake Public Use Area.

Table 3-13. Public Use Facilities

Facility	Description
Champion Lake Public Use Area	This area contains: fully accessible T-shaped 150' fishing/observation pier; 5,000-sq-ft butterfly garden with walkway and parking; portable toilet; and two boat ramps
Silver Lake photo/hunt blind	10' x 10' accessible blind at end of a boardwalk
Kiosk	Located at trail head of Brierwood unit
Parking lots	Located at Champion Lake, Brierwood, Page, Hirsch, Silver Lake, McGuire, and Butler units
Trails	See Public Use Map 3-10

3.6.4 Special Management Areas

This section identifies special management areas designated within a 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 thought the actions of other agencies or organizations. The influence special designations may have on the management of lands and waters within refuges may vary considerably.

3.6.4.1 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."

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 Trinity River 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. There are no designated wilderness areas on Trinity River NWR. The refuge's Wilderness Review is provided in Appendix G.

3.6.4.2 Research Natural Areas

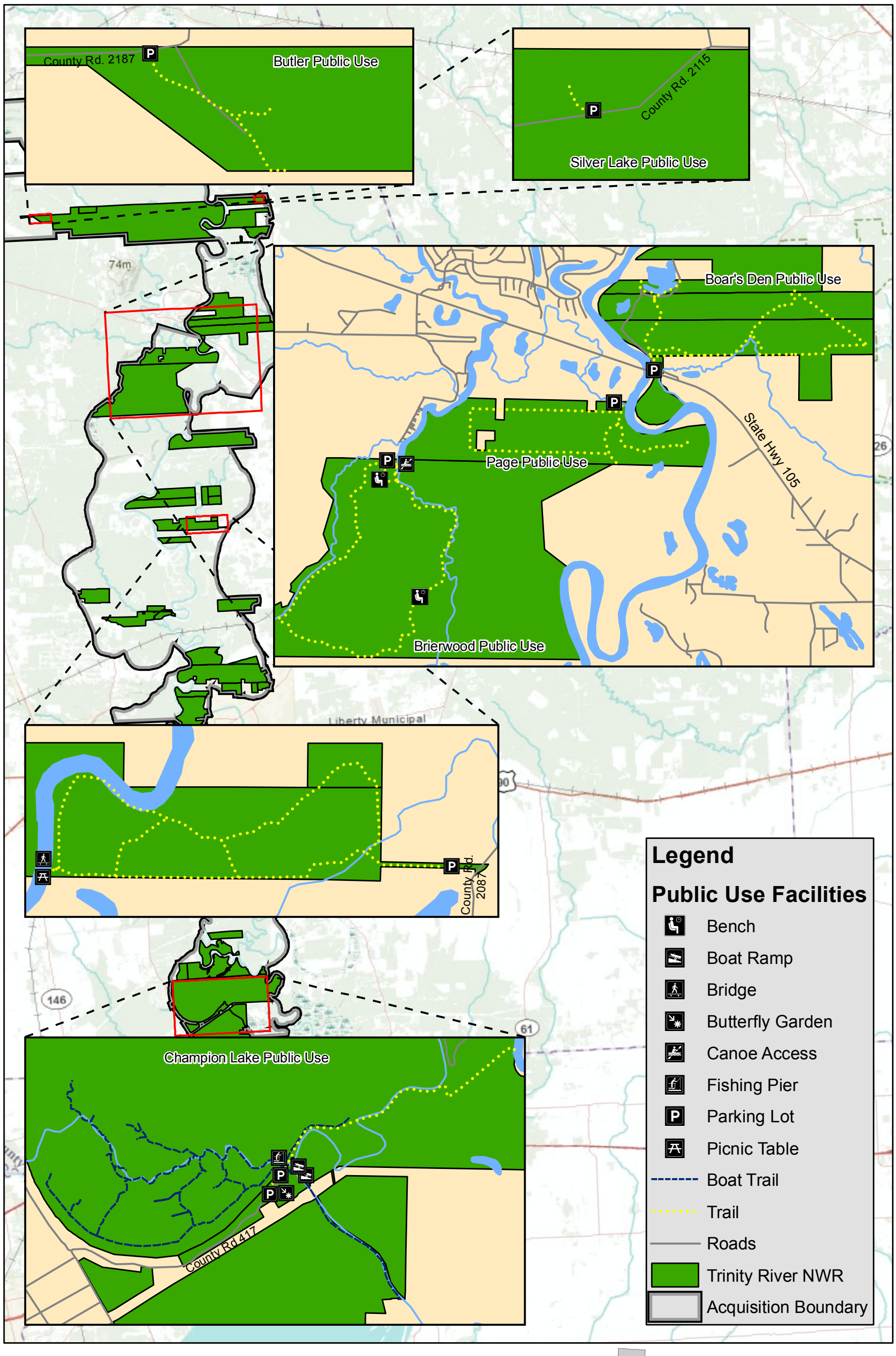
The Service recognizes the importance of preserving plant and animal communities in a natural state for research purposes. Research Natural Areas (RNAs) on National Wildlife Refuges are part of a national network of research areas under various ownerships. This network is the result of a designation system recognized by other Federal land administering agencies and the Federal Committee on Ecological Reserves. RNAs are intended to represent the full array of North American ecosystems; biological communities, habitats, and phenomena; and geological and hydrological formation and conditions. 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.

U.S. Fish & Wildlife Service

Trinity River National Wildlife Refuge

Liberty County, Texas

Public Use



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: trn_public_use_6.21.11_shl

0 2 4 8 Miles

0 2 4 8 Kilometers

UTM ZONE 15
NAD 83

Designation and management of RNAs is delegated to the director of the Service by the National Wildlife Refuge System Administration Act of 1966.

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. Trinity River NWR does not administer any RNAs at this time.

3.6.4.3 Other Special Management Areas

The Champion Lake Rookery Site on Champion Lake. This area is administratively closed from March through June to protect herons, egrets, anhingas, and cormorants. Seasonal closures were initiated in 2001.

3.6.4.4 Concerns Regarding Special Management Areas

The introduction of exotic invasive plants and animals has affected the refuge's rookery site as well as most refuge habitats. Most notable of these invasive species include McCartney 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.

3.6.5 Land Protection and Acquisition

The initial acquisition boundary for the refuge was approved in 1992 (USFWS 1992). The proposed 20,000-acre refuge was essentially owned by a single entity, the Wirt-Davis Trust. The first 4,400-acre unit was purchased in January 1994. Due to changes made by the Service and Wirt Davis Trust, it appeared that by 1998, property could no longer be purchased from the Trust. A determination was made and subsequently approved (USFWS 1999) to expand the acquisition boundary an additional 60,000 acres, now making an approved boundary of 80,000 acres (see Map 3-3). Since 1999, approximately 20,000 acres has been added in fee title to the refuge.

3.6.6 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, 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 body of Federal historic preservation laws has grown dramatically since the enactment of the Antiquities Act of 1906. Several themes recur in these laws, their promulgating regulations, and more recent Executive orders. They include: 1) each agency is to systematically inventory the historic properties on their holdings and to scientifically assess each property's eligibility for the National Register of Historic Places; 2) Federal agencies are to consider the impacts to

cultural resources during management activities and seek to avoid or mitigate adverse impacts; 3) the protection of cultural resources from looting and vandalism are to be accomplished through a mix of informed management, law enforcement efforts, and public education; and 4) consultation with groups, such as Native American tribes, will continue, addressing how a project or management activity may impact specific archaeological sites and landscapes deemed important to those groups. The Service, like other Federal agencies, is legally mandated to inventory, assess, and protect cultural resources located on those lands that the agency owns, manages, or controls. The Service's cultural resource policy is delineated in 614 FW 1-5 and 126 FW 1-3. In the Service's Southwest Region, the cultural resource review and compliance process is initiated by contacting the Regional Historic Preservation Officer/Regional Archaeologist, who will determine whether the proposed undertaking has the potential to impact cultural resources, identify the "area of potential effect," determine the appropriate level of scientific investigation necessary to ensure legal compliance, and initiate consultation with the pertinent State Historic Preservation Office and federally recognized Tribes.

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 Regional Historic Preservation Officer and State, tribal, and local officials. The Refuge Manager assists the Regional Historic Preservation Officer by protecting archeological sites and historic properties on Service managed and administered lands, by monitoring archaeological investigations by contractors and permittees, and by reporting Archaeological Resources Protection Act violations.

4. Refuge Management Direction: Goals, Objectives, and Strategies

The following goals, objectives, and strategies are the Service's response to the issues and concerns expressed by the planning team and the public; unless otherwise noted in the text, they are expected to be implemented throughout the 15-year term of this CCP. Because the CCP is a working document, modifications to the following objectives and strategies are anticipated.

Goals and objectives are the unifying elements of successful refuge management. They identify and focus management priorities, provide a context for resolving issues, guide specific projects, provide rationale for decisions, and offer a defensible link among management actions, refuge purpose(s), Service policy, and the National Wildlife Refuge System mission. Goals define general targets in support of the vision, followed by objectives that direct effort into incremental and measurable steps toward achieving those goals. Finally, strategies identify specific tools or actions to accomplish objectives. The goals are organized into four broad categories: habitat, wildlife, visitor services, and facilities.

Planning Horizon: 15 Years

Short-Term Objectives: 1 to 7 years

Long-Term Objectives: by end of 15-year period

4.1 Wildlife and Habitat Management

Goal 1: Habitat Conservation (Protection and Restoration): To acquire, restore, enhance, and manage healthy bottomland hardwood forests and associated habitat in order to support a natural diversity of plant and animal species that will foster the ecological integrity of the lower Trinity River floodplain ecosystem.

Objective 1: **Land Acquisition**

Throughout the life of the CCP, increase land acquisition and conservation easement efforts within the approved 80,000-acre refuge boundary to 3,500 acres per year, while updating the 1999 Preliminary Project Proposal (PPP) to add approximately 20,000 acres to acquisition and conservation easement efforts.

Rationale:

Since the completion and approval of the Lower Trinity River Floodplain Habitat Stewardship Plan in 1999, the refuge has acquired an average of nearly 2,000 acres per year of bottomland hardwood forest and associated habitat from willing sellers. Annually, the refuge purchases more land than almost all other refuges in Region 2. If that pace were to continue, it still would take more than 27 years to complete refuge acquisition. The number of willing sellers in this area is greater than the ability for Service Realty Specialists to handle the acquisition deals. Additionally, the number of private property owners just outside the approved acquisition boundary wishing to sell their bottomland hardwood forest and associated wetlands has increased since the 1999 plan. An updated PPP taking these additional areas under consideration needs to be developed. No conservation easements have been attained yet, but negotiations continue with at least one landowner.

The bottomland forests are critical for migratory songbirds and native wildlife (Barrow et al. 2000). They store large amounts of carbon in their foliage, roots, and soil, and they offer opportunities for carbon offsets with local industry (Delaney et al. 2002). Natural bottomland forests buffer flooding related to heavy rainfall common on the Texas coast, protecting human communities.

Strategy 1: Assign on-site regional level Service Realty Specialist to the refuge.

Strategy 2: Develop a systematic approach to identify appropriate lands available for acquisition within the area approved for acquisition.

Strategy 3: Develop updated PPP, increasing and redefining refuge acquisition boundary by approximately 20,000 acres.

Strategy 4: Maximize various funding opportunities needed to acquire lands, including Land and Water Conservation Funds, Migratory Bird Funds (duck stamps), mitigation funds, donations, grants, and possible land swaps.

Strategy 5: Enter into formal agreements, at the localized level for funding or acquisition assistance with NGOs such as The Conservation Fund, Trust for Public Lands, and land trusts.

Strategy 6: Strengthen and establish additional partnerships with an ecoregional approach to wildlife conservation/management with nearby State and Federal land management agencies. Two State parks, one national preserve, one national forest, one State river authority, and one Corps of Engineers lake project area, totaling over 380,000 acres, are located within 15–20 miles of the refuge.

Objective 2: **Invasive Floral Monitoring and Management**

Treat and monitor approximately 450 acres annually (short-term 300 acres; long-term 600 acres) of bottomland hardwood forests and associated habitats for encroachment of exotic vegetative species to achieve a 90 percent kill rate with herbicides approved for use by the Service.

Rationale:

Preventing the introduction and spread of invasive species is an ongoing and serious threat to native habitat. Executive Order 13112 requires that Federal agencies use relevant programs, authorities, and funds to monitor for, prevent, and control the spread of invasive species. The refuge treats 100–200 acres of invasive species annually. Although the refuge has treated more than a dozen species, the predominant invasive species are Chinese tallow tree, Chinaberry tree, trifoliate orange, and water hyacinth. Various and time consuming eradication methods are used depending on target species (Langeland and Stocker 1997).

Strategy 1: Develop an Integrated Pest Management Plan.

Strategy 2: Monitor for and map “hotspots” of invasive/exotic species.

Strategy 3: Develop a systematic approach to target and treat units annually followed by monitoring for and proactive spot treatments of new plants.

Strategy 4: Treat exotic species with basal bark, foliar, or aerial application methods.

Strategy 5: Initiate invasive species strike team.

Objective 3: **Invasive Faunal Monitoring and Management**

Throughout the life of the CCP, improve invasive species management of feral hogs and nutria by trapping for up to 200 nights per year for feral hogs and as needed for nutria, while increasing opportunities for the public to hunt feral hogs.

Rationale:

Preventing the introduction and spread of exotic wildlife species is an ongoing and serious threat to wildlife and native habitat. The greatest non-native wildlife species posing habitat challenges to the refuge is the feral hog. Feral hogs tend to move throughout the "bottoms" and pose a threat by eating all forms of native fauna ranging from grubs, snakes, and ground-nesting birds to newborn deer (Taylor 1991). They also host a variety of zoonotic diseases. While hogs can "root up" levee embankments, nutria can burrow through levees, creating safety issues. The refuge traps 20–30 feral hogs and small numbers of nutria annually with an average of 50 trap-nights annually. These permanent or mobile traps will rotate over 3–4 units per year depending on observed areas of destruction. An increase in trap nights and additional hunting opportunities will increase annual harvest, decreasing some destruction caused by feral hogs.

Strategy 1: Develop a Hog Management Plan.

Strategy 2: Trap and remove all nutria and as many hogs as possible in partnership with the USDA Animal Damage Control via approved methods.

Strategy 3: Develop a systematic approach to trap in units targeted for treatment annually followed by monitoring and proactive spot trapping as needed.

Strategy 4: Increase recreational hunt opportunities focusing on feral hogs.

Objective 4: **Bat Monitoring**

Throughout the life of the CCP, monitor State-threatened Rafinesque's big-eared bat colony population by surveying occupancy biweekly; documenting a 10 percent decrease in population over two years would warrant a determination by the refuge on whether bats are transitioning to natural roost sites or populations are declining.

Rationale:

Bottomland hardwood forests in east Texas are the western extent of the range of this bat. This bat is considered uncommon throughout its range. Rafinesque's big-eared bats are dependent upon mature, healthy bottomland forests that feature open mid-stories for foraging and mature, live trees with hollow cavities for raising young (Reyes 2002). These bats produce only one young per year and are therefore easily susceptible to decreases in population numbers. Population status has not been adequately monitored, but available evidence indicates that this species has declined significantly and is considered to be of special concern. Monitoring by refuge staff in three artificial structures and a few natural tree roosts that were located indicate a dramatic local population increase. In 2003, approximately 40 bats were first discovered in an old wooden house on the refuge. In 2004, two large artificial roosts that provide conditions suitable for bat maternity colonies were erected adjacent to the old house. They are enclosed cinderblock towers measuring 5' x 5' and 14' tall with slits where bats may enter and exit and a door where researchers can enter to count the bats. In 2010, approximately 100 bats were using all three structures. Based on current population growth

rates in the artificial structures, it is estimated they could support approximately 150 roosting bats over the life of this CCP. Refuge radio tagging has shown that bats in the artificial structures also use numerous mature trees in the immediate area. Over time, as more refuge trees are left to mature and form natural hollow cavities, bats will become less dependent upon artificial roost sites. Population of the bat colony is measured by counting bats in the known artificial and natural roost sites. The refuge does not plan to erect any other artificial roosting structures but will attempt to identify natural roost sites in the vicinity to document the difference between transitioning to natural sites versus a true reduction in the population. This species is recognized as a Category II Species of Concern by the Service.

Strategy 1: Maintain, monitor, and protect current natural and artificial roost sites for any changes or damages.

Strategy 2: Monitor population by counting roost occupancy every two weeks.

Strategy 3: Continue with no logging activities in the refuge to allow existing timber stands to mature, thus increasing natural roosting habitat for bats in the future.

Strategy 4: Initiate adaptive management practices if a drop of population numbers by 10 percent over two sequential years occurs to prevent further population decline.

Objective 5: **Habitat Inventory and Monitoring**

Within two years of the CCP's approval, gather baseline inventory and monitoring data of the composition of vegetative species at 40 surveys points within a 1,500-acre parcel, representing approximately 60 percent of the refuge, to determine best management practices for providing high quality habitat for birds, mammals, reptiles, and amphibians.

Rationale:

Trinity River NWR plays an important role in contributing to the conservation of wildlife at the local, regional, and ecosystem levels, as well as the overall biological diversity of the Refuge System. The refuge must maintain or improve the biological integrity and diversity of the habitat upon which the wildlife depend for forage and shelter to ensure the conservation of wildlife species.

The refuge will gather baseline inventory data on the composition of vegetative species on a 1,500-acre parcel representing approximately 60 percent of the refuge. The other 40 percent of refuge land is influenced by tidal flow, has slight differences in elevation, has been logged within the last 30 years, or has a pine ridge or severely altered habitats. The 1,500-acre parcel is, for the most part, indicative of a mature bottomland hardwood forest with a closed canopy.

The refuge will use a standard-random design of 40 sample points using a forest bird habitat monitoring protocol such as a modified James and Shugart (1970) vegetation sample methodology to gather measurements of plant species diversity and density of forbs, shrubs, and trees. This methodology may be used to compare samplings within the refuge and with other agencies also associated with bottomland hardwood habitat inventory and monitoring. The sample points will be re-sampled every five years to determine if any actions are needed to improve the habitat. Data acquired from this monitoring effort may be used to corroborate habitat is suitable for birds, mammals, reptiles, and amphibians, and to assess adaptive management techniques.

To clarify its role, the refuge will develop a step-down Habitat Management Plan (HMP) that develops priorities among species and species groups; it will be used to guide the development of appropriate strategies to achieve habitat objectives. The HMP will provide a process whereby refuge staff use key historical refuge data, scientific literature, expert opinion, and staff expertise to make habitat management decisions. The HMP will be a dynamic document, providing a decision-making process and guidance for the management of refuge habitat.

Strategy 1: Complete a detailed vegetation map for the entire refuge to establish an overall baseline to monitor future changes in management direction and changes related to climate change.

Strategy 2: Develop habitat monitoring programs in bottomland and riparian areas to document results of management actions; evaluate these in terms of habitats objectives, focusing on bottomland hardwood species composition changes over time.

Strategy 3: Complete a step-down HMP for the refuge (short-term). The HMP further helps define how the refuge can best contribute to maintaining biological diversity and determine biodiversity objectives within the context of the ecoregions that are part of the refuge.

Strategy 4: Develop habitat monitoring techniques for all areas undergoing active management. Document results of management actions, and evaluate these in terms of habitat objectives. Identify factors that limit the refuge's ability to meet objectives and to amend habitat management plans when monitoring and evaluation data support adjustments.

Strategy 5: Develop a monitoring program and database to evaluate wetlands in terms of key habitat components, such as numbers and types of invertebrates, wildlife use, water quality, and vegetation response to water management.

Strategy 6: Develop small scale hydrological projects to maintain or improve water flow and levee structures.

Objective 6: Climate Change Monitoring

Within two years of the CCP's approval, gather baseline inventory and monitoring data of refuge resources at 40 surveys points within a 1,500-acre parcel, representing approximately 60 percent of the refuge, to determine the effects on refuge resources (long-term) related to changes in climate.

Rationale:

Secretarial Order 3226 states that "there is a consensus in the international community that global climate change is occurring and that it should be addressed in governmental decision making…This Order ensures that climate change impacts are taken into account in connection with Departmental planning and decision making…Each bureau and office of the Department will consider and analyze potential climate change impacts when undertaking long-range planning exercises, when setting priorities for scientific research and investigations, when developing multi-year management plans, and/or when making major decisions regarding the potential utilization of resources under the Department's purview. Departmental activities covered by this Order include, but are not limited to, programmatic and long-term environmental reviews undertaken by the Department, management plans and activities

developed for public lands, planning and management activities associated with oil, gas and mineral development on public lands, and planning and management activities for water projects and water resources" (US Secretary of Interior 2009). Secretarial Order 3226 applies to Comprehensive Conservation Plans and step-down management plans such as habitat management plans.

Regional modeling of how long-term climate change patterns might emerge in the U.S. suggests that future climates along the Texas Gulf Coast could be very different than those of the past. Climate researchers used unique state-of-the art high resolution nested climate simulation models to explore the importance of fine scale processes in determining climate change hotspots in the continental United States and Mexico (Diffenbaugh et al. 2008).

The refuge will gather baseline inventory data on the possible effects of climate change on a 1,500-acre parcel representing approximately 60 percent of the refuge. The other 40 percent of refuge land is influenced by tidal flow, has slight differences in elevation, has been logged within the last 30 years, or has a pine ridge or severely altered habitats. The 1,500-acre parcel is, for the most part, indicative of a mature bottomland hardwood forest with a closed canopy.

Strategy 1: Continue to restore native habitat to sequester carbon by allowing forests to mature and reforesting pastures as needed.

Strategy 2: Introduce soil chemistry monitoring devices at 40 standardized sampling points to measure possible changes in physical environment and compare with weather data to explain possible shifts in vegetation composition.

Strategy 3: Monitor native and non-native plant and animal species range shift at 40 standardized points (i.e., black-bellied whistling duck nesting) for changes related to climate change.

Strategy 4: Utilize best available science to manage resources within ecosystems.

Strategy 5: Support research from partners and contribute to scientific information benefiting the ecoregion, such as Land Conservation Cooperatives (LCCs).

Strategy 6: Support land conservation efforts of partners through coordination of opportunities and resources.

Objective 7: Bird Inventory and Monitoring

Upon the CCP's approval, initiate semiannual surveys to gather baseline inventory and monitoring data of refuge bird species at 40 surveys points within a 1,500-acre parcel representing approximately 60 percent of the refuge to determine the effects on bird populations (long-term).

Rationale:

The Trinity River NWR was established by the Emergency Wetlands Resources Act of 1986 on January 4, 1994 for "…the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory birds treaties and conventions…."

Conservation and restoration of bottomland hardwood and associated habitats (ponds, bayous, ridges, right-of-ways, etc.) will result in a mosaic of microhabitat types that support a variety of

resident and migratory birds found in this area. For example, Swainson's warblers nest in habitats featuring high stem densities with heavy concentrations of small trees (Lanham and Miller 2006) or giant cane *(Arundinaria, gigantia)* or beneath vine tangles with a non-vegetated leaf litter below (Graves 2002). Conversely, prothonotary warblers are cavity nesters that select snags in flooded areas and frequently forage in the forest mid-story (Petit 1999), while acadian flycatchers are found in greatest densities in unlogged forests with all layers intact (Twedt and Somershoe 2009). For migrating songbirds, it appears that birds probably settle in response to gross habitat features such as vegetation density or stratification and then search for resources based on other factors (Moore and Aborn 2000). Nesting raptors typically found on the refuge (i.e., swallow-tailed kite, red-shouldered hawk, Cooper's hawk) generally require larger diameter and taller trees (Bent 1937, Portnoy and Dodge 1979, Brown et al. 1997). The refuge is home to six woodpecker species that require older and larger trees (Shackelford and Conner 1997). Various nesting herons and egrets inhabit "rookeries" located throughout the refuge from March to June. Refuge studies show nesting densities and locations vary yearly due to factors primarily related to water depth and availability.

The refuge will gather baseline inventory data regarding occupancy, range shifts, and population trends of bird species climate change on a 1,500-acre parcel representing approximately 60 percent of the refuge. Data will be analyzed with habitat characteristics collected from vegetative surveys to assess adaptive management efforts, as a change may be related to changes in climate. Data will be measured through point count surveys at 40 standardized points on a semiannual basis. At each point, presence/absence of the indicator forest breeding bird species (Swainson's, prothonotary and hooded warblers; acadian flycatcher; red-shouldered hawk; downy woodpecker; white-eyed vireo; northern parula; summer tanager; and Carolina wren) will be noted. All other bird species heard or seen will also be recorded, including flyovers. If our studies indicate the presence of 8 of these 10 indicator species, then we will be meeting our habitat management objectives for forest breeding bird species throughout the refuge.

Colonial waterbirds will be surveyed once a year in May in accordance with the colonial waterbird surveys collected by the State of Texas. Colonial waterbird rookeries can usually be found in the same places every year; however, they can move due to habitat conditions such as shallow water depths or encroachment of waterweeds. Bird species, pairs, nests, eggs, nestlings, and stages of nestling growth are recorded as a part of the surveys. Rookeries with populations of up to 10,000 birds comprised of up to 10 species have been located on the refuge on several occasions. These surveys will also be analyzed with habitat characteristics measured using standard methodologies used by James and Shugart (1970) to assess adaptive management, as a change may be related to changes in climate.

Strategy 1: Continue to acquire a variety of bottomland habitats that provide corridors for wildlife movement, including the migration of large numbers of migratory birds.

Strategy 2: Locate nesting territories of bald eagles and swallow-tailed kites. Consider these locations a priority in conservation activities.

Strategy 3: Create a research protocol using point counts to gather information on specific bird nesting (Swainson's warbler) in forested habitats.

Strategy 4: Within one year, develop a forest bird habitat monitoring protocol such as a modified James and Shugart (1970) vegetation sampling paired with Landbird Monitoring Protocols.

Strategy 5: Continue Colonial Waterbird Census efforts with added vegetation sampling.

Strategy 6: Increase invasive exotic control of floral and faunal species within the bottomland hardwood forest that affect bird species.

***Objective 8*: Reptiles and Amphibians Inventory and Monitoring**

Within three years of the CCP's approval, initiate semiannual surveys to gather baseline inventory and monitoring data of refuge reptile and amphibian species at 40 surveys points within a 1,500-acre parcel, representing approximately 60 percent of the refuge, to determine the effects on populations (long-term).

Rationale:

Reptile and amphibian populations across the refuge have not been well documented, but many populations of reptile and amphibians have declined due to habitat loss and exploitation of species throughout their range (TPWD 2005b). Assessing reptile and amphibian population status and trends may aid in establishing priorities for conservation of minimal unit size and corridors between units to sustain existing populations, as a change may relate to changes in climate.

Strategy 1: Within three years of the approval of the CCP, develop an inventory and monitoring protocol for reptiles and amphibians across refuge habitats, including wetlands.

Strategy 2: Continue to support research on reptile and amphibian populations in association with education and non-profit organizations.

***Objective 9:* Mammals**

Within four years of the CCP's approval, initiate semiannual surveys to gather baseline inventory and monitoring data of refuge mammal species at 40 surveys points within a 1,500-acre parcel, representing approximately 60 percent of the refuge, to determine the effects on populations (long-term).

Rationale:

Mammal populations are difficult to monitor, thereby populations across the ecoregion are not known. Monitoring the mammal populations on the refuge is essential in determining the status of population throughout the area. To protect refuge populations, information on population status on and around the refuge is necessary. Aside from bat management (see Objective 4), the refuge has no information on small mammals and minimal data on white-tailed deer and exotic feral hogs. Assessing mammal population status and trends may aid in establishing priorities for conservation of minimal unit size and corridors between units to sustain existing populations, as a change may relate to changes in climate.

Current data, by way of refuge browse surveys, anecdotal information, and personal observation, indicate that deer, feral hog, squirrel, and rabbit populations are remaining stable or increasing—even with the level of hunting currently allowed on the refuge (USFWS 2011).

Strategy 1: Within four years, set up an inventory and monitoring program for small mammals using live-trap lines and conduct additional surveys for deer.

Strategy 2: Coordinate with educational institutions, Federal and State agencies, and other organizations to conduct research and monitoring of specific species.

Objective 10: **Fish**

Rationale:

The refuge, in conjunction with Texas A&M University, has conducted fish surveys throughout the refuge to establish a species list and determine management options to maximize production throughout the refuge. Fish survey techniques have incorporated electroshocking, seining, cast netting, and traditional rod and pole fishing.

Many areas tend to have dissolved oxygen issues and may completely dry out during a drought. Fish from Order Cyprinodontiformes can be found in all size of bodies of water, from leftover flooded puddles to large open bodies of water that do not dry out. Fish from Order Lepisosteiformes (gars) and Amiiformes (bowfins) have shown the most resiliency and survival in the refuge swamps and waterways. They are adapted to survive in low dissolved oxygen conditions. The fish in Order Siluriformes (catfishes) are also quite resilient to low dissolved oxygen conditions, as they can "mouth-breath" when dissolved oxygen conditions become too lethal to other fish, such as those in the Order Perciformes (basses, sunfishes, drums, and mullet).

Champion Lake is the main public use area for fishing. Fish kills commonly occur during the hottest portions of drought seasons. Most fish, with the exception of bowfin and gar species, are asphyxiated as oxygen levels in the water decline to fatally low levels.

Because of unpredictable drought events and the refuge not owning any water rights from the Trinity River, management actions to benefit fisheries are limited. The refuge is striving to document species surviving low dissolved oxygen levels and species diversity once drainages, ponds, and lakes are recharged with average precipitation levels and flooding events.

Strategy 1: Throughout the life of the CCP, coordinate with researchers to establish presence/absence while continuing to update the refuge species list.

Strategy 2: Throughout the life of the CCP, utilize best management practices to benefit fisheries throughout the refuge, based on fish surveys and data resulting from the ongoing monitoring.

4.2 Public Use

A Visitors Services Plan, in Table 5-6, will be established to help identify an approach to implement all objectives and strategies under Goal 2. The Visitors Services Plan is designed to increase visitation by improving and enhancing the quality of all wildlife-dependent recreational opportunities on and off the refuge.

Goal 2: Public Use: To provide the public with opportunities for quality wildlife-dependent recreation and access that will lead to a greater understanding and enjoyment of fish, wildlife, and their habitats on the refuge and throughout the National Wildlife Refuge System.

Objective 1: **Hunting Opportunities**

Throughout the life of the CCP, increase refuge hunting opportunities by opening an additional 25 percent of the refuge to big game, upland game, and waterfowl hunting, striving to reach 1,000 hunter use days.

Rationale:

Refuges work to foster public understanding and appreciation of the natural world through wildlife-oriented recreation. This includes hunting. Hunters have supported the conservation of our nation's wildlife resources, including Trinity River NWR, through the purchase of the Federal Duck Stamp. This refuge provides hunting opportunities where appropriate and compatible with refuge purposes. Although Texas has one of the largest hunting populations—estimated at 16 percent in 2001 (Schmidly et al. 2001.)—it is declining, similar to national trends. Comparing 1991 to 2006 estimates, the number of all hunters declined by 11 percent nationwide (USFWS 2006).

The refuge will continue to provide current hunting opportunities for waterfowl, archery, muzzleloader, and general gun for big game (deer and feral hogs) and upland game (squirrel and rabbit). Adding new hunt units on the refuge will provide additional wildlife-dependent recreational opportunities. Current data, by way of refuge browse surveys, anecdotal information, and personal observation, indicate that deer, feral hog, squirrel, and rabbit populations are remaining stable or increasing even with the level of hunting currently allowed on the refuge (USFWS 2011). While similar opportunities exist nearby on private lands, these new units would provide additional quality recreational opportunities for users who do not have access to private land (approximately 97 percent of land in Texas is privately owned). Of the approximately 22,000 refuge visitor use days a year, about four percent (700) come for an opportunity to hunt on the refuge. The proposed increase in hunting opportunities on the refuge would provide approximately 1,000 hunter use days. By conducting hunts on the refuge, we are encouraging family oriented outdoor recreation while supporting the tradition of hunting.

Strategy 1: Through a Refuge Operating Needs (RONS ID FY08-1985, FY08-2031, FY08-2049, FY08-2096) assessment, hire additional staff to initiate and manage a larger hunt program for the refuge.

Strategy 2: Implement recommendations outlined in Refuge Hunt Plan for additional recreational opportunities to include new units, youth hunters, and persons with disabilities (USFWS 2011).

Strategy 3: Promote hunter compliance with Federal and State regulations and encourage good sportsmanship, ethical hunting behavior, and understanding of the refuge and its purposes through law enforcement visibility and effective wording in informational brochures with high quality maps, and on signs and posts on the refuge website.

Objective 2: **Fishing Opportunities**

Throughout the life of the CCP, expand refuge fishing opportunities by opening three additional ponds to public fishing (one pond short-term and two additional ponds long-term), striving to increase from 18,000 visitor use days to 25,000 visitor use days.

Rationale:

Fishing is a traditional use of the area's lakes and bayous that adjoin and are within the refuge. TPWD (2001) estimated 38 percent of Texans participate in fishing as a recreational activity. With the expected continued growth in the Houston Metropolitan Area, the number of fishing visits is likely to increase. Currently, refuge visitation is approximately 22,000 visitors per year, with approximately 85 percent (18,000) of the visitation is related to fishing. Trinity River NWR has more than doubled in acreage since fishing was allowed at the Champion Lake unit in 2001, yet acreages open to the public for fishing have remained the same since 2001. Fishing provides opportunities to connect many people, particularly children, with nature. By providing safe and accessible fishing opportunities to the public, the refuge will continue to meet public needs while protecting resources.

Strategy 1: Through a Refuge Operating Needs (RONS ID FY08-1985, FY08-2049, FY08-2096) assessment, hire additional staff to manage a larger fishing program for the refuge.

Strategy 2: Update the refuge's 2000 Fishing Plan (USFWS 2000 [Trinity River NWR Fishing Plan]).

Strategy 3: Continue to provide a variety of fishing opportunities, including bank fishing and canoe, kayak, and motorboat access areas.

Strategy 4: Maintain and construct additional accessible facilities at public fishing areas.

Strategy 5: Promote angler compliance with Federal and State regulations and encourage good sportsmanship, conservation practices, and understanding of the refuge and its purposes through law enforcement visibility and effective wording in informational brochures with high quality maps, and on signs and on the refuge website.

Objective 3: **Wildlife Observation Opportunities**

Throughout the life of the CCP, expand refuge wildlife observation opportunities by opening 10 additional miles of trails in the short-term and 20 additional miles in the long-term striving, to increase from 1,000 visitor use days to 3,000 visitor use days.

Rationale:

Currently, refuge visitation is approximately 22,000 visitors per year. Visitation is expected to continue rising based on yearly informal surveys along with the refuge becoming more well-known. Most visitors to the refuge are hunters and anglers who observe wildlife while they hunt and fish. This refuge objective would target to increase visitor use days of guests who visit to watch birds and butterflies, seek wildflowers, and observe wildlife during opportunities not related to hunting or fishing.

Approximately 40 miles of trails are currently located on the eight units. Most trails are closed temporarily during short refuge hunt seasons; however, some trails are open for wildlife observation year-round. Additional trails would be located at Champion Lake South and Palmetto units, in close proximity to the surrounding communities of Dayton and Liberty, Texas. Trails promote an appreciation for biological diversity while providing safe and accessible wildlife observation opportunities to the public.

Strategy 1: Through a Refuge Operating Needs (RONS ID FY08-1985, FY08-1982, FY08-2096) assessment, hire additional staff to manage a larger wildlife observation program for the refuge.

Strategy 2: Partner with local Chamber of Commerce, gaining support for refuge programs and promoting the refuge as a Great Texas Coastal Birding Trail designated site.

Strategy 3: Establish scheduled programs for wildlife-viewing such as interpretive tours, guided bird and wildflower/butterfly walks.

Strategy 4: Maintain all viewing areas on the refuge, including walking trails, viewing areas, decks, and boardwalks.

Strategy 5: Continue to evaluate existing facilities for accessibility requirements every three years and make necessary improvements to these facilities as resources allow.

Strategy 6: Provide social media outlets, including maintaining the refuge websites and working with the Friends group to obtain and then post the latest information on wildlife observation opportunities such as bird sightings, optimal viewing times, and links to other important wildlife observation websites.

Strategy 7: Open additional area at Champion Lake South unit within two years.

Strategy 8: Open an additional area at Palmetto unit within four years.

Objective 4: **Wildlife Photography Opportunities**

Throughout the life of the CCP, expand wildlife photography opportunities by constructing two additional photo blinds (long-term) striving to increase from 100 visitor use days to 300 visitor use days.

Rationale:

The refuge is a destination for professional and novice wildlife photographers wishing to get that perfect shot of wildlife or Texas bottomland hardwood scenery. The refuge only has one photo blind (Silver Lake unit). Currently, refuge visitation is approximately 22,000 visitors per year, of which approximately 100 visitors come for serious photography.

Recreational wildlife photography programs will promote understanding and appreciation of natural resources and their management on all lands and waters in the Refuge System (General Guidelines for Wildlife Dependent Recreation 605 FW 1).

Strategy 1: Facilitate nature photography on the refuge in partnership with local schools or other organizations for children and adults by initiating photo contests.

Strategy 2: Establish photo blind at Brierwood along Gaylor Lake within eight years.

Strategy 3: Establish photo blind at McGuire unit within five years.

Objective 5: **Interpretation Opportunities**

Throughout the life of the CCP, expand on- and off-site interpretation opportunities by installing six additional on-site kiosks and ten additional off-site events, striving to reach 2,000 visitor use days and 10,000 off-site contacts, respectively.

Rationale:

Many visitors do not realize the distinction between national wildlife refuges, parks, and Federal or State agency lands that are managed for different purposes. Increased efforts are needed to help the public better understand the role of national wildlife refuges and the Service mission and gain a heightened awareness of conservation and stewardship concepts. Except for one kiosk at the Brierwood trailhead, the refuge does not have any self-guided interpretive signage. Currently, refuge visitation is approximately 22,000 visitors per year, of which just a few hundred come for interpretive events (i.e., Earth Day, Free Fishing Day). Most interpretive opportunities (3,000–4,000) occur off- refuge when giving talks to groups or staffing booths at county events. Increasing on-refuge visitation would be accomplished with the addition of six trailhead kiosks with interpretive materials. Off-refuge visitation would be increased by attending 10 more countywide events.

Strategy 1: Through a Refuge Operating Needs (RONS ID FY08-1985, FY08-1982, FY08-2096) assessment, hire additional staff to develop, build, and manage kiosks and conduct interpretive events for the refuge.

Strategy 2: Develop and design refuge-specific interpretive and outreach materials.

Strategy 3: Continue to seek funding to complete the implementation of the approved 2005 Visitor Services Review.

Strategy 4: Develop an updated Visitor Services Plan that evaluates existing public use facilities, identifies additional facilities needed to provide high-quality compatible wildlife-dependent recreation, and identifies sources of funding for development and maintenance of facilities.

Strategy 5: Throughout the life of this CCP, provide social media outlets, including maintaining the refuge websites and working with the Friends group to obtain and then post the latest information on wildlife observation opportunities such as bird sightings, optimal viewing times, and links to other important wildlife observation websites.

Strategy 6: Throughout the life of this CCP, update all informational and interpretive materials to improve accuracy, consistency, quality, and availability. Revise and make some brochures available to local visitors in Spanish.

Strategy 7: Within two years, build additional two kiosks at Hirsch and Page units and four others throughout the life of this CCP.

Objective 6: Environmental Education Opportunities

Within three years of the CCP's approval, develop and implement the environmental education (EE) program, striving to meet State of Texas education standards for approximately 50 percent of all third graders in Liberty County.

Rationale:

Environmental education is a critical first step in providing visitors with an awareness of the refuge and Refuge System and should ultimately translate into support for the refuge and the Refuge System mission. EE includes a broad range of teaching methods, topics, audiences, and educators (Monroe et al. 2007). EE provides a way for people to connect with nature through a "hands on" approach and provides educational experiences that are not easily

gained in a classroom. The refuge does not currently have any formal EE programs or infrastructure available to the public, although parts of the refuge could be used as an outdoor classroom. In 2011, Hardin Independent School District came to the refuge with a general outline of what they would like to do using the refuge as an outdoor lab site. Although this program is in preliminary stages, it could be used as a template for other local school districts.

All EE activities both on- and off-refuge will comply with Service policy (605 FW 6), which is aligned with State and national environmental educational criteria.

Strategy 1: Through a Refuge Operating Needs (RONS ID FY08-1982) assessment, hire additional staff to implement and manage an EE program for the refuge.

Strategy 2: Within three years of this CCP, develop and design refuge-specific educational and outreach materials.

Strategy 3: Recruit, enlist, and train a cadre of volunteers that could assist staff in conducting age-appropriate EE programs on a weekly basis.

Strategy 4: Promote the learning trunks and resource materials for the EE program to use on-site and take it off-site for programs. These trunks include materials for topics such as wetlands, wildlife, plants, conservation, and endangered species.

Strategy 5: Develop and maintain a multi-faceted EE resource library comprised of books, videos, posters, field trip guides, specific topic packets, and pertinent written materials. These would be available for use in refuge educational programs and by educators.

Strategy 6: Update all educational materials to improve accuracy, consistency, quality, and availability.

Strategy 7: Develop EE programs in conjunction with rehabilitation of the 1940s-era lodge as an educational facility at the Champion Lake Public Use Area.

Objective 7: Law Enforcement and Visitor Safety

Throughout the life of the CCP, expand law enforcement presence by 50 percent to protect natural resources, facilities, and people, and provide visitor safety and emergency response.

Rationale:

Currently, the refuge is limited to one full-time law enforcement officer to cover 25,000 acres spread out over 50 units. The refuge is about 45 miles from the northernmost unit to the southernmost unit spread out on two sides of the Trinity River. There is currently inadequate law enforcement presence on many parts of the refuge. Building strong partnerships and liaisons with Federal, State, and local law enforcement agencies *somewhat* improves our ability to provide a 24/7 presence to *some* parts of the refuge. As a general rule, most local law enforcement officers would be unable to assist the refuge officer in off-road situations.

Strategy 1: Provide visitor safety, protect resources, and ensure compliance with Federal, State, and refuge-specific regulations by hiring an additional law enforcement officer.

Strategy 2: Continue to build strong partnerships to increase law enforcement coverage, enhance visitor safety, and emergency response. Continue to work

cooperatively, developing good relations and radio communications with local law enforcement offices of the Liberty County Sheriff's Department, two local police departments, TPWD Law Enforcement, Texas Department of Public Safety, and the Service Law Enforcement Office in Houston to enforce Federal, State, and refuge-specific hunting and fishing regulations.

Strategy 3: Maintain a good working relationship with Emergency Medical Services of Liberty County and local volunteer fire departments to provide immediate emergency response as needed.

Strategy 4: Annually review and revise refuge-specific visitor regulations for consistency and compatibility.

Strategy 5: Maintain current law enforcement and emergency equipment and provide, as necessary, any patrol vehicles to meet applicable Federal and State emergency vehicle standards.

Strategy 6: Increase the public's knowledge of refuge regulations and boundaries on refuge lands via updated website, maps, boundary posting, and brochures.

4.3 Facilities

Goal 3: Visitor Services: To provide additional access to administrative and public use facilities to accomplish the refuge's purposes, goals, and objectives.

Objective 1: **Public Use Facilities**

Throughout the life of the CCP expand public use access and facilities (i.e., construct a Visitor Center, parking, trails, piers, boat ramps and rehabilitate Champion Lake cabin) to support a 50 percent increase in refuge visitation.

Rationale:

The refuge has limited infrastructure available to the public, supporting approximately 22,000 visitors use days per year. The newly constructed administrative office is limited to maps and brochures while the Champion Lake Public Use Area offers parking, fishing pier, trails, butterfly garden, and portable toilet. Seven other units only offer parking and various walking trails. Three local area Chambers of Commerce would like the refuge to create a larger eco-tourism base for this area. There is a need to assist in nature-based education, as no nature-related classrooms are present in the entire county. This could be accomplished within five years by developing a new visitor center capable of handling class sizes of up to 30. Additionally, within five years, the large 1940s-era lodge at Champion Lake would be restored and used as an environmental education center for up to 50 percent of all third graders within Liberty County. The visitor center and log cabin would allow a segment of the population to experience the diversity of a bottomland hardwood forest ecosystem even if they were unable to walk a trail. Local schools and the community would have a place to enjoy and gain a better understanding of the refuge.

Strategy 1: Through a Refuge Operating Needs (RONS ID FY10-1082, FY10-1080) assessment, rehabilitate the large 1940s-era lodge for use as an interpretive and/or environmental education building at Champion Lake.

Strategy 2: Through new construction funding sources, build a visitor center adjacent to the administrative office.

Strategy 3: Pave the dirt road into the Champion Lake Public Use Area along with construction of restroom facilities (see Strategy 4).

Strategy 4: Through a Refuge Operating Needs (RONS ID FY10-1081) assessment, construct public use restroom facilities at the Champion Lake Public Use Area.

Strategy 5: Through a Refuge Operating Needs (RONS ID FY08-1982) assessment, hire additional staff to implement and manage visitor services for the refuge.

Strategy 6: Continue to seek funding to complete the implementation of the approved 2005 Visitor Services Review.

Strategy 7: Recruit, enlist, and train naturalists and volunteers to assist in providing interpretive and EE programs at these facilities.

Strategy 8: Construct fishing piers at Brierwood, Silver Lake, and McGuire units, a kayak launch site at Brierwood, and an open trail system for Champion Lake South to expand public use access opportunities.

Objective 2: **Administrative Facilities**

Throughout the life of the CCP, expand staff and volunteer facilities to foster productive environments for staff and volunteers (short-term) by rehabilitating the small log cabin for office space.

Rationale:

Since 1994 (refuge establishment), only a storage building (30' x 30'), open pole shed (50' x 100'), three RV pads sites, and the recently completed administrative headquarters office and storage/maintenance building have been built. These limited facilities have restricted the amount of on-site volunteers needed to support administrative, maintenance, biological, and management programs. Expanding administrative, maintenance, and storage facilities are critical for protecting government-owned equipment and staff essential to completing the refuge's mission.

Strategy 1: Rehabilitate the smaller log cabin at the Champion Lake Public Use Area for two staff offices.

Strategy 2: Construct maintenance shop facility at Champion Lake equipment area.

5. Plan Implementation and Monitoring

The CCP will serve as the primary management reference document for refuge planning, operations, and management for the next 15 years or until it is formally revised or amended within that period.

The effectiveness of any management plan is dependent on a multitude of factors that change over time. This chapter describes a number of these factors in further detail, including the funding, staff, projects, compliance requirements, partnerships, monitoring, and additional planning associated with CCP implementation. Adaptive management will also be necessary to meet new, unforeseen challenges, and to take advantage of new opportunities.

As noted in the inside cover of this document, this plan does not constitute a commitment for additional staffing or increases in operational and maintenance resources. These decisions are at the discretion of Congress in overall appropriations, and in budget allocation decisions made at the national and regional levels of the Service.

5.1 Personnel and Budget Needs

Table 5-1 and 5-2 show the existing and additional staff needed to implement the projects identified later in this chapter.

5.1.1 Personnel

5.1.1.1 Existing Personnel

In fiscal year 2011, Trinity River NWR had a staff consisting of seven employees, including five permanent full-time (FT), and two part-time (PT) on call (1,040-hour appointments). The refuge also had a Student Conservation Association intern, 3 Youth Conservation Corpsmen, and about 15 "regular" volunteers to conduct its work each year, as shown in Table 5-1.

Table 5-1. Existing Personnel

Function / Program	Title	Series	Grade	Type
Management/Supervision	Refuge Manager	0485	GS-13	FT Permanent
Biology	Wildlife Biologist	0486	GS-9	FT Permanent
Maintenance	Heavy Equipment Operator	5716	WG-9	FT Permanent
Administration	Administrative Technician	0303	GS-7	FT Permanent
Law Enforcement	Park Ranger/Law Enforcement Officer	0025	GS-9	FT Permanent
Technicians	Maintenance Helpers (2)	4749	GS-5	PT On Call
Technicians	Student Conservation Association Intern	NA	NA	Seasonal
YCC	Youth workers (3)	NA	NA	Summer
Visitor Services	Volunteers (15)	NA	NA	Volunteers

5.1.1.2 Additional Personnel Needs

Table 5-2 identifies primary full-time staff needed, beyond current levels, to fully implement the management direction presented in this CCP. Costs associated with these additional personnel are listed in Table 5-4.

Table 5-2. Additional Personnel Needed Beyond Current Levels (in priority)

Function / Program	Title	Series	Grade	Type
Maintenance	Maintenance Worker	4749	WG-7	FT Permanent
Visitor Services	Outdoor Recreational Planner	0025	GS-9	FT Permanent
Law Enforcement	Park Ranger/Law Enforcement Officer	0025	GS-9	FT Permanent
Biology	Biological Technician	0404	G-7	FT Permanent
Management	Deputy Manager	0485	GS-11	FT Permanent
Maintenance	Maintenance Helper	4749	WG-4	Temporary
Visitor Services	Outdoor Recreational Planner	0025	GS-5	Temporary

5.1.2 Budget

5.1.2.1 Existing Budget

The refuge's base operational budget in fiscal year 2010 was $541,886. Additional base funds necessary to operate refuge programs included annual maintenance – $40,971; Youth Conservation Corpsmen program – $10,051; volunteer program – $7,500; Student Conservation Association program – $5,000; and vehicle replacement – $34,541. The **total** operations and maintenance funding came to **$634,859**. *A one time, deferred maintenance project to design and build an administrative headquarters office building for $750,000 was also budgeted in FY 2010 but is not included in Table 5-3.* **NOTE:** This base funding total for FY 2010 does not include needed increases for the administrative headquarters building and maintenance/storage building completed in early 2012.

Table 5-3. Base Budget Funding in FY 2010

Source	Fiscal Year 2010
Refuge Base Operational Budget	541,886
Annual Maintenance	40,971
Youth Conservation Corps	10,051
Volunteers	7,500
Student Conservation Association	5,000
Annual Vehicle/Equipment Replacement	34,541
Total Budget	**634,859***

*Does not include operation and maintenance funds for headquarters and maintenance buildings completed in early 2012.

Refuge Operational Needs System

The Refuge Operational Needs System (RONS) is the mechanism that the refuge uses to justify needed funds and personnel for new programs and projects necessary to meet legal mandates, refuge plans, and departmental and Service directives. This database is used by all refuges to compete for dollars needed to adequately fund programs. There are nine projects totaling $956,000, which **only** includes a total first-year need based in FY 2010 dollars. **All** the

RONS projects have recurring annual base costs estimated at 577,900. Of the nine RONS projects, four are for new permanent staff positions, with an additional two for temporary positions (Table 5-4).

Service Asset Maintenance Management System
The Service Asset Maintenance Management System (SAMMS) is a database the refuge uses to document and justify significant maintenance projects and equipment replacement. Trinity River NWR's SAMMS project list currently has six projects identified for a total of $3,918,633. Of the six projects, three have recurring annual base costs estimated at $90,000 (Table 5-4).

Additional SAMMS projects will be submitted for funding to achieve management direction identified in this CCP.

5.1.2.2 Additional Budget Needs

Additional budget needs are also identified, beyond current levels, to fully implement the management direction presented in this CCP. Two projects are documented under the "Other" category and include some recurring costs as shown in Table 5-4. The projected amount does not include funding for larger projects, such as construction, that are normally funded from other sources, and it does not include funding needed for land acquisition.

Table 5-4. Projected Budget Needs for Full Implementation (using FY 2011 dollars)

Project	Type	RONS $	SAMMS $	Other $	Recurring Base
Maintenance Worker	FT Staff	72,400	-	-	72,400
Outdoor Recreation Planner	FT Staff	110,300	-	-	110,300
Biological Technician	FT Staff	90,200	-	-	90,200
Law Enforcement Officer	FT Staff	-	-	175,000	125,000
Deputy Manager	FT Staff	133,500	-	-	133,500
Maintenance Helper	Temporary Staff	35,500	-	-	25,000
Visitor Services Programs	Temporary Staff	35,500	-	-	25,000
Long-term Effects of Cattle Grazing	Habitat	112,200	-	-	5,000
Exotic Control Program	Habitat	314,900	-	-	112,000
Long-term Bat monitoring	Habitat	51,500	-	-	4,500
Visitor Center	New Construction WO[1]-2008855989	-	2,028,600	-	40,000
Lodge at Champion Lake	Deferred Maintenance WO-2010107576	-	280,500	-	10,000
Log Cabin at Champion Lake	Deferred Maintenance WO-10059989	-	125,000	-	5,000
Improve Public Access and Use to Champion Lake (paving & bathroom)	New Construction WO-2009942579	-	1,250,000	-	15,000
Repair Dirt Roads for Other Public Access Areas	Deferred Maintenance WO-2009913085	-	105,000	-	15,000
Rehabilitate Parking Lots for Other Public Use Areas	Deferred Maintenance WO-2009908967	-	129,533		5,000
Fire Operations	Habitat	-	-	10,000	10,000
Average Annual Equipment Replacement Needs	Equipment Replacement	-	-	-	100,000
Total Additional Budget Needed		956,000	3,918,633	185,000	902,900

WO[1] = Work Order as described under the SAMMS Database

5.2 Appropriate Refuge Uses and Compatibility

5.2.1 Appropriate Refuge Uses

As described in Chapter 1, all uses of a national wildlife refuge over which the Service has jurisdiction must be evaluated under the Appropriate Refuge Uses policy (603 FW 1).

If an existing use is not appropriate, the refuge manager will eliminate or modify the use as expeditiously as practicable. If a new use is not appropriate, the refuge manager will deny the use without determining compatibility. If a use is determined to be an appropriate refuge use, the Refuge Manager will then determine if the use is compatible (see Compatibility Policy in

next section). Although a use may be both appropriate and compatible, the Refuge manager retains the authority to not allow the use or modify the use. Uses that have been administratively determined to be appropriate are the six wildlife-dependent recreational uses (hunting, fishing, wildlife observation and photography, environmental education, and interpretation) and take of fish and wildlife under State regulations.

5.2.2 Compatibility Determinations

As described in Chapter 1, all uses of a national wildlife refuge must comply with the Service Compatibility Policy.

Compatibility determinations (CDs) are not required for refuge management activities (e.g., conducting bird surveys) unless management activities are also an economic activity (e.g., haying). Economic uses of a natural resource must contribute to achieving refuge purposes and the Refuge System mission. If a use is found to be incompatible, the refuge will follow normal administrative procedures for stopping the action.

When a determination is made as to whether a proposed use is compatible or not, this determination is provided in writing and is referred to as a compatibility determination. An opportunity for public review and comment is required for all CDs. Compatibility determinations for existing hunting, fishing, wildlife observation and photography, and environmental education and interpretation must be re-evaluated with the preparation or revision of a comprehensive conservation plan or at least every 15 years. Compatibility determinations for all other uses must be re-evaluated every 10 years or earlier if conditions change or significant new information relative to the use and its effects becomes available. Refuge Managers must complete a written compatibility determination for each use, or collection of like-uses, that is signed by the manager and the Regional Refuge Chief.

Appendix D contains eight compatibility determinations that have been drafted as part of this comprehensive conservation planning effort, including:

- Hunting
- Fishing
- Wildlife Observation
- Wildlife Photography
- Environmental Education
- Interpretation
- Boating
- Research non-Service

5.3 Intra-Service Section 7 (Endangered Species Act Consultation)

An Intra-Service Section 7 consultation was conducted for the implementation of CCP objectives and strategies with the Clear Lake Ecological Services Field Office (see Appendix F).

5.4 Step-Down Management Plans

Implementation of this CCP will be accomplished, in part, through various step-down management plans. Each step-down plan has its own program focus, identifying and directing

the implementation of strategies (i.e., actions, techniques, and tools) designed to achieve programmatic objectives outlined in the CCP.

5.4.1 Current Step-Down Plans

Table 5-5. Current Refuge Step-down Management Plans

Plan	Completed Date	Review/Update Date
Hurricane Plan	05/2005	Yearly
Law Enforcement Plan	2005	2015
Hazard Communication Plan – Material Safety Data Sheets	08/2003	Yearly
Visitor Services Review	04/2005	Yearly
Fire Management Plan	04/2011	Yearly
Station Safety Plan	06/2010	Yearly
Hunting Plan	02/2004	Yearly
Fishing Plan	08/2000	2013
Lower Trinity River Floodplain Habitat Stewardship Plan	1999	2013

5.4.2 Future Step-Down Plans

Table 5-6. Future Refuge Step-down Management Plans

Plan	Anticipated Completion Date
Integrated Pest Management Plan (to include hog management and exotic plant and animal control)	2013; dependent on hiring additional biological staff
Biological Inventory and Monitoring Plan	2015; dependent on hiring additional biological staff
Habitat Management Plan	2014; dependent on hiring additional biological staff
Visitor Services Plan	2014; dependent on hiring visitor services staff
Preliminary Project Proposal (PPP)	2013

5.5 Refuge Projects

The following list of refuge projects have been identified as needed to fulfill the goals and objectives indentified in Chapter 4: Management Direction.

5.5.1 Existing Projects

5.5.1.1 Wildlife and Habitat Management

Project 1. Land Acquisition

Since the completion and approval of the Lower Trinity River Floodplain Habitat Stewardship Plan in 1999, the refuge has acquired about 1,900 acres per year of bottomland hardwood forest from willing sellers. Continuing and increasing land acquisition efforts could lead to landscape level conservation and preservation of vanishing bottomland hardwood forests.

This project supports Goal 1: Objective 1 and Objective 4 as identified in Chapter 4: Management Direction.

Project 2. Exotic Floral Species Control Using Chemical Treatments

The refuge treats approximately 200 acres annually for mostly Chinese tallow, water hyacinth, alligatorweed, McCartney rose, Chinaberry, and trifoliate orange. Treatment methods include basal bark, foliar, and aerial application.

This project supports Goal 1: Objective 2 as identified in Chapter 4: Management Direction.

Project 3. Exotic Faunal Species Control Using Trapping

The refuge sporadically maintains three corral type traps for capture and removal of feral hogs. Staff also shoots exotic nutria when possible.

This project supports Goal 1: Objective 3 as identified in Chapter 4: Management Direction.

Project 4. Planting/Monitoring Native Hardwood Trees for Restoration

The refuge sporadically plants native hardwood bare-root seedlings in various disturbed tracts. This is only possible after purchase of a disturbed tract (i.e., hayfield) and funding becomes available. Monitoring is completed by using survey markers sampling a portion of the replanted areas.

This project supports Goal 1: Objective 5 as identified in Chapter 4: Management Direction.

Project 5. Bat Management

Bottomland hardwood forests in east Texas are the western extent of the range of Rafinesque's big-eared bats. This bat is considered uncommon throughout its range, with the refuge having the largest known colony in Texas. The bats are dependent upon mature, healthy bottomland forests that feature open mid-stories for foraging and mature, and live trees with hollow cavities for raising young. With continued bat research and acquisition of bottomland hardwood forests, the refuge may be able to assist in keeping this State threatened animal off the Federal list.

This project supports Goal 1: Objective 1 and Objective 4 as identified in Chapter 4: Management Direction.

5.5.1.2 Public Use

Project 1. Wildlife-Dependent Recreation Opportunities

The refuge currently conducts programs, to varying degrees, for five of the six "Big 6" wildlife-dependent recreation opportunities as outlined in the National Wildlife Refuge System Improvement Act of 1997. These five are hunting, fishing, wildlife observation, wildlife photography, and interpretation. The refuge has doubled the acreage and tripled visitor use since 2003, but staff has remained the same. Creating and enforcing additional opportunities are no longer possible without additional staff and funding.

This project supports Goal 2: Objectives 1-5 and Objective 7 as identified in Chapter 4: Management Direction.

5.5.1.3 Facilities

Project 1. Public Use Facilities

Public use facilities currently found on the refuge are limited to about 20 miles of unmarked trails, one portable toilet, eight trailheads with dirt parking lots, one fishing/observation pier, one photo blind, and the administrative headquarters office. As stated, the refuge has doubled the acreage and tripled visitor use since 2003, but staff has remained the same. Creating and maintaining additional public use facilities are no longer possible without additional staff and funding.

This project supports Goal 3: Objective 1 as identified in Chapter 4: Management Direction.

Project 2. Staff and Volunteer Facilities

Staff and volunteer facilities currently are located on three different areas of the refuge. They include the administrative headquarters office on FM 1011, the Champion Lake Public Use Area trailer on CR 417, and the Die House area on FM 787. These areas are currently sufficient to locate and house various staff and volunteers.

This project supports Goal 3: Objective 2 as identified in Chapter 4: Management Direction.

5.5.2 Future Projects

5.5.2.1 Wildlife and Habitat Management (listed in priority order)

Project 1. Expanding Land Acquisition Efforts

The refuge would significantly expand its ability to purchase land from willing sellers if a Regional Office Realty Specialist is assigned and stationed on site. This person could concentrate on locating willing sellers and securing funding avenues for purchases. Acquiring enough land to reach the boundaries of other State and Federal land management agencies would help in landscape conservation for bottomland hardwood habitat and associated habitats. This would help numerous species found in this area. Cost would be related to acquisition, appraisals, surveys, and boundary posting of each particular unit. Funding would come from the Land and Water Conservation Fund, Migratory Bird Fund, and the Refuge Mitigation Fund held by the National Fish and Wildlife Foundation.

This project supports Goal 1: Objective 1, Objectives 4-9 as identified in Chapter 4: Management Direction.

Project 2. Expanding Exotic Control Program

The refuge would significantly expand its exotic control program for both floral and faunal species with addition of staff and funding. As described in Table 5-4, the exotic control program would include $112,000 first-year costs for new staff and supplies. Estimated costs would go higher if contract help (aerial spraying) and temporary staff are used to assist in this long-term project of mapping, eradicating, and monitoring various exotic species throughout the refuge.

This project supports Goal 1: Objective 2 and 3 as identified in Chapter 4: Management Direction.

Project 3. Expanding Research Efforts

The refuge would significantly expand its ability to conduct or supervise research projects that would lead to better management practices with addition of staff and funding. As described in Table 5-4, the bat management and effects of grazing research would cost about $9,500 for equipment and supplies per year for a short-term project. The addition of a new refuge biologist would cost about 90,000 with recurring costs. There would be an opportunity to conduct some climate change research in this habitat type.

This project supports Goal 1: Objectives 4 thru 9 as identified in Chapter 4: Management Direction.

5.5.2.2 Public Use (listed in priority order)

Project 1. Initiate Environmental Education Program

The refuge currently does not have staff to conduct a curriculum-based, state certified, environmental education program. The addition of an Outdoor Recreation Planner would be used to develop on-refuge and off-refuge programs for the local school system. As described in Table 5-4, this position would cost about $110,300 with recurring costs. This person would also handle volunteers, interns, and temporary staff for occasional large scale events.

This project supports Goal 2: Objective 6 as identified in Chapter 4: Management Direction

Project 2. Expand Wildlife-Dependent Recreational Opportunities

The refuge would expand five of the six "Big 6" wildlife-dependent recreation opportunities as outlined in the National Wildlife Refuge System Improvement Act of 1997. These are hunting, fishing, wildlife observation, wildlife photography, and interpretation. Staff hired under Project 1 (Initiate Environmental Education Program) would be used to facilitate this expansion. Additional costs would include maintenance of additional trails, facilities, and parking areas included in Table 5-4.

This project supports Goal 2: Objectives 1-5 as identified in Chapter 4: Management Direction.

Project 3. Expand Law Enforcement Operations

Currently, the refuge is limited by a national deployment plan to one full-time law enforcement officer. This one officer is responsible for covering 25,000 acres spread out over 50 units. The refuge is about 45 miles from the northernmost unit to the southernmost unit spread out on two sides of the Trinity River. As described in Table 5-4, this position's first-year cost would be about $175,000 and has recurring costs. Aside from the safety aspect of only having a single law enforcement officer available 24/7 and continued acquisition of refuge lands, this added position would assist in most phases of the "Big 6" wildlife-dependent public uses.

This project supports Goal 2: Objectives 1–7 as identified in Chapter 4: Management Direction.

5.5.2.3 Facilities (listed in priority order)

Project 1. Construction of Visitor Center Adjacent to Administrative Office

The new visitor center would have room for displays, interactive kiosks, student lab facility, volunteer office space, and a room large enough to hold a normal classroom for children and

teachers. The facility would be build to meet LEED standards. As described in Table 5-4, this visitor center would cost just over $2,000,000 with annual recurring costs.

This project supports achievement of Goal 2: Objectives 5 and 6 and Goal 3: Objective 1 as identified in Chapter 4: Management Direction.

Project 2. Rehabilitation of Lodge at Champion Lake

The rehabilitation of the 1940s-era lodge would be used as interpretive and/or environmental education building for the public. The lodge is located at the refuge's most visited site. It would offer students and teachers the opportunity to conduct classroom activities in an outdoor and classroom setting. As described in Table 5-4, this rehabilitation project would cost about $280,500 with annual recurring costs.

This project supports achievement of Goal 2: Objectives 5 and 6 and Goal 3: Objective 1 as identified in Chapter 4: Management Direction.

Project 3. Construction of Restroom Facilities at Champion Lake

About 20,000 visitors per year use the Champion Lake Public Use Area. Only a single use, portable toilet is available with no water or electricity. Construction of a full use restroom facility is needed to meet the public and staff's need for sanitation. The cost for this new restroom was included as one SAMMS project work order with Project 5 (see subsequent projects and Table 5-4). The cost for just the bathroom with four stalls, janitor closet, plumbing, electricity, septic system, parking, and site preparation is estimated at $100,000.

This project supports Goal 3: Objectives 1 and 2 as identified in Chapter 4: Management Direction.

Project 4. Rehabilitation of Small Cabin at Champion Lake

The rehabilitation of the 1940s-era two-room log cabin would be used as office space for employees stationed at the Champion Lake Public Use Area. This would allow on-site stationing of employees at the refuge's most popular site. This site also stores over $850,000 of refuge equipment, some of it visible to the passing public. As described in Table 5-4, this rehabilitation project would cost about $125,000 with annual recurring costs.

This project supports Goal 3: Objectives 1 and 2 as identified in Chapter 4: Management Direction.

Project 5. Paving Entrance Road to Champion Lake

About 20,000 visitors per year use the Champion Lake Public Use Area. The one-mile entry road leading to a fishing pier and two boat ramps is a dirt road that is in constant need of maintenance, and it kicks up clouds of dust during dry periods. The cost for paving this road was included as one SAMMS project work order with Project 3 (see previous project and Table 5-4). The estimated cost for site preparation, one mile of paving, and installation of new culverts, gates and signs is $1,100,000.

This project supports Goal 3: Objectives 1 and 2 as identified in Chapter 4: Management Direction.

5.6 Partnerships and Agreements

Because the refuge exists within a dynamic ecosystem and many of its resources are of national and international importance, members of the public, organizations, and other government agencies have interests in the refuge and the work of the Service. Successful implementation of many refuge programs requires active community participation, support, and assistance. Partnerships are among the best ways for the refuge to accomplish its work and fulfill its mission, and it seeks opportunities with others to do that work, including but not limited to the following stakeholders:

5.6.1 Refuge Partners

- Friends of Trinity River Refuge
- Texas AgriLife Extension Service
- Texas A&M University
- Texas Parks and Wildlife Department
- Natural Resources Conservation Service
- National Fish and Wildlife Foundation
- The Conservation Fund
- Trust for Public Lands
- Houston Audubon Society
- Student Conservation Association
- City of Liberty Animal Control
- City of Liberty Economic Council
- Liberty/Dayton Chamber of Commerce
- Liberty County Commissioners (and maintenance division)
- Dayton Chamber of Commerce
- Dayton Economic Council
- Bat Conservation International
- Gulf Coast Bird Observatory
- Boy Scouts of America
- Houston Wilderness
- Local wildlife rehabilitators

5.6.2 Memorandums of Understanding and Other Agreements

Trinity River NWR has a Memorandum of Understanding (MOU) between the Liberty County Sheriff's Department and Texas Parks and Wildlife Department for law enforcement use of radio frequencies (effective January 2009–January 2014).

5.7 Monitoring and Evaluation

Monitoring and evaluating the progress of project objectives helps the refuge assess the status of the goals outlined in the CCP. The results show if objectives are, or are not, being achieved and measure progress towards accomplishing goals. The refuge will monitor the implementation of the CCP in order to evaluate the efficiency and effectiveness. The goals of refuge monitoring are:

- To evaluate, document, and report how well the CCP is applied.
- To determine how well the CCP meets its stated goals.
- To determine if the CCP's purpose and direction remain appropriate.

Table 5-7 displays proposed habitat (and wildlife) conservation projects. Table 5-8 displays proposed public use projects. Table 5-9 displays proposed visitor services projects. These proposed monitoring plans and projects will be refined and updated as various management actions are implemented and when additional funding and staffing become available.

Monitoring and evaluating CCP implementation is critical to the refuge's management actions and its ability to continue to meet goals, objectives, and strategies. Adaptive management allows the use of alternative solutions to meet desired conditions. It includes defining measurable objectives, monitoring, learning and making changes, and recognizing uncertainties of outcomes.

5.8 Plan Amendment and Revision

Periodic review and change of this CCP will be necessary. As knowledge of refuge resources, user groups, and use evolves, changes in management may be identified. Fish and wildlife populations, user groups, adjacent land users, and other management considerations change with time—often in unforeseen ways. Challenges also may be encountered in trying to implement some portions of the CCP. CCP revision is a necessary part of the adaptive management approach used by the Service. This means that objectives and strategies identified to reach goals can be adjusted.

Service policy calls for an annual review of CCPs and revision when significant events or new information necessitate change to achieve the refuge purposes, vision, and goals (602 FW 3). It may be reviewed during routine inspections or programmatic evaluations. Results of the reviews may indicate a need to modify the CCP. Monitoring objectives is an integral part of the CCP, and management activities may be modified if desired results are not achieved. If minor changes are required, the Refuge Manager will determine the level of public involvement and associated NEPA documentation. This CCP will be formally revised at least every 15 years.

Table 5-7. Habitat Conservation Assessment

CCP Component	Assessment Question	Performance Measure Standard	Start-up; Target Completion Date
Goal 1 – Habitat Conservation			
Objective 1 – Land Acquisition	Are refuge land acquisition and conservation easement efforts above current management level averages?	Number of acres acquired or set up under conservation easements exceeding 1,900 acres per year	As land and funding becomes available; throughout life of CCP
Objective 2 –Invasive Floral Monitoring and Management	Are refuge treatment efforts of targeted exotic plants above current management levels?	Number of acres treated averaging 450 acres or more per year	Continue annually; throughout life of CCP
Objective 3 – Invasive Faunal Monitoring and Management	Are refuge eradication and control efforts of targeted exotic animals above current management levels?	Number of trap nights averaging 200 or more per year	Continue annually; throughout life of CCP
Objective 4 – Bat Monitoring	Are refuge efforts to monitor bat populations adequate to determine changes or shifts in roosting behavior?	A 10% decrease in populations in known roosts over 2 years would trigger further research efforts	Continue annually; throughout life of CCP
Objective 5 – Habitat Inventory and Monitoring	Is the refuge gathering baseline I & M data of vegetative species representing most of the Refuge?	40 survey points sampled within a representative 1,500-acre unit	Initiate in 2013 then survey every 5 years; throughout life of CCP
Objective 6 – Climate Change Monitoring	Is the refuge gathering baseline data similar to Objective 5 but adding additional parameters to include the physical environment (i.e., soil)?	40 survey points sampled within a representative 1,500-acre unit, including additional parameters	Initiate in 2013 then survey annually; throughout life of CCP
Objective 7 – Bird Inventory and Monitoring	Is the refuge gathering baseline I & M data of bird species representing most of the Refuge?	40 survey points sampled within a representative 1,500-acre unit	Initiate in 2013 then survey semiannually; throughout life of CCP
Objective 8 – Reptiles and Amphibians Inventory and Monitoring	Is the refuge gathering baseline I & M data of reptile and amphibian species representing most of the Refuge?	40 survey points sampled within a representative 1,500-acre unit	Initiate in 2014 then survey semiannually; throughout life of CCP
Objective 9 – Mammals	Is the refuge gathering baseline I & M data of mammal species representing most of the refuge?	40 survey points sampled within a representative 1,500-acre unit	Initiate in 2015 then survey semiannually; throughout life of CCP

Table 5-8. Public Use Assessment

CCP Component	Assessment Question	Performance Measure Standard	Start-up; Target Completion Date
Goal 2 – Public Use			
Objective 1 – Hunting Opportunities	Is the refuge managing hunts for wildlife-dependent recreation above current management levels?	Minimum of 474 permits allowed for all types of Refuge hunting	Continue annually; throughout life of CCP
Objective 2 – Fishing Opportunities	Is the refuge managing fishing for wildlife-dependent recreation above current management levels?	Minimum of 2 ponds opened and 2 piers constructed	Continue annually; throughout life of CCP
Objective 3 – Wildlife Observation Opportunities	Is the refuge providing opportunities for wildlife observation above current management levels?	Minimum of 20 miles of trails opened and maintained and 6 kiosks constructed	Continue annually; throughout life of CCP
Objective 4 – Wildlife Photography Opportunities	Is the refuge providing opportunities for wildlife photography above current management levels?	Minimum of 2 photo blinds constructed and 20 miles of trails opened	Continue annually; throughout life of CCP
Objective 5 – Interpretation Opportunities	Is the refuge providing opportunities for interpretation above current management levels?	Minimum of 10 off-site refuge interpretive programs and construct 6 kiosks	Continue annually; throughout life of CCP
Objective 6 – Environmental Education Opportunities	Has the refuge initiated an EE program meeting state standards?	Minimum of 50% of all third grade school children in Liberty County educated by staff and volunteers certified to conduct state standard EE programs	Initiate in 2015; throughout life of CCP
Objective 7 – Law Enforcement and Visitor Safety	Has the refuge expanded law enforcement presence by 50% protecting resources and people?	Hired 1 additional law enforcement officer	Initiate in 2013; throughout life of CCP

Table 5-9. Visitor Services Assessment

CCP Component	Assessment Question	Performance Measure Standard	Start-up; Target Completion Date
Goal 3 – Visitor Services			
Objective 1 – Public Use Facilities	Is the refuge building, updating, and maintaining public use facilities to accommodate a 50% increase in visitation above current management levels?	Visitor Center constructed, bathroom constructed, and lodge renovated as EE center at Champion Lake	2013; throughout life of CCP
Objective 2 – Staff/Volunteer Facilities	Is the refuge building, updating, and maintaining administrative facilities for fulfillment of the refuge's purpose?	Small log cabin renovated as office, maintenance shop constructed, and 2 RV pads added to the Champion Lake Public Use Area	2015; throughout life of CCP

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GLOSSARY

Accessible facilities: Structures accessible for most people with disabilities without assistance; facilities that meet Uniform Federal Accessibility Standards (UFAS); Americans with Disabilities Act (ADA)-accessible.

Adaptive management: The rigorous application of management, research, and monitoring to gain information and experience necessary to assess and modify management activities. A process that uses feedback from research, monitoring, and evaluation of management actions to support or modify objectives and strategies at all planning levels.

Alternatives: Different sets of objectives and strategies or means of achieving refuge purposes and goals, helping fulfill the Refuge System mission, and resolving issues. A reasonable way to fix an identified problem or satisfy a stated need [40 CFR 1500.2 (cf. "management alternative")].

Appropriate use: A proposed or existing use on a refuge that is a wildlife-dependent recreational use as identified in the 1997 Refuge System Improvement Act (hunting, fishing, wildlife observation and photography, and environmental education and interpretation) or a use that contributes to the fulfillment of refuge purpose(s), the Refuge System mission, or goals or objectives described in a refuge management plan approved after October 9, 1997.

Approved acquisition boundary: A project boundary that the Director of the U.S. Fish and Wildlife Service approves upon completion of the planning and environmental compliance process. An approved acquisition boundary only designates those lands which the Service has authority to acquire or manage through various agreements. The approval of an acquisition boundary does not grant the Service jurisdiction or control over lands within the approved boundary. Lands do not become part of the National Wildlife Refuge System until the Service buys them or they are placed under an agreement that provides for their management as part of the System.

Best management practices: Land management practices that produce desired results (e.g., best management practices for herbicide application, grazing etc.).

Biological diversity: The variety of life and its processes, including the variety of living organisms, the genetic differences among them, and communities and ecosystems in which they occur.

Biological integrity: Biotic composition, structure, and functioning at genetic, organism, and community levels comparable with historic conditions, including the natural biological processes that shape genomes, organisms, and communities.

Biotic community: A set of plants, animals, and microorganisms occupying an area interacting directly or indirectly with each other and their physical environment.

Breeding habitat: Habitat used by animals during the breeding season.

Candidate species: Species for which we have sufficient information on file about their biological vulnerability and threats to propose listing them.

Compatible use: A wildlife-dependent recreational use or any other proposed or existing use on a refuge that will not materially interfere with or detract from the purposes of the refuge or the National Wildlife Refuge System mission.

Comprehensive conservation plan: A document that describes the desired future conditions of a refuge or planning unit and provides long-range guidance and management direction to achieve the purposes of the refuge; helps fulfill the mission of the Refuge System; maintains and, where appropriate, restores the ecological integrity of each refuge and the Refuge System; helps achieve the goals of the National Wilderness Preservation System; and meets other mandates.

Concern: *"see issue"*

Connectivity: Community occurrences and reserves that have permeable boundaries and thus are subject to inflows and outflows from the surrounding landscape. Connectivity in the selection and design of nature reserves relates to the ability of species to move across the landscape to meet basic habitat requirements. Natural connecting features within the ecoregion may include river channels, habitat corridors, ridgelines, or migratory pathways.

Conservation: Managing natural resources to prevent loss or waste [Management actions may include preservation, restoration, and enhancement.].

Conservation easement: A non-possessory interest in real property owned by another imposing limitations or affirmative obligations with the purpose of returning or protecting the property's conservation values.

Conservation status: Assessment of the status of ecological processes and of the viability of species or populations in an ecoregion.

Cooperative agreement: A legal instrument reflecting a relationship between the Federal government and a recipient when the principle purpose is to fund a project to support or stimulate activities that are not for the direct benefit or use of the Federal government but instead for a public purpose that the government participates substantially in.

Cultural resources: The remains of sites, structures, or objects used by people in the past.

Desired future condition: The qualities of an ecosystem or its components that an organization seeks to develop through its decisions and actions.

Disturbance: Any relatively discrete event in time that disrupts ecosystem, community, or population structure and changes resources, substrate availability, or the physical environment.

Ecological integrity: The relative intactness of biotic and abiotic components and their interrelated structure and function within a given ecosystem.

Ecoregion: A territory defined by a combination of biological, social, and geographic criteria, rather than geopolitical considerations; generally, a system of related, interconnected ecosystems.

Ecosystem: Dynamic and interrelating complex of plant and animal communities and their associated non-living environment.

Ecosystem approach: A strategy or plan to protect and/or restore the natural function, structure and species composition of an ecosystem, recognizing that all components are interrelated.

Ecosystem management: Management of an ecosystem that includes all ecological, social, and economic components, which make up and/or that affect the whole of the system.

Endangered species: A plant or animal species listed under the Endangered Species Act that is in danger of extinction throughout all or a significant portion of its range.

Environmental assessment: A systematic analysis to determine if proposed Federal actions would result in a "significant effect on the quality of the human environment" thereby requiring either the preparation of an environmental impact statement (EIS) or a determination of a "Finding of No Significant Impact."

Environmental education: Curriculum-based education aimed at producing a citizenry that is knowledgeable about the biophysical environment and its associated problems, aware of how to help solve those problems, and motivated to work toward solving them.

Exotic: A non-native plant or animal species introduced intentionally or unintentionally to the ecosystem under consideration.

Extinction: The termination of any lineage of organisms, from subspecies to species and higher taxonomic categories from genera to phyla. Extinction can be local, in which one or more populations of a species or other unit vanish but others survive elsewhere, or total (global), in which all the populations vanish.

Fauna: All animal life associated with a given habitat, country, area, or period.

Federal land: Public land owned by the Federal government, including national forests, national parks, and national wildlife refuges.

Federal-listed species: A species listed either as endangered, threatened, or a species at risk (formerly, a "candidate species") under the Endangered Species Act of 1973, as amended.

Federal trust species: Important fish and wildlife resources that the U.S. Fish and Wildlife Service is specifically mandated to protect including migratory birds, threatened species, endangered species, inter-jurisdictional fish, marine mammals, and other species of concern.

Fee-title acquisition: The acquisition of most or all of the rights to a tract of land; a total transfer of property rights with the formal conveyance of a title. While a fee-title acquisition involves most rights to a property, certain rights may be reserved or not purchased, including water rights, mineral rights, or use reservation (e.g., the ability to continue using the land for a specified time period, such as the remainder of the owner's life).

Finding of No Significant Impact (FONSI): Supported by an environmental assessment, a document that briefly presents why a Federal action will have no significant effect on the human environment and for which an environmental impact statement, therefore, will not be prepared [40 CFR 1508.13].

Fire regime: The characteristic frequency, intensity, and spatial distribution of natural fires within a given ecoregion or habitat.

Flora: All the plants found in a particular place.

Floodplain: Flat or nearly flat land that may be submerged by floodwaters; a plain built up or in the process of being built up by stream deposition.

Flyway: Any one of several established migration routes of birds.

Focal species: A species that is indicative of particular conditions in a system (ranging from natural to degraded) and used as a surrogate measure for other species of particular conditions. An element of biodiversity selected as a focus for conservation planning or action. The two principal types of targets in planning projects are species and ecological communities.

Fragmentation: The disruption of extensive habitats into isolated and small patches. Fragmentation has two negative components for biota: the loss of total habitat area and the creation of smaller, more isolated patches of habitat.

Geographic information system (GIS): A computerized system to compile, store, analyze, and display geographically referenced information. (GIS can overlay multiple sets of information on the distribution of a variety of biological and physical features.)

Goal: Descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not defined measurable units.

Guild or species guild: An aggregation or group of species that tend to use the same kinds of resources for feeding or reproduction in a similar manner. Species guilds are useful in helping to focus wildlife and habitat management efforts or in environmental impact studies.

Habitat fragmentation: The breaking up of a specific habitat into smaller, unconnected areas

Habitat conservation: Protecting an animal or plant habitat to ensure that the use of that habitat by the animal or plant is not altered or reduced.

Habitat: The place or type of site where species and species assemblages are typically found and/or successfully reproduce. (An organism's habitat must provide all of the basic requirements for life, and should be free of harmful contaminants.)

Historic conditions: The composition, structure, and functioning of ecosystems resulting from natural processes that we believe, based on sound professional judgment, were present prior to substantial human-related changes to the landscape.

Hydrology: The science of waters of the earth: their occurrences, distributions, and circulations; their physical and chemical properties; and their reactions with the environment, including living beings.

Interpretive facilities: Structures that provide information about an event, place, or thing by a variety of means, including printed, audio-visual, or multimedia materials (e.g., kiosks that offer printed materials and audiovisuals, signs, and trail heads).

Interpretive materials: Any tool used to provide or clarify information, explain events or things, or increase awareness and understanding of the events or things (e.g., printed materials like brochures, maps or curriculum materials; audio-visual materials like video and audio tapes, films, or slides; and, interactive multimedia materials, CD-ROM, or other computer technology).

Invasive plant species: A non-native plant to the ecosystem that lacks natural controls and tends to aggressively dominate the plant community, often forming extensive mono-cultures. Invasive species generally reduce the diversity and health of ecosystems when they become dominant.

Issue: Any unsettled matter that requires management decision, e.g., an initiative, opportunity, resource management problem, threat to the resources of the unit, conflict in uses, public concern, or the presence of an undesirable resource condition.

Land protection plan (LPP): A document that identifies and prioritizes lands for potential Service acquisition from willing sellers, and describes other methods of providing protection.

Limiting factor: An environmental limitation that prevents further population growth.

Mima mound: a term used for low, flattened, circular to oval, domelike, natural mounds. Mima mounds also occur within landscapes where a permanent water table impedes drainage, creating waterlogged soil conditions for prolonged periods.

Mission statement: A succinct statement of the purpose for which the unit was established; its reason for being.

Mitigation: Actions to compensate for the negative effects of a particular project (e.g., wetland mitigation usually restores or enhances a previously damaged wetland or creates a new wetland).

National Environmental Policy Act of 1969 (NEPA): Requires all Federal agencies to examine the environmental impacts of their actions, incorporate environmental information, and use public participation in planning and implementing environmental actions [Federal agencies must integrate NEPA with other planning requirements and prepare appropriate NEPA documents to facilitate better environmental decision-making (cf. 40 CFR 1500)].

National wildlife refuge: A designated area of land or water or an interest in land or water within the National Wildlife Refuge System, such as refuges, wildlife management areas, waterfowl production areas, and other areas under Service jurisdiction for the protection and conservation of fish and wildlife and plant resources. A complete listing of all units of the Refuge System may be found in the current "Annual Report of Lands under Control of the U.S. Fish and Wildlife Service."

National Wildlife Refuge System: All lands, waters and interests therein administered by the U.S. Fish and Wildlife Service as wildlife refuges, wildlife ranges, wildlife management areas, waterfowl production areas, and other areas for the protection and conservation of fish, wildlife and plant resources.

Native: A species that historically occurred in a particular ecosystem.

Native plant: A plant that has grown in the region since the last glaciation and occurred before European settlement.

Natural disturbance event: Any natural event that significantly alters the structure, composition, or dynamics of a natural community (e.g., floods, fires, and storms).

Notice of Intent (NOI): An announcement we publish in the *Federal Register* that we will prepare and review an environmental impact statement [40 CFR 1508.22].

Objective: A concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it, and who is responsible for the work. Objectives derive from goals and provide the basis for determining strategies, monitoring refuge accomplishments, and evaluating the success of strategies. Objectives should be attainable, time-specific, and measureable.

Partnership: A contract or agreement among two or more individuals, groups of individuals, organizations, or agencies in which each agrees to furnish a part of the capital or some service in kind (e.g., labor) for a mutually beneficial enterprise.

Population: An interbreeding group of plants or animals. Also refers to the entire group of organisms of one species.

Prairie: An extensive area of flat or rolling grassland.

Prescribed fire: The application of fire to wildland fuels, either by natural or intentional ignition, to achieve identified land use objectives (FWS Manual 621 FW 1.7).

Priority public use: Wildlife-dependent recreational uses involving hunting, fishing, wildlife observation and photography, and environmental education and interpretation; these uses receive priority consideration in refuge planning and management. Priority public uses were designated by the Refuge System Administration Act, as amended.

Priority species: Wildlife or plant species that include Federal trust species such as migratory birds, threatened species, endangered species, inter-jurisdictional fish, marine mammals, and other species of concern. Priority species also include rare, declining, or species of management concern that are on lists maintained by natural heritage programs, State wildlife agencies, other Federal agencies, or professional, academic, and scientific societies, and those mentioned in landscape-level or other conservation plans.

Private land: Land owned by a private individual, group, or non-government organization.

Public involvement: Offering an opportunity to interested individuals and organizations potentially affected by actions or policies to become informed and provide input. Public input is thoroughly studied and given thoughtful consideration in shaping decisions about managing refuges.

Public uses: Normally refers to the six priority public uses (hunting, fishing, wildlife observation and photography, and environmental education and interpretation) but may include other permitted special uses.

Purposes of the refuge: "The purposes specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit." (601 FW 1)

Ranchette: a small-scale ranch, typically of only a few acres.

Refuge lands: Lands in which the Service holds full interest in fee title or partial interest like an easement.

Refuge Operating Needs System (RONS): A national database that contains the unfunded operational needs of each refuge. Projects are required to implement approved plans and meet goals, objectives, and legal mandates.

Restoration: Management of a disturbed or degraded habitat that results in the recovery of its original state (e.g., restoration may involve planting native grasses and forbs, removing shrubs, prescribed burning, or reestablishing habitat for native plants and animals on degraded grassland).

Riparian: Of or relating to land lying immediately adjacent to a water body and having specific characteristics of that area, such as riparian vegetation. A stream bank is an example of a riparian area.

Scoping: A process for identifying the "scope of issues" to be addressed in planning refuge activities. Involved in the scoping process are Federal, State, and local agencies; private organizations; and individuals.

Sound professional judgment: A finding, determination, or decision that is consistent with principles of sound fish and wildlife management and administration, available science and resources, and adherence to the requirements of the Refuge Administration Act and other appropriate laws.

Species: The basic category of biological classification intended to designate a single kind of animal or plant. Any variation among the individuals may be regarded as not affecting the essential sameness that distinguishes them from all other organisms.

Stakeholders: Those agencies, organizations, groups, and individuals of the public having an interest or stake in an organization's program and that may be affected by its implementation.

Step-down management plan: A plan that provides specific guidance on management subjects (e.g. habitat, public use, fire, safety) or groups of related subjects. It describes strategies and implementation schedules for meeting CCP goals and objectives.

Strategy: A specific action, tool, technique, or combination of actions, tools, and techniques used to meet unit objectives.

Threatened species: A plant or animal species listed under the Endangered Species Act that is likely to become endangered within the foreseeable future.

Trust species: (*See Federal Trust Species*).

Vision statement: A concise statement of what the planning unit should be, or what is planned to be accomplished, based primarily upon the Refuge System mission and specific refuge purposes and other mandates. The vision statement for the refuge should be linked to the mission of the Refuge System, the purpose(s) of the refuge, the maintenance or restoration of the ecological integrity of each refuge and the Refuge System, and other mandates.

Wetland: Areas such as lakes, marshes, ponds, swamps, or streams that are inundated by surface or groundwater long enough to support plants and animals that require saturated or seasonally saturated soils.

Wildfire: Unplanned ignition of a wildland fire (such as a fire caused by lightning, volcanoes, unauthorized and accidental human-caused fires) and escaped prescribed fires.

Wildland fire: Every wildland fire is either a wildfire or a prescribed fire (FWS Manual 621 FW 1.3). A general term describing any non-structure fire that occurs in the wildland.

Wildlife-dependent recreational use: "A use of a refuge involving hunting, fishing, wildlife observation and photography, or environmental education and interpretation." (605 FW 1). These are the six priority public uses of the Refuge System Administration Act, as amended. Wildlife-dependent recreational uses, other than the six priority public uses, are those that depend on the presence of wildlife. Other uses are also considered in the preparation of refuge CCPs; however, the six priority public uses always will take precedence.

Wildlife management: Manipulating wildlife populations, either directly by regulating the numbers, ages, and sex ratios harvested, or indirectly by manipulating habitat conditions. Wildlife management is not always to increase populations (e.g., wildlife damage control).

ABBREVIATIONS AND ACRONYMS

ADA	Americans with Disabilities Act
ARPA	Archeological Resources Protection Act
BCR	Bird Conservation Region
CAP	Contaminant Assessment Process
CCP	Comprehensive Conservation Plan
CD	Compatibility Determinations
CO_2	Carbon dioxide
DOI	Department of the Interior
EA	Environmental Assessment
EE	Environmental Education
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
EO	Executive Order
ESA	Endangered Species Act
FM	Farm-to-Market (State secondary road)
FONSI	Finding of No Significant Impact
FOTRR	Friends of Trinity River Refuge
FR	Federal Register
FTE	Full-time equivalent
GCP&M	Gulf Coast Prairies and Marshes
GCP LLC	Gulf Coast Prairie LCC
GPCO LCC	Gulf Coastal Plains and Ozarks Landscape Conservation Cooperative
GS	General Schedule (pay rate schedule for certain Federal positions)
HMP	Habitat Management Plan
IPCC	International Panel on Climate Change
IUCN	International Union for Conservation of Nature
lbs.	Pounds
JV	Joint Venture
LCC	Landscape Conservation Cooperative
LEED	Leadership in Energy and Environmental Design
LWRCRP	Land and Water Resources Conservation and Recreation Plan
MOU	Memorandum of Understanding (Agreement)
N	Nitrogen
NAAQS	National Ambient Air Quality Standards
NABCI	North American Bird Conservation Initiative
NALCP	North American Landbird Conservation Plan
NAWCP	North American Waterbird Conservation Plan
NAWMP	North American Waterfowl Management Plan
NEPA	National Environmental Policy Act
NGOs	Non-governmental Organizations
NVCS	National Vegetation Classification System
NWR	National Wildlife Refuge
NWRS, Refuge System	National Wildlife Refuge System

PIF	Partners in Flight
PPP	Preliminary Project Proposal
RNA	Research Natural Area
RONS	Refuge Operating Needs System
SAMMS	Service Asset Maintenance Management System
SCP	Shorebird Conservation Plan
SHC	Strategic Habitat Conservation
T&E	Threatened and Endangered Species
TCEQ	Texas Commission on Environmental Quality
TBHI	Texas Bottomland Hardwood Initiative
TNC	The Nature Conservancy
TPWD	Texas Parks and Wildlife Department
TWCP	Texas Wetlands Conservation Plan
USDA	United States Department of Agriculture
USGS	United States Geological Survey
USFWS, FWS, Service	United States Fish and Wildlife Service
UWGCP	Upper West Gulf Coastal Plain (ecoregion)
WG	Wage Grade Schedule (pay rate schedule for certain Federal positions)
WGCP	West Gulf Coastal Plain (ecoregion)

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B. Key Legislation and Service Policies

Administrative Procedure Act (1966; 5 U.S.C. 551-559, 701-706 and 801-808, as amended): Contains procedures that Federal agencies must follow, including public information, open meetings, and privacy of information requirements, and provisions for hearings, adjudications, rule making, and judicial and congressional review of Federal agency actions.

Agricultural Credit Act of 1987 (7 U.S.C. 5104; P.L. 100-233): Authorizes the Farmer's Home Administration (FmHA) to transfer land to any Federal or State agency for conservation purposes (e.g., the FmHA can transfer fee title or assign interests in real estate to the U.S. Fish and Wildlife Service for the protection of floodplains, wetlands, and surrounding uplands).

American Indian Religious Freedom Act (1978): Directs agencies to consult with Native traditional religious leaders to determine appropriate policy changes necessary to protect and preserve Native American religious cultural rights and practices.

Americans with Disabilities Act (1992): The Americans with Disabilities Act is the most comprehensive Federal civil-rights statute that prohibits discrimination on the basis of disability in employment, State and local government, public accommodations, commercial facilities, transportation, and telecommunications.

Antiquities Act of 1906 (16 U.S.C. 431-433): First United States law to provide general protection of cultural or natural resources. This act authorizes the scientific investigation of antiquities on Federal land and provides penalties for unauthorized removal of objects taken or collected without a permit.

Archaeological and Historic Preservation Act (1974): Requires that Federal agencies provide for "*...the preservation of historical and archeological data (including relics and specimens) which might otherwise be irreparably lost or destroyed as the result of...any alteration of the terrain caused as a result of any Federal construction project of Federally-licensed activity or program.*"

Archaeological Resources Protection Act of 1979, as amended (16 U.S.C. 470aa-470mm): The Archaeological Resources Protection Act (ARPA) was enacted "*...to secure, for the present and future benefit of the American people, the protection of archaeological resources and sites which are on public lands and Indian lands, and to foster increased cooperation and exchange of information between governmental authorities, the professional archaeological community, and private individuals.*" The main focus of ARPA is on regulation of legitimate archeological investigation on public lands and the enforcement of penalties against looting or vandalism of these resources. Protects materials of archaeological interest from unauthorized removal or destruction and requires Federal managers to develop plans and schedules to locate archaeological resources.

Appropriate Uses Policy (2006) 603 FW1: Describes procedures for Refuge Managers to follow when deciding if uses are appropriate on a refuge. Appropriate uses are either proposed or existing uses on a refuge that meet at least one of the following four conditions: 1) the use is a wildlife-dependent recreational use as identified in the 1997 Improvement Act; 2) the use contributes to fulfilling the refuge purpose(s), the Refuge System mission, or goals or

objectives described in a refuge management plan approved after October 9, 1997, the date the Improvement Act was signed into law; 3) the use involves the take of fish and wildlife under State regulations; or 4) the use has been found to be appropriate as described further in the Appropriate Refuge Uses policy. This policy applies to all proposed and existing uses in the Refuge System only where the Service has jurisdiction over the use. The policy does not apply in: 1) situations where reserved rights or legal mandates provide that the Service must allow the use, and 2) refuge management activities (e.g., fish and wildlife population or habitat management actions, including but not limited to: prescribed burns, water level management, invasive species control, routine scientific monitoring, law enforcement activities, and maintenance of existing refuge facilities).

Architectural Barriers Act (1968): Requires federally-owned, leased, or funded buildings and facilities to be accessible to persons with disabilities.

Bald and Golden Eagles Protection of 1940 (16 U.S.C. 668-668d; 54 Statute 250), as amended: Provides for the protection of the bald eagle (the national emblem) and the golden eagle by prohibiting, except under certain specified conditions, the taking, possession, and commerce of such birds.

Biological Integrity, Diversity, and Environmental Health (2001) 601 FW 3: As part of the comprehensive conservation planning process, this policy provides for the consideration and protection of the broad spectrum of fish, wildlife, and habitat resources found on refuges and associated ecosystems. It provides Refuge Managers with an evaluation process to analyze their refuge and recommend the best management direction to prevent further degradation of environmental conditions and, where appropriate and in concert with refuge purposes and Refuge System mission, restore lost or severely degraded components.

Clean Air Act (1970; 42 U.S.C. 7401 et seq.), as amended: A comprehensive Federal law that regulates air emissions from area, stationary, and mobile sources. This law authorizes the U.S. Environmental Protection Agency to establish National Ambient Air Quality Standards to protect public health and the environment.

Clean Water Act (1977); Federal Water Pollution Control Act: This is the principal law that governs pollution of the Nation's surface waters. The Clean Water Act employs several regulatory and non-regulatory tools to sharply reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. Section 404 of the Clean Water Act requires permits (issued by the U.S. Army Corps of Engineers) for the discharge of dredged or fill material into waters of the United States, including wetlands.

Coastal Barrier Resources Act (1982; 16 U.S.C. 3501 et seq.), as amended: This act (CBRA) designated various undeveloped coastal barrier islands, depicted by specific maps, for inclusion in the Coastal Barrier Resources System. Areas so designated were made ineligible for direct or indirect Federal financial assistance that might support development, including flood insurance, except for emergency life-saving activities. Exceptions for certain activities, such as fish and wildlife research, are provided, and national wildlife refuges and other, otherwise protected areas are excluded from the System.

Compatibility Policy (2000) 603 FW 2: Incorporates the compatibility provisions of the National Wildlife Refuge System Improvement Act of 1997, which amends the National Wildlife Refuge System Administration Act of 1966. The Compatibility Policy is for determining whether proposed and existing uses, which the Service has jurisdiction over and are occurring on national wildlife refuges, are compatible (i.e., will not detract from or materially interfere) with the purpose(s) of the refuge or with the Refuge System's mission. The policy is to ensure that we (the Service) administer proposed and existing national wildlife refuge uses according to laws, regulations, and policies concerning compatibility, and provides procedures for documentation and periodic review of existing refuge uses.

Comprehensive Conservation Plans (2000) 602 FW 3: As required by the National Wildlife Refuge System Improvement Act of 1997, Comprehensive Conservation Plans (CCPs) describe the desired future conditions of a refuge and provide long-range guidance and management direction to achieve refuge purposes; help fulfill the Refuge System mission; maintain and, where appropriate, restore the ecological integrity; and meet other mandates. The purpose of developing the CCP is to provide the Refuge Manager with a 15-year management plan for the conservation of fish, wildlife, and plant resources and their related habitats, while providing opportunities for compatible wildlife-dependent recreational uses.

Convention Between the United States of America and the Mexican States for the Protection of Migratory Birds and Game Mammals, 1936 (50 Statute 1311).

Convention of Nature Protection and Wildlife Preservation in the Western Hemisphere, 1940 (56 Statute 1354).

Convention Between the United States and Great Britain (for Canada for the Protection of Migratory Birds). (39 Statute 1702; TS 628), as amended.

Convention on Wetlands of International Importance, Especially as Waterfowl Habitats (I.L.M. 11:963-976, September 1972, Ramsar Convention).

Cooperative Research and Training Units Act (1960; 16 U.S.C. 753a-753b), as amended: Authorizes the Secretary of the Interior to enter into cooperative agreements with colleges and universities, State fish and game agencies, and non-profit organizations for the purpose of developing adequate, coordinated, cooperative research and training programs for fish and wildlife resources.

Criminal Code Provisions of 1940 (18 U.S.C. 41), as amended: Provides for fines and penalties for the unlawful taking, disturbing, hunting, trapping, capturing of "*...any bird, fish, or wild animal of any kind whatever, or takes or destroys the eggs or nest of any such bird or fish, on any lands or waters which are set apart or reserved as sanctuaries, refuges or breeding grounds for such birds, fish, or animals under any law of the United States or willfully injures, molests, or destroys any property of the United States on any such lands or waters...*"

Disaster Relief Act of 1974 (42 U.S.C. 5121 et seq.), as amended: Provides authority for Federal agencies to assist State and local governments during Presidentially-declared emergencies.

Economy Act (1932; 31 U.S.C. 1535): Provides authority for Federal agencies to order goods and services from other Federal agencies and to pay the actual costs of those goods and services. The act was passed to obtain economies of scale and eliminate overlapping activities of the Federal government.

Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901-3932, as amended): The purpose of this act is to promote wetlands conservation for the public benefit and to help fulfill international obligations in various migratory bird treaties and conventions. The act authorizes the purchase of wetlands from Land and Water Conservation Fund monies; it also requires the Secretary of the Interior to establish a National Wetlands Priority Conservation Plan, requires the states to include wetlands in their Comprehensive Outdoor Recreation Plans, and transfers funds from import duties on arms and ammunition to the Migratory Bird Conservation Fund.

Endangered Species Act of 1973, as amended: The main purposes of the Endangered Species Act are to: 1) provide a means whereby ecosystems of threatened and endangered species may be conserved; and 2) provide a program for the conservation of threatened and endangered species. The provisions of the Endangered Species Act include but are limited to land acquisition, cooperative programs with the states, and interagency cooperation (Section 7). Section 7(a)(1) directs Federal agencies to carry out programs for the conservation of threatened and endangered species.

Environmental Education Act of 1990 (20 U.S.C. 5501-5510): Established the Office of Environmental Education within the Environmental Protection Agency, to develop and administer a Federal environmental education program. The Office is required to develop and support environmental programs in consultation with other Federal natural resource management agencies, including the Service.

Environmental Education Policy (2006) 605 FW 6: Provides the Service's policy governing the management of environmental education programs on units of the Refuge System. Environmental education is a priority appropriate use of the Refuge System when compatible. The policy encourages Refuge Managers to provide quality environmental education programs that can promote understanding and appreciation of natural and cultural resources and their management on all lands and waters in the Refuge System. The policy also emphasizes that refuge staff develop and take full advantage of opportunities to work with volunteers and partners who have an interest in conducting quality environmental education programs on refuges.

Executive Order 11514; Protection and Enhancement of Environmental Quality (1970): This directs that the "*...Federal Government shall provide leadership in protecting and enhancing the quality of the Nation's environment to sustain and enrich human life. Federal agencies shall initiate measures needed to direct their policies, plans, and programs so as to meet national environmental goals...*"

Executive Order 11644; Use of off-road vehicles on the public lands (1972): Requires that the Service designate areas as open or closed to off-highway vehicles in order to protect refuge resources, promote safety, and minimize conflict among the various refuge users; monitor the effects of these uses once they are allowed; and amend or rescind any area designation as necessary based on the information gathered.

Executive Order 11987; Exotic organisms (1977): Executive agencies shall, to the extent permitted by law, restrict the introduction of exotic species into the natural ecosystems on lands and waters which they own, lease, or hold for purposes of administration; and shall encourage the states, local governments, and private citizens to prevent the introduction of exotic species into natural ecosystems of the United States.

Executive Order 11988; Floodplain Management (1977): This directs that each Federal agency *"...shall provide leadership and take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains...,"* in carrying out its responsibilities.

Executive Order 11989; Off-Road Vehicles on Public Lands (1977): Requires the Service to close areas to off-highway vehicles when we determine that the use cause or will cause considerable adverse effects on the soil, vegetation, wildlife, habitat, or cultural or historic resources.

Executive Order 11990; Protection of Wetlands (1977): This directs that each Federal agency *"...shall provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities..."*

Executive Order 12996; Management and General Public Use of the National Wildlife Refuge System (1996): This spells out the mission of the Refuge System along with establishing guiding principles to help insure the long-term enjoyment of the Refuge System for present and future generations. The order directs the Secretary of the Interior to recognize compatible wildlife-dependent recreational activities involving hunting, fishing, wildlife observation and photography, and environmental education and interpretation as priority general public uses on the Refuge System (i.e., the big six).

Executive Order 13007; Indian Sacred Sites (1996): Directs Federal land management agencies to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners, avoid adversely affecting the physical integrity of such sacred sites and where appropriate, maintain the confidentiality of sacred sites.

Executive Order 13112; Invasive Species (1999): This order was established to address the growing ecological and economic damage caused by invasive species. Executive Order 13112 requires Federal agencies to: 1) identify actions that might impact the status of invasive species and prevent introductions of invasive species; 2) not authorize, fund, or carry out actions likely to cause the introduction or spread of invasive species; 3) detect and respond rapidly to control invasive species populations; 4) monitor and conduct research on invasive species; 5) restore native species and habitat conditions in ecosystems that have been invaded; and 6) promote public education on invasive species.

Executive Order 13158; Marine Protected Areas (2000): directs protection of the significant natural and cultural resources within the marine environment for the benefit of present and future generations by strengthening and expanding the Nation's system of marine protected areas (MPAs). An MPA is any area of the marine environment that has been reserved by Federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein. The Executive order directs Federal

agencies to work together with states, territories, tribes and non-governmental partners to develop and maintain an effective national system of MPAs in the United States and to accomplish a variety of related tasks working with public and private partners. The "marine environment" is defined as those areas of ocean and coastal waters, the Great Lakes and their connecting waters, and submerged lands thereunder, over which the United States exercises jurisdiction, consistent with international law.

Executive Order 13186; Responsibilities of Federal agencies to protect migratory birds (2001): Provides guidance for Service programs relative to the management and conservation of migratory birds. Its purpose is to minimize the potential adverse effects of migratory bird take, with the goal of striving to eliminate take, while implementing our mission. This guidance includes but is not limited to: 1) integrating migratory bird conservation measures into our activities; 2) restoring and enhancing the habitat of migratory birds; 3) ensuring our actions/plans promote migratory bird conservation; 4) promoting inventory, monitoring, research, management studies, and information exchange related to migratory birds; 5) promoting education and outreach related to migratory birds; 6) identifying special migratory bird habitats; and 7) strengthening non-Federal partnerships to further bird conservation.

Executive Order 13443; Facilitation of Hunting Heritage and Wildlife Conservation (2007): Directs Federal agencies that have programs and activities that have a measurable effect on public land management, outdoor recreation, and wildlife management, including the Department of the Interior and the Department of Agriculture, to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat.

Farmland Protection Policy Act (7 U.S.C. 4201 et seq.): Requires Federal agencies to identify and take into account the adverse effects of their programs on the preservation of farmlands.

Federal Aid in Sport Fish Restoration Act (1950; 16 U.S.C. 777-777k), as amended: Commonly called the Dingell-Johnson Act or Wallop-Breaux Act, this provides Federal aid to the states for management and restoration of fish having *"…material value in connection with sport or recreation in the marine and/or fresh waters of the United States."* In addition, amendments to the act provide funds to the states for aquatic education, wetlands restoration, boat safety, and clean vessel sanitation devices (pumpouts), and a non-trailerable boat program. Funds are derived from a 10 percent excise tax on certain items of sport fishing tackle, a 3 percent excise tax on fish finders and electric trolling motors, import duties on fishing tackle, yachts and pleasure craft, interest on the account, and a portion of motorboat fuel tax revenues and small engine fuel taxes. To participate in the Federal Aid in Sport Fish Restoration program, states are required to agree to this law and pass laws for the conservation of fish, which includes a prohibition against the diversion of license fees for any other purpose than the administration of the State fish department.

Federal Aid in Wildlife Restoration Act (1937; 16 U.S.C. 669-669i), as amended: Commonly called the "Pittman-Robertson Act," this provides Federal aid to states for management and restoration of wildlife. Funds from an 11 percent excise tax on sporting arms and ammunition are appropriated to the Secretary of the Interior and apportioned to states on a formula basis for paying up to 75 percent of the cost-approved projects. Project activities include acquisition and improvement of wildlife habitat, introduction of wildlife into suitable habitat, research into wildlife problems, surveys and inventories of wildlife problems, acquisition and development of

access facilities for public use, and hunter education programs, including construction and operation of public target ranges.

Federal Environmental Pesticide Control Act of 1972 (7 USC 136-136y), as amended: This established, under the administrator of the EPA, a program for controlling the sale, distribution, and application of pesticides through an administrative registration process. The amendments provided for classifying pesticides for "general" or "restricted" use. "Restricted" pesticides may only be applied by or under the direct supervision of a certified applicator. Amendments to this act also authorized experimental use permits and provided for administrative review of registered pesticides and for penalties for violations of the statute. States were authorized to regulate the sale or use of any pesticide within a state, provided that such regulation does not permit any sale or use prohibited by the act. The Federal Environmental Pesticide Control Act of 1972 amended the **1947 Federal Insecticide, Fungicide, and Rodenticide Act** (FIFRA). The 1947 statute (FIFRA), prohibited the sale or distribution of "*economic poisons*," provided for the registration of such materials, and authorized penalties for violation of the act. The Endangered Species Act later amended FIFRA to define imminent hazard to include situations involving *unreasonable hazard to the survival of a species declared by the Secretary of the Interior to be endangered or threatened*.

Federal Fire Prevention and Control Act of 1974 (15 U.S.C. 2201 et seq.), as amended: This authorizes reimbursement to State and local fire services for costs incurred in firefighting on Federal property.

Federal Noxious Weed Act (1990): Requires the use of integrated management systems to control or contain undesirable plant species and an interdisciplinary approach with the cooperation of other Federal and State agencies.

Federal Property and Administrative Services Act of 1949 (40 U.S.C. 471-535), as amended: Sets forth requirements for the management and disposal of government property, including excess property (property under the control of any Federal agency, but which it no longer needs) and surplus property (excess property not required for the needs of any Federal agency).

Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j, not including 742 d-l), as amended: This established a comprehensive national fish and wildlife policy and broadened the authority for acquisition and development of refuges. The policy emphasizes the commercial fishing industry and includes a direction to administer the act with regard to the inherent right of every citizen and resident to fish for pleasure, enjoyment, and betterment, and to maintain and increase public opportunities for recreational use of fish and wildlife resources. Among other things, the act directs a program of continuing research, extension, and information services on fish and wildlife matters, both domestically and internationally. A 1974 amendment to the Fish and Wildlife Act of 1956 abolished the "Bureau of Sport Fisheries and Wildlife" and re-designated it as the "United States Fish and Wildlife Service"(Public Law 93-271). In 1978, the Fish and Wildlife Act was amended to allow the Service to accept donations of both real and personal property. In 1998, the Fish and Wildlife Act of 1956 was further amended to promote volunteer programs and community partnerships for the benefit of national wildlife refuges. This also required the Secretary of the Interior to develop refuge education programs to provide outdoor classroom opportunities for students to promote understanding of the

Refuge System and to improve scientific literacy in conjunction with both formal and informal education programs.

Fish and Wildlife Conservation Act of 1980 ("Nongame Act") (16 U.S.C. 2901-2911), as amended: Authorizes financial and technical assistance to the states for the development, revision, and implementation of conservation plans and programs for non-game fish and wildlife. A 1988 amendment requires the Service to monitor and assess migratory non-game birds, determine the effects of environmental changes and human activities, identify those likely to be candidates for endangered species listing, identify appropriate actions, and report to Congress one year from enactment. It also requires the Service to report at five year intervals on actions taken.

Fish and Wildlife Coordination Act (1934), as amended: Authorizes the Secretary of the Interior to assist Federal, State, and other agencies in development, protection, rearing and stocking fish and wildlife on Federal lands and to study effects of pollution on fish and wildlife. The act also requires consultation with the U.S. Fish and Wildlife Service and the wildlife agency of any State wherein the waters of any stream or other water body are proposed to be impounded, diverted, channelized or otherwise controlled or modified by any Federal agency, or any private agency under Federal permit or license; with a view to preventing loss of, or damage to, wildlife resources in connection with such water resource projects. The act further authorizes Federal water resource agencies to acquire lands or interests in connection with water use projects specifically for mitigation and enhancement of fish and wildlife.

Fish and Wildlife Improvement Act of 1978 (16 U.S.C. 7421; 92 Stat. 3110), as amended: Authorizes the Secretaries of the Interior and Commerce to establish, conduct, and assist with National training programs for State fish and wildlife law enforcement personnel. It also authorized funding for research and development of new or improved methods to support fish and wildlife law enforcement. The law provides authority to the Secretaries to enter into law enforcement cooperative agreements with State or other Federal agencies, and authorizes the disposal of abandoned or forfeited items under the fish, wildlife, and plant jurisdictions of these Secretaries. It strengthens the law enforcement operational capability of the Service by authorizing the disbursement and use of funds to facilitate various types of investigative efforts.

Flood Control Act of 1944, as amended: This act, supplemented by other flood control acts and river and harbor acts, authorizes various Corps of Engineers water development projects. The Flood Control Act expressed congressional intent to limit the authorization and construction of navigation, flood control, and other water projects to those having significant benefits for navigation and which could be operated consistent with other river uses. This authorized the construction of numerous dams and modifications to previously existing dams. Several provisions of this act impact the responsibilities of the Service under the **Fish and Wildlife Coordination Act**.

Food Security Act of 1985 "Farm Bill" (99 Stat. 1354), as amended by the Food, Agriculture, Conservation, and Trade Act of 1990: This contains several provisions that contribute to wetland conservation. The "Swampbuster" provisions stated that farmers who produce an agricultural commodity on wetlands converted after enactment are ineligible for most farmer program subsidies. Administration of the program in the Department of Agriculture (USDA), which is required to consult with the U.S. Fish and Wildlife Service on matters relating to wetland identification, determination of exemptions to the wetland

conservation provisions, issuance of implementing regulations, mitigation, and restoration of values and functions on converted wetlands. This act also authorized the Secretary of Agriculture to grant or sell conservation easements, which may include wetlands, to State or local governments or private non-profit organizations for conservation purposes. In addition, the 1985 act also established a Conservation Reserve program, providing incentives to private landowners (e.g., farmers) to return farmland to permanent vegetative cover and for applying soil conservation prescriptions such as wildlife habitat development. The program was expanded in 1988 by regulation to make cropped wetlands eligible for the program, with the intended result of wetland restoration (i.e., The Wetland Reserve Program).

Freedom of Information Act (1966; 5 U.S.C. 552): Requires all Federal agencies to make available to the public, for inspection and copying, administrative staff manuals and staff instructions, official, published and unpublished policy statements, final orders deciding case adjudication, and other documents. Special exemptions have been reserved for nine categories of privileged material, including but not limited to confidential matters relating to National defense or foreign policy, law enforcement records, and trade or commercial secrets. The act requires the party seeking the information to pay reasonable search and duplication costs.

Historic Sites, Buildings, and Antiquities Act (16 U.S.C. 461-462, 464-467), as amended: Also known as the Historic Sites Act, this declared it a national policy to preserve historic sites and objects of national significance, including those located on refuges. It provided procedures for designation, acquisition, administration, and protection of such sites. Among other things, National Historic and Natural Landmarks are designated under authority of this act. As of January 1989, 31 national wildlife refuges contained such sites.

Lacey Act of 1900 (16 U.S.C. 701), as amended: Makes it unlawful to import, export, sell, acquire, or purchase fish, wildlife or plants taken, possessed, transported, or sold: 1) in violation of U.S. or Indian law, or 2) in interstate or foreign commerce involving any fish, wildlife, or plants taken possessed or sold in violation of State or foreign law. The Lacey Act covers all fish and wildlife and their parts or products, and plants protected by the Convention on International Trade in Endangered Species and those protected by State law. Commercial guiding and outfitting are considered to be a sale under the provisions of the act. The act also includes prohibitions on the importation of wild vertebrates and other animals listed in the act or declared by the Secretary of the Interior to be injurious to man or agriculture, wildlife resources, or otherwise, except under certain circumstances and pursuant to regulations. The Lacey Act includes penalties and fines for violations involving imports or exports or violations of a commercial nature.

Land and Water Conservation Fund Act (1965): Authorizes the use of the receipts from the sale of surplus Federal land, outer continental shelf oil and gas sales, and other sources for land acquisition. Section 7(a)(l) of this act provides authority to use Land and Water Conservation Fund money for acquisition of refuge areas under paragraph (5) of section 7(a) of the Fish and Wildlife Act of 1956.

Marine Mammal Protection Act (1972): The Marine Mammal Protection Act (MMPA) was enacted on October 21, 1972. All marine mammals are protected under the MMPA. The MMPA prohibits, with certain exceptions, the “take” of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S.

Migratory Bird Conservation Act (1929; 16 U.S.C. 715-715d, 715e, 715f-715r), as amended: This established a Migratory Bird Conservation Commission to approve areas recommended by the Secretary of the Interior for acquisition with Migratory Bird Conservation Funds.

Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712), as amended: The Migratory Bird Treaty Act (MBTA) is one of the earliest Federal wildlife management laws enacted to protect migratory birds, which were rapidly declining from unregulated sport and commercial hunting. Specific provisions in the MBTA include the establishment of a Federal prohibition, unless permitted by regulations, to "*...pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention ...for the protection of migratory birds...or any part, nest, or egg of any such bird.*"

Migratory Bird Hunting and Conservation Stamp Act (1934; 16 U.S.C. 718-718j), as amended: Known as the "Duck Stamp Act," this requires each waterfowl hunter 16 years of age or older to possess a valid Federal hunting stamp. Receipts from the sale of the stamp are deposited in a special Treasury account known as the Migratory Bird Conservation Fund and are not subject to appropriations. Funds appropriated under the Wetlands Loan Act (16 U.S.C. 715k-3 - 715k-5), as amended, are merged with duck stamp receipts and provided to the Secretary of the Interior for the acquisition of migratory bird refuges under provisions of the Migratory Bird Conservation Act (16 U.S.C. 715 et seq), as amended, and since August 1, 1958, for acquisition of "Waterfowl Production Areas."

National Environmental Policy Act of 1969 (42 U.S.C. 4321-4347), as amended: The National Environmental Policy Act (NEPA) requires that all Federal agencies prepare detailed environmental impact statements for "every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment." NEPA stipulates factors to be considered in environmental impact statements, and requires that Federal agencies employ an interdisciplinary approach in related decision-making and develop means to ensure that unquantified environmental values are given appropriate consideration, along with economic and technical considerations.

National Historic Preservation Act of 1966 (16 U.S.C. 470-470b, 470c-470n), as amended: Provides for preservation of significant historical features (buildings, objects, and sites) through a grant-in-aid program to the states. It established a National Register of Historic Places and a program of matching grants under the existing National Trust for Historic Preservation (16 U.S.C. 468-468d). The act established an Advisory Council on Historic Preservation, which was made a permanent independent agency in 1976. That act also created the Historic Preservation Fund. Federal agencies are directed to take into account the effects of their actions on items or sites listed or eligible for listing in the National Register. As of January 1989, 91 historic sites on national wildlife refuges have been placed on the National Register, including Aransas NWR (Matagorda Island Lighthouse).

National Wilderness Preservation System (1964): Also known as the "Wilderness Act of 1964"; the purpose was to preserve and protect wild lands in their natural condition "*...to secure for the American people of present and future generations the benefits of an enduring*

resource of wilderness." This act directed Federal agencies such as the U.S. Fish and Wildlife Service to survey their roadless lands for possible wilderness designation. Wilderness areas are protected from development and the operation of motorized equipment. A Wilderness Area is defined as an area with at least 5,000 acres of undisturbed, undeveloped land affected by the forces of nature and may contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

National Wildlife Refuge System Administration Act of 1966 as amended by the National Wildlife Refuge System Improvement Act of 1997, 16 U.S.C. 668dd-668ee. (Refuge Administration Act): Defines the National Wildlife Refuge System and authorizes the Secretary to permit any use of a refuge provided such use is compatible with the purposes for which the refuge was established. The Refuge Improvement Act clearly defines a unifying mission for the Refuge System; establishes the legitimacy and appropriateness of the six priority public uses (hunting, fishing, wildlife observation and photography, and environmental education and interpretation); establishes a formal process for determining compatibility; established the responsibilities of the Secretary of Interior for managing and protecting the System; and requires a comprehensive conservation plan for each refuge by 2012. This act amended portions of the Refuge Recreation Act and National Wildlife Refuge System Administration Act of 1966.

National Wildlife Refuge System Improvement Act (1997): Sets the mission and administrative policy for all refuges in the National Wildlife Refuge System. Clearly defines a unifying mission for the Refuge System; establishes the legitimacy and appropriateness of the six priority public uses (hunting, fishing, wildlife observation and photography, and environmental education and interpretation); establishes the responsibilities of the Secretary of the Interior for managing and protecting the system; and requires a comprehensive conservation plan for each refuge by the year 2012. This act amended portions of the Refuge Recreation Act and National Wildlife Refuge System Administration Act of 1966.

Native American Graves Protection and Repatriation Act (1990): Requires Federal agencies and museums to inventory, determine ownership of, and repatriate cultural items under their control or possession.

North American Wetlands Conservation Act (1989; 16 U.S.C. 4401-4412), as amended: Provides funding and administrative direction for implementation of the North American Waterfowl Management Plan and the Tripartite Agreement on wetlands between Canada, the U.S., and Mexico.

Protection Act (1922; 16 U.S.C. 594): Provides for the Secretary of the Interior to protect and preserve timber on the public lands owned by the United States from fire, disease, or the ravages of beetles or other insects.

Reciprocal Fire Protection Act of 1955 (42 U.S.C. 1856), as amended by the Wildfire Suppression Assistance Act of 1989 (102 Stat. 1615): Provides authority for Federal agencies to enter into mutual assistance agreements with foreign, State, and local governments for combating wildfires and to provide emergency assistance when no agreement exists.

Refuge Recreation Act of 1962 (16 U.S.C. 460k-460k-4), as amended: Authorizes the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for

recreational use, when such uses do not interfere with the area's primary purposes. The act provides for public use fees and permits, and penalties for violation of regulations. It also authorizes the acceptance of donations of funds and real and personal property to assist in carrying out its purposes. Amendments to the act authorize acquisition of lands and interests suitable for: 1) fish and wildlife-oriented recreation, 2) protection of natural resources, 3) conservation of endangered or threatened species, or 4) carrying out two or more of these stipulations. Such lands were required to be adjacent to or within an existing conservation area. Acquisition was not permitted with "duck stamp" receipts for these purposes.

Refuge Revenue Sharing Act of 1935 (16 U.S.C. 715s), as amended: Provides for payments to county governments in lieu of taxes, using revenues derived from the sale of products from refuges. Revenues received from refuge products, such as animals, timber and minerals, or from leases or other privileges, are required to be deposited in a special Treasury account and net receipts distributed to counties. Remaining monies are required to be transferred to the Migratory Bird Conservation Fund for land acquisition under provisions of the Migratory Bird Conservation Act. The act was later amended to expand the revenue sharing system to include National Fish Hatcheries and Service research stations. It also included in the Refuge Revenue Sharing Fund receipts from the sale of salmonid carcasses. Payments to counties were established as: 1) on acquired land, the greatest amount calculated on the basis of 75 cents per acre, three-fourths of one percent of the appraised value, or 25 percent of the net receipts produced from the land; and 2) on land withdrawn from the public domain, 25 percent of net receipts and basic payment, in lieu of taxes on public lands. Amendments to the act authorized appropriations to make up any difference between the amount in the Revenue Sharing Fund and the amount scheduled for payment in any year. Counties are also required to pass payments along to other units of local government within the county that suffer losses in revenues due to the establishment of Service areas.

Refuge Trespass Act of 1948 (18 U.S.C. 41): This consolidated penalty provisions of various acts from 1905 through 1934, establishing and protecting fish and wildlife areas, and restated the intent of Congress to protect all wildlife within Federal sanctuaries, refuges, fish hatcheries, and breeding grounds.

Rehabilitation Act (1973): Requires programmatic accessibility in addition to physical accessibility for all facilities and programs funded by the Federal government to ensure that anybody can participate in any program.

Rivers and Harbors Act (1899; 33 U.S.C. 403): Section 10 of this act requires the authorization by the U.S. Army Corps of Engineers prior to any work in, on, over, or under a navigable water of the United States.

Secretarial Order No. 3226; Evaluating Climate Change Impacts in Management Planning (2001): The Department of the Interior Secretarial Order 3226 states that "there is a consensus in the international community that global climate change is occurring and that it should be addressed in governmental decision making…This Order ensures that climate change impacts are taken into account in connection with Departmental planning and decision making." Additionally, it calls for the incorporation of climate change into long-term planning documents such as the CCP.

Transfer of Certain Real Property for Wildlife Conservation Purposes Act of 1948 (16 U.S.C. 667b-d), as amended: This act provides that, upon a determination by the Administrator of the General Services Administration, real property no longer needed by a Federal agency can be transferred without reimbursement to the Secretary of the Interior if the land has particular value for migratory birds or to a State agency for other wildlife conservation purposes.

Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. 4601 et seq.), as amended: Establishes uniform land acquisition policies for all Federal agencies and establishes requirements for the uniform and equitable treatment of persons displaced from their homes, businesses, or farms by Federal or federally-assisted programs, including land acquisition.

Volunteer and Partnership Enhancement Act (1998): This amended the Fish and Wildlife Act of 1956 to promote volunteer programs and community partnerships for the benefit of national wildlife refuges, and for other purposes.

Waterfowl Depredations Prevention Act (1956; 7 U.S.C. 442-445), as amended: This act authorizes the Secretary of the Interior to use surplus grain owned by Commodity Credit Corporation in feeding waterfowl to prevent crop damage. Findings regarding possible crop damage are to be made by the Secretary of the Interior, and grain is to be used to lure waterfowl away from crops while not exposing them to shooting over areas to which they have been lured. Such grain may be made available to Federal, State or local governments or private organizations or individuals. Appropriations are authorized to reimburse the Corporation for packaging and transporting such grain.

Water Resources Planning Act (1965), as amended: This established a Water Resources Council to be composed of Cabinet representatives, including the Secretary of the Interior. The council was empowered to maintain a continuing assessment of the adequacy of water supplies in each region of the U.S. In addition, the council was mandated to establish principles and standards for Federal participants in the preparation of river basin plans and in evaluating Federal water projects. Upon receipt of a river basin plan, the Council was required to review the plan with respect to agricultural, urban, energy, industrial, recreational, and fish and wildlife needs. This also established a grant program to assist states in participating in the development of related comprehensive water and land use plans.

Wetlands Reserve Program: The Wetlands Reserve Program (WRP) is a voluntary program. It provides technical and financial assistance to eligible landowners to address wetland, wildlife habitat, soil, water, and related natural resource concerns on private lands in an environmentally beneficial and cost-effective manner. The program provides an opportunity for landowners to receive financial incentives to restore, protect, and enhance wetlands in exchange for retiring marginal land from agriculture. There are three enrollment options for landowners: 1) permanent easement, 2) 30-year easement, and 3) a restoration cost-share agreement. The WRP was re-authorized in the Farm Security and Rural Investment Act of 2002 (Farm Bill). The Natural Resources Conservation Service administers the program (**See also: Food Security Act of 1985).**

Wilderness Act of 1964 (16 U.S.C. 1131): This act directed the Secretary of the Interior to review every roadless area of 5,000 or more acres and every roadless island (regardless of

size) within National Wildlife Refuge and National Park Systems and to recommend to the President the suitability of each such area or island for inclusion in the National Wilderness Preservation System, with final decisions made by Congress. The act provides criteria for determining suitability and establishes restrictions on activities that can be undertaken on a designated area. It authorizes the acceptance of gifts, bequests, and contributions in furtherance of the purposes of the act and requires an annual report at the opening of each session of Congress on the status of the wilderness system.

Environmental Assessment

Trinity River NWR Comprehensive Conservation Plan

February 10, 2012

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1.0 PURPOSE OF AND NEED FOR PROPOSED ACTION ALTERNATIVE

1.1 Introduction:

The United States Fish and Wildlife Service (Service) proposes to implement a Comprehensive Conservation Plan (CCP) for the Trinity River National Wildlife Refuge (refuge, Trinity River NWR), which would guide management on the refuge for the next 15 years. This Environmental Assessment (EA) is being prepared to evaluate the effects associated with this proposal and complies with the National Environmental Policy Act (NEPA) in accordance with Council on Environmental Quality regulations (40 CFR 1500-1509) and Department of the Interior (516 DM 8) and Service (550 FW 3) policies (see Section 1.7 for a list of additional regulations with which this EA complies). NEPA requires examination of the effects of proposed actions on the natural and human environment. In the following chapters, we describe three alternatives for future refuge management, the environmental consequences of each alternative, and our preferred management direction. Each alternative was designed to contain a reasonable mix of fish and wildlife habitat prescriptions and wildlife-dependent recreational opportunities consistent with the Refuge System Improvement Act and specific refuge purposes.

The environmental consequences of each alternative are described in the following text and form the basis for selection of the proposed action. This EA is designed to cover the environmental consequences for future management actions and current facilities on the Trinity River NWR. However, some future actions, such as the construction of major facilities, will require further environmental documentation.

1.2 Location:

The Trinity River NWR is located in the floodplain of the lower Trinity River in Liberty County, Texas. The refuge consists of over 51 units and continues to emphasize acquisition opportunities throughout the floodplain of the Trinity River. The refuge is approximately 50 miles northeast of Houston and 40 miles west of Beaumont in southeast Texas. Although located in a rural setting, the refuge is within 65 miles of over 5,000,000 people (see Map 1-3 in the CCP).

1.3 Background:

Trinity River NWR is currently composed of various units (50 plus) of land totaling 25,000 acres. The refuge was established January 4, 1994, by the Emergency Wetlands Resources Act of 1986 for the purpose of protecting a remnant of the bottomland hardwood forest ecosystem along the Trinity River. It is one of only 14 priority one bottomland sites identified for protection in the Texas Bottomland Protection Plan (USFWS 1985). Additionally, this refuge is highly valuable for a diversity of waterfowl species within the Central Flyway. The type of habitat found on this refuge is used during migration or nesting by nearly 50 percent of the Neotropical migratory bird species listed by the Service.

Since the refuge is relatively new, the Service is in an active acquisition phase for incorporating lands into the refuge. With total anticipated acquisition of nearly 80,000 acres, the principle value of refuge lies in its potential as an outstanding waterfowl wintering area

and as a strategically located stopover, either migrating or nesting, for Neotropical migratory bird species.

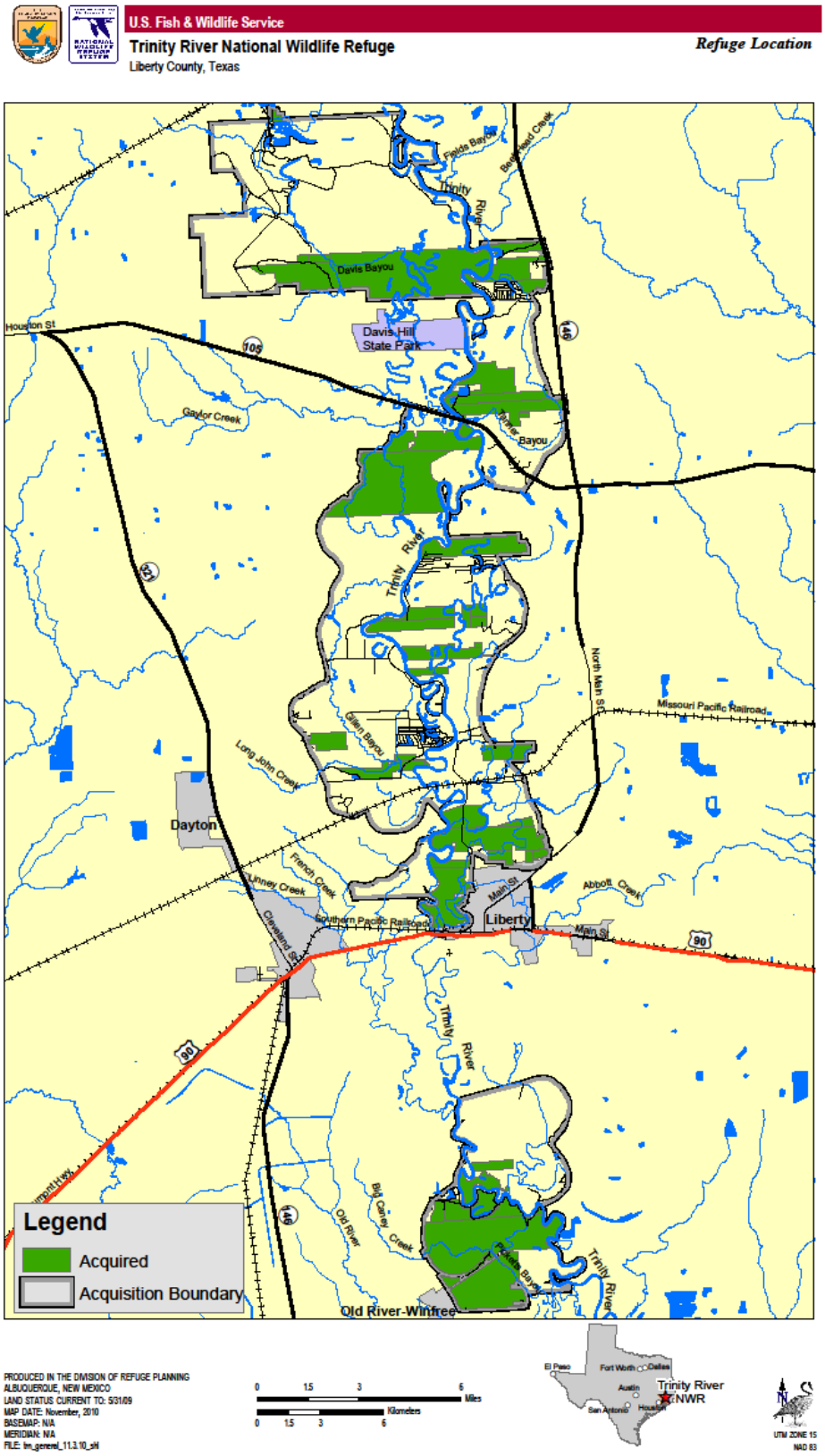
The acquisition area is the remnant of what was once a much larger natural area but still consists of a broad, flat floodplain with numerous sloughs, oxbow lakes, cypress/tupelo swamps, artesian wells, and tributaries, with few modifications. Timber harvest, gravel mining, and residential and commercial development are imminent threats to the stability of this system, due to the proximity to Houston and other nearby metropolitan areas.

Lands in Liberty County, specifically those in the proposed acquisition area around the Trinity River, are primarily used for timber or agriculture. Along with many older bottomland hardwood areas, there are also tree (primarily pine) plantations on drier sites. It is evident that an increasing number of Texas landowners, typical of those in Liberty County, are thinking of forestry as an agricultural crop, rather than of harvesting and gathering the natural woods already in place. This may be an indication that some of the natural forests in Liberty and other similar bottomland counties will be replaced with tree plantations for easier and faster harvesting in the near future.

The following is the vision of the Trinity River NWR:

The Trinity River National Wildlife Refuge will preserve, protect, and restore the wildlife and habitat of the Lower Trinity River bottomland hardwood forest floodplain and associated habitats. Through persistent exotic species control, reforestation, and biological monitoring, the refuge will serve as an anchor for biodiversity, model for habitat restoration and enhancement, and advance climate change practices throughout southeast Texas. The refuge will serve as a resilient source of evolving habitats and ecosystem processes even as structure and composition are altered due to climate changes. The refuge will continue to seek partnerships with landowners, local and regional organizations, and State and Federal agencies to achieve national and regional conservation goals, for the benefit of present and future generations. The refuge will also continue to provide and develop high quality programs and facilities for hunting, fishing, wildlife observation, photography, interpretation, and environmental education. This will allow people to connect with nature while building support for the refuge and enhancing the local community.

Map 1-1. Current Refuge Ownership (green) and Approved Acquisition Boundary (dark outline)



1.4 Purpose:

The purpose of the Proposed Action is to specify a management direction for Trinity River NWR over the next 15 years. The purpose of the EA is to select a management direction for the refuge that best achieves the refuge's purposes, vision, and goals; contributes to the mission of the National Wildlife Refuge System; is consistent with principles of sound fish and wildlife management; and address relevant mandates and major issues during scoping. The proposed management direction is described in detail through a set of goals, objectives, and strategies in the Comprehensive Conservation Plan (CCP). The purpose of this EA is to assess the impacts of proposed management actions.

1.5 Need for Action:

The action is needed because adequate long-term management direction does not currently exist for the refuge. Management is guided by various general policies and short-term plans that do not reflect current conditions or recent scientific knowledge. The action is also needed to address current management issues and to satisfy the legislative mandates of the National Wildlife Refuge System Improvement Act of 1997, which requires the preparation of a CCP for all national wildlife refuges in the United States.

1.6 Decision to be Made:

The Regional Director for the Southwest Region (Region 2 of the U.S. Fish and Wildlife Service) will make two decisions based on this EA:

1. Select which alternative the refuge will implement, and
2. Determine if the selected alternative is a major Federal action significantly affecting the quality of the human environment, thus requiring preparation of an Environmental Impact Statement (EIS), or whether the Proposed Action alternative can proceed.

The refuge's Proposed Action is Alternative C. Assuming no significant impact is found, the final Plan will include a Finding of No Significant Impact (FONSI), a statement explaining why the selected alternative will not have a significant effect on the quality of the human environment. This determination takes into consideration the Service and refuge System mission, the purpose(s) for which the refuges were established, and other legal mandates. Once the FONSI is signed, the CCP will be implemented, monitored annually, and revised when necessary.

1.7 Regulatory Compliance:

National wildlife refuges are guided by the mission and goals of the National Wildlife Refuge System (NWRS), the purposes of an individual refuge, Service policy, and laws and international treaties. Relevant guidance includes the National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997, Refuge Recreation Act of 1962, and selected portions of the Code of Federal Regulations and the U.S. Fish and Wildlife Service Manual.

The CCP's overriding consideration is to carry out the purpose for which the refuge was established. Refuge purposes are stated in the laws that established the refuge and provided the funds for acquisition. Fish and wildlife management is the first priority in refuge management, and the Service allows and encourages public use (wildlife-dependent

recreation) as long as it is compatible with, or does not detract from, the refuge missions and purposes.

This EA was prepared by the Service and represents compliance with applicable Federal statutes, regulations, Executive orders, and other compliance documents. Appendix B of the CCP contains a list of the key laws, orders, and regulations that provide a framework for the Proposed Action.

Further, this EA reflects compliance with applicable State of Texas and local regulations, statutes, policies, and standards for conserving the environment and environmental resources such as water and air quality, endangered plants and animals, and cultural resources. An Endangered Species Act (ESA) Section 7 Consultation will be completed for inclusion in the CCP (Appendix F).

Comprehensive Conservation Plans include a review of the appropriateness and compatibility of existing refuge uses and of any planned future public uses. If a use is determined to be an 'Appropriate Refuge Use' by a Refuge Manager, it is then taken through the 'Compatibility Determination' process. Compatibility determinations (CD) have been completed and are provided in Appendix D of the CCP. For more information on Appropriate Refuge Uses and Compatibility Determinations, including a list of CDs, see Chapter 5 of the CCP.

1.8 Scoping/Public Involvement and Issues Identified:

Formal scoping began with publication of a notice of intent to prepare a CCP and EA in the *Federal Register* on August 10, 2007. In December 2008, a letter was sent to individuals at Texas Parks and Wildlife Department (TPWD) formally inviting them to participate in the development of the CCP. We received input from TPWD in January 2009. Planning Update #1, released to the public in December of 2009, announced the beginning of the planning process and asked the public to help identify issues that needed to be addressed in the CCP. Three public open house meetings were held in 2009 in Liberty (November 30), Beaumont (December 1), and Houston, Texas (December 2, 2009).

In addition to three open house public meetings, the refuge hosted a government-to-government meeting and invited regional representatives from both State and Federal government agencies on February 4, 2010. The meeting was held at the Liberty/Dayton Area Chamber of Commerce in Liberty, Texas, with representatives from the refuge, U.S. Fish and Wildlife Service Endangered Species Office in Houston, TPWD, and the National Park Service.

In addition to the scoping activities, one member of the Trinity River NWR staff participated in an ecoregion-wide coordination meeting with different agencies and organizations on December 9, 2009. This helped provide a better understanding of what issues are occurring within the Gulf Coast Prairies and Marshes ecoregion for the Texas Mid-coast Comprehensive Conservation Plan. This meeting utilized the Texas State Wildlife Action Plan and the Nature Conservancy's Ecoregion Assessment to describe the biological characteristics of the ecoregion and associated threats. This meeting was designed to determine where the conservation community collectively stands at addressing ecoregional threats and the role the refuge plays within the broader landscape. This meeting was also very beneficial to the Trinity River NWR since a portion of the refuge also falls within the Gulf Coast Prairies and Marshes Ecoregion.

Planning Update #2, released in February 2010, offered an opportunity to the public to review and comment on the issues identified during the public scoping process. This update announced the draft goal statements and the preliminary range of management alternatives developed by the planning team.

The feedback received at the conclusion of the public involvement period identified concerns from a variety of stakeholders. The issues and concerns provided the basis for developing the refuge's management direction and played a role in determining desired conditions for the refuge. The issues have been divided into three categories for the refuge to address:

1. Habitat and Wildlife Management
2. Visitor Services
3. Facilities

All the following issues are refuge management concerns unless otherwise specified.

1.8.1 Habitat and Wildlife Management

Conservation/Enhancement of Bottomland Hardwood Forests

The majority of comments received on habitat and wildlife management issues were based on an aggressive acquisition program to expand the refuge with continuous units of land from willing sellers and land donors. Comments from all stakeholder groups on habitat management were based on preservation and reversing the trends of fragmentation and development. Many groups, including the refuge, had concerns over the increased spread of invasive and non-native flora throughout the refuge and preserving existing units while allowing them to develop and mature into old growth forests.

Native Flora/Faunal Conservation

Members of the public commented on numerous concerns, including the priority for managing wildlife and initiating management actions for public use opportunities. Concerns were expressed on restoring native flora and impacts of invasive species and damage initiated from feral hog rooting activities.

Invasive Flora/Fauna Management

Invasive, exotic, and nuisance species issues were raised by the public, State, and the refuge. All comments indicated the refuge needs to continue to treat invasive flora. The refuge also identified concerns of the red imported fire ant and the potential impacts to native wildlife.

Wetland Management

The refuge identified issues with existing water control structures and the need to maintain and improve existing levees, as well as developing a consistent program to conduct water sampling and fish surveys as indicators of quality wetlands.

Land Acquisition

Acquisition efforts are focused on the floodplain of the Trinity River with special emphasis on bottomland hardwood forests. The bottomland forests of the ecosystem have high wildlife and wetland values and provide quality habitat for a large variety of wildlife species. Many

stakeholders identified acquisition efforts as the desired direction to offset the impacts of fragmentation; there were also general comments promoting refuge expansion.

Climate Change

Many concerns were discussed during our ecoregional planning meeting held for the Prairies and Marshes Ecoregional meeting on Brazoria National Wildlife Refuge in 2009. Many concerns were focused on the concerns of global climate change and the impacts warmer temperatures would have on the entire ecoregion. Issues included climate change and its potential for alterations to habitat components and wildlife migrations, and habitat fragmentation from the development of sprawling communities or other land use developments. As habitats change, the wildlife species that inhabit those habitats will also change. There is little the refuge can do to affect this issue, but it can realize that is occurring, document these changes through data collection, and adapt management as hydrology and plant communities change. Concerns regarding climate change focused on initiating baseline data to develop a better understanding of the immediate impacts of climate change and the long-term trends in habitat and wildlife species shifts.

Resource Protection

Many concerns were bought up by the public and the refuge on the increased need for law enforcement and patrols to better protect refuge resources and provide for visitor safety.

1.8.2 Visitor Services

Public Use Opportunities

The public expressed concerns for growing each of the big six wildlife-dependent recreational opportunities provided throughout the refuge (hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation). Many comments were in favor of increased access to the various refuge units and additional canoe and kayak access points. Many constituents were in favor of the numerous special events such as Earth Day, Free Fishing Day, and National Public Lands Day. Overall, public comments reflected care in growing opportunities for increased conservation efforts and building upon the unique wildlife viewing and extraordinary wildlife-dependent recreational opportunities provided on the refuge.

1.8.3 Facilities

The planning team reviewed comments on public use facilities, administrative facilities, and refuge access issues. Members of the public commented on issues such as increasing interpretive signs and kiosks, establishing a visitor center, and creating and improving on “green” infrastructure.

Public Use Access

Members of the public would like to see additional areas of the refuge open for wildlife-dependent recreational opportunities. Some constituents commented on additional maps or web information indicating which areas of the refuge contain public access and the types of activities allowed on certain units.

Public use Facilities

Members of the general public expressed concern about having additional public use facilities throughout the refuge. Many members of the public requested a new visitor center.

Cultural Resources

Cultural resources include both archaeological and historic sites and other artifacts. Some comments were received during the public meetings to provide interpretive materials on cultural resources occurring throughout the refuge.

Oil and Gas Operations

Many members of the public would like to see no petroleum development on the refuge and many would like to see special mitigations incorporated to minimize negative impacts to wildlife.

2.0 DESCRIPTION OF ALTERNATIVES

2.1 Formulation of Alternatives:

Alternatives are different approaches or combinations of management actions designed to achieve a refuge's purposes and vision, the goals identified in the CCP, the goals of the Refuge System, and the mission of the Service. Alternatives are developed to address the significant issues, concerns, and opportunities heard during the scoping process. The planning team developed three alternative management scenarios that represent a reasonable range of alternatives that could be used at Trinity River NWR.

This EA considers three alternatives in detail (see section 2.4), which cover a reasonable range of alternatives. In addition, three other alternatives were considered but eliminated from detailed analysis (see section 2.2). These alternatives represent different approaches or management scenarios for the future protection, restoration, and management of the refuge fish, wildlife, plants, habitats, and other resources, as well as compatible wildlife-dependent recreation. Refuge staff assessed the biological conditions of refuge habitats and analyzed the external relationships affecting each refuge unit. This information contributed to the development of refuge goals and, in turn, helped formulate the alternatives, summarized in Table 1. Based on input from the public and the initial interdisciplinary team meetings, these alternatives represent a full range of reasonable alternatives in refuge resources that will help guide management actions over the next 15 years on the refuge. Alternatives will be examined in three broad issue categories:

> **Habitat and Wildlife Management**: How will the refuge address habitat management issues while ensuring the conservation, diversity, and enhancement of the bottomland hardwood forests?
>
> **Visitor Services**: How will the refuge provide public use opportunities while ensuring the conservation, diversity, and enhancement of bottomland hardwood forests?
>
> **Facilities**: How will the Refuge manage facilities while ensuring the conservation, diversity, and enhancement of bottomland hardwood forests?

2.2 Alternatives Considered But Dismissed From Detailed Analysis:

During the public scoping period, many alternative actions for managing the refuge were suggested. Many of these suggestions were consistent with refuge purposes and the mission of the Refuge System and were incorporated into the action alternatives. Some of the public suggestions for refuge uses were found to be not appropriate, through an appropriate use determination, and were removed from further consideration. Actions and alternatives that are not feasible or may cause substantial harm to the environment are usually not considered in an EA. Similarly, an action (and therefore, an alternative containing that action) should generally not receive further consideration if:

- It is illegal (unless it is the No Action Alternative, which must be considered to provide a baseline for evaluation of other alternatives, even though it may not be capable of legal implementation).
- It does not fulfill the mission of the National Wildlife Refuge System.
- It does not relate to or help achieve one of the goals of the refuge.
- Its environmental impacts have already been evaluated in a previously approved NEPA document.

However, if such actions or alternatives address a controversial issue or an issue on which many public comments were received, they may be considered in detail in a NEPA document to demonstrate clearly why they are not feasible or would cause substantial harm to the environment.

During the alternatives development process, the planning team considered a wide variety of potential actions on the refuge. The following actions were ultimately rejected and excluded from the proposed alternatives because they did not achieve refuge purposes or were incompatible with one or more goals.

Some members of the public expressed concern over controlling the water levels of the Trinity River for the benefit of wildlife on the refuge and requested that the refuge establish agreements to mandate continuance of current cycle. Although the Trinity River is critical in waterfowl and wildlife habitat needs, the refuge does not own any water rights to the River. The Trinity River Authority, with no contribution from the refuge, controls the river flow. This alternative, although desirable, is considered infeasible due to legal constraints and does not satisfy the purpose and need for which this EA is being prepared.

Some members of the public requested that the refuge purchase Davis Hills State Park and incorporate this land into the Trinity River NWR. Although the refuge is in an aggressive acquisition mode, all units are only purchased from willing sellers. This alternative is considered infeasible due to legal constraints with land ownership and does not satisfy the purpose and need for which this EA is being prepared.

Some members of the public expressed a concern against any entrance fees being implemented on refuge lands. The refuge currently does not charge any entrance fees and has no desire to initiate any entrance fees within the life of this CCP.

2.3 Management Direction Common to All Alternatives:

Although the alternatives differ in many ways, there are similarities among them; several elements of refuge management are common to all alternatives. Listed below, these common management activities reduce the length and redundancy of the individual alternative descriptions.

Threatened and Endangered Species

The purpose of the Endangered Species Act (ESA) of 1973 (Endangered Species Act 1973) 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 (E)" or "threatened (T)." Endangered means a species is in danger of extinction throughout all or a significant portion of its range; threatened means a species likely to become endangered within the foreseeable future. Proposed species means any species of fish, wildlife, or plant that is proposed in the *Federal Register* to be listed under section 4 of the ESA. Several endangered and threatened species have the potential occur on the refuge. No federally listed plant species are documented on the refuge.

The refuge will continue to provide resting habitat for piping plovers and interior least tern, as well as provide breeding habitat for American alligator and potential habitat for all species listed in Liberty County under the Endangered Species Act.

A total of eight federally listed species have been identified as potentially occurring in Liberty County and are identified on Table 3-3 of the CCP.

The Gulf Coast Bird Observatory surveyed the refuge for ivory-billed woodpeckers during 2007-2009 but did not find any signs. This species is believed to have been extirpated from the State of Texas, as well as other southeastern states (Hornaday 1913). J.T. Tanner's studies between 1937 and 1939 demonstrated that the ivory-billed woodpecker still existed but in only a fraction of its original range. By the time of Tanner's study (Tanner 1942), the ivory-billed woodpecker only survived in the Madison Parish region of Louisiana, the Santee Swamp of South Carolina, and the Suwanee River and Big Cypress regions of Florida (Tanner 1942). The last verified observation of an ivory-billed woodpecker in the United States was in 1969 (USFWS 1999).

None of the current or projected future lands within the acquisition boundary of the refuge has been designated critical habitat for any species listed as endangered under the ESA of 1973, as amended. The American alligator, brown pelican, and southern bald eagle occur on the refuge but are no longer designated as endangered.

Species of Special Management Concern

Species of special management concern are species for which further biological research and field study are needed to resolve their conservation status or are considered sensitive, rare, or declining on lists maintained by Natural Heritage Programs, State wildlife agencies, other Federal agencies, or professional scientific societies. This includes State listed endangered or threatened species not included in the previous text. Actions are not currently being taken to manage for these species. A total of 22 species have been identified as species of special management concern and are identified in Table 3-5 of the CCP.

Cultural Resources

The refuge would continue to identify, protect, and manage all significant cultural resources in a spirit of stewardship for the benefit of future generations. The refuge would administer, preserve, and protect these resources in such a manner that sites, buildings, structures, and other objects of cultural value are preserved and maintained for scientific study and public appreciation and use. The refuge would ensure that during the appropriate stages of decision-making affecting these resources such as construction, land use, or resource planning, and land acquisition or disposal, full consideration is given to cultural resources. The refuge will ensure that prior to any ground disturbing activities, archeological surveys will be conducted according to State Historical Preservation Office (SHPO) standards. The refuge will also ensure that if new sites are discovered, they will be secured, recorded, and archived according to SHPO standards.

Oil and Gas Operations

The refuge does not own any mineral rights. The refuge does not currently have any active oil or gas well sites or production facilities, although the potential exists. There are currently over 16 miles of pipelines located through various refuge units. Except for pipeline construction projects within existing right-of-ways, the remaining pipelines were in place before the inception of the refuge. Although very rare, occasional spills or blow-outs could occur in pipes, causing damage to habitat and wildlife. Mitigation measures will be incorporated to all special use permits allowing any activities relating to oil and gas development and require operators to submit a "Development and Operations Plan" for approval by the Refuge Manager.

Service policy 612 FW 2 states that the objectives of oil and gas management on Service lands are to protect wildlife populations, habitats, and other resources and to provide for the exercise of non-Federal oil and gas rights while protecting Service resources to the maximum extent possible. In accordance with 50 CFR 29.32, persons holding mineral rights shall, to the greatest extent practicable, conduct all exploration, development, and production operations in such a manner as to prevent the damage, erosion, pollution, or contamination to the lands, waters, facilities, and vegetation of the area. Such operations must also be conducted without interference with the operation of the refuge or disturbance to wildlife and would be subject to prior approval by the Service. All operations would be required to operate under current local, State, and Federal regulations and policies.

Operators would be required to prevent, to the maximum extent possible, releases of hazardous materials and substances, crude oil, and produced water. Each operator and/or facility operator would have a current Oil Discharge Prevention and Contingency Plan, outlining procedures for securing and clean-up of accidental releases. Sampling, remediation, and restoration of contaminated sites would be the responsibility of the operator and/or facility operator and would occur in consultation with the Service and the appropriate State agency. All sites no longer being used by industry would be sampled for contaminants at the operator's expense to ensure proper disposal of material and that refuge staff and/or the visiting public are not exposed to contaminants.

All oil and gas activities conducted on the refuge require the use of "best management practices" as defined in the Operational Plan and/or Special Use Permit. Efforts to minimize environmental impacts in wetland habitats include special conditions such as timing of activity, types of equipment used, and use of on-site environmental monitors, as well as habitat restoration

requirements, if needed. Best management practices and mitigation measures are discussed and agreed upon before the initiation of any seismic, drilling, or production activities.

The Service would request, on a case-by-case basis, that wells, roads, pipelines, and associated infrastructure and facilities not needed to support ongoing operations be removed and the sites restored to the satisfaction of the Refuge Manager.

Wildland Fire
All wildland fires will be suppressed. Suppression strategies range from monitoring the fire while allowing it to burn itself out (as in the case where no life, property, or resources are threatened and/or smoke management is not an issue of concern), to full suppression (if life, property, and resources are threatened and/or smoke management is an issue of concern).

The Trinity NWR will use a decision support process to guide and document wildfire management decisions. The process will provide situational assessment, analyze hazards and risks, define implementation actions, and document decisions with corresponding rationale. When needed, the refuge would manage wildland fires for more than one objective, and objectives can change as the fire moves across the landscape. Objectives are affected by changes in fuels, weather, topography; varying social understanding and tolerance; and involvement of other governmental jurisdictions having different missions and objectives (National Interagency Fire Center 2009). Initial action on human-caused wildfire will be to suppress the fire at the lowest cost with the fewest negative consequences with respect to firefighter and public safety. Fire management strategies will consider current landscape conditions and spatial and temporal components of the fire regime.

2.4 Alternatives Analyzed in Detail:

The following alternatives were developed to comply with NEPA and to provide ways to represent a number of issues, concerns, and opportunities that were identified during the public and internal scoping process. Though the alternatives may have different emphases, habitat maintenance, restoration, and preservation are common elements of each alternative. Each alternative was intended to provide a range of public uses and access and respond to significant issues or concerns identified during the planning process.

2.4.1 Alternative A - No Action (Current Management)

2.4.1.2 Habitat and Wildlife Management

Native Flora/Fauna Conservation:

The refuge would continue to acquire and conserve units within the approved acquisition boundary. The refuge would continue habitat management activities to restore and reintroduce native flora and fauna. Management tools will continue to be implemented to improve or maintain the integrity of bottomland hardwood forests such as treating non-native flora and planting trees. Management of native nuisance flora includes limited control by herbicides of cattail and frogbit along various ponds covered in those plants. The use of herbicides would continue at approximately 200 acres per year.

The refuge has planted over 12 species of native trees since 1995. Plantings primarily occurred in 1995–1996 with 10,000 bare-root seedlings, while another 50,000 plus seedlings were planted in 2006.

Management of potentially native nuisance fauna includes hunting white-tailed deer and trapping beaver that could potentially affect adjacent landowners.

The refuge would continue to maintain three artificial roosting structures specifically for cavity-roosting bats: one abandoned farmhouse and two cinderblock towers. Artificial bat towers were erected to provide maternity roosts. The population has been showing a small but steady growth from 2005 to 2011. Surveys of artificial roosting structures over five years have shown that this particular species of bat is increasing. It has increased by approximately 10 percent each year from 2005 to 2011. Information regarding bat roost selection was collected as a part of a three-year study funded by U.S. Geological Survey (USGS).

The refuge will continue to work with TPWD to establish and record deer browse line surveys to ensure that deer population numbers in and around the refuge are within the unit's carrying capacity.

The refuge will continue to record colonial nesting bird activity in our major rookeries.

Invasive Flora/Fauna Management:

Invasive Species (flora)

The refuge would continue to concentrate its efforts on controlling Chinese tallow, trifoliate orange, McCartney rose, Chinaberry, water hyacinth, alligatorweed, and giant salvinia and other invasive species on a case-by-case basis to preserve the integrity of the bottomland hardwood ecosystem. Herbicidal treatments would be the primary tools used to implement this management direction, while biological control methods may be used on approved species such as weevils for alligatorweed, salvinia, and water hyacinth.

For exotic/nuisance plants, herbicides approved by use at the Washington, D.C. level would be applied either by basal bark treatment or foliar application. Basal bark treatment uses a hand-held or backpack 1-3 gallon container using herbicides appropriate for the species being treated. Herbicide is sprayed around the entire base of the plant to a height of about 12 inches. Foliar application uses a battery powered spray rig with a wand capable of distributing a mist all the way to a straight stream that can reach about 25 feet. This rig can be mounted on boats, all-terrain vehicles (ATVs), or utility vehicles.

Herbicide treatment would continue on 100-200 acres on average annually. This average is based on regular annual funding and does not include special circumstances where additional budget allocations have been available in individual years to treat additional acres. For example, in fiscal year 2008 a special contract was awarded to aerially treat approximately 300 acres of water hyacinth and 300 acres of alligatorweed. These occasional budget allocations are infrequent and unpredictable and therefore are not included in our annual averages. Treatments to date are focused on problem areas rather than systematic control that the refuge can achieve given its limited budget and resources.

Table 2-1. Chemical Treatments on the Trinity River NWR

Active Ingredient	Brand Name	Target Species	Application	Purpose
Imazapyr	Habitat, Imazapyr E-pro 2	Chinese tallow, Japanese mimosa, Chinaberry, trifoliate orange, water hyacinth, alligatorweed	Foliar	Eradicate invasive flora in bottomland forest and waterways
Imazamox	Clearcast	Chinese tallow, Japanese mimosa, Chinaberry, trifoliate orange, water hyacinth, alligatorweed	Aerial, Foliar	Eradicate invasive flora in bottomland forest and waterways
Glyphosate	Rodeo, Glyphos Aquatic	Chinese tallow, Japanese mimosa, Chinaberry, trifoliate orange, water hyacinth, alligatorweed	Foliar	Eradicate invasive flora in bottomland forest and waterways
Triclopyr	Garlon 4	Chinese tallow, Japanese mimosa, Chinaberry, trifoliate orange, water hyacinth, alligatorweed	Foliar, basal bark	Eradicate invasive flora in bottomland forest and waterways
Metsulfuron methyl + aminopyralid	Chaparral	McCartney Rose	Foliar	Eradicate invasive flora in bottomland forest and waterways

Floral (woody) Species:

***Chinese tallow*:** Most control efforts involve basal bark application of herbicide to each individual tree. In areas of dense infestation, high volume foliar application of the entire tree is conducted. Control of this species has averaged approximately 75 acres per year over the past 15 years.

***Chinaberry tree*:** Herbicides are applied using a basal bark application method on each individual tree. In areas of dense infestation, high volume foliar application with a 25-gallon sprayer mounted on ATV is used. Control of this species has averaged approximately five acres per year over the past 15 years.

Trifoliate orange: Herbicides are applied using basal bark application method on each individual shrub. In areas of dense infestation, high volume foliar application with a 25-gallon sprayer mounted on an ATV is used. Control of this species has averaged approximately 15 acres per year over the past three years.

***McCartney rose*:** Foliar spraying of individual bushes has removed most of this shrub, but constant monitoring is necessary. In areas of dense infestation, high volume foliar application with a 25-gallon sprayer mounted on an ATV is used. Control of this species has averaged approximately 10 acres per year over the past three years.

Floral (aquatic) Species:

Water hyacinth: Approximately 300 acres are targeted for eradication and monitored yearly. The refuge is currently controlling this species through helicopter spraying on large sites with a combination of hand removal and hand spraying used on smaller sites (less than five acres).

Alligatorweed: Is found in similar ponds and waterways as hyacinth, but more prevalent. The refuge is currently controlling this species through helicopter spraying on large sites.

Giant salvinia: The refuge has done very limited spraying with herbicides since 2006 with a 25-gallon spray tank mounted on a boat. Most areas do not support boating operations, making it difficult to access. TPWD has used a biological control method by releasing salvinia weevils to help control giant salvinia in small ponds throughout the refuge.

Faunal Species:

The refuge would continue limited control on feral hogs and nutria on a continuous basis. Removal of feral hogs will be by hunting, removal by staff, and trapping, while nutria removal will be by trapping and removal by staff. Current eradication efforts are focused on problem areas rather than systematic control.

Nutria: There is limited nutria trapping by refuge staff in the Palmetto Unit and Ander's Pond.

Feral hogs: The refuge has a few large corral type traps on Mann and Champion Lake units and allows hunting at Brierwood, Page, McGuire, Butler, Hirsch, Boar's Den, and Silver Lake units during a limited hunt season.

Wetland Management:

Water Management: There are no pumping structures to add water to the 800-acre Champion Lake (average, normal size) during times of drought. There are no plans or need for any additional water control structures or pumps on any of the current units within the refuge. Rebuilding of the levee along the southern border of Champion Lake was completed by contract in 2003 and is maintained by refuge staff.

Water Quality Sampling: Sampling consists of monthly testing for salinity, dissolved oxygen, temperature, conductivity, and pH. The refuge is in the early phases of baseline data collection.

Fish Surveys: Results of surveys include species, frequency, and size. Surveys on Champion Lake have been conducted by university staff and students three times since 2003. There is no stocking of fish in any of the refuge ponds.

Land Acquisition:

The refuge would continue to implement the actions outlined in the 1999 Lower Trinity River Floodplain Habitat Stewardship Program. The refuge would continue to acquire lands from willing sellers as they become available. This would be on a case-by-case basis with available funding. Since 2000, yearly acquisition has averaged nearly 1,900 acres.

Climate Change:

The refuge will continue to plant native bare-rooted tree seedlings in an attempt to sequester carbon. As opportunities arise, units that were previously pastureland before Service acquisition may be restored with native tree species. The refuge would use green infrastructure and related technologies when opportunities and funding permits to reduce its carbon footprint and contribution to climate change as well as reduce, reuse and recycle used materials to the extent possible and maximize "green" technologies. In addition to traditional

recycling activities, the refuge participates in local city recycling days for tires and document shredding. Refuge controlled structures such as trailers and Die House have converted most incandescent light bulbs to compact fluorescent light bulbs. The 12-volt generator batteries are trickled charged by a solar panel. Vehicle fleet includes a hybrid Chevy Malibu. The refuge strives to minimize its carbon footprint on a daily basis.

Resource Protection:

Currently, the refuge has one law enforcement officer to cover 25,000 acres on over 50 units, located 45 miles from north to south on two sides of a river. The law enforcement officer (LEO) averages about four physical arrests, 20 notices of violation, and 50 verbal warnings per year. Most contacts involve illegal fishing/boating activities, but there are also considerable trespassing and outstanding warrant violations.

2.4.2 Visitor Services

The refuge receives over 22,000 visitors annually and provides opportunities for the public to hunt waterfowl, big game, and upland game; fish; and observe, photograph, and learn about bottomland hardwood forests. However, there are currently limited opportunities for visitor education and interpretation.

Hunting:

The refuge would continue to allow hunting by permit only for big game, upland game, and waterfowl in eight units. Approximately 700 annual visitor use days for hunting occur on the refuge.

Table 2-2. Current Hunt Program

Units Currently Open/Acres	Type of Hunt (Number Of Permits Issued)	Species
Page - 2,200	**BIG GAME** • archery (22) • general gun (16)	deer, feral hog
Brierwood -1,800	**BIG GAME** • general gun (14) • muzzleloader (25) **UPLAND GAME** (30)	deer, feral hog squirrel, rabbit
McGuire - 550	**BIG GAME** • general gun (10) • muzzleloader (15) **UPLAND GAME** (20)	deer, feral hog squirrel, rabbit
Butler – 250	**BIG GAME** • archery (8)	deer, feral hog
Hirsch – 890	**BIG GAME** • archery (14) • general gun (8) • muzzleloader (10)	deer, feral hog
Boar's Den - 2,000	**BIG GAME** • general gun (18) • muzzleloader (30) **UPLAND GAME** (35)	deer, feral hog squirrel, rabbit
Silver Lake - 260	**BIG GAME** • general gun (5)	deer, feral hog
Champion Lake - 800	**WATERFOWL** (120)	ducks

Big Game Hunting:
The refuge currently allows two nine-day "mini-seasons" for big game hunting (deer and hog) by permit only within the Butler, Brierwood, Page, McGuire, Hirsch, Boars Den, and Silver Lake units. There is also a "mini-season" for muzzleloader and archery (See Table 2-2). A "mini season" is a hunt season specific to the refuge, which is shorter than the hunting season allowed by the State outside of refuge managed lands. Each drawn hunter is allowed to bring one guest and one youth, between 12 and 17 years old, or two youths. There are no standby hunters.

Upland Game Hunting:
The refuge currently allows a 23-day "mini-season" for upland game hunting (squirrel and rabbit) by permit only within the Brierwood, McGuire, and Boar's Den units. Permits are issued on a first-come, first-serve basis. Each permitted hunter is allowed to bring two youths, aged 12-17. There are no standby hunters.

Waterfowl Hunting:
The refuge currently allows waterfowl hunting by permit only on the 800-acre Champion Lake Unit on weekends. This two day per week hunt is a limited drawing of 20 participants. Hunters are selected in groups of 20, and then allowed to hunt for a designated two weekends only. Each drawn hunter is allowed to bring one guest and one youth, aged 17 or younger, or two youths. There are no standby hunters.

Fishing:

Approximately 18,000 visitor use days come for fishing opportunities. The refuge currently allows fishing at the 800-acre Champion Lake and along Pickett's Bayou. Seasons, creel, and size limits are within the guidelines established by TPWD. The refuge's fishing program is more restrictive than the State guidelines to assure compatibility with other refuge objectives. Additional restrictions include area closures to minimize disturbance near colonial rookeries; no gigs, trotlines, bow fishing, or nets are allowed; and all fishing is limited to daylight hours.

Wildlife Observation:

Current wildlife observation opportunities would continue by walking or boating access only. There are no auto tour routes on the refuge. The eight units currently open to wildlife observation are shown in Table 2-3.

Table 2-3. Wildlife Observation Trails

Unit Name	Unit #	Acres	Type	Miles of Trails
Butler	10	500	Hiking	0.5
Brierwood	47	2,983	Hiking	7.3
Page	21	877	Hiking	4.5
Hirsch	64	892	Hiking	2.2
McGuire	31	521	Hiking	7.1
Silver Lake	47a	259	Hiking	0.1
Boar's Den	46, 46a, 47	4,471	Hiking	7.5
Champion Lake Public Use Area	27	2,850	Hiking	2.3
			Boating	7.1

Wildlife Photography:

Current wildlife photography opportunities would continue at the same units listed for wildlife observation. Wildlife photography opportunities are conducted by walking or boating. Auto tour routes are not present on the refuge.

Environmental Education:

State recognized environmental education (EE) programs do not occur on the refuge.

Interpretation:

Current interpretative programs would continue on the refuge. They include two "on-refuge" annual events and approximately six "off-refuge" annual events.

2.4.3 Facilities

Facilities for administrative and public uses would remain at current numbers and would be routinely maintained. The office for the refuge consists of a single field station administrative headquarters office and a storage/maintenance building. The office is approximately 3,200 square feet and includes eight offices, storage space, conference room, kitchenette, and visitor and staff parking areas. The storage/maintenance building encompasses 2,250 square feet and is adjacent to the headquarters. The entire footprint of both buildings is approximately 2.5 acres. Other "on-refuge" facilities are listed below.

Table 2-4. Current Facilities on Trinity River NWR

Facility Type	Condition
Public Use Facilities	
Champion Lake Public Use Area	This area contains fully accessible T-shaped 150' fishing/observation pier; 5,000-square-foot butterfly garden with walkway and parking; portable toilet; and two boat ramps.
Silver Lake photo/hunt blind	10' x 10' accessible blind at end of a boardwalk
Kiosk	Located at trail head of Brierwood unit
Parking lots	Located at Champion Lake, Brierwood, Page, Hirsch, Silver Lake, McGuire, and Butler units
Trails	See Chapter 3 of the CCP for more information on trails
Administrative Facilities	
Headquarters Office	Built in 2011 on refuge unit with 8 offices
Storage/maintenance (adjacent to headquarters)	Built 2011 on refuge unit with 4 bays
Champion Lake - Enclosed Storage Shed	Heavy equipment storage, ATV, herbicides, tools
Champion Lake - Open Storage Shed	Pipe and heavy equipment storage
Champion Lake - Freight Containers	Two, 8' x 40' ft containers storing equipment
Champion Lake - Mobile Home	Houses interns, 3 bedrooms
Champion Lake - RV pads	Pads with water and electricity for 3 RVs used for volunteers
Champion Lake - Wooden Storage Building	Houses washer, dryer, and recycling bins
Champion Lake - Septic System	For mobile home and RV pads

Facility Type	Condition
Champion Lake - Water Well	For mobile home, RV pads, and butterfly garden
Champion Lake - Above Ground Storage Tanks	1,500 gallons diesel and 1,500 gallons gas storage
Champion Lake - Stand-by Generator	Diesel– handles all operations for Champion Lake
Champion Lake - Log Cabin (not currently usable)	1950s-era log cabin with 2 small rooms
Champion Lake - Lodge (not currently usable)	1940s-era large log cabin with 5 large rooms
Die House - Residence	Houses volunteers and researchers, 2 bedrooms
Die House - Butler Building	Enclosed 30' x 30' storage for mowers and tools
Die House - Water Well/Storage Building	Supplies water to the Die House
Die House - Herbicide/Oil/Paint Storage Building	Store various herbicides, paints, oils, etc
Die House - Above Ground Storage Tanks	1,000 gallons diesel, 500 gallons diesel, and 500 gallons gas
Die House - Travel Trailer	Used by researchers, temporary volunteers
Die House - Open Pole Shed	Pipe and heavy equipment storage
Die House - Stand-by Generator	Diesel– handles all operations for Diesel
Radio Tower Building (off-refuge)	Houses two-way radio components

Public Use Access:

The refuge currently contains two miles of government maintained, public use roads. These are all dirt roads leading to parking areas. Most other roads that lead to refuge parking areas come off county maintained roads, which may be either dirt or paved. Auto tours routes are not present on the refuge. Current public access would continue on approximately 25 percent of the refuge. Vehicular access to parking lots is on designated roads to all public use areas listed previously in the Visitor Services section. From the parking lot, entry is by walk-in only or boating. Boat motor size is limited to 10-horse power or less for Champion Lake and 40-horsepower or less for Pickett's Bayou.

Staffing and Budget:

Base funding and staffing would continue at current levels, maintaining five full-time staff. Since 2008, the refuge has been able to fund two temporary employees working on an intermittent basis. Budget breakdown is approximately 75 percent for staff salaries and benefits with the remainder used for all other costs.

2.4.4 Alternative B

2.4.4.1 Habitat and Wildlife Management

Native Flora/Fauna Conservation:

Management of these resources would be the same as Alternative A plus initiating a prescribed fire program on four units (Die, Wirt Davis, Champion Lake South, and 47a), burning approximately 200 acres to benefit nesting habit for Henslow's sparrow and other grassland nesting and migratory birds. Prescribed fire would be used on the refuge as a

management tool to enhance or restore habitat, reduce hazardous fuels, and maintain small isolated pockets of grasslands.

The refuge would continue to monitor the artificial roost structure use for Rafinesque's bats on an annual basis. If these structures continue to provide habitat, their use is expected to decline because the refuge is managing for old growth bottomland hardwood forests; therefore, as protected units begin to provide older growth trees, more natural roosting sites for bats will be available, theoretically decreasing the use of artificial sites.

Invasive Flora/Fauna Management:

Management of these resources would be the same as Alternative A plus develop an invasive species strike team program. This would also include mapping "hotspots" to prioritize eradication efforts.

Wetland Management:

Management of these resources would be the same as Alternative A plus plan a small-scale restoration of hydrological flow on Champion Lake South Unit using better management of culverts, ditch restoration, or ditch removal.

Land Acquisition:

Management of these resources would be the same as Alternative A plus updating the 1999 Lower Trinity River Floodplain Habitat Stewardship Plan to add approximately 20,000 acres to acquisition and conservation easement efforts. This updated acquisition area will take a biological approach following the floodplain of the Trinity River. This would require updating of the refuge's original land protection plan and NEPA documentation.

Climate Change:

In addition to the actions identified under Alternative A, the refuge will gather baseline inventory and monitoring data of refuge resources at 40 surveys points within a 1,500-acre parcel, representing approximately 60 percent of the refuge's overall habitat, to determine the effects on refuge resources (long-term), as this may relate to changes in climate. The refuge would continue to monitor bottomland hardwood forest habitat and condition to determine the effects of climate change by conducting groundwater modeling, water quality/water quantity analyses to fully understand the refuge's water resources, and utilize the best available science to minimize the anticipated impacts associated with climate change. The refuge would use green infrastructure and related technologies when opportunities and funding permits to reduce its carbon footprint minimizing its contribution to climate change.

Resource Protection:

Management of these resources would be the same as Alternative A plus planning for additional patrols as the refuge continues to grow. This could be accomplished using law enforcement officers from other refuges.

2.4.4.2 Public Use Opportunities

Hunting:

Management of these activities would be the same as Alternative A plus opening one additional unit and potentially more units within the acquisition boundary as the refuge

continues to expand. The new unit added to the hunting program would be Champion Lake South, which is a 1,500-acre unit that would allow hunting for big game. This new unit would have same seasons for big game as those listed in the Table 2-2. Opening of additional units of the refuge to hunting throughout the acquisition boundary is contingent on availability of suitable habitat, adequate species populations, and sufficient staff and budget to administer the program.

Fishing:

Management of these activities would be the same as Alternative A plus directing visitors to two additional units. After piers and trails are developed, anglers could fish at the McGuire and Silver Lake units.

Wildlife Observation:

Management of these activities would be the same as Alternative A plus open an additional unit. After trails are developed, visitors could enter the Champion Lake South Unit.

Wildlife Photography:

Management of these activities would be the same as Alternative A plus the construction of a photo blind at Brierwood Unit.

Environmental Education:

Develop and implement off-refuge EE program, striving to meet State of Texas education standards for students and teachers.

Interpretation:

Management of these activities would be the same as Alternative A plus hosting approximately 10 additional off-refuge presentations. The presentations would include schools and some non-traditional user groups. Develop and provide self-guided interpretive materials at Champion Lake and Brierwood units.

2.4.4.3 Facilities

Public Use Access:

Management of these facilities would be the same as Alternative A plus increase access to additional units. After the dirt road is improved, vehicular access to McGuire pond area could occur. Boating access would be increased by establishing a canoe/kayak launch site at the Brierwood Unit.

Public Use Facilities:

Management of these facilities would be similar to Alternative A with the addition of rehabilitating the 1940s-era lodge at the Champion Lake Public Use Area to be used as an environmental education center. Additional construction activities would be a fishing pier at McGuire unit and paving the one-mile dirt road to Champion Lake Public Use Area.

Administrative Facilities:

Management of these facilities would be the same as Alternative A plus the construction of additional facilities. This would include constructing a maintenance shop at Champion Lake with an equipment storage area.

Staffing and Budget:

Base funding and staffing would increase as determined by the CCP in order to fully implement this alternative. The refuge would hire an additional maintenance worker to handle increased maintenance of additional trails, boundary lines, and structures. We would also hire a visitor services specialist to initiate an environmental education program, increase interpretive opportunities, and manage volunteer program.

2.4.5 Alternative C – Proposed Action

2.4.5.1 Habitat and Wildlife Management

Native Flora/Fauna/habitat Conservation:

Management of these resources would be the same as Alternative B.

Invasive Flora/Fauna Management:

Management of these resources would be the same as Alternative B.

Wetland Management:

Management of these resources would be the same as Alternative B.

Land Acquisition:

Management of these resources would be the same as Alternative B.

Climate Change:

Management of these resources would be the same as Alternative B.

Resource Protection:

Management of these resources would be the same as Alternative B plus add full-time refuge officer to assist existing officer as refuge grows to 80,000 acres.

2.4.5.2 Public Use Opportunities

Hunting:

Management of these activities would be the same as Alternative B plus opening one additional unit (Palmetto) for big game and upland game. This new 330-acre unit would have same seasons for big game and upland game as those listed in the Table 2-2.

Fishing:

Management of these activities would be the same as Alternative B plus directing visitors to an additional unit. Anglers would be allowed to fish at the Brierwood Unit after piers and trails are developed.

Wildlife Observation:

Management of these activities would be the same as Alternative B plus one additional area would be opened at Palmetto Unit.

Wildlife Photography:

Management of these activities would be the same as Alternative B plus the construction of photo blind at the McGuire unit.

Environmental Education:

Management of these activities would be the same as Alternative B plus the development of on-refuge EE programs in conjunction with the rehabilitation of the lodge as an educational facility at the Champion Lake Public Use Area.

Interpretation:

Management of these activities would be the same as Alternative B plus the development of on-refuge interpretive programs at the Visitor Center once it is constructed. Additionally, provide kiosks at six remaining public use areas.

2.4.5.3 Facilities

Public Use Access:

Management of these facilities would be the same as Alternative B plus opening a trail system for Champion Lake South.

Public Use Facilities:

Management of these facilities would be the same as Alternative B plus the construction of an on-refuge visitor center along FM 1011 adjacent to administrative headquarters. This alternative would also include constructing a fishing pier at Brierwood Unit and full-service bathroom at Champion Lake Public Use Area.

Administrative Facilities:

Management of these facilities would be the same as Alternative B plus the rehabilitation of the two-room log cabin at Champion Lake. This would be used for additional staff or volunteers offices.

Staffing and Budget:

Base funding and staffing would increase in addition to Alternative B in order to meet the needs of increased habitat management and public use opportunities. New construction and maintenance would be increased over levels provided for under Alternative B. Additional facilities for administrative uses (and for public uses) would be upgraded or newly built to accommodate increased staffing and public use. The expanded staff would include additions of one law enforcement officer, one biologist, and one assistant Refuge Manager.

Table 2-5. Comparison of Alternatives

Issues	Preliminary Range of Alternatives Alternative A No Action Current Management	Alternative B	Alternative C Proposed Action
Issue 1: How will the refuge address habitat and wildlife management issues to ensure the conservation, diversity, and enhancement of the bottomland hardwood forests?			
Native Flora/Fauna Conservation	Conservation/restoration of bottomland hardwood forests; restore native flora; reintroduce native fauna; manage native nuisance flora/fauna	Same as Alternative A plus use prescribed fire for resource management and initiate baseline monitoring for flora and fauna	Same as Alternative B
Invasive Flora/Fauna Management	Removal of exotic and invasive flora/fauna as resources permit; Prevent reintroduction of exotic and invasive flora/fauna as resources permit	Same as Alternative A plus develop invasive species strike team and map "hotspots" to prioritize management efforts	Same as Alternative B
Wetland Management	Maintain the integrity of water control structures/levees; conduct water quality sampling and fish surveys	Same as Alternative A plus small-scale restoration of hydrological flow at Champion Lake South Unit	Same as Alternative B
Land Acquisition	Acquire lands from willing sellers within the approved acquisition boundary on a case-by-case basis	Update Trinity River Floodplain Habitat Stewardship Program and Land Protection Plan to update the acquisition boundary; assign Realty Specialist to office	Same as Alternative B
Climate Change	Planting trees to sequester carbon, use "green" technologies wherever possible, and recycle	Same as Alternative A plus gather baseline inventory and monitoring data	Same as Alternative B
Resource Protection	LEO patrols and opportunistic observations by other refuge staff conducted on 25,000 acres	Same as Alternative A plus add patrols using other refuge's officers	Same as Alternative B plus add an additional refuge officer to patrol up to 80,000 acres

Issues	Preliminary Range of Alternatives Alternative A No Action Current Management	Alternative B	Alternative C Proposed Action
Issue 2: How will the refuge provide public use opportunities while ensuring the conservation, diversity, and enhancement of the bottomland hardwood forests?			
Hunting	Designated units open to hunting by permit only for big game, upland game, and waterfowl currently in 8 units	Same as Alternative A plus open 1 additional unit for big game at Champion Lake South Unit	Same as Alternative B plus open 1 additional unit for big game and upland game at Palmetto Unit
Fishing	Visitors are directed to Champion Lake and Pickett's Bayou	Same as Alternative A plus direct visitors to McGuire and Silver Lake units when piers are developed	Same as Alternative B plus direct visitors to Brierwood Unit once pier is developed
Wildlife Observation	Refuge open to wildlife observation; Visitors directed to 8 public use areas	Same as Alternative A plus open 1 additional area at Champion Lake South Unit	Same as Alternative B plus open 1 additional area at Palmetto Unit
Wildlife Photography	Refuge open to photography; visitors directed to 8 public use areas	Same as Alternative A plus construct photo blind at Brierwood Unit	Same as Alternative B plus construct photo blind at McGuire Unit.
Environmental Education	No EE programs occur on the refuge	Develop off-refuge EE curricula working with local schools to meet State requirements	Same as Alternative B plus develop on-refuge program with the completion of the educational facility at Champion Lake Public Use Area
Interpretation	Host two on-refuge annual festivals on Earth Day and on fishing day; host approximately 6 off-refuge annual events such as county jubilee and various public speaking events	Same as Alternative A plus host approximately 10 additional off- refuge events as requested; develop and provide self-guided interpretative materials at Champion Lake and Brierwood units	Same as Alternative B plus develop interpretive programs at visitor center; develop and provide kiosks in all areas with public use facilities

Issues	Preliminary Range of Alternatives Alternative A No Action Current Management	Alternative B	Alternative C Proposed Action
Issue 3: How will the refuge manage facilities while ensuring the conservation, diversity, and enhancement of bottomland hardwood forests?			
Public Use Access	Vehicular access allowed on designated unpaved roads; walk-in only access allowed on 8 designated units; boating access allowed on Pickett's Bayou and Champion Lake	Same as Alternative A plus improve road to McGuire Pond; establish canoe/kayak launch site at Brierwood Unit	Same as Alternative B plus open trail at Champion Lake South Unit
Public Use Facilities	Limited facilities at Champion Lake Public Use Area include: fishing pier, butterfly garden, parking, and portable toilet; 7 other public use areas have parking lot only and 1 photo blind	Rehabilitate lodge at Champion Lake Public Use Area plus pave road at Champion Lake Public Use Area and construct fishing pier at McGuire Unit	Construct visitor center adjacent to headquarters plus construct fishing piers at Brierwood Unit and full-service bathroom at Champion Lake Public Use Area
Administrative Facilities	Refuge owned headquarters and storage facility along FM 1011	Construct a maintenance shop at Champion Lake equipment storage area	Rehabilitation of 2-room log cabin at Champion Lake for staff and volunteer offices
Budget Needs to Implement Alternative (based on FY 2011 dollars)	**$660,000*** ***Currently includes:* Refuge base operational budget; annual maintenance; Youth Conservation Corps; volunteers; Exotic Control Program; Student Conservation Association Interns; and annual vehicle/equipment replacement**	**$2,862,000**** ****Same as Alternative A PLUS 2 more full-time staff (maintenance worker, recreation planner); research programs; deferred maintenance Projects; and increased funding for annual repair and replacement of major equipment**	**$4,330,000***** *****Same as Alternative B PLUS 3 more full-time staff (bio tech, law enforcement officer, deputy manager), 2 seasonal staff, construction of Visitor Center, and other deferred maintenance projects (road, trail, piers, parking lot maintenance)**
Staff Needs to Implement Alternative	(Current Staff) 5	7	10

Table 2-6. Mitigation Measures and Monitoring

Mitigation Measure and Monitoring Description	Alternatives
General	
Gather updated resource baseline data to form a current analytical base from which to judge future management impacts and effects.	A, B, C
Develop and implement an extensive and ongoing monitoring program to judge management action effectiveness and provide alternative solutions that would lessen any short-term or long-term negative impacts on fish and wildlife resources and other environmental elements.	B, C
Regulate management actions to adequately address any potential impacts. For example, activities would be conducted during times of the year and in areas where breeding and nesting activities are at a minimum.	A, B, C
Prohibit or restrict activities in areas where listed species occur. The potential effects of CCP implementation on federally listed species has been reviewed per an Intra-Service Section 7 Consultation (See Appendix F).	A, B, C
Seek public input in future planning for any management actions that are considered major Federal actions, as per NEPA requirements.	A, B, C
Air Quality	
For prescribed burning, the following precautions would be in place: habitat management involving prescribed burning will occur only under ideal weather conditions, and smoke management practices will be implemented during all burning events; an approved prescribed Burn Plan, favorable weather conditions, and adequate firefighting resources all work together to prevent pervasive air pollution and prevent adverse effects to air quality.	A, B, C
Blowing dust is abated by performing work during times of low to no wind.	A, B, C
Water Management and Quality	
Avoid spraying during or immediately before a rainfall event to reduce the chances of run-off and herbicide delivery to water resources.	A, B, C
Agency-approved application practices and guidelines will be implemented during all herbicide treatments and prescribed fire events and under an approved plan to prevent or minimize effects to water quality.	A, B, C
Conduct water quality analysis, throughout the refuge as needed.	A, B, C
Spraying will not occur after a moderate/heavy rain or if significant precipitation is forecasted within six hours to reduce the chances of run-off and herbicide delivery to water resources.	A, B, C
Soils	
Erosion fences will be established on construction sites when erosion is a concern.	A, B, C
Habitat and Wildlife	
Take a proactive approach to working with information provided through biological surveys, inventories, and monitoring to assess needs and results of carbon sequestration efforts, hunting program, bat research, bottomland hardwood restoration projects, and exotic pest plant and animal control programs.	A, B C
Refuge management activities would not result in direct take of any federally listed species.	A, B, C
No fishing is allowed within 200 yards of any documented colonial waterbird rookeries from March 1 through August 31 to minimize disturbances to nesting birds.	
Oil and Gas Activities	
The refuge will work with oil and gas companies to ensure that to the greatest extent practicable, all exploration, development, and production operations are conducted in such a manner as to minimize the damage, erosion, pollution, or contamination to the lands, waters, facilities, and vegetation of the area.	A, B, C

3.0 AFFECTED ENVIRONMENT

Refer to Chapter 3 of the Comprehensive Conservation Plan.

4.0 ENVIRONMENTAL CONSEQUENCES

This section analyzes and discusses the potential environmental effects or consequences that can be reasonably expected by the implementation of each of the three alternatives described in Chapter 2 of this EA. For each alternative, the expected outcomes are portrayed through the 15-year life of the CCP.

This chapter identifies, describes, and compares the impacts of implementing the three alternatives proposed in this EA on the refuge's physical, biological, and socio-economic environment. Current management (Alternative A, the No Action Alternative) provides the basis for comparing the effects of the action alternatives (Alternatives B and C). The direct, indirect, and cumulative effects of each alternative are analyzed in this chapter, as defined in section 4.1.

An analysis of the effects of management actions on the physical environment has been conducted for air quality, water resources, and soils. Analysis of the effects of management actions on the biological environment have been conducted for vegetation/habitat, wildlife, and species of special concern (e.g., threatened and endangered species). Although all plant, animal, and fish species on the refuge are important, many species are not expected to experience any change as a result of implementing any of the alternatives. Therefore, the only species discussed are those that will be impacted. An analysis of the effects of management actions on the socio-economic environment were conducted for cultural resources, local populations and economy, public use opportunities, aesthetic/visual resources, and visitor use facilities.

Potential impacts are described in terms of type, duration, intensity, and context (scale). General definitions are as follows.

4.1 Definition of Terms:

Effects:

Direct effects are the impacts that would be caused by the alternative at the same time and place as the action.

Indirect effects are impacts that occur later in time or distance from the triggering action.

Cumulative effects are incremental impacts resulting from other past, present, and reasonably foreseeable future actions, including those taken by Federal and non-Federal agencies, as well as undertaken by private individuals. Cumulative impacts may result from singularly minor but collectively significant actions taking place over a period of time.

Impact Type:

Beneficial impacts are those resulting from management actions that maintain or enhance the quality and/or quality of identified refuge resources or recreational opportunities.

Adverse impacts are those resulting from management actions that degrade the quality and/or quantity of identified refuge resources or recreational opportunities.

Duration of Impacts:
Short-term impacts affect identified refuge resources or recreational opportunities; they occur during implementation of the management action but last no longer.

Medium-term impacts affect identified refuge resources or recreational opportunities that occur during implementation of the management action; they are expected to persist for some time into the future though not throughout the life of the CCP.

Long-term impacts affect identified refuge resources or recreation opportunities; they occur during implementation of the management action and are expected to persist throughout the life of the CCP and possibly longer.

Intensity of Impact:
Negligible impacts result from management actions that cannot be reasonably expected to affect identified refuge resources or recreational opportunities at the identified scale.

Minor impacts result from a specified management action that can be reasonably expected to have detectable though limited effect on identified refuge resources or recreation opportunities at the identified scale.

Moderate impacts result from a specified management action that can be reasonably expected to have apparent and detectable effects on identified refuge resources or recreation opportunities at the identified scale.

Major impacts result from a specified management action that can be reasonably expected to have readily apparent and substantial effects on identified refuge resources and recreation opportunities at the identified scale.

Scale of Impact:
Site-specific impacts occur solely within the project area.

Local impacts are those that can be reasonably expected to have noticeable effects within and immediately surrounding the project area.

Refuge-wide impacts are those that can be reasonably expected to have noticeable effects across the entire refuge landscape.

Widespread impacts are those that can be reasonably expected to have noticeable effects beyond the refuge landscape.

4.2 Effects Common to all Alternatives:

Several potential effects will be very similar under each alternative, as summarized in this section.

Climate Change

Carbon sequestration is climate-related impact to be considered in planning. Vegetated land is a tremendous factor in carbon sequestration. Terrestrial biomes of all sorts—grasslands, forests, wetlands, tundra, and desert—are effective both in preventing carbon emission and acting as biological "scrubber" of atmospheric CO_2 (U.S. Department of Energy 1999).

Conserving the Trinity River corridor and sustaining the bottomland hardwood forest is the main management focus for this CCP. The actions proposed in this CCP would conserve or restore land and habitat, and would thus retain existing carbon sequestration efforts on the refuge and help mitigate human-induced global climate change.

One potential refuge activity in particular, prescribed burning, releases CO2 directly into the atmosphere from the biomass consumed during combustion. The refuge prescribed fire program is primarily limited to small, isolated islands of early successional grasslands to promote wintering habitat for Henslow's sparrow and promoting about 200 acres of fire resistant isolated pine stands. Overall, there should be little or no net change in the amount of carbon sequestered at the refuge from any of the proposed management alternatives. The use of green technology and products would reduce the refuge's carbon footprint.

Predicted long-term climate-change-related impacts would occur regardless of which of the management alternatives under consideration here is ultimately selected by the Service. Over the 15-year life of the CCP, impacts associated with climate change are likely to be adverse, minor to moderate, and widespread.

Impacts from Herbicide Application

Chemical herbicides are one of the main methods the Service uses to control invasive plants on national wildlife refuges. Herbicides can efficiently and effectively suppress or kill unwanted plants and used in such a manner as to minimize adverse effects on non-target resources. An herbicide suppresses or kills plants by decreasing their growth, seed production, and competitiveness (USFWS 2009).

The benefits of herbicides in controlling invasive plants must be weighed against the potential for exposure and impacts to human health, non-target organisms, and the environment. The Federal and State governments regulate herbicides to ensure that they do not pose unreasonable risks. The Environmental Protection Agency (EPA) requires extensive test data from herbicide producers to show that their products can be used safely. EPA scientists and analysts carefully review these data to determine whether to register (license) an herbicide and whether certain restrictions on use are needed (USFWS 2009). More information about EPA registration and re-registration of chemicals can be found at: http://www.epa.gov/pesticides.

EPA evaluates both exposure and toxicity to determine the risk associated with use of a given herbicide. People, non-target flora and fauna, water, and soil may all be exposed directly or indirectly to herbicides during applications and subsequent movement; this exposure can be minimized or avoided by following proper instructions and labels. For wildlife and humans, herbicides may enter the body through the skin, by swallowing, and by breathing. Once herbicides have been applied, the potential for exposure is further influenced by the many biotic (living) and abiotic (non-living) processes that affect the fate of herbicides in the environment.

Herbicide use on national wildlife refuges must be in compliance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and other Federal laws and authorities. The use of herbicides and other pesticides on refuges is governed by the U.S. Department of Interior Integrated Pest Management Policy (517 DM 1), the Service's Pest Management Policy and Responsibilities (30 AM 12), and the Service's Refuge Manual (7 RM 14).

Service policies and the Refuge Manual state that we will use herbicides only after full consideration of management alternatives, including chemical, biological, physical, and no action. If, after considering all of these factors, managers determine that we must use herbicides to meet invasive plant management objectives, then we will use the least hazardous, most effective herbicides to meet those objectives (USFWS 2009).

Refuge staff must complete a Pesticide Use Proposal (PUP) whenever an herbicide on a refuge is used, including applications by staff, volunteers, contractors, or in association with a right-of-way easement or Special Use Permit. Individuals with duties related to plant management and knowledge and experience with herbicides typically complete and submit the PUP. An online PUPS database enables staff to complete and submit PUPS electronically at https://systems.fws.gov/PUPS/. Depending on the pesticide and other conditions listed in the PUP, the PUP may need regional office review and approval, and under some circumstances, the regional office may need to submit the PUP for Washington Office review and approval. PUPS that are part of an approved integrated pest management plan may receive five-year approvals. The Director periodically issues specific guidance that includes details about PUP approval authority and which herbicides and application scenarios require review beyond the field station.

As outlined in 569 FW 1.9 J (USFWS 2010), Refuge Managers or project leaders must ensure that:

- Pest management decisions are consistent with all applicable policies, laws and regulations;
- Anyone applying pesticides, releasing biological control agents, and conducting other Integrated Pest Management (IPM) activities has the appropriate training and equipment necessary to protect their safety and health;
- The refuge will apply pesticides only after the appropriate reviewer approves the PUP;
- The refuge will establish threshold levels of damage or pest populations according to Service or field station goals and objectives and applicable laws;
- Staff store, handle, and dispose of pesticides and pesticide containers in accordance with the label and in a manner that safeguards human, fish, and wildlife health and prevents soil and water contamination; and
- Submit annual reports documenting pesticide use and efficacy into the online PUPS database (USFWS 2009).

In addition to Service policy, the approved PUPs include measures to minimize environmental impacts through the following best management practices:

- Calibrate application equipment
- Application must be in accordance with chemical label
- Field scouting/monitoring before pesticide application
- Use pesticide application buffers around sensitive areas
- Use lowest effective application rate
- Herbicides will not be applied within 100 feet of wetlands
- Foliar applications will not be made if wind speeds are in excess of 10 mph
- Pesticides will not be applied after a moderate/heavy rain or if significant rainfall is forecast within six hours

Each of the alternatives would follow the procedures and each would use the same herbicides and have approximately similar rates of application. Alternative B would develop an invasive species strike team and map hotspots to prioritize efforts and attempting to increase from approximately 200 acres treated per year to up to 600 acres treated per year. Environmental impacts associated with herbicide use throughout the refuge would be both adverse and beneficial. Adverse impacts may occur from localized toxicity of non-target organisms (plant and animal) and would be short-term to long-term (short-term for any given application, but long-term if the applications are repeated regularly). Herbicides would also have negligible, short-term adverse impacts on water quality. They may potentially leach into and pollute groundwater and may be flushed into surface water if improperly applied. However, proper application under conditions specified on product labels and the use of best management practices minimizes movement of herbicides from their intended targets.

Beneficial impacts from herbicide application would also occur under each alternative. Benefits would result from control of invasive plants that threaten to infest large areas, displacing native species of flora and fauna; these beneficial effects would be long-term, refuge-wide, and of moderate intensity.

Table 4-1 contains a list of approved chemical herbicides that are used on the refuge to control invasive plants. Each alternative would continue to allow for the use of these herbicides.

Table 4-1. Herbicides Used on Trinity River NWR

Active Ingredient	Brand Name	Target Species	Application	Purpose
Imazapyr	Habitat, Imazapyr E-pro 2	Chinese tallow, Japanese mimosa, Chinaberry, trifoliate orange, water hyacinth, alligatorweed	Foliar	Eradicate invasive flora in bottomland forest and waterways
Imazamox	Clearcast	Chinese tallow, Japanese mimosa, Chinaberry, trifoliate orange, water hyacinth, alligatorweed	Aerial, Foliar	Eradicate invasive flora in bottomland forest and waterways
Glyphosate	Rodeo, Glyphos Aquatic	Chinese tallow, Japanese mimosa, Chinaberry, trifoliate orange, water hyacinth, alligatorweed	Foliar	Eradicate invasive flora in bottomland forest and waterways
Triclopyr	Garlon 4	Chinese tallow, Japanese mimosa, Chinaberry, trifoliate orange, water hyacinth, alligatorweed	Foliar, basal bark	Eradicate invasive flora in bottomland forest and waterways
Metsulfuron methyl + aminopyralid	Chaparral	McCartney Rose	Foliar	Eradicate invasive flora along pastures and levees

Impacts from Biological Control Agents

Releasing approved biological control agents such as insects (i.e. salvinia weevils, *Cyrtobagous salviniae*) are an important component of an Integrated Pest Management (IPM) approach to effectively controlling and managing populations of invasive exotic plant species. The effects of

biological control agents are often subtle, but when combined with other control techniques such as herbicides, physical controls, public awareness, and mechanical controls, they can effectively limit the further spread and establishment of unwanted exotic plant species. Biological control is the intentional manipulation of natural enemies by humans for controlling pests. Biological control of aquatic weeds is especially attractive because rivers and lakes are sensitive ecosystems important to wildlife and human health (Jackman 1999).

Invasive aquatic vegetation such as giant salvinia (*Salvinia molesta*) is one of the greatest threats to the aquatic resources of Texas. Salvinia was most likely transported from South America to the U.S. through the aquatic garden or aquarium trade. It was first discovered in the Houston area in 1998 and has been reported on 18 Texas reservoirs. Given ideal growing conditions, giant salvinia can double the area it covers in 7-10 days, forming thick mats that disrupt water chemistry, make aquatic habitat unsuitable for native species, and interfere with boating access (Moret 2011).

Salvinia molesta is a free-floating aquatic fern. In its native range in southeastern Brazil, giant salvinia is a component of the floating and emergent plant communities, supports a variety of natural enemies (Forno and Bourne 1984), and normally does not form the extensive mats prevalent in its exotic range.

The family Salviniaceae includes only one genus, Salvinia. The genus Salvinia is composed of 10 species that occur naturally in South America, Africa, and Asia. There are no native members of the Salviniaceae in the United States. However, two other families are taxonomically related to the Salviniaceae: the Azollaceae and Marsileaceae. These plant families contain species native to the United States (Lumpkin 1993).

The Azollaceae consists of the single genus Azolla. Three species of Azolla, Azolla caroliniana Willdenow, Azolla mexicana C. Presl, and Azolla filiculoides Lam. are native to North America (Lumpkin 1993).

The Marsileaceae includes two North American genera, Marsilea and Pilularia. Six species of Marsilea are in the North American flora. They are Marsilea quadrifolia Linnaeus, Marsilea ancylopoda A. Braun, Marsilea oligospora Gooding, Marsilea mollis B. L. Robinson and Fernald, Marsilea macropoda Engelmann, and Marsilea vestita Hooker and Greville (Johnson 1993).

Numerous studies have shown that the release of salvinia weevil are host specific. A total of 53 plants from 33 families were tested to determine if weevils would utilize these species once host plant was eliminated. Results showed that in host specificity tests, only two non-target plants showed slight indication of feeding but no development or reproduction of the weevils took place on those plants (USDA APHIS, 2001).

The salvinia weevil has proven highly effective in controlling salvinia in equatorial regions and areas with climates similar to their native range in South America (Moret 2011). Current control agents consisting of salvinia weevils are used in conjunction with representatives from TPWD. TPWD raises the weevils and assists refuge staff in stocking various ponds located throughout the refuge. They also assist in monitoring results of the stocking program.

In 2004, TPWD initiated large-scale releases of salvinia weevils in Toledo Bend area of eastern Texas approximately 100 miles from the refuge. Since that time, weevils have been collected

from the environment and distributed by Aquatic Habitat Enhancement (AHE) office of TPWD on Toledo Bend, Caddo Lake, B.A. Steinhagen, and the refuge. Weevils are transported with infested salvinia and distributed on salvinia mats where weevil populations are low or nonexistent. Introduction of weevils are introduced into areas that are not easily accessible and difficult to treat with herbicides (Moret 2011).

Research has shown weevils over-winter in east Texas, although a significant reduction of adult weevils occurs every year due to cold temperatures. Weevil populations may not fully recover from cold weather until late spring or early summer. In the meantime, giant salvinia continues to expand until the weevil population reaches effective levels. Therefore, to provide maximum biological control it will be necessary to raise weevils and release them to the environment in early spring and throughout the growing season (Moret 2011).

In Texas, raising and harvesting salvinia weevils under controlled conditions has been practiced by the U.S. Army Corps of Engineers at the Lewisville Aquatic Environmental Research Facility and the USDA Animal and Plant Health Inspection Service (APHIS). APHIS has also published extensive guidelines on raising and harvesting weevils for controlling giant salvinia (Moret 2011).

With financing from the Service, AHE constructed a large-scale weevil rearing facility at the Jasper Fish Hatchery in May 2010. Additional funding from the Service and a grant from Senator Kay Bailey Hutchison provided the materials for a similar weevil rearing facility to be built at the Caddo Lake National Wildlife Refuge in Karnack, Texas. The Caddo facility was built by the cooperative efforts of TPWD and the Texas AgriLife Extension Service and now operates as the Center for Invasive Species Eradication (CISE).

Since 2004, Texas AgriLife personnel have released over 70,000 adult weevils from the CISE facility to supplement populations on Caddo Lake. AHE has released 42,000 to 46,000 adult salvinia weevils in less than two months from the facility at the Jasper State Fish Hatchery. Research suggests that for every adult weevil there may be three or four times as many weevil present in earlier life stages within the infested material (Moret 2011).

Despite the early success of the weevil rearing projects and Caddo Lake and the Jasper Fish Hatchery, it is important to remember that biological control is a long-term option. It may take years of research and focused management for the weevils to reach their full potential.

The successful biological control of a giant salvinia will result in reduction, not eradication, of the target weed. Therefore, biological control agents are unlikely to eliminate the plant, except perhaps in isolated locations. In cases of local eradication, the weevils will disperse to find new salvinia or starve. Overall, as the population of the weed declines, so will the population of the insect. The result is equilibrium between weed and insect where no further weed controls are necessary. Although giant salvinia will remain as part of the flora of the United States, it will no longer dominate and damage the local ecosystems as it once did (USDA 2002).

Beneficial impacts may occur from localized introduction of weevils controlling populations of salvinia, and since literature shows the weevil is host specific and no other negative impacts have been identified in over eight years of treatments, no adverse impacts are anticipated. Impacts would be short-term to long-term (short-term for any given application, but long-term if the applications are repeated regularly). Best management practices, along with

coordination with TPWD and field observations of treated areas, will dictate rates and applications of biological control agents under each alternative.

Each of the alternatives would allow similar rates of application in conjunction with TPWD and the latest scientific literature to support treatment areas. Beneficial impacts from biological control agents would also occur under each alternative. Benefits would result from control of invasive plants that threaten to infest large areas, displacing native species of flora and fauna; these beneficial effects would be long-term, refuge-wide, and of moderate intensity.

Petroleum Development Impacts

Oil and gas drilling or production is not currently occurring on the refuge. On the refuge, 3-D seismic activities do occur and require a Plan of Operations produced at the operator's expense. If and when drilling/extraction seems likely to occur on the refuge, the companies involved will be required to present the Refuge Manager with a Plan of Operations for those activities. Each operator and/or facility operator must have a current Oil Discharge Prevention and Contingency Plan outlining procedures for accidental releases. Sampling, remediation, and restoration of contaminated sites would be the responsibility of the operator and/or facility operator and would occur in consultation with the Service and the appropriate State agency. All sites no longer in use must be sampled for contaminants at the operator's expense to ensure proper disposal of material and that refuge staff and/or the visiting public are not exposed to contaminants. The Service may request that wells, roads, pipelines, and associated infrastructure and facilities not needed to support ongoing operations be removed and the sites restored to the satisfaction of the Refuge Manager.

Reasonable restrictions include restriction on time of year for operations designed to minimize wildlife disturbance during certain months and restriction on equipment to include low-pressure tired vehicles and small drilling equipment in the bottomlands. The locations of production lines and temporary and permanent storage of equipment and facilities are negotiated prior to drilling. Only closed loop drilling operations would be permitted. All oil and gas operations must hire an environmental monitor at operator's expense, who reports to the Refuge Manager and monitors all operations and ensures habitat damage is minimized. In Texas, refuges may accept payment for restoration work required after the operations are completed. The refuge will then conduct restoration and monitoring efforts utilizing those funds.

Petroleum exploration, extraction, and facilities operations would affect each alternative equally if initiated on the refuge. These impacts would be adverse, long-term, site-specific, and of negligible to minor intensity.

Cultural Resources

The Service is responsible for managing archeological and historic sites found on national wildlife refuges. Undertakings initiated on the refuge, as well as any ground disturbing activities, have the potential to impact cultural resources. The consequences for cultural resources would be the same under each management alternative. All refuge undertakings and ground disturbing activities to occur on the refuge are subject to Section 106 of the National Historic Preservation Act and must include consent from the State Historical Preservation Office (SHPO).

The Refuge Manager, during early planning, will provide the Regional Historic Preservation Officer (RHPO) with:

1. a description and location of all projects, activities, routine maintenance, and operations that affect ground and structures;
2. requests for permitted uses; and
3. alternatives being considered.

The RHPO analyzes these undertakings for potential to affect historic properties and enters into consultation with the SHPO and other parties as appropriate.

The Refuge Manager will ask the public and local government officials to identify concerns about impacts caused by the undertaking in a notification that is at least equal to, and preferably with, the public notification carried out for NEPA and compatibility.

Impacts on cultural resources associated with each alternative would at most be negligible to minor, site-specific, and long-term.

Environmental Justice

Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority and Low-Income Populations; February 11, 1994) was designed to focus the attention of Federal agencies on the environmental and human health conditions of minority and low-income populations, with the goal of achieving environmental protection for all communities. The order directed Federal agencies to develop environmental justice strategies to aid in identifying and addressing disproportionately high and adverse human health and environmental effects of their programs, policies, and activities on minority and low-income populations. The order intends to promote nondiscrimination in Federal programs substantially affecting human health and the environment and to provide minority and low-income communities with access to public information and opportunities for participation in matters related to human health and the environment.

None of the three management alternatives described in this EA would disproportionately place any adverse environmental, economic, social, or health impacts on minority and low-income populations. Implementation of any alternative that includes public use and environmental education is anticipated to provide a benefit to the residents residing in the surrounding communities.

Indian Trust Assets

No Indian Trust Assets have been identified in the proposed acquisition boundary of the refuge. There are no reservations or ceded lands present. Because resources are not believed to be present, no impacts are anticipated to result from implementation of either alternative described in the EA.

Other Common Effects

None of the alternatives would have more than negligible or, at most minor, effects on topography, noise levels, transportation, waste management, human health and safety, or visual resources.

4.3 Physical Environment:

4.3.1 Impacts on Air Quality

Each of the alternatives would implement the following mitigation measure to protect air quality:

- For prescribed burning, the following precautions would be in place: habitat management involving prescribed burning will occur only under ideal weather conditions, and smoke management practices will be implemented during all burning events; an approved prescribed Burn Plan, favorable weather conditions, and adequate firefighting resources all work together to prevent pervasive air pollution and prevent adverse effects to air quality.
- Foliar applications of all herbicides will not be made in wind speeds greater than 10 miles per hour.

The following analysis assumes implementation of this mitigation measure to protect air quality.

Alternative A - No Action (Current Management):
Actions and activities associated with Alternative A that could potentially affect air quality include equipment and vehicle operation, and landscape conservation.

Dust and emissions produced by equipment and vehicle operation associated with construction such as road maintenance would be minor and localized. Performing work during times of low to no wind would abate blowing dust. Most construction occurs as maintenance to already existing facilities or infrastructure that is small scale and localized.

Herbicides are an important management tool used to gain an upper hand on the invasion of aggressive non-native flora. The refuge would continue to treat up to 200 acres annually with approved herbicides such as Rodeo and Chaparral (see Table 4.1). There is the potential for spray drift resulting from chemical control of invasive species, especially concerning aerial spraying. Herbicide applications are primarily dispersed through backpack sprayers for basal applications, sprayed off of all terrain vehicles (ATV) or from a boat mounted sprayer targeting species such as Chinese tallow, Chinaberry, trifoliate orange McCartney rose and water hyacinth.

Occasionally, under special budget allocations, opportunities exist for aerial (helicopter) spraying of larger units from 300-600 acre treatments targeting water hyacinth and alligatorweed. Herbicides and target species are identified in Table 4.1.

Dust and emissions produced by equipment and vehicle operation associated with maintenance would be minor and localized. Performing work during times of low to no wind would abate blowing dust. Furthermore, most construction occurs as maintenance to already existing facilities or infrastructure that is small scale and localized.

Continuation of management activities in Alternative A would produce adverse air quality effects that would be short-term, direct, negligible, and occur at the local scale. Vehicle use in parking areas would be negligible.

No other refuge management activities and public uses are expected to adversely affect air quality to any measurable degree.

Important beneficial impacts from Alternative A on regional air quality would accrue from the refuge's continuing management of tens of thousands of acres of bottomland hardwood forest. The extensive forests throughout the refuge serve as air filters, filtering out particulates, aerosols, and other pollutants, thus improving air quality in the region.

In summary, Alternative A would entail both adverse and beneficial impacts on air quality on the Trinity River NWR. Impacts from vehicular operation would be adverse, short-term, negligible, and localized. The beneficial impact of Alternative A on air quality would be minor, direct/indirect, long-term, and widespread.

Alternative B:
Alternative B will initiate a small prescribed fire program burning up to 400 acres throughout the refuge. Prescribed fire would have generally minor, sometimes moderate, adverse impacts that are short-term in duration at the local to widespread scales due to smoke emitted from burning vegetation. Prescribed fire would be used on the refuge as a management tool to enhance or restore habitat, reduce hazardous fuels, and maintain small isolated pockets of grasslands. Smoke consists of particulate matter, aerosols, soot, and a variety of gases, all of which degrade air quality. Prescribed burns will be conducted according to stipulations identified in Fire Management Plans where suitable weather conditions exist to dissipate smoke where air masses are not stagnant, and smoke will rise and disperse, minimizing impacts on ground level air quality, visibility, and human health.

An increase of the annual average use of herbicides on invasive species would occur from 200 acres to up to 600 acres depending on available budget and resources. A strike team will be developed to help target, map, and treat invasive species hotspots to improve efficiency and long-term impacts of invasive species.

Under this alternative, the amount of inventory and monitoring would also increase, along with visitor services increasing the amount of vehicular traffic on the refuge. Paving the road to Champion Lake, rehabilitation of the lodge, and construction of a maintenance shop and equipment storage area at Champion Lake would be initiated.

Under this alternative, additional units will be opened for wildlife-dependent public use activities such as improving the road to McGuire Pond and establishing canoe/kayak launches at Brierwood unit.

These activities may have a greater adverse impact on air quality. Impacts would be due to increased dust and emissions produced by equipment, particulate matter from prescribed burning, vehicle operations associated with more public uses, maintenance of more trails and parking areas, and larger scale construction projects. Although the adverse impacts would be slightly greater, those impacts would be considered direct, short-term, minor, and occur at the local scale.

Alternative B would conserve and restore additional habitat acreage, with a focus on bottomland hardwood forests and associated wetlands. By providing for additional habitat and

filtering foliage, this alternative would be slightly more beneficial for air quality than Alternative A.

Alternative C - Proposed Action:
The effects of Alternative C are expected to be similar to Alternative B; however, the construction of a new visitor center, opening of additional units for wildlife-dependent public use activities, and increased maintenance requirements may have a greater adverse impact on air quality. Impacts would be due to increased dust and emissions produced by construction activities, as well as equipment and vehicle operations associated with more public uses. Although the adverse impacts would be slightly greater, those impacts would still be considered direct, short-term, minor, and occur at the local scale but would be offset by the addition of bottomland hardwood forest with additional opportunities of filtering foliage. Although the adverse impacts would be slightly greater than Alternative A and B, those impacts would be considered direct, short-term, minor, and occur at the local scale.

Due to the greater amount of habitat conserved under Alternative C, the beneficial impacts on air quality from habitat conservation, management, and restoration would be greater than Alternatives A and B. These benefits would be long-term, moderate, and widespread.

4.3.2 Impacts on Water Resources

Each of the alternatives benefits water resources, both in terms of quality and quantity, simply by maintaining and conserving large areas of healthy, vegetated habitats that protect soils and waters. These vegetated habitats filter out contaminants; minimize erosion, turbidity, and sedimentation; and regulate water flows by serving as “sponges” that soak up rainfall and slowly release moisture back into the system.

Each of the alternatives would implement the following mitigation measures to further protect water quality:

- Spraying will not occur after a moderate/heavy rain or if significant precipitation is forecasted within six hours to reduce the chances of run-off and herbicide delivery to water resources;
- Agency-approved application practices and guidelines will be implemented during all prescribed burn events and under an approved plan to prevent or minimize effects to water quality; and
- Conduct water sampling throughout the refuge.

The analysis below assumes implementation of these mitigation measures to protect water quality.

Alternative A - No Action (Current Management):
The following activities that would continue under Alternative A could potentially have impacts on water quality include invasive species control, herbicide use, and oil and gas operations. Herbicide use and oil and gas operations were discussed previously in Section 4.2, Effects Common to All Alternatives.

Herbicides have the potential of leaching into and polluting groundwater and getting flushed into surface water if improperly applied. Proper application under conditions specified on

product labels as well as refuge-specific mitigation measures with the use of best management practices minimizes movement of herbicides from their intended targets. Therefore, impacts on water quality are expected to be negligible to minor, localized, and short-term. Habitat conservation efforts throughout the refuge would have beneficial, moderate, long-term, and widespread effects on water quality (extending beyond the boundaries of the refuge).

Alternative B:
Under Alternative B, a small prescribed fire program would be initiated on the refuge targeting approximately 200 acres in four refuge units. This alternative will also update the acquisition boundary and protect additional bottomland hardwood forests that have beneficial effects on both water quality and quantity. The effects of Alternative B are expected to be similar to Alternative A with additional undisturbed protected acres.

This alternative will initiate a small-burn prescribed fire program but only up to 400 acres are targeted for prescribed burning under the CCP in four separate units. These small burns will reduce herbaceous vegetation and have short-term impacts on hydrological flows that might be more vulnerable after rainfall events delivering additional sediments into hydrological systems. These effects would be adverse, medium-term, minor, and localized.

Since Alternative B would eventually protect more riparian lands and conserve their bottomland hardwood forests than Alternative A, its long-term beneficial impacts on water quality and resources would be somewhat greater than Alternative A.

Overall, Alternative B, like Alternative A, would cause both adverse and beneficial impacts. Its adverse impacts would be slight greater than Alternative A. Its beneficial impacts would be somewhat greater than Alternative A.

Alternative C - Proposed Action:
Under Alternative C, impacts on water resources would be the same as Alternative B.

4.3.3 Impacts on Soils:

Each of the alternatives would implement the following mitigation measure to protect soils:

- Erosion fences will be established on construction sites when erosion is a concern.

The analysis below assumes implementation of this mitigation measure to protect soils.

Alternative A - No Action (Current Management):
The following activities that would continue under Alternative A could potentially impact refuge soils: maintenance activities, road and trail maintenance, prescribed fire and fire suppression, public use facilities, feral hog rooting, and habitat conservation. All of these activities, with the exception of habitat conservation, would have adverse effects on soils; habitat conservation would have a beneficial effect.

Construction activities (including excavation), road maintenance, and some fire suppression and prescribed fire activities all have the potential to disturb, compact, or disrupt and move soils. Soil movement can occur through bulldozer blades, front-end loaders, tractor discs, hand held tools from fire fighters, or by means of treads or tires. These activities remove vegetation and expose soils to potential wind and water erosion; however, the flat topography of the

refuge minimizes the risk of erosion and soil loss. When protective vegetation is stripped away and even more when soils are altered, they are then exposed to the erosive forces of wind and water. However, the constant flooding of the bottomland hardwood forest offsets the potential for erosion that is more likely to cause additional sedimentation. On nearly flat slope, water will have little or no velocity and will tend to pond rather than flow. Thus, the various cited activities would probably result in minimal actual erosion and soil loss.

The high feral hog population foraging across the refuge causes widespread soil disturbance due to their particular feeding habits, namely their aggressive rooting behavior, which rips up extensive areas removing existing vegetation and creating a seed bed for noxious weeds. While this is certainly damaging to vegetation and native plants and serves as one of the biggest threats of noxious weed invasions, the amount of soil damage it causes is unclear, since the area's flat topography does not facilitate soils erosion and transport offsite. The refuge's ongoing efforts to control feral hog populations helps reduce potential damage.

Impacts from habitat conservation, including conserving ground cover, which protects the soil surface and minimizes erosion, would be largely beneficial, long-term, negligible to minor, and refuge-wide. Over considerable time, conserving the protective cover provided by vegetation gives soils a chance to develop, improving stability, fertility, and depth.

Overall, Alternative A would lead to both adverse and beneficial effects on the refuges' soils. Adverse effects would tend to be direct, minor, short-term, and localized. The beneficial impact of Alternative A on soil would be direct, minor, direct/indirect, long-term, and localized.

Alternative B:
The following activities proposed under Alternative B could potentially have additional impacts on the refuge soils: the establishment of a prescribed fire program, public use facilities, additional road maintenance and development, additional construction activities such as rehabilitating the lodge at Champion Lake Public Use Area, and constructing a maintenance shop at Champion Lake with an equipment storage facility.

The prescribed fire program is designed to treat approximately 400 acres throughout the life of the CCP, maintaining nesting habit for Henslow's sparrow and other grassland nesting and migratory birds.

Under this alternative, the Land Protection Plan will be updated and the acquisition boundary will be focused on protecting more of the floodplain of the Trinity River, protecting additional bottomland hardwood forests and will have a beneficial, long-term, moderate and widespread affect on soils.

Impacts from Alternative B would be similar to Alternative A with the same type of impacts, along with additional opportunities to potentially affect soils. The types of impacts would be the same with varying degrees of soil disturbance depending on the amount and location of management.

Alternative B would lead to both adverse and beneficial effects on soils. Adverse effects would tend to be direct, minor, short-term, and localized. The beneficial impact of Alternative B on soil would be direct, minor, direct/indirect, long-term, and localized.

Alternative C - Proposed Action:
Impacts from implementing Alternative C would be similar but not identical to Alternative B.

Some additional public use facilities and wildlife recreational activities are proposed under this alternative, as well as additional construction activities such as the construction of a visitor center and rehabilitation of a two-room log cabin at Champion Lake to facilitate additional offices.

In general, under Alternative C, adverse effects (from additional facilities, activities and construction) would be more than Alternatives A and B, and beneficial effects (from habitat conservation) would be the same as Alternative B.

4.4 Biological Environment:

4.4.1 Impacts on Habitat/Wildlife

Alternative A - No Action (Current Management):
Under Alternative A, the current levels and type of management activities for bottomland hardwood forests and native wildlife would continue. Current management includes planting of native hardwood species (allowing natural regeneration) and controlling invasive species, including feral hog and nutria. These activities support native wildlife populations and diversity. Planting of native hardwood species would emphasize the benefits of native species that offer compensation to wildlife. Natural regeneration would continue to allowing stands to mature into old growth forests. Invasive species would also be controlled to prevent them from displacing and out-competing natives. Controlling feral hogs and nutria will help minimize the effects on both native wildlife and habitat.

The refuge would continue to concentrate its efforts on controlling Chinese tallow, trifoliate orange, McCartney rose, Chinaberry, water hyacinth, alligatorweed, and giant salvinia and other invasive species on a case-by-case basis to preserve the integrity of the bottomland hardwood ecosystem. Herbicidal treatments would be the primary tools used to implement this management direction, while biological control methods maybe used on approved species. Herbicide treatment would be used on 200-300 acres on average annually. Removal of feral hogs will be by hunting, removal by staff, and trapping, while nutria removal will be by trapping and removal by staff. Treatments to date focus on problem areas rather than systematic control.

The refuge would continue to prohibit grazing and continue to use chemical treatments to control Chinese tallow, deep-rooted sedge, trifoliate orange and Japanese mimosa, and any additional invasive species on an as-needed basis. A full list of chemicals and target species are identified on Table 4-1.

The refuge maintains thousands of acres of bottomland hardwood forests, a disappearing habitat along the Trinity River due to extensive water diversion; sand and gravel extraction; and suburban, industrial, and agricultural development. Currently, the refuge's emphasis in land acquisition focuses on bottomland hardwood forest and associated wetlands along the floodplain of the Trinity River.

Existing visitor use facilities and management/administrative infrastructure such as buildings, parking lots, roads, trails, pipelines, and power lines contribute to habitat fragmentation and

wildlife disturbance potential. Although these developed lands represent a small fraction of the total area of the refuge, this is still land that could have been natural habitat if not occupied by artificial structures. Habitat fragmentation is detrimental because it interferes with proper ecosystem functions in a variety of ways. The refuge attempts to minimize the continuation of fragmentation through its acquisition and restoration program, which provides undisturbed parcels of wildlife habitat.

Implementation of these management actions can result in minor short-term adverse impacts, such as temporary disturbance and displacement of native wildlife; however, these actions are specifically designed to improve habitat conditions for the benefit of wildlife. Controlling invasive flora and fauna precludes or minimizes the displacement of native species.

Under Alternative A, no appreciable changes in populations or species diversity are expected. Wildlife population and habitat management on the refuge already renders considerable benefits for resident indigenous wildlife, and these benefits would continue under this alternative. The adverse impacts from disturbance associated with public use programs such as hunting, fishing, wildlife observation, wildlife photography, and interpretation, all of which bring people into relatively close proximity to wildlife, which would be negligible to minor, short-term to long-term, localized to widespread.

Overall effects from Alternative A on habitat and wildlife on the refuge would be both adverse and beneficial. However, the beneficial effects exceed the adverse effects by providing undisturbed habitat. Adverse effects from controlling invasive flora and fauna (including the use of herbicides and biological control agents), increase in visitor use facilities (including the effects of fragmentation) would be moderate, long-term, and localized to refuge-wide. Beneficial effects of planting native hardwood species, allowing natural regeneration, and land acquisition efforts would be moderate, long-term, and refuge-wide.

Alternative B:

Under Alternative B, both adverse and beneficial impacts on habitat and wildlife would occur from the same actions and activities as under Alternative A. However, Alternative B would be more beneficial than Alternative A due to the additional actions described here.

Under Alternative B, the effects are expected to be the similar but not identical to Alternative A; however, Alternative B is expected to have minor, adverse impacts due to construction projects and disturbance through habitat management but would result in direct, moderate, beneficial impacts and would be refuge-wide. There would be moderate, beneficial impacts due to greater emphasis on research, land acquisition, exotic species control, small-prescribed fire units, law enforcement, and habitat restoration.

A prescribed fire program is designed to treat approximately 400 acres throughout the life of the CCP, maintaining nesting habitat for Henslow's sparrow and other grassland nesting and migratory birds. Since only small islands of grasslands have been identified on four separate units, the prescribed fire program will not have a drastic affect on non-target wildlife species or on non-target habitat. Impacts on wildlife will only be in the immediate vicinity of the burn and will only temporarily displace wildlife onto nearby available habitat.

The construction of a new visitor center facility and increase in wildlife-dependent recreational opportunities is expected to have a minor adverse impact in the short-term at site-

specific/local scale with minimal clearing of vegetation, wildlife disturbance, and fragmentation.

Currently, the refuge's emphasis in land acquisition focuses on bottomland hardwood forest and associated wetlands. Alternative B would continue and expand upon this acquisition emphasis on bottomland hardwoods, especially along riparian corridors. Alternative B's benefits for bottomland hardwood forests would exceed those of Alternative A's due to the additional acreage protected.

As a result of these additional actions and activities, the beneficial effects of Alternative B would outweigh the negative impacts and overall will be more beneficial for habitat and wildlife than Alternative A. Overall effects from Alternative B on habitat and wildlife would be both adverse and beneficial. Adverse effects from implementing a small-burn prescribed fire program, additional visitor service facilities and construction activities related to the development a new visitor center would be moderate, long-term, and localized to refuge-wide. Beneficial effects of an updated acquisition boundary, initiating a prescribed fire program, additional acres of noxious weed control, and increased efforts in exotic fauna control would be moderate, long-term and refuge-wide.

Alternative C - Proposed Action:
The effects of Alternative C are expected to be similar to Alternative B; however, the addition of more wildlife-dependent recreational opportunities and a new visitor center are expected to slightly increase minor, adverse impacts in the short-term at site-specific/local scale with minimal clearing of vegetation, wildlife disturbance, and fragmentation. Beneficial effects of this alternative are the additional wildlife-dependent recreational opportunities that will improve the image of the refuge and increased public appreciation for management actions that benefit habitat and wildlife.

4.4.2 Impacts on Species of Special Concern (e.g., Threatened and Endangered Species, etc)

Alternative A - No Action (Current Management):
Table 1-2 of the CCP is a list of Federal and State threatened and endangered species, as well as species of concern, that are expected to occur on the refuge and within Liberty County. Within the refuge, the only known species to occur are the piping plover and the interior least tern. Both of these birds have been known to migrate along sandy banks within the refuge but are very rare. The refuge will continue to provide habitat and implement the recovery plans of each of these species.

All the federally listed species would continue to be protected under the Endangered Species Act, and any projects that could potentially affect listed species would undergo Section 7 consultation prior to any ground disturbing activities. Appendix F is the Intra-Service Section 7 Biological Evaluation Form for this Plan.

Alternative A would manage a variety of habitats for resting, feeding, and reproductive purposes for the benefit of listed species, migratory birds, and species of special management concern. Under Alternative A, the current levels and type of management activities for bottomland hardwood forests would continue to have beneficial and adverse impacts on listed species. Current management includes continue habitat management activities to restore and

reintroduce native flora and fauna to the refuge. Management of native nuisance flora includes limited control by herbicides of cattail and frogbit along various ponds covered in those plants.

Under Alternative A, no impacts to threatened, endangered, or special status species are expected from continuation of current management. Controlling invasive flora and fauna precludes or minimizes the displacement of native species and increases the possibility of providing additional suitable habitat for listed species and species of special management concern. No effects to endangered piping plovers and interior least terns that migrate along the Trinity River are expected under this alternative. No other federally listed species occur on the refuge.

Overall, Alternative A would result in both adverse and beneficial impacts on species of special concern. Adverse effects of maintaining wildlife-dependent recreational opportunities would be minor, long-term, and localized to refuge-wide. Beneficial effects from the actions described above would be moderate, long-term, and refuge-wide to widespread.

Alternative B:
Under Alternative B, impacts would be similar but not identical to Alternative A; however, with additional land acquisition, the possibility of protecting larger undisturbed acreage increases the potential of providing habitat for listed species and species of special management concern. There is also the chance that candidate species (Rafinesque's big-eared bat) may be listed in the future.

Tools and techniques used on behalf of these species would include increases in invasive species control, research, and land acquisition. Each of these would be used explicitly to maintain and restore habitats that would benefit listed species, migratory waterfowl, Neotropical migrants, and other migratory birds.

Additional adverse impacts from disturbances associated with public use programs identified under Alternative A would be expected with additional wildlife-dependent recreational opportunities, including additional hunting proposed under Alternative B.

As a result of these additional actions and activities, the beneficial effects of Alternative B would outweigh the negative impacts and overall will be more beneficial for species of special management concern than Alternative A. Overall, the impacts are not identical to Alternative A but will still result in both adverse and beneficial impacts on species of special management concern. Adverse effects of increasing wildlife-dependent recreational opportunities would be minor, long-term, and localized to refuge-wide. Beneficial effects from additional invasive species control and an increased acquisition program would be moderate, long-term, and refuge-wide to widespread.

Alternative C - Proposed Action:
Under Alternative C, impacts would be similar to Alternative B with an additional unit open for big game hunting, additional area open for wildlife observation, an additional photo blind, and an additional trail and fishing pier. With these additional activities, adverse impacts will be slightly greater than Alternative B but would remain minor, long-term, and localized to refuge-wide. The beneficial impacts would be the same as Alternative B.

4.5 Human Environment:

4.5.1 Impacts on Socio-economics

Alternative A - No Action (Current Management):

The economic and social condition of the area would remain the same having beneficial impacts on surrounding areas. The presence and operation of the refuge provides a variety of economic benefits to the surrounding communities within a 30-mile radius. The refuge attracts local, national, and international visitors to the area, generating revenue for the local economy. Hunting, fishing, and wildlife observation opportunities account for around 22,000 visitor use days. Much of the refuge's annual budget is recycled into local businesses through refuge staff, as well as purchases of equipment and supplies. The refuge provides full-time employment for five individuals that live in nearby communities.

Under Alternative A, the economic benefits would continue at current levels. The impact of refuge operation and visitation on the local economy would be beneficial, minor, long-term, and widespread.

Alternative B:

The effects of Alternative B are expected to be more beneficial than Alternative A with additional construction activities such as a new visitor center. It is expected to have a minor, short-term benefit to local contractors. Additionally, the construction of more piers, restoring old trails, and opening additional units to wildlife-dependent public uses are expected to have long-term benefits by attracting additional visitors under controlled circumstances. Under this alternative, an increase in refuge programs, actions, staffing, budget, and spending would occur. In addition, the populations of east Texas and Houston metro areas are projected to continue growing in the near future. This would likely result in an increase in visitation to the refuge and associated visitor spending, which is a stimulus for the local economy, contributing jobs, income, and tax revenues. Relative to the enormous local economy, these socio-economic benefits would be small but still tangible and appreciated around the refuge.

Alternative C - Proposed Action:

Economic impacts of Alternative C would also be beneficial and would also exceed those of Alternative B, due to the proposed increase in refuge programs, actions, staffing, budget, and spending under this alternative and the addition of a couple more units opened for wildlife-dependent public use activities. Overall, the net effect of Alternative C on the local economy would be would be beneficial, negligible to minor, long-term, and widespread under this alternative.

4.5.2 Impacts on Aesthetic and/or Visual Resources

Alternative A - No Action (Current Management):

Under Alternative A, the impacts of refuge facilities, operations, and visitation on aesthetic and visual resources would be minor, beneficial, long-term, and local. The refuge would continue to protect thousands of acres of scenic bottomland hardwood forests, lakes, bayous and associated wetlands. In an area of the State that is developing rapidly and already has substantial industrial, commercial, and residential footprints, the maintenance of this aesthetically pleasing open space is a great benefit to the refuge and surrounding area. Oil and gas operations, if initiated, would detract from the visual quality of the refuge.

Proposed maintenance (no new construction planned) of infrastructure under Alternative A is on a small scale and would not have more than negligible, short-term, or localized adverse effects on visual resources within the refuge. Overall, the impacts of refuge facilities, operations, and visitation on aesthetic and visual resources are expected to be beneficial, moderate, long-term, and widespread.

Alternative B:
Alternative B would have both adverse and beneficial impacts on visual resources on the refuge. During the construction phase of the new visitor center, there would be minor, adverse visual effects occurring from construction equipment, dust, and the loss of vegetative cover. In the long term, visitors may experience improved visual quality of the site and its surroundings consistent with natural native vegetation.

Alternative C - Proposed Action:
The effects of Alternative C would be the same as B.

4.5.3 Impacts Public Use Opportunities

Alternative A - No Action (Current Management):
Under Alternative A, current opportunities for hunting, fishing, wildlife observation and photography, and interpretation on the refuge would all remain approximately as they are.

Existing hunting opportunities would be maintained under Alternative A. Big game, upland game, and waterfowl hunting will be open in designated units by permit only. Hunting is one of the big six wildlife-dependent public uses identified in the National Wildlife Refuge System Improvement Act of 1997 as being generally compatible with the purposes of national wildlife refuges. The beneficial impact of Alternative A on hunting opportunities would be minor, direct/indirect, beneficial, long-term, and localized.

Alternative A will continue to direct fishing opportunities to Champion Lake and Pickets Bayou. Fishing opportunities would be minor, direct/indirect, beneficial, long-term, and localized.

Alternative A will maintain current wildlife observation and photography opportunities and facilities. Visitors will continue to be directed to eight public use areas on the refuge. Wildlife observation and photography are two of the big six wildlife-dependent public uses identified in the National Wildlife Refuge System Improvement Act of 1997 as being generally compatible with the purposes of national wildlife refuges. The beneficial impacts of Alternative A on wildlife observation and photography would be beneficial, minor, long-term, and refuge-wide.

Under Alternative A, there is currently no State-recognized environmental education program on the refuge.

Alternative A would maintain existing opportunities for interpretation on the refuge. The refuge would continue to host two on-refuge annual festivals on Earth Day and on Free Fishing Day with additional off-refuge events such as a county jubilee and various public speaking events. Other interpretive opportunities are present and would continue along trails and at public use areas.

The refuge would continue to tailor messages and delivery methods to specific audiences and present them at the various interpretation events. Interpretation enhances opportunities for a

quality visitor experience on the refuge and promotes visitor understanding for America's natural resources. Visitors would continue to make their own connection with natural resources through talks, publications, brochures, fact sheets, species lists, signs, and interpretive panels.

Interpretation is one of the big six wildlife-dependent public uses identified in the National Wildlife Refuge System Improvement Act of 1997 as being generally compatible with the purposes of national wildlife refuges. Alternative A would maintain existing interpretive facilities and opportunities on the refuge, which would be a benefit. The beneficial impacts of Alternative A on interpretation would be minor, long-term, and widespread.

Under this alternative, there would also be certain adverse impacts from disturbance associated with public use programs, including hunting. The presence of hunters and other humans participating in visitor service opportunities may agitate and disturb flocks of birds, placing them under energetic and psychological stress. Even wildlife watchers may inadvertently scare off large flocks of ducks and other water associated birds, causing them to use energy unnecessarily when they need to be feeding, resting, adding weight, and building strength in preparation for migration. These adverse impacts would be short-term to long-term, negligible to minor, and localized but also potentially widespread because they have the potential to affect waterfowl populations throughout the flyway.

Alternative B:
In general, under Alternative B, the refuge would enhance wildlife-dependent recreation opportunities.

In regards to hunting, Alternative B would be slightly more beneficial than Alternative A with the opening of one additional big game and upland game unit at Champion Lake South Unit and potentially other areas within the acquisition boundary. Other areas open to hunting could occur as the refuge continues to expand and would be contingent on availability of suitable habitat, adequate species populations, and sufficient staff and budget to administer the program.

Refuges are specifically closed to hunting unless open through the Code of Federal Regulations (CFRs). The Refuge will have to go through the process of opening any additional units (Champion Lake South, Palmetto, or any additional units) to hunting in the future. Prior to any new units being open, those new hunting opportunities will be detailed in a separate environmental assessment, which when complete will be included in a Hunt Opening Package that is submitted to the Washington Office and published in the *Federal Register*. Expected minor impacts include additional trail maintenance, construction of a parking lot, and increased visitor use.

Under Alternative B, fishing opportunities would be slightly more beneficial and expanded by directing visitors to McGuire and Silver Lake units upon completion of the piers. Additionally, Alternative B would open an area for wildlife observation on Champion Lake South as well as allow for constructing a photo blind for wildlife observation and wildlife photography on the McGuire unit. Because of these new facilities for both wildlife observation and photography, Alternative B would be slightly more beneficial than Alternative A. The beneficial impacts of Alternative B on fishing would be moderate, long-term, and localized.

Under Alternative B, wildlife observation and wildlife photography would be slightly more beneficial than Alternative A with an additional open area for wildlife observation on Champion Lake South Unit. Expected minor impacts include additional trail maintenance, construction of a parking lot, and increased visitor use. The beneficial impacts of Alternative B on wildlife observation and photography would be moderate, long-term, and refuge-wide.

Alternative B would develop an environmental education program with local schools.

The environmental education program on the refuge would provide opportunities for both children and adults to learn about the refuge and natural habitats of the bottomland hardwood forests. The educational programs improve the quality of visitors' experiences and provide them with a better understanding of the benefits, issues, and challenges of natural resource conservation in the bottomland hardwood forest. The program will meet local and State of Texas education standards, allow professional development for teachers, provide community-based service organization programs, meet youth group merit badge requirements, and instill a sense of stewardship and understand of conservation issues.

Environmental education is one of the big six wildlife-dependent public uses identified in the National Wildlife Refuge System Improvement Act of 1997 as being generally compatible with the purposes of national wildlife refuges. Alternative B would develop an environmental education program on the refuge, which would benefit all surrounding counties. The beneficial impacts of Alternative B on environmental education would be moderate, long-term, and widespread.

Alternative B would expand the interpretive program at a variety of refuge venues while including additional off-refuge events and developing and providing self-guided interpretive materials at Champion Lake and Brierwood units. Due to this expanded program, Alternative B would be slightly more beneficial than Alternative A. The beneficial impacts of Alternative B on interpretation would be moderate, long-term, and widespread.

Alternative C - Proposed Action:
In general, wildlife-dependent public uses under Alternative C would be somewhat more expansive than Alternative B.

In regards to hunting, Alternative C would be slightly more beneficial than Alternative B with the opening of one additional unit for big game and upland game at the Palmetto unit. Expected minor impacts include additional trail maintenance, construction of a parking lot, and increased visitor use. The beneficial impacts of Alternative C on hunting would be moderate, long-term, and local.

Under Alternative C, fishing would be slightly more beneficial than Alternative B with the opening of one additional waterway at the Brierwood Unit. The beneficial impacts of Alternative C on fishing would be moderate, long-term, and local.

Wildlife observation and wildlife photography under Alternative C would be slightly greater that Alternative B with an additional open area for wildlife observation on Palmetto unit and an additional photo blind at Brierwood Unit. Minor impacts are expected with trail maintenance, construction of a photo blind, and increased visitor use. The beneficial impacts of

Alternative C on wildlife observation and photography would be moderate, long-term, and refuge-wide.

Under Alternative C, environmental education benefits would be greater than Alternative B with the addition of an educational facility at the Champion Lake Unit. The impact of Alternative C would be minor, direct/indirect, beneficial, long-term, and refuge-wide. Minor impacts are expected with trail maintenance and increased visitor use. The beneficial impacts of Alternative C on environmental education would be moderate, long-term, and widespread.

Overall, under Alternative C, the benefits of these additional wildlife-dependent public use opportunities would outweigh the minor adverse impacts of Alternative B.

4.5.4 Impacts on Visitor Use Facilities:

Alternative A - No Action (Current Management)
The impacts of Alternative A would be minor, direct, beneficial, long-term, and site specific. All visitor use facilities and related infrastructure, including roads, parking lots, fishing pier, kiosks, and the butterfly garden, would be maintained.

Alternative B:
Alternative B would be slightly more beneficial than Alternative A by expanding visitor use facilities such as signs, trails, canoe/kayak launch sites, kiosks, and fishing pier. Minor impacts are expected with trail maintenance, construction projects, and increased visitor use. The impacts of Alternative B would be minor, direct, beneficial, long-term, and site specific.

Alternative C - Proposed Action:
Alternative C would be slightly more beneficial than Alternative B by constructing a Visitor Center, fishing pier, kiosks, and developing a trail at Champion Lake South Unit. Minor impacts are expected with trail maintenance, construction of Visitor Center and kiosks, and increased visitor use. The impacts of Alternative C would be minor, direct, beneficial, long-term, and site specific.

4.6 Assessment of Cumulative Impacts:

A cumulative impact is defined as an impact on the environment that results from the incremental impact of the Proposed Action when added to other past, present, and reasonably foreseeable future action regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

Cumulative impacts are the overall, net effects on a resource that arise from multiple actions. Impacts can “accumulate” spatially, when different actions affect different areas of the same resource. They can also accumulate over the course of time from actions in the past, present, and future. Occasionally, different actions counterbalance one another, partially cancelling out each other’s effects on a resource. But more typically, multiple effects add up, with each additional action contributing an incremental impact on the resource. Accurately summarizing cumulative effects is difficult in that while one action increases or improves a resource in an area, other unrelated actions may decrease or degrade that resource in another area.

As stated in the Service Manual (550 FW 1 and 2), in an EA, a cumulative impact assessment should be conducted if it is determined necessary through scoping to make a determination of significance of the Proposed Action. When a cumulative effects analysis is included in an EA, the analysis need only be sufficient for the decision maker to reach a conclusion on the significance of the impact in order to determine if the preparation of an EIS is required.

Trinity River NWR exists within a matrix of surrounding land uses, including urbanization, which is expanding from Houston, with a population estimated at 5.9 million people (Texas Comptroller's Office 2009), as well as expansion from Beaumont. The refuge is surrounded mainly by cattle ranches and fragmented forests. Historically, much this area was contained within large ranches or prospected and developed for oil and gas drilling and extraction. Now the trend is toward subdivision of the large ranches for residential development, yet the oil and gas industry still has as strong presence. However, much of the land within the region is still used for agricultural purposes such as grazing, logging, or crop production.

The following section addresses the potential cumulative effects for all the alternatives and is intended to consider the activities on the refuge in the context of other actions on a larger spatial and temporal scale. The impacts of past and present actions that have taken place on the refuge are reflected in the current resource conditions (Affected Environment) as described in Chapter 3 of the CCP. The impacts of proposed future actions (for all alternatives) are discussed in earlier parts of this EA. The adverse direct and indirect effects of current refuge management and the proposed actions (all alternatives) on air, water, soil, habitat, wildlife, the local economy and population, and aesthetic/visual resources are expected to be mostly negligible to moderate and short-term to long-term. The benefits to habitat, wildlife, and public use that the Proposed Action would achieve greatly outweigh any of the adverse impacts discussed in this document. The Service also considered past, present, and future planned actions on other State, Federal, and private lands surrounding the refuge. The Service is not aware of any refuge management actions that—when added to other past, present or future proposed actions—would result in significant cumulative impacts. The analysis area for potential cumulative effects on each resource and a summary of those potential impacts is provided below.

Cumulative Impacts on Physical Resources:

Air Quality

Air quality is always a concern on the refuge and within Liberty County, which is located within 65 miles of one of the most industrialized and populated areas in the U.S. Hundreds of refineries and chemical plants occur in surrounding counties, including Harris, Chambers, Jefferson, and Galveston (see Appendix I). Approximately 60 natural gas and coal power plants; some of the nation's largest shipping ports; and two major airports, several regional airports, and one military base also surround the refuge. No air quality monitoring stations are located in Liberty County. The closest station is in Harris County, 30 miles southwest from the City of Liberty, the county seat of Liberty County.

The Houston area is populated by nearly five million people and is a sprawling urban commuter population in one of the largest industrial complexes in the country. The climate is hot and humid, with the breeze driven over land and sea by the Gulf of Mexico. Air pollution is created from pollutants such as carbon monoxide, sulfur dioxide, oxides of nitrogen, and highly

reactive volatile organic compounds emitted by cars, power plants, refineries, chemical plants, and other sources that react to sunlight, which are the leading ozone precursors.

Projects on the refuge that affect air quality would be consistent with the minimal effects produced in the past (as described earlier in this draft EA), with ongoing refuge activities consisting of negligible impacts in comparison to the industrialization occurring in the surrounding counties. Even with the addition of the prescribed fire program, which is designed to burn under 200 acres over the course of the CCP (15 years), impacts will still be considered negligible. Refuge actions will have minimal effects on air quality based primarily on weather and wind conditions. All alternatives would essentially have the same effects to refuge air quality, even with the prescribed burning program, construction activities, and increased visitor use. Continued refuge acquisition and preservation of native bottomland hardwood habitat would be a long-term benefit to air quality by reducing local development and increasing carbon sequestration. These adverse and beneficial impacts, however, would not be cumulatively significant.

Water Management and Quality

Over the past century, the waters of the Trinity River have become increasingly polluted. Run-off containing pesticides and herbicides and dumping of industrial and human waste—particularly in the Dallas-Fort Worth metro-plex—have combined to cause serious deterioration of water quality (TRA 2010). The most severely affected area is the 250-mile-long stretch that extends from Dallas-Fort Worth to the headwaters of Lake Livingston. By the early 1960s, the river below Dallas for 100 miles was so polluted that the United States Public Health Service described it as "septic." Since that time, there were efforts made to clean up the river. A Water Quality Management Plan was adopted in the 1970s (TDWR 1984, Gard 2010); however, pollution problems continued (TRA 2010). For decades, pollutants have been banned, yet legacy pollutants are still found in the environment in concentrations deemed detrimental to humans. The sources of these are typically unknown and continue to contribute to contaminated sediment that, were it to be removed, could cause greater harm and possibly alter the entire hydrology of a system.

The majority of water quality impacts are influenced by natural flooding events of the Trinity River that can cover over 90 percent of the refuge. As experienced over the past decade, the refuge is generally near the extremes of the rainfall charts, either suffering extreme drought or excessive rains. Rarely does annual rainfall occur near the annual average. Managing the refuge at climatic extremes is difficult. Effects of severe droughts and floods affect they hydrology of the entire Trinity River floodplain, which in turn affects water quality. Concerns of population increases and urbanization may contribute to additional water removed from the Trinity River. Decreased water flows may increase salinity levels, altering species composition, survivability, and overall water quality. Continued refuge acquisition and preservation of native bottomland hardwood habitat would be a long-term benefit to water management and quality by acting as a natural filtration system.

The Port of Liberty shipped commodities to the Gulf Coast via steamboat along the Trinity River from 1838-1940. Portions of the Trinity River were channeled and dredged, which may have had an impact on hydrology in the area.

Road and trail maintenance and herbicide spraying are some past, present, and reasonable foreseeable future refuge activities that may affect water quality. Water is also affected by

local landowner use of fertilizer and herbicide; however, the amount contributed by the refuge under Alternatives A is negligible. Alternative B and C would allow for additional construction and potentially more herbicide spraying and therefore more of a cumulative impact. Even with the additional spraying under Alternative B and C, the impact would still be negligible in comparison to contaminants surrounding the refuge.

All of the described activities, actions, and trends have had adverse implications for water quality and quantity in the area. These large detrimental influences work against and offset the refuge's largely beneficial impacts on water quality and quantity, from conserving over 25,000 of natural vegetative cover, riparian and bottomland hardwood forest habitats. In view of these increasing adverse pressures on water quality and quantity, which are likely to continue to increase in the foreseeable future, the refuge's positive effects on water resources become even more important. However, the net cumulative effect on water resources in the coming decades would probably be more negative than positive considering the amount of industrialization continuing to expand around the refuge. Overall, at the close of the planning period (15 years), the overall condition of water resources on the refuge as a result of cumulative effects is likely to be somewhat less than at present, with less water and lower water quality. These impacts, however, would not be cumulatively significant.

Soils

Past, present, and foreseeable future area impacts to soils include ground disturbance, which can result in erosion, sedimentation, and nutrient loss. Impacts are caused by activities such as construction, farming, livestock grazing, feral hogs, and oil and gas development both on and off the refuge.

Historically, the forest and forest soils were seen as major marketable commodities that were not in short supply. Logging severely altered the bottomlands by the 1900s (Bray 1906). The cypress swamps were modified the most severely. Minimal old growth forest were left in the county, as it had mostly been harvested. Areas in the uplands were planted with loblolly pine, a more desired pine species. Most of the older growth hardwoods could be found in the bottoms where the soil was too moist for equipment to enter. However, during dry periods, even this timber became vulnerable and was eventually harvested. Most of the major swamps were logged by 1915 (Tanner 1942). In 1980, forest products were well-recognized county assets.

Prospecting for oil began in 1901. Oil fields were placed around much of the southern half of the county. Oil and natural gas pipelines were installed to move the vast amounts of products through the county (Kleiner 2010). Disturbances from oil and natural gas productions may have included pollution, seismic surveys affecting ground integrity, and the creation of roads and oil well pads. The refuge has no active well pads or pump jacks, although there are a number of facilities and pipelines right outside the refuge boundaries. The refuge does not own any mineral rights; therefore, the potential for additional oil and gas operations, including pipelines, is always possible. There could be potential long-term cumulative effects on soil quality if oil and gas operations increase in the future.

In the 1940s, mining became an important industry as a result of World War II. Sulfur was mined in the southern part of the county. As many as 52 firms opened during the decade, further impacting soil and hydrology to the area. By 1958, 40 manufacturing plants operated along with 165 mineral companies, resulting in further impacts to soil and hydrology.

Additionally, frequent flooding of the Trinity River contributes to both deposition and sedimentation throughout the floodplain. Floods accrete new sand along the shoreline, erode the shoreline, scour/flush bayous or channels, or deposit sediment along vast areas of the refuge.

Soil impacts under Alternative A are negligible. Alternatives B and C would allow for additional site-specific land use activities, such as construction, small prescribed fire program, and parking lot and trail maintenance with more impacts, however; it would still be negligible. Continued refuge acquisition and preservation of native bottomland hardwood habitat would be a long-term benefit to soils, as previously disturbed areas are allowed to progress back into old growth hardwood forests with increased soil holding capabilities.

Alternative B proposes similar amounts of construction and other management activities and would have similar effects to soils. Alternative C proposes much more construction and intensive management activities than the other alternatives; therefore, it would likely have a larger contribution to cumulative impacts.

Overall, cumulative effects on soils (from all alternatives) would be a mix of minor adverse and minor to moderate, beneficial effects. Adverse cumulative effects would probably occur to those soils that are regularly or continually subjected to some form of disturbance. These adverse effects are not anticipated to be major.

Minor to moderate, beneficial effects on soils would be expected to occur at those sites constituting the great majority of the area of the refuge, whereupon undisturbed soils would continue to develop (slowly increasing in depth as well as fertility) as a result of nearly continuous vegetative cover. These adverse and beneficial impacts, however, would not be cumulatively significant.

Cumulative Impacts on Biological Resources:

Wildlife/Habitats

Farm practices have lead to the introduction of non-native domestic animal species. The cattle industry was introduced in 1840 starting with 14,058 head. Cattle production was still quite popular a century later. The practice of grazing cattle in the bottomland forest has contributed to the spread of invasive flora species and possible changes in understory forest composition. Liberty County was the swine production capital of the State in the 1930s. Ironically, feral hogs are a leading invasive species in Liberty County in the present era. By the 1980s, 52 percent of land in Liberty County was in farms and ranches and 36 percent was under cultivation (Kleiner 2010).

Agriculture has impacted the relatively non-fragmented forest by the creation of open spaces to cultivate, introduction of seeds, alteration of soil properties, and changes in hydrology. Grazing of livestock has impacted flora and fauna species in the understory of the forests, the creation of open pastures, and introduction of feral hogs. The timber industry drove the harvest of native trees and the introduction of loblolly pine trees, while also influencing stand ages of trees, and impacting flora and fauna species that depend upon a mature forest. Mining practices and industrial facilities greatly impacted the soils and hydrology in areas where mining minerals were located further creating possible pollution issues. Oil and gas pipelines, railroad, human transportation, and even the introduction of electricity via power lines, all have contributed to right-of-ways that have further impacted the continuity of the relatively

non-fragmented Big Thicket forest prior to Antebellum Liberty County (Cozine 2004, Abernethy 2010).

Long-term beneficial cumulative impacts from the refuge's proposed management on bottomland hardwood forests would be direct/indirect, long-term, minor to major, and local to refuge-wide. There would also be cumulative adverse impacts on wildlife/habitat due to maintenance or construction of roads, trails, buildings, piers, blinds, and oil and gas facilities. Additionally, increased visitation could adversely affect wildlife/habitat. These adverse impacts would be direct, short to medium-term, negligible to moderate, and site-specific to local.

There are at least 25 other Federal, State, county, city, and privately managed conservation, wildlife-dependent recreation land, and/or mitigation banks consisting of at least 567,000 acres within the seven counties that surround Liberty County (Harris, Chambers, San Jacinto, Jefferson, Hardin, Polk, and Montgomery) that contribute to wildlife/habitat conservation efforts in the area.

In combination, these and other initiatives will have a generally beneficial, cumulative effect on restoration of bottomland hardwood forests on a landscape level. The refuge would be contributing to these positive impacts under any of the alternatives of this CCP.

Migratory Birds

Under each of the alternatives, beneficial effects on migratory birds from proposed management actions would be direct/indirect, long-term, moderate to major, and widespread. Under the Proposed Action, there would also be some adverse impacts from disturbance associated with all public use programs. Adverse impacts from the disturbance of visitor use activities would be direct, short-term, negligible to minor, and site-specific to local. None of these impacts would be cumulatively significant.

These actions on the refuge are a small part of a number of integrated efforts to manage migratory birds on the flyway, continental, and hemispheric scales. The refuge contributes to and collaborates with waterfowl management efforts by the Service and a number of states and Canadian provinces in the Central Flyway. The North American Waterfowl Management Plan (NAWMP) seeks to restore waterfowl populations in Canada, the United States, and Mexico to levels recorded in the 1970s.

The North American Bird Conservation Initiative (NABCI) seeks to ensure the long-term health of North America's native bird populations by increasing the effectiveness of existing and new bird conservation initiatives, enhancing coordination among the initiatives, and fostering greater cooperation among the continent's three national governments and their people. In 1999, the NABCI approved a framework for delineating ecologically-based planning, implementation, and evaluation units for cooperative bird conservation in the U.S. and Canada known as Bird Conservation Regions (BCRs). BCRs are ecologically distinct regions in North America with similar bird communities, habitats, and resource management issues.

Partners in Flight (PIF) is a cooperative effort involving partnerships among numerous governments and non-governmental organizations (NGOs) concerned about Neotropical migrants and other birds. PIF was created in 1990 in response to growing concerns about declining populations of many land bird species and to emphasize the conservation of birds not covered by existing conservation initiatives. Bird conservation plans are developed in each

region to identify species and habitats most in need of conservation, to establish objectives and strategies to provide needed conservation, to establish objectives and strategies to provide needed conservation activities, and to implement and monitor progress on the plans. This North American Landbird Conservation Plan (Rich et al. 2004) summarizes the conservation status of landbirds across North America, illustrating broad patterns based on a comprehensive, biologically-based species assessment~~.~~

At the State level, a number of initiatives in Texas have positive cumulative consequences for migratory birds, including the Texas Parks and Wildlife Texas Wildlife Action Plan (2005), Land and Water Resources Conservation and Recreation Plan (2005), and Texas Wetlands Conservation Plan (1997). While these are not focused on migratory birds per se, their implementation would still provide long-term, cumulative benefits for them.

In combination, all of the foregoing efforts should improve the prospects for many migratory birds species at all scales, from local to widespread. However, these efforts confront a wide variety of threats to migratory birds at all scales. Most of these are threats to habitats where the birds breed in the spring and summer months (in more northerly areas) and where they winter (in more southerly areas), as well as crucial stopover habitats that migratory birds need when they are in transit between summer and winter ranges. Habitat conversion, degradation, and fragmentation from diverse human activities, including urbanization, agriculture, logging and forestry, mining, and hydroelectric development, all on a vast scale, threaten populations of migratory birds species.

Cumulative Impacts on the Human Environment:

Beneficial cumulative impacts from the refuge's socio-economic environment would be direct, long-term, minor to moderate, and local. As the refuge grows, it is becoming a better-known eco-tourism destination, which is a plus to the local community. Additionally, refuge staff and management operations directly purchase numerous supplies in the area. There would also be cumulative adverse impacts due to a slight increase in road traffic where public use facilities are located. These adverse impacts would be direct, short-term, negligible, and site-specific. Based on the analysis presented earlier in this chapter, the Service has concluded that there would be no significant cumulative impacts on the human environment from proposed refuge management actions, when considered in context with other State, Federal, and private actions (as summarized in subsequent text). All management alternatives have similar impacts and conclusions.

Local Population and/or Economy

As a result of projected population and economic growth in the region over the coming 15 years, overall cumulative economic impacts would continue to be beneficial. The refuge would continue to contribute positive, relatively minor, economic effects on the region.

Aesthetic and Visual Resources

In combination, the long-term, overall effects to aesthetic and visual resources from the refuge's proposed management actions under all three alternatives would be moderately beneficial and widespread. The refuge has an overall beneficial effect on aesthetic and visual resource in this area where open space and natural beauty are diminishing and the refuge continues to acquire, manage, and maintain large units of land.

Visitor Service/Recreation Opportunities

Hunting

As in most states, there is a long-term, generalized decline in hunting participation in Texas, even as the State's population (and thus the number of potential hunters) continues to grow very rapidly. While a number of factors undoubtedly contribute to this, the rising cost of hunting on private land may be growing prohibitively expensive for many hunters to participate. Under these circumstances, the importance of public lands and wildlife habitat to hunters, such as those available on the refuge, will be in high demand by the hunting public. However, if hunting demand or participation on the refuge were to increase greatly as a result of declining opportunities elsewhere, this excessive competition could eventually decrease the quality of the hunting experience available on the refuge.

Wildlife Observation and Wildlife Photography

There are a growing number of other formal and informal opportunities for wildlife observation and photography in the region. There is over one-half million acres of public property in the surrounding counties that offer some type of wildlife observation and photography opportunities. The refuge will contribute to these long-term, cumulatively beneficial effects related to wildlife observation and photography in the region by expanding upon current opportunities.

However, even as these formal facilities and opportunities increase, an expected decrease in the amount of overall wildlife habitat present due to the area's continuing growth and development (and associated habitat conversion) may reduce the amount of wildlife actually available for viewing and photography.

Environmental Education

Except for some limited activities in local schools, there are no other formal education programs for children or adults in the local community. The refuge would contribute to a beneficial cumulative effect by promoting refuge resources as well as the mission of Service through formal EE programs throughout the surrounding counties.

Interpretation

The refuge would to play an integral role in growing opportunities for nature and wildlife interpretation opportunities around the region with the proposed expansions. Formal interpretation opportunities are not available for children or adults in local communities surrounding the refuge.

Visitor Use Facilities

No outside forces or factors would cause or contribute to cumulative effects on any of the refuge facilities.

Land Acquisition

Beneficial cumulative impacts from the refuge's acquisition program under all alternatives would be direct/indirect, long-term, moderate to major, and local to refuge-wide. The refuge would likely acquire more lands for wildlife/habitat protection under any alternative. Alternative C would take a more active approach to secure additional lands. Landscape level acquisition of rapidly disappearing bottomland hardwood forests is a priority. Over one-half million acres of public property is present in the surrounding counties, much of it consisting of

bottomland hardwoods and associated wetlands. The refuge contributes to these landscapes by creating beneficial effects related to protection and conservation efforts in the region.

The acquisition program will create cumulative adverse impacts. These adverse impacts would be direct/indirect, long-term, moderate to major, and local to refuge-wide. Acquisition will remove land from the private sector such that housing development, logging, mining, or agricultural practices will cease to exist. All acquisition is from willing sellers only. Private landowners still can use or sell their property as they see fit. Under current U.S. congressional actions implemented in 2011, refuge-owned lands would no longer pay the county in lieu of taxes based on property values.

Climate Change

The refuge's acquisition program, habitat management, and green infrastructure building guidelines will create beneficial impacts to assist with climate change. Under all alternatives, these impacts would be direct/indirect, long-term, minor to moderate, and local to widespread. Continuing with acquisition and managing lands for long-term tree growth will benefit carbon sequestration efforts. The office and maintenance/storage shop built in 2011-2012 met Leadership in Energy and Environmental Design (LEED) standards. A visitor center, when built, will also meet LEED standards.

Except for an increase in visitor use, thus more vehicles (negligible), there would be no other adverse cumulative impacts from refuge programs and acquisition.

As the refuge begins experiencing greater effects from climate change, the need for adaptive management will increase. More scientific data on when and where these changes may occur, along with what changes may entail, is necessary before determining how to counteract or adapt to them.

4.7 Short-Term Uses Versus Long-Term Productivity:

The habitat protection and management actions under the Proposed Action are dedicated to maintaining the long-term productivity of refuge habitats. The benefits of this plan for long-term productivity far outweigh any impacts from short-term actions, such as the construction of a visitor center or creation of new trails. While these activities would cause short-term negative impacts, the educational values and associated public support gained from the improved visitor experience would produce long-term benefits for the refuge's entire ecosystem.

The key to protecting and ensuring the refuge's long-term productivity is to find the threshold where public uses do not degrade or interfere with the refuge's natural resources. The plans proposed have been carefully conceived to achieve that threshold. Therefore, implementing the Proposed Action would lead to long-term benefits for wildlife protection and land conservation that far outweigh any short-term impacts.

4.8 Unavoidable Adverse Effects and Mitigation Measures:

All action alternatives may have some unavoidable adverse impacts. Most impacts are minor and/or short-term in duration. The refuge would attempt to minimize these impacts wherever possible. The following sections describe the measures the refuge would employ to mitigate and minimize the potential impacts that could result from implementation of the Proposed Action.

Water Quality from Soil Disturbance and Use of Herbicides

Foot traffic on new and existing trails will have a negligible impact on soil erosion. To minimize the impacts from public use, the refuge would include informational signs that request trail users to remain on the trails to avoid causing potential erosion problems.

Long-term herbicide use for exotic plant control could result in a slight decrease in water quality in areas prone to exotic plant infestation. Through the proper application of herbicides, however, this will have a minor impact on the environment, with a greater over all benefit of reducing or eliminating exotic plant infestations.

Wildlife/Habitat Disturbance

Disturbance to wildlife is an unavoidable consequence of any public use program, regardless of the activity involved. Planning and monitoring would be used to avoid unacceptable levels of impact from public use activities or construction. The refuge would minimize these impacts by installing informational signs that request users to stay on trails. This is expected to be a minor, short-term impact. All of the public use activities proposed under Proposed Action would be designed to minimize levels of impact

Other Unavoidable and Adverse Impacts

Adverse impacts from development of buildings, parking lots, trails, and other improvements would be direct, short-term, minor, and site-specific to local to habitat, soils, and some wildlife species. All construction activities would comply with the requirements of Section 404 of the Clean Water Act; the National Historic Preservation Act; Executive Order 11988, Floodplain Management; and other applicable regulatory requirements.

4.9 Irreversible and Irretrievable Commitment of Resources:

Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that this use could have on future generations. Irreversible effects primarily result from the use or destruction of specific resources that cannot be replaced within a reasonable time frame, such as energy or minerals. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored from this action, such as extinction of a threatened or endangered species or the disturbance of a cultural resource.

None of the alternatives would result in a large commitment of nonrenewable resources.

Project implementation would require the irretrievable commitment of fossil fuels (diesel and gasoline), oils, and lubricants used by heavy equipment and vehicles during construction activities. Maintaining new trails, parking lots, buildings, and piers and increasing law enforcement activities would become necessary. Management actions in this CCP will require a commitment of funds that would then be unavailable for use on any other Service projects. At some point, commitment of funds to these projects would be irreversible, and once used,

these funds would be irretrievable. The Proposed Action would result in some unavoidable harm or harassment to some wildlife. The Service would implement best management practices to minimize potential impacts.

The Propose Action alternative will require additional staffing and funding for full implementation.

None of the alternatives described in this EA will disproportionately place any adverse environmental, economic, social, or health impacts on minority and low-income populations. It is anticipated that implementation of the Proposed Action would benefit the environment and people in the surrounding communities.

Table 4-2. - Summary of Environmental Effects by Alternative:

Environmental Resource	Alternative A: No Action/Current Management	Alternative B:	Alternative C: Proposed Action
Air Quality	*Effects/Impacts from prescribed fire:* Direct/Adverse & Beneficial; Short-term; Minor; Site-specific *Effects/Impacts from land acquisition & habitat management:* Direct-Indirect/Beneficial; Long-term; Moderate; Local *Effects/Impacts from increasing visitor use days and public use programs:* Direct/Adverse; Short-term; Minor; Site-specific	Same as Alternative A plus more benefit as acquisition increases.	Same as Alternative B plus cumulative effects, both minor beneficial and adverse impacts, would increase.
Water Resources	*Effects/Impacts from land acquisition & restoring hydrology:* Direct-Indirect/Beneficial; Long-term; Minor; Local	Same as Alternative A plus more benefit as acquisition increases.	Same as Alternative B plus minor beneficial cumulative effects would increase.

Environmental Resource	Alternative A: No Action/Current Management	Alternative B:	Alternative C: Proposed Action
Bottomland Hardwood Forests (and Associated Habitats)	*Effects/Impacts from controlling invasive species, land acquisition, research, planting native hardwood species, and restoring hydrology:* Direct-Indirect/Beneficial; Long-term; Minor; Local *Effects/Impacts from increasing visitor use days and public use programs:* Direct/Adverse; Long-term; Minor; Site-specific	Same as Alternative A plus moderate benefit as acquisition increases along with habitat management. Minor increase in adverse impacts as more public use programs are developed increasing visitors.	Same as Alternative B plus cumulative effects, both moderate beneficial and adverse impacts, would increase.
Resident, Native Wildlife (Including Threatened and Endangered Species)	*Effects/Impacts from controlling invasive species, land acquisition, research, planting native hardwood species, and restoring hydrology:* Direct/Beneficial; Long-term; Minor; Local *Effects/Impacts from increasing visitor use days and public use programs:* Direct/Adverse; Medium-term; Minor; Site-specific	Same as Alternative A plus moderate benefit as acquisition increases along with habitat management. Minor increase in adverse impacts as more public use programs are developed increasing amount of visitors.	Same as Alternative B plus cumulative effects, both minor beneficial and adverse impacts, would increase.
Cultural Resources	*Effects/Impacts from land acquisition, law enforcement, and contact with preservation officers:* Direct/Beneficial; Long-term; Major; Site-specific	Same as Alternative A.	Same as Alternative A.

Environmental Resource	Alternative A: No Action/Current Management	Alternative B:	Alternative C: Proposed Action
Socio-economic	*Effects/Impacts from land acquisition and "big six" recreational opportunities:* Direct-Indirect/Beneficial; Long-term; Moderate; Local	Same as Alternative A plus increase in benefits as more compatible wildlife-dependent recreational opportunities become available.	Same as Alternative B plus moderate beneficial cumulative effects would increase.
Hunting	*Effects/Impacts from hunting:* Direct-Indirect/Adverse & Beneficial; Long-term; Minor; Local	Same as Alternative A plus increases benefits to hunters as more compatible hunting opportunities become available. Minor impacts when used as management tool for population management of deer and feral hog and increase in visitor use.	Same as Alternative B plus cumulative effects, both minor beneficial and adverse impacts, would increase.
Fishing	*Effects/Impacts from fishing:* Direct-Indirect/Adverse & Beneficial; Long-term; Minor; Local	Same as Alternative A plus increases benefits to anglers as more compatible fishing opportunities become available. Minor adverse impacts to habitat with pier construction and increase in visitor use.	Same as Alternative B plus cumulative effects, both minor beneficial and adverse impacts, would increase.
Wildlife Observation	*Effects/Impacts from wildlife observation:* Direct-Indirect/Adverse & Beneficial; Long-term; Minor; refuge-wide	Same as Alternative A plus increases benefits to wildlife observers as more compatible observation opportunities become available. Minor adverse impacts to habitat with parking lot and trail maintenance and increase in visitor use.	Same as Alternative B plus cumulative effects, both minor beneficial and adverse impacts, would increase.
Wildlife Photography	*Effects/Impacts from wildlife photography:* Direct-Indirect/Adverse & Beneficial; Long-term; Minor; refuge-wide	Same as Alternative A plus increases benefits to photographers as more compatible photographic opportunities become available. Minor adverse impacts to habitat with parking lot and trail maintenance, photo blind construction, and increase in visitor use.	Same as Alternative B plus cumulative effects, both minor beneficial and adverse impacts, would increase.

Environmental Resource	Alternative A: No Action/Current Management	Alternative B:	Alternative C: Proposed Action
Environmental Education	None	*Effects/Impacts from initiating EE program:* Direct-Indirect/Adverse & Beneficial; Long-term; Minor; refuge-wide	Same as Alternative B plus increases benefits to students and teachers as more compatible EE opportunities become available. Minor adverse impacts to habitat with parking lot and trail maintenance, visitor center construction, and increase in visitor use.
Interpretation	*Effects/Impacts from interpretation:* Direct-Indirect/Adverse & Beneficial; Long-term; Minor; refuge-wide	Same as Alternative A plus increases benefits to visitors as more compatible interpretive opportunities become available. Minor adverse impacts to habitat with parking lot and trail maintenance and increase in visitor use.	Same as Alternative B plus cumulative effects, both minor beneficial and adverse impacts, would increase, especially after construction of a visitor center.
Visitor Use Facilities	*Effects/Impacts from visitor use facilities:* Direct/Adverse & Beneficial; Long-term; Minor; Site-specific	Same as Alternative A plus increases benefits to visitors as more compatible facilities become available. Minor adverse impacts to habitat with construction projects and increase in visitor use.	Same as Alternative B plus cumulative effects, both minor beneficial and adverse impacts, would increase.

5.0 CONSULTATION, COORDINATION, AND DOCUMENT PREPARATION

5.1 Document prepared by:

Please refer to Appendix H in the Plan

5.2 References

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Draft Compatibility Determinations

Draft Compatibility Determination

Use: Recreational Hunting for Big Game (deer and hog), Upland Game (squirrel and rabbit), and Waterfowl

Refuge Name: Trinity River National Wildlife Refuge

County: Liberty, TX

Establishing and Acquisition Authorities:

Emergency Wetlands Resources Act of 1986, Public Law 99-645

Refuge Purposes:

"…the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions…" 16 U.S.C. 3901(b) (Emergency Wetlands Resources Act of 1986)

National Wildlife Refuge System Mission:

The mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

The Refuge Recreation Act of 1962 (16 U.S.C. 460K) authorizes the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use. The Refuge Recreation Act requires 1) that any recreational use permitted will not interfere with the primary purpose for which the area was established; and 2) that funds are available for the development, operation, and maintenance of the permitted forms of recreation.

Hunting as specified in this plan is a wildlife-dependent recreational use, and the law states that as such, it "shall receive priority consideration in national wildlife refuge planning and management." The Secretary of Interior may permit hunting on a refuge if it is determined that the use is compatible. The hunting program would not materially interfere with or detract from the fulfillment of the purposes of the refuge or the mission of the National Wildlife Refuge System.

Description of Use:

Refuges are specifically closed to hunting unless open through the Code of Federal Regulations (CFRs). The Refuge will have to go through the process of opening any additional units (Champion Lake South, Palmetto, or any additional units) to hunting in the future. Prior to any new units being open, those new hunting opportunities will be detailed in a separate environmental assessment, which—when complete—will be included in a Hunt Opening Package that is submitted to the Washington Office and published in the *Federal Register*.

Hunting on the Trinity River NWR is an existing use and consists of hunts for big game (deer and feral hogs) and upland game (squirrels and rabbits) on 7,690 acres and waterfowl on 800 acres.

Different segments of the hunt program for Trinity River NWR were opened in 2002-2003, 2006-2007, and 2011-2012. Waterfowl hunting started in 2002-2003, big game (general gun and muzzleloader) started in 2004-2005, while big game (archery) was added in 2006-2007. Three big game and upland game hunt units were added in 2011-2012. Additional hunting opportunities throughout the acquisition boundary may be provided contingent upon availability of suitable habitat, adequate species populations, and sufficient staff and budget to administer the program.

Environmental assessments (EAs), hunt plans, Finding of No Significant Impacts (FONSIs), Section 7 consultations, and compatibility determinations were previously completed separately for each types of refuge hunting opened (U.S. Fish and Wildlife Service 2001, U.S. Fish and Wildlife Service 2004, U.S. Fish and Wildlife Service 2004a, U.S. Fish and Wildlife Service 2007, U.S. Fish and Wildlife Service 2010). This action will consolidate all hunts under a single compatibility determination (CD) with a single expiration date. Future expansion of refuge units or hunt types will require updated National Environmental Policy Act (NEPA) actions.

Table 1: Current Hunt Program

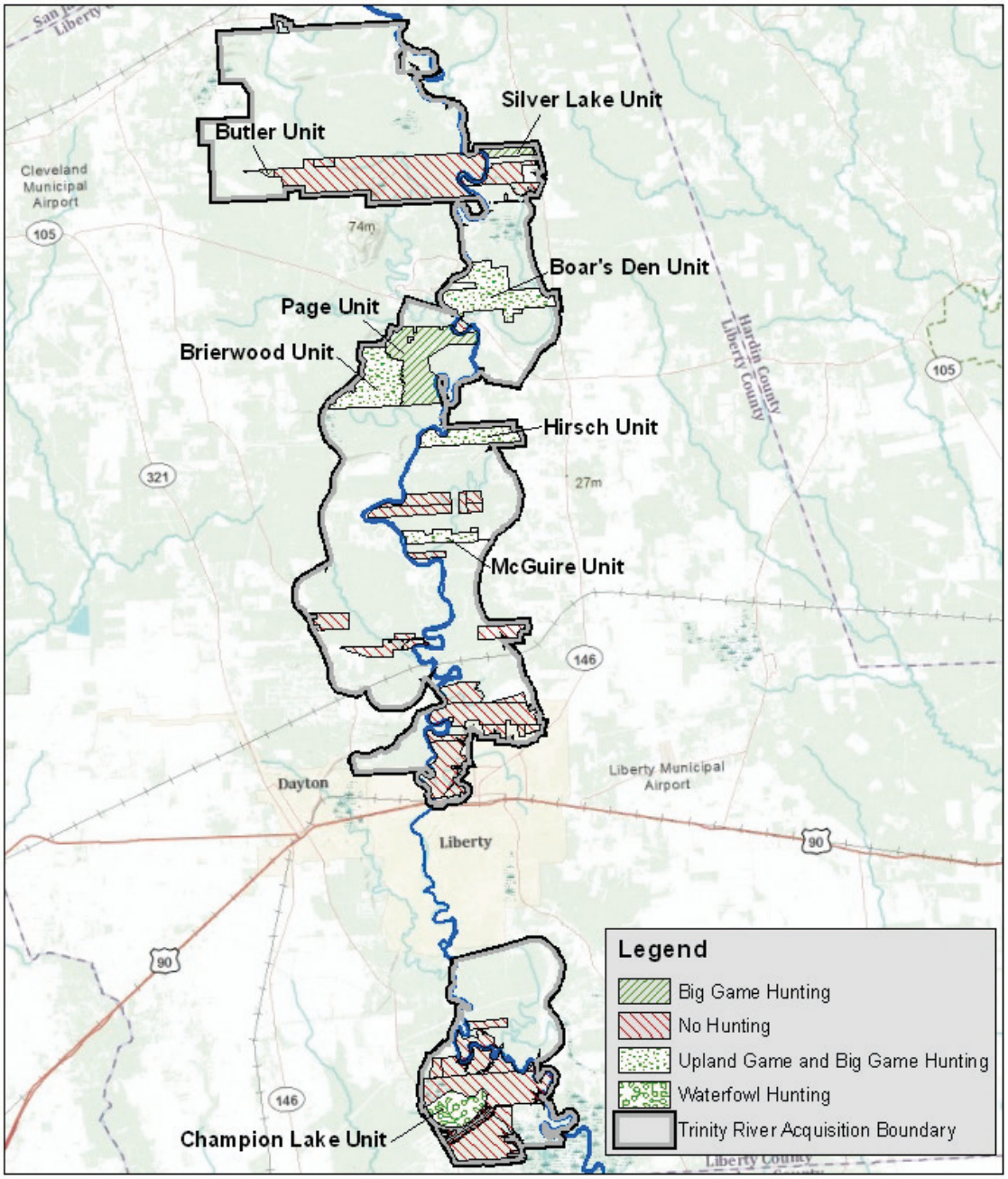
Units Currently Open/Acres	Type Of Hunt (Number Of Permits Issued)	Species
Page - 2,200	**Big game** ▪ archery (22) ▪ general gun (16)	deer, feral hog
Brierwood - 1,800 (allows all terrain vehicles for hunters with disabilities)	**Big game** ▪ general gun (14) ▪ muzzleloader (25) **Upland game (30)**	deer, feral hog squirrel, rabbit
McGuire - 550	**Big game** ▪ general gun (10) ▪ muzzleloader (15) **Upland game (20)**	deer, feral hog squirrel, rabbit
Butler - 250	**Big game** ▪ general gun (8)	deer, feral hog
Hirsch - 890 (allows all-terrain vehicles for hunters with disabilities)	**Big Game** ▪ archery (14) ▪ general gun (8) ▪ muzzleloader (10)	deer, feral hog
Boar's Den - 2,000	**Big Game** ▪ general gun (18) ▪ muzzleloader (30) **Upland Game (35)**	deer, feral hog squirrel, rabbit
Silver Lake - 260	**Big Game** ▪ general gun (5)	deer, feral hog
Champion Lake - 800	**Waterfowl (120)**	ducks

U.S. Fish & Wildlife Service

Trinity River National Wildlife Refuge

Liberty County, Texas

Hunt Units



PRODUCED IN THE DIVISION OF REFUGE PLANNING
ALBUQUERQUE, NEW MEXICO
LAND STATUS: CURRENT TO 5.8.109
MAP DATE: December, 2010
BASEMAP: NA
MERIDIAN: NA
FILE: tm_hunt_8.5by11_12.14.10_sN

0 2.5 5 10 Miles

0 2.5 5 10 Kilometers

Table 2: Proposed Hunt Units

Units Currently Open/Acres	Type of Hunt (Number of Permits Issued)	Species
Champion Lake South - 1,500	**Big game** ▪ archery (20) ▪ general gun (12) ▪ muzzleloader (20)	deer, feral hog
Palmetto -330	**Big game** ▪ general gun (3) ▪ muzzleloader (20)	deer, feral hog
	Upland game (5)	squirrel, rabbit

When would the use be conducted?

The State of Texas' general gun season (big game) for white-tailed deer is open from early November to mid January, while feral hog hunting is allowed year-round. The refuge will allow two nine-day seasons within the two month State season by permit only within all refuge units open to big game hunting (See Table 1). It is only during these two nine-day seasons that hunters will be allowed to hunt both deer and feral hog.

The State of Texas' archery hunting season is open for about 32 days from early October to early November. The refuge would allow a 23-day archery season within that 32-day State season for deer and hog by permit only within all units open to archery hunting (See Table 1).

The State of Texas' white-tailed deer muzzleloader hunting season is open 14 days in January. The refuge would have a nine-day "mini-season" for muzzleloader hunts within that 14-day State season for deer and hog by permit only within all units open to muzzleloader hunting (See Table 1).

The State of Texas' squirrel season (upland game) is open from October 1 to early February and then again for the whole month of May. Rabbit hunting in Texas is allowed year-round. The refuge would allow a 23-day "mini-season" (in October) for the upland game hunt within the five-month State season by permit only within all units open to upland game hunting (See Table 1).

The State of Texas' waterfowl season is generally open for a set amount of days (can vary yearly) in November, December, and January that is determined jointly by the Service and Texas Parks and Wildlife Department (TPWD). Hunting is only allowed at the 800-acre Champion Lake Unit. This "mini-season" consists of only weekends from one-half hour before daylight to noon for waterfowl hunting during the length of the state determined season. There is no early teal season or extended goose season.

How would the use be conducted?

All refuge hunts are shortened by using "mini-seasons" (which are shorter seasons than the

State allows). Hunt permits are issued through lottery drawings or first come, first serve (FCFS). Each permit identifies what unit the permittee can hunt, type of hunting weapon, dates of hunt, safety requirements, and general refuge regulations. Hunt units are described in maps and written directions. Big game and upland game hunting is by walk-in only except for

Brierwood and Hirsch units that allow all-terrain vehicles (ATVs) for hunters with disabilities. Waterfowl hunting requires some time of boat using a 10 horsepower motor of less. All hunters must park at a designated parking lot, but no overnight camping is allowed. There are no sanitary facilities except for a portable toilet at the waterfowl hunt site at Champion Lake Unit. All hunt units are posted "closed" to other recreational uses during refuge mini-seasons.

Why is this use being proposed?

Hunting on the refuge provides compatible wildlife-dependent recreational opportunities. While similar opportunities exist nearby on private and public lands, these units would provide additional quality recreational opportunities for users who do not have access to private land (approximately 97 percent of land in Texas is privately owned).

Big game hunting is one management tool used to enhance healthier populations of deer and to decrease feral hog populations on Trinity River NWR; however, impacts to the overall populations of these species are minimal. The primary purpose of big game, upland game, and waterfowl hunting on the refuge provides more wildlife-dependent recreation to help meet public demand. By conducting hunts on the refuge, we will be encouraging family-oriented outdoor recreation and supporting the tradition of hunting by promoting outdoor family-oriented activities. Refuge staff will continue to promote native flora and fauna diversity through active habitat management that achieves refuge wildlife habitat priorities and objectives.

Availability of Resources:

A current full-time refuge staff of five, along with some volunteers (or interns), can assist with the hunt program. Use of State game wardens may be required.

Special equipment, facilities, or improvements necessary to support the use:

Maintenance of access roads, gates, trails, parking areas, signs, permits, and boat ramp would be ongoing.

The figures shown here are FY 2012 estimated costs and include big game, upland game, and waterfowl hunting. Subsequent yearly costs will vary depending on numerous factors. Costs include estimated staff time and supplies used in running hunt program. Mitigating factors are included in these estimated cost determinations since same units are used for other public uses.

1.	**Preparation/Maintenance of Units** - posting and painting boundaries and recurring road, boat ramp, and parking lot maintenance.	$ 10,000
2.	**Administrative Time** - hunt planning, drawing and permit process, hunter inquiries, completing hunting and fee report, etc.	$ 20,000
3.	**Biological Review** - consultation with State and wildlife surveys; post-hunt data review.	$ 3,000
4.	**Enforcement of Hunt** - includes overtime or hiring temporary staff.	$ 10,000
	Estimated Total	$ 43,000

Offsetting revenues: The refuge receives 80 percent of the application fee collection under the recreation fee program. This averages around $4,000 per year (using 2008, 2009, 2010 totals) from just over $5,000 collected in fees per year under the current hunt program. The refuge has seen a steady rise in the number of applications with additional units opened and the program becoming better known.

Based on a review of the refuge budget and staff allocation for the hunt program, resources are adequate to insure compatibility and to administer and manage the current hunt program. All of these units are open and maintained for other wildlife-dependent public uses when hunting is not occurring.

Anticipated Impacts of the Use:

Short-term Impacts: Direct mortality to hunted species (deer, feral hogs, squirrels, rabbits, and waterfowl) would, of course, occur. Some wounding of animals may occur as well. In all cases, the refuge would seek to provide a quality hunt experience while minimizing negative impacts to refuge resources. Foot travel associated with these hunting activities could potentially result in vegetation trampling. Boating use may temporarily stir up mud from the lake bottom. However, these impacts are expected to be minimal. The activity of hunters pursuing game on the refuge could disturb some other wildlife species. Hunters walking or boating in close proximity to wetlands, and gunfire from hunting, can result in behavioral responses by other resident wildlife. Thus, the permitted activity will cause minor disturbances of limited duration and the effects are likely to be minimal.

There is a potential displacement of other visitors who would not be able to participate in other refuge activities during the period of the hunt on some units. However, the length of the designated hunting seasons will be limited and thus provides ample opportunities for these other activities to occur.

As public use levels gradually expand across the refuge, the potential for unanticipated conflicts among and with user groups may arise. In the event such unanticipated conflicts may occur as a result of the hunt program, the refuge's visitor use programs would be adjusted as needed to eliminate or minimize potential conflicts. Hunting season dates and regulations would be set and regulated to allow most user groups to experience a quality visit while on the refuge.

The average breakdown of the approximately 22,000 annual visitor use days over the past six years is as follows: fishing approximately 85 percent, hunting approximately 5 percent, and other wildlife-dependent uses (photography, wildlife observation, and interpretation) approximately percent. Hunting will affect anglers that use a boat on Champion Lake from daybreak to noon during 12 weekends of waterfowl hunting. Anecdotal evidence indicates this may affect about 50 use days. All other anglers are unaffected when using the pier or levee to fish at Champion Lake. Entry is not allowed on seven units of the refuge during designated "mini-seasons" for big game and upland game hunting. This limits opportunities for other wildlife-dependent activities during this time; however, other units on the refuge are open to these activities during hunting season. Anecdotal evidence indicates this may affect about 20–30 use days for persons wishing to engage in other than hunting wildlife- dependent public uses. Most wildlife observation and hiking visits occur on the Champion Lake Unit. They are not affected during the waterfowl hunting season. The refuge has received two complaints from persons wanting to use trails that were temporarily closed during hunts over the last seven years.

Deer:

In 2002 and 2008, the refuge and TPWD staff conducted visual, spotlight, and browse surveys on various units. During 2003-2007 and 2009-2010, refuge staff conducted visual and browse surveys. Browse surveys are conducted by walking and observing areas. These areas may show excessive browsing on various plants or a lack of herbaceous understory expected to be seen in that area. It is not an exact science but can be quite noticeable in areas of heavy use by deer. It can be exacerbated at times of flooding when deer are forced to higher ground in concentrated numbers. An average of 29 deer per year have been harvested from 2005-2010 under the refuge's general gun, archery, and muzzleloader "mini-season."

The data indicate that the refuge deer herd is at/near "carrying capacity" in areas of the refuge that have been hunted over the past six years. (*Carrying capacity* is defined as the population size of the species that the environment can sustain indefinitely, given the food, habitat, water and other necessities available in the environment; the carrying capacity is the number of individuals an environment can support without significant negative impacts to the given organism and its environment.) While the proposed limited deer hunt will only marginally impact the number of deer on the refuge, hunting is the only management tool currently available to affect the deer population.

Feral Hog:

The refuge attempts to control and/or eliminate invasive species in accordance with Executive Order 13112. The feral hog is a destructive invasive species that degrades refuge habitats and adversely impacts native wildlife. Hunting is one management tools used to try to control this species. While the refuge's hunting program may not impact the overall feral hog population, any reduction in feral hog numbers will reduce the negative impacts caused by this species.

Squirrel:

Squirrel populations will not be impacted by refuge hunting because of their prolific breeding capabilities and more than adequate refuge habitat. Eastern gray squirrels breed twice a year and normally have two to six young in each litter, but this number can be as high as eight. Eastern gray squirrels can start breeding as early as five and a half months old (Lawniczak 2002). Fox squirrels can produce two litters in a year. Average litter size is 2–3, but litters range from 1–7. Sexual maturity is attained at eight months for females (Fahey 2001). In the three years since the squirrel hunt has occurred on the refuge, the maximum number of squirrels taken was 332 during 2006. That peak of 332 occurred on 105 hunter days, which comes to three squirrels per hunter. The limit set by the State is 10 squirrels per day. Consequently, less than one third of what the State allows was harvested from the refuge per day. Additionally, the refuge's 23-day mini-season was much more restrictive than the 180-plus days the State allows.

Rabbit:

Rabbit populations will not be impacted by refuge hunting because of their prolific breeding capabilities and more than adequate refuge habitat. *Swamp rabbits (S. aquaticus)* have litter sizes from one to six, and produce two to five litters per year, while eastern cottontail rabbits *(S floridanus)* can have 1–7 litters of 1–12 young per year (Chapman and Ceballos 1990). In the three years since the rabbit hunt has occurred on the refuge, the maximum number of

three were taken. Additionally, the refuge's 23-day mini-season was much more restrictive than the open year-round season the State allows.

Waterfowl:

National waterfowl populations will not be impacted by refuge hunting. The process for adopting migratory game bird hunting regulations, located in 50 CFR part 20, is constrained by various factors. Legal and administrative considerations dictate how long the rule making process will last. Most importantly, however, the biological cycle of migratory game birds controls the timing of data-gathering activities and thus the dates on which these results are available for consideration and deliberation.

The refuge harvested an average of 257 waterfowl per year from 2005 to 2010. This harvest impact represents 0.03 percent of Texas' four-year average harvest of 906,863 ducks, (Kruse 2006). Waterfowl hunting occurs on 800 acres, or 3.2 percent of the 25,000-acre refuge.

Long-term impacts (for the four game species): Current data, by way of six years of refuge hunter data, browse surveys and personal observations, indicates that deer, squirrel, rabbit, and waterfowl populations will likely remain stable or increase even with an expanded refuge hunt program. The feral hog populations continue to rise even with hunting and refuge trapping. Hunting programs (both on and off the refuge) are not sufficient to control feral hogs. Harvesting game species depends on factors such as: population number of animals, condition of habitat, number and experience level of hunters, type of weapon allowed, length of season, and weather conditions. If yearly monitoring surveys through personal observation or browse line data indicate dramatic changes in populations, the refuge may further limit (or increase) the deer hunt. For reasons stated, there will not be any long-term impacts to squirrel, rabbit, and waterfowl.

Cumulative impacts:

Deer:

In the early 1900s, there were an estimated 500,000 white-tailed deer in the United States. Unregulated commercial hunting and subsistence hunting threatened to eliminate the white-tailed deer from much of its range. At that time, many state wildlife agencies were formed with the goal of conserving the Nation's depleted wildlife resources. Hunting regulations were put into place, and the harvest of antlerless (female) deer was prohibited. The rebound of white-tailed deer populations that followed is considered a wildlife management success story. Today there are over 20 million deer in the United States, and numbers are rising (Swihart and DeNicola 1997). Anticipated annual deer harvest on the refuge and other national wildlife refuges open to deer hunting is an extremely small percentage of the state's annual harvest and just a fraction of the national population. TPWD estimated 44,182 deer were harvested in the Pineywoods region of the State in 2004 and 2005 seasons (Liu 2006). Harvesting 100 deer a year on the refuge would only represent 0.26 percent of the Pineywoods region harvest. The impact of removing an estimated 25-50 white-tailed deer from the refuge is negligible within the context of the estimated four million white-tailed deer found in Texas (Graves 2004). The refuge will continue to support a substantial deer herd that will be at, or above, the habitat's carrying capacity to the detriment of other wildlife species. The timing, duration, and anticipated harvest levels of the refuge's hunt

program would result in negligible cumulative impacts to refuge resources, wildlife populations or the surrounding environment.

Feral hogs:

Feral hogs are an extremely invasive, non-native species and not considered a game species by the State of Texas. There is an estimated population in excess of 1.5 million feral hogs in Texas (Taylor 2003). This is due in part to intentional releases, improved habitat, increased wildlife management, disease eradication, limited natural predators, and high reproductive potential. There seem to be very few inhibiting factors to curtail this population growth (Taylor 2003). No bag limits or set seasons are established for feral hogs. Hunting of feral hogs provides the refuge with another management tool in reducing this detrimental species, and at the same time, is widely enjoyed by hunters. Cumulative effects to an exotic species should not be of concern because the refuge would like to extirpate this species on refuge lands. Hunting of hogs is not considered detrimental to the biological integrity of the refuge, is not likely to create conflict with other public uses, and is within the wildlife-dependant public uses given priority consideration. They are a priority species for refuge management only in terms of their negative impacts on refuge biota and need for eradication. The public interest would best be served by allowing this activity on the refuge. However, even with hunting, feral hogs are likely to always be present because they are prolific breeders. The refuge hunt has averaged harvesting 27 hogs per year from 2004 through the 2010 season. The State of Texas allows for year-round hunting (day and night) of feral hogs.

Squirrel:

For reasons stated, there will not be any long-term cumulative impacts to squirrels.

Rabbit:

For reasons stated, there will not be any long-term cumulative impacts to rabbits.

Waterfowl:

For reasons stated, there will not be any long-term cumulative impacts to waterfowl.

Public Review and Comment:

All older, but still current, CDs were completed for the various phases of opening the refuge hunt program (U.S. Fish and Wildlife Service 2001, U.S. Fish and Wildlife Service 2004, U.S. Fish and Wildlife Service 2004a, U.S. Fish and Wildlife Service 2007, U.S. Fish and Wildlife Service 2010). The latest public review occurred on July 30, 2010, when the Service announced its intent to prepare an EA for expanding hunting opportunities on Trinity River NWR. During public scoping for the preparation of the CCP, verbal and written comments were solicited from members of the general public on all aspects of current refuge management through public meetings, special mailings, and local media. This Draft CD is being made available for public review in conjunction with the public comment period for the Trinity River NWR Draft CCP/EA. Public comments on this Draft CD are due by the deadline stated on the cover letter with the Draft CCP/EA.

Determination (check one below):

____Use is Not Compatible

_X_Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

1. Ensure that hunting regulations are enforced or followed based on seasons, weapon type, etc.
2. Any hunt program would need to be carried out in accordance with State laws and Service policy for the protection of refuge resources and safety of participants.
3. Dogs, feeders, baiting, campsites, fires, bicycles, and ATVs (except units that allow ATV use for hunters with documented disabilities) are prohibited.
4. Gather and review (annually) population data in coordination with Texas Parks and Wildlife Department to ensure potential harvest from hunting would not unacceptably impact target populations.
5. Hunting opportunities will be based on the availability of adequate staff and funding, along with interagency coordination to insure a quality hunt experience while maintaining sustainable populations.

Justification:

Hunting is an appropriate use of the Refuge System when compatible. It is also a priority general public use of the Refuge System and increases opportunities for families to experience compatible wildlife-dependent recreation, particularly opportunities for parents and their children to safely engage in traditional outdoor activities as described in the National Wildlife Refuge System Improvement Act of 1997, and it receives enhanced consideration over non-priority uses.

Hunting is not expected to have any significant effects on other refuge/public use management activities because:

1. this use is compatible with the general Service policy regarding the establishment of hunting on National Wildlife Refuges;
2. this use is compatible with the purposes for which Trinity River NWR was established;
3. this use does not initiate widespread controversy or litigation;
4. there are no conflicts with local, regional, state, or federal plans or policies; and
5. hunting is accepted as an important recreational use of Texas' natural resources.

Additionally, hunting provides wildlife-oriented recreation to the public in a region where these opportunities are quickly vanishing. The refuge is located within 65 miles of over five million people. Private leases (if one can be found) can cost over $1,500 per person. The refuge provides a low cost, safe, and enjoyable option.

It is our conclusion that hunting conducted at Trinity River National Wildlife Refuge is in accordance with the analysis of the EA and stipulations stated here, and will not "materially interfere with or detract from the fulfillment of the mission of the System or the purpose of the refuge was established," nor will it conflict with any of the other priority public uses,

adversely impact other biological resources, or detract from refuge goals, objectives, and refuge management activities as described in the National Wildlife Refuge System Improvement Act of 1997.

Signature: Refuge Manager _____

(Signature and Date)

Concurrence: Regional Chief _____

(Signature and Date)

Mandatory 15-year Re-Evaluation Date: 2027

References Cited:

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U.S. Fish and Wildlife Service. 2001. Proposed Opening Package for Hunting at Trinity River National Wildlife Refuge.

U.S. Fish and Wildlife Service. 2004. FINAL Big Game Hunting Plan for Trinity River National Wildlife Refuge.

U.S. Fish and Wildlife Service. 2004a. FINAL Upland Game Hunting Plan for Trinity River National Wildlife Refuge.

U.S. Fish and Wildlife Service. 2007. FINAL Environmental Assessment for Trinity River National Wildlife Refuge.

U.S. Fish and Wildlife Service. 2010. DRAFT Big Game and Upland Game Hunt Plan for Trinity River National Wildlife Refuge.

Draft Compatibility Determination

Use: Fishing

Refuge Name: Trinity River National Wildlife Refuge

County: Liberty, TX

Establishing and Acquisition Authority(ies):

Emergency Wetlands Resources Act of 1986, Public Law 99-645

Refuge Purpose(s):

"...the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions…" 16 U.S.C. 3901(b) (Emergency Wetlands Resources Act of 1986).

National Wildlife Refuge System Mission:

The mission of the System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

Description of Use:

(a) What is the use?
Fishing on the Trinity River National Wildlife Refuge is an existing wildlife-dependent public use and currently consists of freshwater fishing on the 800 acre Champion Lake (USFWS 2000). Fishing is one of the six priority public uses of national wildlife refuges, as specified in the Refuge Improvement Act of 1997. Over 80 percent of the visitation to the refuge occurs for the purpose of fishing for catfish, bass, crappie, gar, etc., and blue crab and crawfish. Additional areas that would be opened to fishing are listed in Table 2.

(b) Where is the use conducted?

Table 1: Current Fishing Program

Unit Currently Open	Approximate Acres	Common Species Harvested
Champion Lake (which feeds into Pickett's Bayou)	800	Bass, crappie, catfish, gar, crawfish, blue crab

Table 2: Proposed Fishing Program

Proposed Units	Approximate Acres	Common Species Harvested
McGuire and Silver Lake Units with fishing piers	McGuire – 2 Silver Lake – 15	Bass, crappie, catfish
Brierwood Unit with fishing pier	10	Bass, crappie, catfish

Maps are included in Comprehensive Conservation Plan (CCP) showing unit locations.

(c) When is the use conducted?
Fishing is allowed year-round in all designated areas, in accordance with applicable State and Federal regulations, from sunrise to sunset.

(d) How is the use conducted?
Refuge fishing is allowed without refuge permit by pole and line, rod and reel, or hand held line only. State licenses are required.

The refuge law enforcement officer has stepped up patrol to prevent littering and illegal taking of fish, while educational efforts have been increased to encourage anglers to collect and discard excess and old fishing line, hooks, and sinkers, as wildlife are known to die after ingesting this debris.

The refuge does not allow the use of cast nets for collecting bait or any type of net to catch fish, crabs or crayfish. Only dip nets are allowed to pick up fish, crabs, or crayfish once they are "reeled" in.

(e) Why is this use being proposed?
Limited freshwater fishing on the refuge provides a wildlife-dependent recreational opportunity, one of the six identified in the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57). While similar opportunities exist nearby on private and public lands, refuge fishing would provide additional quality recreational opportunities for users who do not have access to private land and do not wish to compete with other anglers on the scarce public lands (approximately 97 percent of land in Texas is privately owned).

A limited fishing program on Trinity River NWR would provide:

1. The public with a quality recreational experience.
2. Wildlife-dependent public recreation as mandated by and according to Service policy.
3. Encourage outdoor recreation and support the tradition of fishing by promoting outdoor family oriented activities.

Availability of Resources:

A current full-time Refuge Staff of five, along with some volunteers (or interns), can assist with the fishing program. Use of State game wardens may be required.

Special equipment, facilities, or improvements necessary to support the use:

Maintenance of access roads, gates, trails, parking areas, and boat ramps would be ongoing. The addition of fishing signage to specific new units and printing of brochures would also be needed.

The figures shown here are **first year** estimated FY 2011 costs and include **all units** that may be opened to fishing within the time frame of the CCP. Costs shown exclude regular pay and usually just include goods and supplies.

1.	**Preparation/Maintenance of Units** – pier and parking lot development; posting and painting boundaries and signs; and recurring road, boat ramp, and parking lot maintenance.	$ 50,000
2.	**Enforcement of Fishing** – includes overtime.	$ 1,000
	Estimated Total	$ 51,000

Anticipated Impacts of the Use:

Fishing on the Trinity River NWR support the Refuge System mission and refuge establishment purposes and objectives by providing a quality recreational opportunity for public use and enjoyment of wildlife resources. There are no expected impacts to the biological integrity of the refuge.

There is a no displacement of other visitors who would not be able to participate in other refuge activities during the times anglers are fishing. Anglers in boats are not permitted in areas of bird nesting rookeries from March 1 to May 30.

As public use levels gradually expand across the refuge, the potential for unanticipated conflicts among and with user groups may arise. In the event such unanticipated conflicts may occur as a result of expanding the fishing program, the refuge's visitor use programs would be adjusted as needed to eliminate or minimize potential conflicts.

Short and long-term impacts: Current data, collected from nine years of spot-checking anglers, indicates that fishing will likely remain stable even with an expanded fishing program. Harvesting of fish depends on factors such as: fish population, condition of habitat, number and experience level of angler, type of fishing equipment used for a particular species, and weather conditions. By far, the most important factor is water. There are times that even the 800-acre Champion Lake has been virtually dry with no fish and other times when it has been so severely flooded that it is closed to fishing. Regular flooding from the Trinity River always replenishes ponds, bayous, and lakes with new fish within the floodplains of the refuge boundary.

Cumulative impacts: These actions would have both beneficial and adverse impacts; however, they would amount to minor cumulative effects from expanding fishing opportunities. When these new units are opened for fishing, both the refuge and community would benefit. The economic impact of the proposed programs by attracting visitors and children would help the local community, while educating the public and promote the mission of the Service. As long as regular flooding continues from the Trinity River, stocks of fish, crabs, and crayfish will be replenished to all lakes and pond within the refuge.

Public Review and Comment:

During public scoping for the preparation of the CCP, verbal and written comments were solicited from members of the general public on all aspects of current refuge management through public meetings, special mailings, and local media. This Draft Compatibility Determination (CD) is being made available for public review in conjunction with the public comment period for the Trinity River NWR Draft CCP/EA. Public comments on this Draft CD are due by the deadline stated on the cover letter with the Draft CCP/EA.

Determination (check one below):

___ Use is Not Compatible

___ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

1. Ensure that fishing regulations are enforced followed based on seasons, creel limits, etc.
2. The fishing program would need to be carried out in accordance with State laws and Service policy for the protection of refuge resources and safety of participants.
3. The use of nets, cast nets (dip nets okay), trot lines, fish or crab traps, set lines, jugs, gigs, spears, bush hooks, snatch hooks, crossbows, or bows and arrows of any type are not allowed. Harassment of alligators, frogs, or turtles is prohibited.
4. Motors are limited to 10 horsepower or less in Champion Lake and 40 horsepower or less at the Pickett's Bayou boat launch. All other fishing ponds and lakes are limited to non-powered boats.
5. No fishing or entry within 200 yards of an established bird rookery from March 1 through the end of May.
6. Persons possessing, transporting, or carrying firearms on national wildlife refuges must comply with all provisions of federal, state and local law.
7. Fishing opportunities will be based on the availability of adequate staff and funding, along with interagency coordination to insure a quality fishing experience while maintaining sustainable populations.

Justification:

Fishing is an appropriate use of the Refuge System when compatible. It is also a priority general public use of the Refuge System and increases opportunities for families to experience compatible wildlife-dependent recreation, particularly opportunities for parents and their children to safely engage in traditional outdoor activities as described in the National Wildlife

Refuge System Improvement Act of 1997, and it receives enhanced consideration over non-priority uses.

Fishing is not expected to have any significant effects on other refuge/public use management activities because:

1. Fishing is compatible with the general Service policy regarding the control of exotic and nuisances species control on national wildlife refuges;
2. Use is compatible with the purposes for which Trinity River NWR was established;
3. Fishing does not initiate widespread controversy or litigation; and
4. There are no conflicts with local, regional, State, or Federal plans or policies.

Fishing conducted at Trinity River National Wildlife Refuge is in accordance with the analysis of the Environmental Assessment and stipulations described, and it will not "materially interfere with or detract from the fulfillment of the mission of the System or the purpose of the refuge was established," nor will it conflict with any of the other priority public uses, adversely impact other biological resources, or detract from refuge goals, objectives and refuge management activities as described in the National Wildlife Refuge System Improvement Act of 1997.

Signature: Refuge Manager _____

(Signature and Date)

Concurrence: Regional Chief _____

(Signature and Date)

Mandatory 15-year Re-Evaluation Date: 2027

References Used

U.S. Fish and Wildlife Service. 2000. Proposed Opening Package for Fishing at Trinity River National Wildlife Refuge.

U.S. Fish and Wildlife Service. 2006. Service Manual. Part 605 FW 3: Recreational Fishing. Division of Conservation, Planning and Policy.

Draft Compatibility Determination

Use: Wildlife Observation

Refuge Name: Trinity River National Wildlife Refuge

County: Liberty, TX

Establishing and Acquisition Authority(ies):

Emergency Wetlands Resources Act of 1986, Public Law 99-645

Refuge Purpose(s):

"…the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions…" 16 U.S.C. 3901(b) (Emergency Wetlands Resources Act of 1986).

National Wildlife Refuge System Mission:

The mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Use:

(a) What is the use?
Wildlife observation is an existing wildlife-dependent recreational opportunity occurring on Trinity River Nation Wildlife Refuge (refuge, Trinity River NWR). Bird watching continues to be the most popular form of wildlife observation on the refuge. Visitors can view numerous species of waterfowl, Neotropical songbirds, herons, and raptors. Other wildlife observation opportunities allow the public to view alligators, butterflies, and dragonflies, as well as wildflowers.

(b) Where is the use conducted?
The refuge has wildlife observation opportunities on various units, as described here.

Wildlife observation opportunities may occur throughout the refuge but visitors are currently directed to eight designated units with parking lots and trails. The Champion Lake Public Use Area has the most to offer with trails, levee, pier, portable toilet, and butterfly garden.

Table 1: Wildlife Observation Trails

Unit Name	Unit #	Acres	Type	Miles of Trails
Butler	10	500	Hiking	0.5
Brierwood	47	2,983	Hiking	7.3
Page	21	877	Hiking	4.5
Hirsch	64	892	Hiking	2.2
McGuire	31	521	Hiking	7.1
Silver Lake	47a	259	Hiking	0.1
Boar's Den	46, 46a, 47	4,471	Hiking	7.5
Champion Lake Public Use Area	27	2,850	Hiking	2.3
			Boating	7.1

(c) When is the use conducted?
Wildlife observation activities are allowed year-round, from sunrise to sunset, in all designated areas. What a visitor might like to see will dictate the best time of year to visit for that particular plant or animal.

(d) How is the use conducted?
The refuge contains multiple means for refuge visitors to experience wildlife observation with the assistance of an observation pier, butterfly garden, and trails. The refuge does not current provide loaner binoculars but currently provides a photo blind opportunity.

(e) Why is this use being proposed?
The objective for wildlife observation is to provide safe, enjoyable, quality, and accessible opportunities on the refuge. In addition, the program aims to promote visitor understanding for America's natural resources, while minimizing conflicts with visitors participating in other compatible wildlife-dependent activities. The refuge provides local, regional, National and international visitors with a wide range of wildlife observation opportunities, supporting a rapidly growing nature tourism industry in Texas. Wildlife observation could provide opportunities for visitors to make their own connection with nature by promoting outdoor family oriented activities.

Availability of Resources:

The total estimated cost per year would range from $3,000 to $5,000. Based on a review of the refuge budget allocated for interpretation, there is currently sufficient funding to ensure compatibility and to administer and manage the existing use. Strategies to improve the wildlife observation program have been identified and would require erecting additional photo blinds to capture the potential for this area.

Resources involved in the administration and management of the use: None

Special equipment, facilities, or improvements necessary to support the use:

Maintenance of litter removal, access roads, gates, trails, parking areas, photo blind, and boat ramps would be ongoing.

Erecting additional photo blinds.

Maintenance costs: $5,000 – recurring cost

Monitoring costs: None

Offsetting revenues: None

Anticipated Impacts of the Use:

Short-term impacts: The overall impacts to the refuge and associated habitat and wildlife from wildlife observation would be minimal. There would be some disturbance to wildlife and vegetation at the locations where wildlife observation programs occur but at levels that would not interfere with the purposes of the refuge. Motorized vehicles would utilize developed roads and parking areas to access trails that are already in place. Self-guided wildlife observation would be sporadic, by small groups of people, and at established trails. This may cause short-term disturbance as well but would have minimal impact.

Long-term impacts: Anticipated long-term impacts are beneficial to the refuge, as these activities promote a conservation ethic in the local community. As improvements are made, there may be some additional short-term, localized disturbance, but use would continue to be in existing developed areas.

Cumulative impacts: There are no anticipated cumulative impacts. Other public uses such as environmental education, interpretation, and photography at the same sites used for wildlife observation may increase over time, but it is not anticipated to be enough to cause cumulative impacts. The cumulative impacts of wildlife observation would be beneficial to meeting the Service mission and refuge purposes.

Public Review and Comment:

During public scoping for the preparation of the CCP, verbal and written comments were solicited from members of the general public on all aspects of current refuge management through public meetings, special mailings, and local media. This Draft Compatibility Determination (CD) is being made available for public review in conjunction with the public comment period for the Trinity River NWR Draft CCP/EA. Public comments on this Draft CD are due by the deadline stated on the cover letter with the Draft CCP/EA.

Determination (check one below):

____ Use is Not Compatible

_X_ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

1. The refuge is open to public access year-round during daylight hours. Public or legal access to units must be available.
   Certain areas may be closed due to emergencies, hunting, or sensitive wildlife.
   Use of motorized vehicles is limited to maintained roads and parking areas.
   Camping, overnight use, and fires are prohibited.
   Federal and/or State law enforcement agencies would ensure regulation compliance, safety, and protection of refuge resources.
   Adequate staffing and funding must be available to ensure a safe experience.

Justification:

Wildlife observation programs are not expected to have any major effects on other refuge/public use management activities because: (1) this use is compatible with the general Service policy regarding the establishment of interpretation on national wildlife refuges; (2) this use is compatible with the purposes for which Trinity River NWR was established; (3) this use does not initiate widespread controversy or litigation; (4) there are no conflicts with local, regional, State, or Federal plans or policies; and (5) the majority of refuge visitors come to the refuge to see wildlife and benefit from wildlife observation.

Wildlife observation conducted at Trinity River National Wildlife Refuge is in accordance with the analysis of the Environmental Assessment and stated stipulations, and will not "materially interfere with or detract from the fulfillment of the mission of the System or the purpose of the refuge was established," nor will it conflict with any of the other priority public uses, adversely impact other biological resources, or detract from refuge goals, objectives, and refuge management activities as described in the National Wildlife Refuge System Improvement Act of 1997.

Signature: Refuge Manager _____

(Signature and Date)

Concurrence: Regional Chief _____

(Signature and Date)

Mandatory 15-year Re-Evaluation Date: 2027

References Used:

U.S. Fish and Wildlife Service. 1999. Lower Trinity River Floodplain Habitat Stewardship Program. Trinity River National Wildlife Refuge.

U.S. Fish and Wildlife Service. 2005. Visitor Services Review. Trinity River National Wildlife Refuge.

U.S. Fish and Wildlife Service. 2006. Service Manual. Part 605 FW 1: Wildlife-Dependent Recreation. Division of Conservation, Planning and Policy.

U.S. Fish and Wildlife Service. 2006. Service Manual. Part 605 FW 4: Wildlife Observation. Division of Conservation, Planning and Policy.

U.S. Fish and Wildlife Service. 2006. Service Manual. Part 601 FW 1: National Wildlife Refuge System Mission and Goals and Refuge Purposes. Division of Conservation, Planning and Policy.

Draft Compatibility Determination

Use: Wildlife Photography

Refuge Name: Trinity River National Wildlife Refuge

County: Liberty, TX

Establishing and Acquisition Authority(ies):

Emergency Wetlands Resources Act of 1986, Public Law 99-645

Refuge Purpose(s):

"…the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions…" 16 U.S.C. 3901(b) (Emergency Wetlands Resources Act of 1986).

National Wildlife Refuge System Mission:

The mission of the National Wildlife Refuge System is Ato administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Use:

(a) What is the use?

Wildlife photography is an existing wildlife-dependent recreational opportunity occurring on Trinity River Nation Wildlife Refuge (refuge, Trinity River NWR). Amateur photography is a popular form of wildlife-dependent recreation on the Refuge. Visitors can view and photograph numerous species of plants, animals, bugs, butterflies, and general scenery.

The following are definitions of terms used in reference to wildlife photography:

A. Film. Film is still photographs, motion pictures, and videotapes in digital and analog formats.

B. Recreational Photography. Recreational photography is any type of visual recording on film performed by amateur owner/operators of photographic equipment. Casual photography is considered recreational photography and follows this policy (e.g., visitors taking photographs for their own use, non-commercial recreational photo contests).

C. News Photography. News photography includes audio-visual productions for news and public affairs, stills, motion pictures, video, records and audio tapes such as those produced for television, newspapers, and magazines. News photography on Refuge

System lands is for the benefit of the general public. Examples of news events are emergencies, special events, or appearances by public figures or other unusual, non-recurring natural phenomenon. News photography will not require a permit, but some restrictions may be placed on the activity by the refuge manager to protect the resource and/or the individuals associated with the media. Refer to the audio-visual chapter in the Service Manual (605 FW 5) for additional information on this subject.

D. Commercial Photography. Commercial photography is visual recordings by firms or individuals (other than news media representatives) who intend to distribute their photographic content for money or other consideration. The creation of educational, entertainment, or commercial enterprises is included in this category. Additionally, advertising audio-visuals for the purpose of paid product or services, publicity, and commercially-oriented photo contests under this section are covered in the audio-visual chapter of the Service Manual (605 FWS).

(b) Where is the use conducted?
Wildlife photography opportunities may occur throughout the refuge, but visitors are currently directed to the same eight designated units as described under wildlife observation.

(c) When is the use conducted?
Wildlife photography activities are allowed year-round, from sunrise to sunset, in all designated areas. What a visitor might like to see will dictate the best time of year to visit for that particular plant or animal.

(d) How is the use conducted?
The refuge contains multiple means for refuge visitors to experience wildlife photography with the assistance of website, brochures, fact sheets, species lists, and trails. The refuge currently provides one photo blind opportunity (Silver Lake Unit) but has proposed additional blinds in the Comprehensive Conservation Plan (CCP) in Brierwood Unit along Gaylor Lake and one at McGuire Unit.

(e) Why is this use being proposed?
The objective for wildlife photography is to provide safe, enjoyable, quality, and accessible opportunities on the refuge. In addition, the program aims to promote visitor understanding for America's natural resources while minimizing conflicts with visitors participating in other compatible wildlife-dependent activities. The refuge provides local, regional, National, and international visitors with a wide range of wildlife photography opportunities, supporting a rapidly growing nature tourism industry in Texas. Wildlife photography could provide opportunities for visitors to make their own connection with nature by promoting outdoor family-oriented activities.

Availability of Resources:

The total estimated cost per year would range from $3,000 to $5,000. Based on a review of the refuge budget allocated for photography, there is currently sufficient funding to ensure compatibility and to administer and manage the existing use. Strategies to improve the wildlife photography program have been identified and would require erecting additional photo blinds to capture the potential for this area.

Resources involved in the administration and management of the use: None

Special equipment, facilities, or improvements necessary to support the use:

Maintenance of litter removal, access roads, gates, trails, parking areas, photo blinds, and boat ramp would be ongoing.

Erecting additional photo blinds.

Maintenance costs: $5,000 – recurring cost

Monitoring costs: None

Offsetting revenues: None

Anticipated Impacts of the Use:

Short-term impacts: The overall impacts to the refuge and its associated habitat and wildlife from wildlife photography would be minimal. There would be some disturbance to wildlife and vegetation at the locations where wildlife photography activities occur but at levels that would not interfere with the purposes of the refuge. Motorized vehicles would utilize developed roads and parking areas to access trails that are already in place. Self-guided wildlife photography would be sporadic, by small groups of people, and at established trails. This may cause short-term disturbance as well but would have minimal impact.

Long-term impacts: Anticipated long-term impacts are beneficial to the refuge, as these activities promote a conservation ethic in the local community. As improvements are made, there may be some additional short-term, localized disturbance, but use would continue to be in existing developed areas.

Cumulative impacts: There are no anticipated cumulative impacts. Other public uses such as environmental education, interpretation, and wildlife observation at the same sites used for wildlife photography may increase over time, but it is not anticipated to be enough to cause cumulative impacts. The cumulative impacts of wildlife photography would be beneficial to meeting the Service mission and refuge purposes.

Public Review and Comment:

During public scoping for the preparation of the CCP, verbal and written comments were solicited from members of the general public on all aspects of current refuge management through public meetings, special mailings, and local media. This Draft Compatibility Determination (CD) is being made available for public review in conjunction with the public comment period for the Trinity River NWR Draft CCP/EA. Public comments on this Draft CD are due by the deadline stated on the cover letter with the Draft CCP/EA.

Determination (check one below):

____ Use is Not Compatible

__X__ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

1. The refuge is open to public access year-round during daylight hours. Public or legal access to units must be available.
2. Certain areas may be closed due to emergencies, hunting, or sensitive wildlife.
3. Use of motorized vehicles is limited to maintained roads and parking areas.
4. Camping, overnight use, and fires are prohibited.
5. Federal and/or State law enforcement agencies would ensure regulation compliance, safety, and protection of refuge resources.
6. Adequate staffing and funding must be available to ensure a safe experience.

Justification:

Wildlife photography programs are not expected to have any major effects on other refuge/public use management activities because: (1) this use is compatible with the general Service policy regarding the establishment of interpretation on national wildlife refuges; (2) this use is compatible with the purposes for which Trinity River NWR was established; (3) this use does not initiate widespread controversy or litigation; (4) there are no conflicts with local, regional, State, or Federal plans or policies; and (5) the majority of refuge visitors come to the refuge to see wildlife and benefit from wildlife observation.

Wildlife photography conducted at Trinity River National Wildlife Refuge is in accordance with the analysis of the Environmental Assessment and stated stipulations and will not "materially interfere with or detract from the fulfillment of the mission of the System or the purpose of the refuge was established," nor will it conflict with any of the other priority public uses, adversely impact other biological resources, or detract from refuge goals, objectives and refuge management activities as described in the National Wildlife Refuge System Improvement Act of 1997.

Signature: Refuge Manager _____

(Signature and Date)

Concurrence: Regional Chief _____

(Signature and Date)

Mandatory 15-year Re-Evaluation Date: 2027

References Used:

U.S. Fish and Wildlife Service. 1999. Lower Trinity River Floodplain Habitat Stewardship Program. Trinity River National Wildlife Refuge.

U.S. Fish and Wildlife Service. 2005. Visitor Services Review. Trinity River National Wildlife Refuge.

U.S. Fish and Wildlife Service. 2006. Service Manual. Part 601 FW 1: National Wildlife Refuge System Mission and Goals and Refuge Purposes. Division of Conservation, Planning and Policy.

U.S. Fish and Wildlife Service. 2006. Service Manual. Part 605 FW 1: Wildlife-Dependent Recreation. Division of Conservation, Planning and Policy.

U.S. Fish and Wildlife Service. 2006. Service Manual. Part 605 FW 5: Wildlife Photography. Division of Conservation, Planning and Policy.

Draft Compatibility Determination

Use: Interpretation

Refuge Name: Trinity River National Wildlife Refuge

County: Liberty, TX

Establishing and Acquisition Authority(ies):

Emergency Wetlands Resources Act of 1986, Public Law 99-645

Refuge Purpose(s):

"…the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions…" 16 U.S.C. 3901(b) (Emergency Wetlands Resources Act of 1986).

National Wildlife Refuge System Mission:

The mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Use:

(a) What is the use?

Interpretation is an existing wildlife-dependent recreational opportunity occurring on Trinity River Nation Wildlife Refuge (refuge, Trinity River NWR). The refuge communicates the most important fish, wildlife, habitat, and resource issues to visitors of all ages and abilities through effective interpretation. Interpretation is a communication process that forges emotional and intellectual connections between the interests of the audience and the inherent meanings in the resource (i.e., more than information). Interpretation occurs in less formal activities with refuge staff and volunteers or through exhibits, signs, brochures, elements of special events, and tours.

(b) Where is the use conducted?

The refuge hosts a few interpretative opportunities on various units, as described below. The refuge also hosts numerous off-refuge interpretive programs with portable displays at schools, local fairs, etc.

Large refuge interpretation events are conducted for Earth Day and Free Fishing Day. Other interpretation opportunities occur at the butterfly garden at Champion Lake Public Use Area, kiosk at Brierwood Unit trail head, various guided tours for bird watchers on numerous units, and brochures, panels, poster, and animal mounts at the administrative headquarters office.

(c) When is the use conducted?
Interpretative activities are allowed year-round, from sunrise to sunset, in all designated units where parking lots and trails are located.

(d) How is the use conducted?
The refuge contains multiple means for visitors to experience the interpretative program through lectures, publications, website, brochures, fact sheets, species lists, signs, trails, and exhibits.

(e) Why is this use being proposed?
Interpretation enhances opportunities for a quality visitor experience on the refuge. It also promotes visitor understanding for America's natural resources by providing safe, enjoyable, and accessible interpretive opportunities, products, and facilities. Many visitors do not realize the distinction between national wildlife refuges and a park or Federal or State agency lands that are managed for different purposes. Increased efforts are needed to help people better understand the role of national wildlife refuges and the Service mission, and to have a heightened awareness of conservation and stewardship concepts. Interpretation at the refuge could provide opportunities for visitors to make their own connection with resources by promoting outdoor family oriented activities.

Availability of Resources:

Approximately 0.5 full-time equivalent (FTE) position is be required to administer and manage these activities adequately. In addition, maintenance and improvement of refuge interpretive signs, trails, parking lots, and kiosk displays will periodically be required. The total estimated cost per year would range from $50,000 to $75,000. Based on a review of the refuge budget allocated for interpretation, there is currently some funding to ensure compatibility and to partially administer and manage the existing use. Strategies to improve the interpretation program have been identified and would require hiring another FTE to capture the potential for this area.

The Comprehensive Conservation Plan (CCP) recommends additional staffing and facilities to support the interpretation program, especially if the Visitor Center is built. Greater numbers of people would learn about, and benefit from, the refuge with additional staff and interpretative materials.

Resources involved in the administration and management of the use:

Depending on event, most current refuge staff may be required for these programs.

Special equipment, facilities, or improvements necessary to support the use:

Maintenance of litter removal, access roads, gates, trails, parking areas, photo blinds, and boat ramp would be ongoing.

Construction of a Visitor Center with numerous interactive displays.

Maintenance costs: $5,000 (without visitor center) – recurring cost

$25,000 (with visitor center) – recurring cost

Monitoring costs: None

Offsetting revenues: None

Anticipated Impacts of the Use:

Short-term impacts: The overall impacts to the refuge and its associated habitat and wildlife from interpretation would be minimal. There would be some disturbance to wildlife and vegetation at the locations where interpretive programs occur but at levels that would not interfere with the purposes of the refuge. School buses and personal vehicles would utilize developed roads and parking areas to access trails that are already in place. Self-guided interpretation would be sporadic, by small groups of people, and at established trails and kiosks. This may cause short-term disturbance as well but would have minimal impact.

Long-term impacts: Anticipated long-term impacts are beneficial to the refuge, as these activities promote a conservation ethic in the local community. This use would increase in the future if a new Visitor Center area is added and an additional staff position with visitor services responsibilities is added as proposed in the CCP. As improvements are made, there may be some additional short-term, localized disturbance, but use would continue to be in existing developed areas.

Cumulative impacts: There are no anticipated cumulative impacts. Other public uses such as environmental education, wildlife observation, and photography at the same sites used for interpretation may increase over time, but it is not anticipated to be enough to cause cumulative impacts. The cumulative impacts of educating the public about conservation issues would be beneficial to meeting the Service mission and refuge purposes.

Public Review and Comment:

During public scoping for the preparation of the CCP, verbal and written comments were solicited from members of the general public on all aspects of current refuge management through public meetings, special mailings, and local media. This Draft Compatibility Determination (CD) is being made available for public review in conjunction with the public comment period for the Trinity River NWR Draft CCP/EA. Public comments on this Draft CD are due by the deadline stated on the cover letter with the Draft CCP/EA.

Determination (check one below):

____ Use is Not Compatible

_X_ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

1. The refuge is open to public access year-round during daylight hours. Public or legal access to units must be available.

2. Certain areas may be closed due to emergencies, hunting, or sensitive wildlife.

3. Use of motorized vehicles is limited to maintained roads and parking areas.

4. Camping, overnight use, and fires are prohibited.

5. Federal and/or State law enforcement agencies would ensure regulation compliance, safety, and protection of refuge resources.

6. Adequate staffing and funding must be available to ensure a safe experience.

Justification:

Interpretation programs are not expected to have any major effects on other refuge/public use management activities because: (1) this use is compatible with the general Service policy regarding the establishment of interpretation on national wildlife refuges; (2) this use is compatible with the purposes for which Trinity River NWR was established; (3) this use does not initiate widespread controversy or litigation; (4) there are no conflicts with local, regional, State, or Federal plans or policies; and (5) the majority of refuge visitors come to the refuge to see wildlife and benefit from interpretation.

Interpretation programs conducted at Trinity River National Wildlife Refuge is in accordance with the analysis of the Environmental Assessment and stated stipulations and will not "materially interfere with or detract from the fulfillment of the mission of the System or the purpose of the refuge was established," nor will it conflict with any of the other priority public uses, adversely impact other biological resources, or detract from refuge goals, objectives and refuge management activities as described in the National Wildlife Refuge System Improvement Act of 1997.

Mandatory 15-year Re-Evaluation Date: 2027

Signature: Refuge Manager _____

(Signature and Date)

Concurrence: Regional Chief _____

(Signature and Date)

References Used:

U.S. Fish and Wildlife Service. 1999. Lower Trinity River Floodplain Habitat Stewardship Program. Trinity River National Wildlife Refuge.

U.S. Fish and Wildlife Service. 2005. Visitor Services Review. Trinity River National Wildlife Refuge.

U.S. Fish and Wildlife Service. 2006. Service Manual. Part 601 FW 1: National Wildlife Refuge System Mission and Goals and Refuge Purposes. Division of Conservation, Planning and Policy.

U.S. Fish and Wildlife Service. 2006. Service Manual. Part 605 FW 1: Wildlife-Dependent Recreation. Division of Conservation, Planning and Policy.

U.S. Fish and Wildlife Service. 2006. Service Manual. Part 605 FW 7: Interpretation. Division of Conservation, Planning and Policy.

Draft Compatibility Determination

Use: Environmental Education

Refuge Name: Trinity River National Wildlife Refuge

County: Liberty, TX

Establishing and Acquisition Authority(ies):

Emergency Wetlands Resources Act of 1986, Public Law 99-645

Refuge Purpose(s):

"…the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions…" 16 U.S.C. 3901(b) (Emergency Wetlands Resources Act of 1986).

National Wildlife Refuge System Mission:

The mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Use:

(a) What is the use?
The refuge does not currently host an environmental education (EE) program. A structured, curriculum-based EE program would provide a safe, accessible, and high-quality educational opportunity for children and adults to learn about the refuge and bottomland hardwood habitats of southeast Texas.

(b) Where is the use conducted?
The refuge does not currently host an EE program. A structured, curriculum-based EE program would be conducted at the numerous locations, including but not limited to all units with parking lots and trails, Champion Lake Public Use Area, and the proposed Visitor Center.

(c) When is the use conducted?
EE activities would be allowed year-round, from sunrise to sunset, in all designated areas in accordance with applicable State and Federal regulations. The use would primarily be conducted during the school year with on-site activities occurring throughout the spring, winter, and fall.

(d) How is the use conducted?
Structured, curriculum-based EE activities comply with Service policy (605 FW 6), which are aligned with State and National EE criteria. EE programs typically involve

groups of teachers or students of varying ages participating in on-site activities led by refuge staff or certified teachers or volunteers about geological, biological, or ecological topics regarding the site. During on-site activities, a small number of organisms, like aquatic insects, may be temporarily removed from their habitat for observation, but these organisms are returned and the students are taught the ethic of leaving the refuge in an undisturbed state. In addition, the refuge teaches students the prohibitions on picking wildflowers and removing bird feathers. Students are taught the importance of good wildlife observation techniques, including moving slowly and quietly to produce the least possible disruption to the environment. At some sites, students have even been involved with habitat restoration. Additionally, this program may allow the refuge to establish partnerships to support environmental education.

(e) **Why is this use being proposed?**
EE provides a way for students and teachers to connect with nature through a hands-on approach and provides educational experiences that are not easily gained in a classroom setting. Texas mandates that a significant percentage of science education be in the form of lab and field investigations, and the refuge program is a perfect fit for these types of field-based experiences. The program would meet local and State of Texas education standards, allow professional development for teachers, provide community-based service organization programs, meet youth group merit badge requirements, and instill a sense of stewardship and understanding of conservation issues. The EE program also improves the quality of the visitors' experiences and provides them with a better understanding of the benefits, issues, and challenges of natural resource conservation in the bottomland hardwood ecosystem.

Availability of Resources:

Approximately one full-time equivalent (FTE) position would be required to administer and manage this activity adequately (in conjunction with interpretation program). In addition, maintenance and improvement of trails, parking lots, and kiosk displays will periodically be required. The total estimated cost per year would range from $60,000 to $80,000. Based on a review of the refuge budget allocated for EE, there is currently no funding to ensure compatibility or to administer and manage. Strategies to initiate the EE program have been identified and would require hiring another FTE to capture the potential for this area.

The Comprehensive Conservation Plan (CCP) recommends additional staffing and facilities to initiate and support an EE program. Many local students would learn about, and benefit from, the refuge with additional staff and educational materials. Additional staff would be able to provide teacher workshops and refuge orientations, and would help develop site-specific curricula, materials, and activities linked to State standards. Students and teachers would also be able to participate in coordinated research projects through long-term monitoring studies.

Resources involved in the administration and management of the use:

Depending on the event, some refuge staff and volunteers may be required for these programs.

Special equipment, facilities, or improvements necessary to support the use:

Maintenance of litter removal, access roads, gates, trails, parking areas, photo blinds, and kiosks would be ongoing.

Construction of a Visitor Center with classroom capabilities.

Maintenance costs: $5,000 (without visitor center) – recurring cost

$25,000 (with visitor center) – recurring cost

Monitoring costs: None

Offsetting revenues: None

Anticipated Impacts of the Use:

Short-term impacts: The overall impacts to the refuge and its associated habitat and wildlife from EE would be minimal. There would be some disturbance to wildlife and vegetation at the locations where EE programs occur but at levels that would not interfere with the purposes of the refuge. School buses and personal vehicles would utilize developed roads and parking areas to access trails that are already in place. EE programs would be sporadic and spread across different units at established trails. This may cause short-term disturbance as well but would have minimal impact.

Long-term impacts: Anticipated long-term impacts are beneficial to the refuge, as these activities promote a conservation ethic in the local community. This use would increase in the future if a new Visitor Center area is added and an additional staff position with EE responsibilities is added as proposed in the CCP. As improvements are made, there may be some additional short-term, localized disturbance, but use would continue to be in existing developed areas.

Cumulative impacts: There are no anticipated cumulative impacts. Other public uses such as interpretation, wildlife observation, and photography at the same sites used for EE may increase over time, but it is not anticipated to be enough to cause major cumulative impacts. The cumulative impacts of educating students about conservation issues would be beneficial to meeting the Service mission and refuge purposes.

Public Review and Comment:

During public scoping for the preparation of the CCP, verbal and written comments were solicited from members of the general public on all aspects of current refuge management through public meetings, special mailings, and local media. This Draft Compatibility Determination (CD) is being made available for public review in conjunction with the public comment period for the Trinity River National Wildlife Refuge (NWR) Draft CCP/EA. Public comments on this Draft CD are due by the deadline stated on the cover letter with the Draft CCP/EA.

Determination (check one below):

___ Use is Not Compatible

_X_Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

1. Evolution of sites and programs will be periodically assessed to determine if objectives are being met and that natural resources are not being adversely impacted.
2. The refuge is open to EE year-round during daylight hours. Public or legal access to units must be available.
3. Certain areas may be closed due to emergencies, hunting, or sensitive wildlife.
4. Use of motorized vehicles is limited to maintained roads and parking areas.
5. Camping, overnight use, and fires are prohibited.
6. Federal and/or State law enforcement agencies would ensure regulation compliance, safety, and protection of refuge resources.
7. Educational groups are required to have a sufficient number of adults to supervise their groups.
8. Adequate staffing and funding must be available to ensure a safe experience.

Justification:

Environmental Education programs are not expected to have any major effects on other refuge/public use management activities because:

> (1) this use is compatible with the general Service policy regarding the establishment of interpretation on national wildlife refuges; (2) this use is compatible with the purposes for which Trinity River NWR was established; (3) this use does not initiate widespread controversy or litigation; and (4) there are no conflicts with local, regional, State, or Federal plans or policies.

Environmental education conducted at Trinity River National Wildlife Refuge is in accordance with the stipulations stated and will not "materially interfere with or detract from the fulfillment of the mission of the System or the purpose of the refuge was established." Environmental education will not conflict with any of the other priority public uses, nor will it adversely impact other biological resources or detract from refuge goals, objectives, and management activities as described in the National Wildlife Refuge System Improvement Act of 1997.

Signature: Refuge Manager _____

(Signature and Date)

Concurrence: Regional Chief _____

(Signature and Date)

Mandatory 15-year Re-Evaluation Date: 2027

References Used:

U.S. Fish and Wildlife Service. 1999. Lower Trinity River Floodplain Habitat Stewardship Program. Trinity River National Wildlife Refuge.

U.S. Fish and Wildlife Service. 2005. Visitor Services Review. Trinity River National Wildlife Refuge.

U.S. Fish and Wildlife Service. 2006. Service Manual. Part 601 FW 1: National Wildlife Refuge System Mission and Goals and Refuge Purposes. Division of Conservation, Planning and Policy.

U.S. Fish and Wildlife Service. 2006. Service Manual. Part 605 FW 1: Wildlife-Dependent Recreation. Division of Conservation, Planning and Policy.

U.S. Fish and Wildlife Service. 2006. Service Manual. Part 605 FW 6: Environmental Education. Division of Conservation, Planning and Policy.

Draft Compatibility Determination

Use: Boating, motorized and non-motorized

Refuge Name: Trinity River National Wildlife Refuge

County: Liberty, TX

Establishing and Acquisition Authority(ies):

Emergency Wetlands Resources Act of 1986, Public Law 99-645

Refuge Purpose(s):

"...the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions..." 16 U.S.C. 3901(b) (Emergency Wetlands Resources Act of 1986).

National Wildlife Refuge System Mission:

The mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Use:

(a) What is the use?
Boating (both motorized and non-motorized) is an existing recreational use occurring on Trinity River National Wildlife Refuge (refuge, Trinity River NWR). Boating opportunities on the refuge include motorized, with restriction horsepower (hp) sizes, canoeing, and kayaking. Although boating is not identified as one of the six wildlife-dependent recreational uses in the National Wildlife Refuge System Improvement Act of 1997, this activity is directly tied to fishing and hunting and supports wildlife observation, photography, and interpretation. Boating is allowed only in designated areas during refuge hours. The refuge is proposing to continue to provide boating opportunities specifically in support of fishing, waterfowl hunting, wildlife observation, photography, and interpretation. Champion Lake would continue with all of these uses with boats having a maximum 10 hp motor. Pickett's Bayou would continue with all of these uses except waterfowl hunting with boats having a maximum 40 hp motor. All other ponds, lakes, or bayous discussed in Comprehensive Conservation Plan (CCP) would only allow non-motorized boats, including no use of electric motors.

(b) Where is the use conducted?
The refuge permits boats with motor restrictions on Champion Lake and Pickett's Bayou. There are two boat ramps on the refuge: one on Champion Lake levee and on Pickett's Bayou, 25 yards south of the same levee. Both are accessible at the end of County Road 417 near the refuge's southern boundary. Boats can make it up Pickett's

Bayou from State regulated waters if the water is high enough and the narrow creeks are free of tree debris. Additional areas proposed for non-motorized boats include the Brierwood Unit and some kayak/canoe trails that snake through the R&M/Daniels adjoining units.

(c) **When is the use conducted?**
Boating activities would be allowed year-round, from sunrise to sunset, in all designated areas in accordance with applicable State and Federal regulations, from sunrise to sunset.

(d) **How is the use conducted?**
Refuge visitors are allowed to access waters via the designated two boat ramps or by carrying a kayak/canoe in from the parking lot. No permits are required. All boats must adhere to all Coast Guard, State of Texas, and refuge-specific regulations. Boats are restricted from all bird rookery sites from March through end of May and are marked with signs. Based on staff observations, boat use in Champion Lake and Pickett's Bayou is low. On busier spring/summer weekends or holidays, those areas have about 15 boats on the water throughout the day. Most other days only see 3–5 boats maximum. Boating can be self-regulated due to common droughts causing low (or little) water; the refuge also closes these sites during frequent flooding events.

(e) **Why is this use being proposed?**
Boating facilitates fishing, hunting, wildlife observation, photography, and interpretation, each of which is one of the wildlife-dependent recreational uses described in the National Wildlife Refuge System Improvement Act of 1997. This supportive recreational opportunity will help establish an enhanced appreciation of the outdoor experience and encourage families and future generations to continue to pursue outdoor recreation. There is only one public boat ramp (usually is disrepair) in Liberty County with access to the Trinity River. There are no other public bodies of water within the county except a two-acre lake at the Liberty City Park. Refuge opportunities will allow the public a use that is severely limited in the county.

Availability of Resources:

This activity can be supported within existing funding levels for the refuge.

Maintenance costs: $5,000 - Litter removal and maintaining access roads, parking areas, and boat ramps would be ongoing.

Staff time costs (law enforcement): $2,500

Anticipated Impacts of the Use:

Short-term and long-term impacts: The overall impacts to the refuge and its associated habitat and wildlife from boating would be minimal. There would be some disturbance to wildlife and aquatic vegetation at the locations where boating occurs but at levels that would not interfere with the purposes of the refuge. Boat trail use would be sporadic, with small groups of people. This may cause short-term disturbance as well but would have minimal impact.

Anticipated long-term impacts may be beneficial to the refuge, as boats, kayaks, and canoes can promote a conservation ethic in the local community. This use would increase in the future as the refuge becomes more popular. With increased use, there may be some additional short-term, localized disturbance.

Cumulative impacts: There are negligible anticipated cumulative impacts expected. Other wildlife-dependent public uses such as hunting, fishing, environmental education, wildlife observation, and photography at the same sites used for boating may increase over time, but it is not anticipated to be enough to cause more than negligible cumulative impacts. The cumulative impacts of some boating being used for six wildlife-dependent public uses would be beneficial to meeting the Service mission and refuge purposes.

Public Review and Comment:

During public scoping for the preparation of the CCP, verbal and written comments were solicited from members of the general public on all aspects of current refuge management through public meetings, special mailings, and local media. This Draft Compatibility Determination (CD) is being made available for public review in conjunction with the public comment period for the Trinity River NWR Draft CCP/EA. Public comments on this Draft CD are due by the deadline stated on the cover letter with the Draft CCP/EA.

Determination (check one below):

___ Use is Not Compatible

_X_ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

1. The refuge is open to public access year-round during daylight hours. Public or legal access to units must be available.
2. Certain areas may be closed due to emergencies, hunting, or sensitive wildlife.
3. Use of motorized vehicles is limited to maintained roads and parking areas.
4. Camping, overnight use, and fires are prohibited.
5. Federal and/or State law enforcement agencies would ensure regulation compliance, safety, and protection of refuge resources.
6. Adequate staffing and funding must be available to ensure a safe experience.
7. Motors are limited to 10 hp or less in Champion Lake and 40 hp or less at the Pickett's Bayou boat launch. All other fishing ponds and lakes are limited to non-powered boats. No jet skies, airboats, fan boats, waterskiing, or swimming are allowed.
8. No boating or entry within 200 yards of an established bird rookery from March through the end of May.

Justification:

Boating activities are not expected to have any major effects on other refuge/public use management activities because:

1. this use is compatible with the general Service policy regarding the establishment of interpretation on national wildlife refuges;
2. this use is compatible with the purposes for which Trinity River NWR was established;
3. this use does not initiate widespread controversy or litigation;
4. there are no conflicts with local, regional, State, or Federal plans or policies; and
5. the majority of refuge visitors come to the refuge to see wildlife and benefit from interpretation.

As defined by the National Wildlife Refuge System Improvement Act of 1997, wildlife-dependent recreational uses are to receive enhanced and priority consideration in refuge planning and management. The continuation of boating at the refuge supports these priority wildlife-dependent public uses offered and is directly tied to fishing, hunting, wildlife observation, photography, and interpretation. Thus, this use will not conflict with any of the other priority public uses, adversely impact biological resources, or detract from refuge goals, objectives, and management activities described in the CCP. In fact, boating in accordance with the described stipulations will enhance the refuge's ability to attract visitors and teach them about the purpose of the refuge and its role in the National Wildlife Refuge System.

Restricted boating conducted at Trinity River National Wildlife Refuge is in accordance with the analysis of the Environmental Assessment and stated stipulations, and will not "materially interfere with or detract from the fulfillment of the mission of the System or the purpose of the refuge was established" or conflict with any of the other priority public uses, nor will it adversely impact other biological resources or detract from refuge goals, objectives and refuge management activities as described in the National Wildlife Refuge System Improvement Act of 1997.

Signature: Refuge Manager _____

(Signature and Date)

Concurrence: Regional Chief _____

(Signature and Date)

Mandatory 15-year Re-Evaluation Date: 2027

References Used:

U.S. Fish and Wildlife Service. 1999. Lower Trinity River Floodplain Habitat Stewardship Program. Trinity River National Wildlife Refuge.

U.S. Fish and Wildlife Service. 2005. Visitor Services Review. Trinity River National Wildlife Refuge.

U.S. Fish and Wildlife Service. 2006. Service Manual. Part 601 FW 1: National Wildlife Refuge System Mission and Goals and Refuge Purposes. Division of Conservation, Planning and Policy.

U.S. Fish and Wildlife Service. 2006. Service Manual. Part 605 FW 1: Wildlife-Dependent Recreation. Division of Conservation, Planning and Policy.

Draft Compatibility Determination

Use: Research

Refuge Name: Trinity River National Wildlife Refuge

County: Liberty, TX

Establishing and Acquisition Authority(ies):

Emergency Wetlands Resources Act of 1986, Public Law 99-645

Refuge Purpose(s):

"…the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions…" 16 U.S.C. 3901(b) (Emergency Wetlands Resources Act of 1986).

National Wildlife Refuge System Mission:

The mission of the System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

Description of Use:

(a) What is the use?

This evaluation is to determine the compatibility of scientific research. Research and studies by non-Service personnel will be permitted throughout the refuge. The research would focus on the study of flora, fauna, ecology, cultural history, archaeological, climate change, and public uses of the refuge.

This use is not a priority public use, but these studies would provide analysis and information about the biological, cultural, natural, and public use activities of the refuge ecosystem. Such information will be useful to managers making decisions on habitat management, public use, and related management decisions for the conservation of natural resources. Collections of water, soil, plants, and invertebrates would be allowed in conjunction with research when appropriate. For each research project, a Special Use Permit will be prepared describing the specific research activity.

(b) Where is the use conducted?

These studies will be conducted throughout the refuge. The exact locations of the studies will be determined by the focus of the study. Each proposal will be evaluated by refuge staff and other subject matter experts to determine the value of the study and study sites.

(c) When is the use conducted?

Depending on the research project, activities could be conducted at any time throughout the year. Individual research projects may require one or two visits per year, while other projects may require daily visits. The time allowed for each project would be limited to the minimum required to complete the project. This activity would be limited in units with ongoing hunting. If public use events conflict with research projects, the public use event shall be given priority as deemed appropriate by the refuge manager.

The majority of research projects for flora would be conducted during the growing seasons (spring, summer, early fall). Research projects for fauna would be based on the life cycles and migration patterns of the organisms under study. For example, waterfowl use is heaviest during the fall and winter, while warbler use is greater during the spring and late summer. Bat and amphibian surveys would be conducted during evening hours while forest interior dwelling bird species would be studied during the hours near sunrise.

(d) How is the use conducted?

Researchers will be required to submit a written proposal that outlines the methods, materials, timing, and justification for the proposed project. These proposals will be reviewed by refuge staff to assess the appropriateness of the research for the refuge, environmental impacts, assure that the projects do not interfere with other resources operations, and provide suggested modifications to the project to avoid disruptions to wildlife and operations.

Research will be restricted to those projects that will be expected to enhance the body of knowledge about the natural and cultural history of the refuge. Researchers will be expected to obtain and present any additional Federal, State, and archaeological permits if applicable. The refuge will not allow any research project that lacks an approved study plan and protocol or compromises public health and safety.

Some research studies may require access by boat. Boat operators in Service boats must have taken and passed the Motorboat Operator's Certification Course. Researchers that use all-terrain vehicles (ATV) must have taken and passed the State-approved certification course.

(e) Why is this use being proposed?

The Directors of the U.S. Fish and Wildlife Service (Service) and the U.S. Geological Survey (USGS) have endorsed the guidelines and recommendations included in the 2006 final report of the National Ecological Assessment Team entitled "Strategic Habitat Conservation, "which encourages the integration of scientific information with management decisions (U.S. Fish and Wildlife Service 2006). Similarly, "Fulfilling the Promise," published in 1999, explained the importance of conducting "good science" on lands managed by the National Wildlife Refuge System within the U.S. Fish and Wildlife Service (U.S. Fish and Wildlife Service 1999). Managers and biologists are required to demonstrate that sound scientific information is used to manage lands within the National Wildlife Refuge System. In addition, wildlife professionals are encouraged to follow the rigorous scientific guidelines as described by The Wildlife Society in their most recent publication, "Techniques for wildlife investigations and

management" (Braun 2005). Collecting, analyzing, and using the most credible scientific information is vital to effectively managing lands within the National Wildlife Refuge System, including Trinity River NWR.

The refuge may also consider research for other purposes which may not be directly related to refuge-specific objectives but would contribute to the broader enhancement, protection, use, preservation, and management of populations of fish, wildlife and plants, and their natural diversity within the region or flyway. Such research projects may generate information that is relevant to management questions that may arise in the future or that may be useful to other refuges within the region. These proposals must comply with the Service's compatibility policy (U.S. Fish and Wildlife Service 1999).

The refuge may develop a list of research needs that will be provided to prospective researchers or organizations upon request. Refuge staff interacts with members of the scientific community on a regular basis, which often generates ideas for future research projects. Refuge support of research directly related to refuge objectives may take the form of funding, in-kind services such as housing or use of other facilities, direct staff assistance with the project in the form of data collection, provision of historical records, conducting of management treatments, or other assistance as appropriate.

Availability of Resources:

This activity can be supported within existing funding levels for the refuge. Any research projects that would be conducted by non-Service staff will be reviewed, coordinated, processed, and approved or modified under a Special Use Permit on a project-by-project basis. Generally, all specialized equipment would be the responsibility of the researcher.

Maintenance costs: $1,000 – generally includes fuel and minor repairs for government equipment.

Monitoring costs: $5,000 – staff time to review and/or assist with research projects.

Anticipated Impacts of the Use:

Short-term impacts: Research activities may disturb habitat and wildlife through observation, a variety of wildlife capture techniques, banding, and accessing the study area by foot, boat, or ATV. For example, the presence of researchers may cause disruption of birds on nests or in breeding territories, or increase predation on nests. Efforts to capture birds may cause disturbance, injury, or death to groups or to individual birds. The energy cost of disturbance may be appreciable in terms of disruption of feeding, displacement from preferred habitat, and the added energy expended to avoid disturbance.

It is possible that direct or indirect mortality could result as a byproduct of research activities. Mist-netting or other wildlife capture techniques, for example, may cause mortality directly through the capture method or indirectly through capture injury or stress caused to the organism. If such mortalities do occur, there would be no impact to the overall population.

Wildlife habitats may also be impacted by research. Sampling activities may cause compaction of soils and the trampling of vegetation, the establishment of temporary foot trails and boat trails through vegetation beds, disruption of bottom sediments, and minor tree damage when equipment is temporarily placed. The removal of vegetation or sediments by core sampling methods may cause increased localized turbidity and disrupt non-target plants and animals.

Installation of posts, equipment platforms, collection devices, and other research equipment may present a hazard if said items are not adequately marked and/or removed at appropriate times or upon completion of the project. Negligible vehicle emissions, contaminants from equipment leaks, and very minor erosion from roads may result from access to the research sites.

Research efforts may also discover methods that result in a reduction in impacts described here. As new and innovative techniques become available, the Service would require researchers to use the least intrusive research methodologies and techniques.

Long-term impacts: No long-term impacts are expected, and the refuge manager can control the potential for long-term impacts through Special Use Permits.

Cumulative impacts: Cumulative impacts would only occur if multiple research projects were occurring on the same resources at the same time or if the duration of the research is excessive. No cumulative impacts are expected, and the refuge manager can control the potential for cumulative impacts through Special Use Permits. Managers retain the option to prohibit research on the refuge that does not contribute to the purposes of the refuge or the mission of the Refuge System, or causes undo resource disturbance or harm.

Public Review and Comment:

During public scoping for the preparation of the CCP, verbal and written comments were solicited from members of the general public on all aspects of current refuge management through public meetings, special mailings, and local media. This Draft Compatibility Determination (CD) is being made available for public review in conjunction with the public comment period for the Trinity River NWR Draft CCP/EA. Public comments on this Draft CD are due by the deadline stated on the cover letter with the Draft CCP/EA.

Determination (check one below):

___Use is Not Compatible

_X_Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

1. Collections will be restricted to permittees who have consulted refuge staff concerning special requirements needed to assure that the collections do not disrupt sensitive flora and fauna and to assure that collections do not disrupt refuge operations.
2. Highly intrusive or manipulative research is generally not permitted in order to protect native wildlife populations and habitats in which they live.
3. Permittees must present appropriate State and Federal permits that may be required in addition to refuge permit.

4. Research projects will follow all State of Texas environmental and wildlife regulations.
5. Field activities will be monitored to assure compliances with permit conditions and assess impacts.
6. Research permits will be issued only for bona-fide natural resource and cultural research purposes to individuals representing agencies, universities or other organizations.
7. Researchers must clearly mark posts, equipment platforms, fencing material, and other equipment left unattended so as to not pose a hazard. Such items shall be removed as soon as practicable upon completion of the research, including flagging.
8. Cultural and archeological surveys will be coordinated with the Regional Historical Preservation Officer and the appropriate State Historic Preservation Officer to assure compliance with the Archeological Resource Protection Act.
9. All research activities will be performed in accordance with recommendations and guidelines described in the Special Use Permits for each research project.
10. To the extent possible, within existing budget and personnel constraints, research projects conducted would promote the new vision and direction of the Service as outlined in "Strategic Habitat Conservation: final report of the National Ecological and Assessment Team" (U.S. Fish and Wildlife Service 2006).

Justification:

Research is compatible with the mission and trust resource responsibilities of the Service and is, in fact, necessary to effectively manage those trust resources. Research and monitoring activities have been conducted at Trinity River NWR since it was established in 1994.

Research by third parties plays an integral role in refuge management by providing information needed to manage the refuge on a sound scientific basis. Investigations into the biological, physical, archeological, and social components of the refuge provide a means to analyze management actions, impacts from internal and outside forces, and ongoing natural processes on the refuge environment. Research provides scientific evidence as to whether the refuge is functioning as intended when established by Congress.

The Service encourages approved research to further understanding of refuge natural resources. Research by non-Service personnel adds greatly to the information base for Refuge Managers to make proper decisions. Additionally:

> (1) this use is compatible with the general Service policy regarding research on national wildlife refuges; (2) this use is compatible with the purposes for which Trinity River NWR was established; (3) this use does not initiate widespread controversy or litigation; and (4) there are no conflicts with local, regional, State, or Federal plans or policies.

Research conducted on Trinity River National Wildlife Refuge is in accordance with the stipulations listed here, and will not "materially interfere with or detract from the fulfillment of the mission of the System or the purpose of the refuge was established," nor will it conflict with any of the other priority public uses, adversely impact other biological resources, or detract from refuge goals, objectives, and refuge management activities as described in the National Wildlife Refuge System Improvement Act of 1997.

Signature: Refuge Manager _____

(Signature and Date)

Concurrence: Regional Chief _____

(Signature and Date)

Mandatory 10-year Re-Evaluation Date: 2022

References Cited:

Braun, C. E., editor. 2005. Techniques for wildlife investigations and management. Sixth edition. The Wildlife Society, Bethesda, Maryland, USA. 974pp.

U.S. Fish and Wildlife Service. 1999. Lower Trinity River Floodplain Habitat Stewardship Program. Trinity River National Wildlife Refuge.

U.S. Fish and Wildlife Service. 1999. Fulfilling the Promise. Fish and Wildlife Service Report, U.S. Department of the Interior. 92pp.

U.S. Fish and Wildlife Service. 2006. Strategic Habitat Conservation: final report of the National Ecological Assessment Team. Fish and Wildlife Service Report, U.S. Department of the Interior. 45pp.

E. Species List

This appendix contains a list of over 1,063 species identified on Trinity River National Wildlife Refuge, including approximately 44 mammals, 214 birds, 17 amphibians, 35 reptiles, 49 fish, 79 butterflies and moths, and 633 vascular plants.

E.1 MAMMALS

ORDER DIDELPHIMORPHA – Marsupials

FAMILY DIDELPHIDAE
Virginia Oppossum *(Didelphis virginiana)*

ORDER XENARTHRA – Edentates

FAMILY DASYPODIDAE
Nine-banded Armadillo *(Dasypus novemcinctus)*

ORDER INSECTIVORA – Insectivores

FAMILY SORICIDAE
Short-tailed Shrew *(Blarina brevidcauda)*
Least Shrew *(Cryptotis parva)*

ORDER CHIROPTERA – Bats

FAMILY VESPERTILIONIDAE
Big Brown Bat *(Estesicus fuscus)*
Eastern Pipistrelle Bat *(Pipistrellus subflavus)*
Eastern Red Bat *(Lasiurus borealis)*
Evening Bat *(Nycticeius humeralis)*
Hoary Bat *(Lasiurus cinereus)*
Northern Yellow Bat *(Lasiurus intermedius)*
Rafinesque's Big-eared Bat *(Corynorhinus rafinesquii)*
Seminole Bat (*Lasiurus seminolus)*
Silver-haired Bats *(Lasionycteris noctivagans)*
Southeastern Myotis Bat (*Myotis austroriparius)*

FAMILY MOLOSSIDAE
Mexican Free-tailed Bat *(Tadarida brasiliensis)*

ORDER CARNIVORA – Carnivores

FAMILY CANIDAE
Coyotes *(Canis latrans)*
Gray Fox *(Urocyon cinereoargenteus)*
Red Fox *(Vulpes vulpes)*

FAMILY PROCYONIDAE
Raccoon *(Procyon lotor)*

FAMILY MUSTELIDAE
Eastern Spotted Skunk *(Spirogale putorius)*
River Otter *(Lutra canadensis)*
Striped Skunk *(Mephitis mephitis)*

FAMILY FELIDAE
Bobcat *(Felis rufus)*

ORDER ARTIODACTYLA – Ungulates

FAMILY SUIDAE
Pig (*Sus scrofa)*

FAMILY CERVIDAE
White-tailed Deer *(Odocoileus virginianus)*

ORDER RODENTIA – Rodents

FAMILY SCIURIDAE
Eastern Fox Squirrel *(Sciurus niger)*
Eastern Gray Squirrel *(Sciurus carolinensis)*
Eastern Flying Squirrel *(Glaucomys volans)*

FAMILY GEOMYIDAE
Attwater's Pocket Gopher *(Geomys attwateri)*
Baird's Pocket Gopher *(Geomys breviceps)*

FAMILY CASTORIDAE
Beaver *(Castor Canadensis)*

FAMILY MURIDAE
Common Muskrat *(Ondatra zibethicus)*
Cotton Mouse *(Peromyscus gossypinus)*
Deer Mouse *(Peromyscus maniculatus)*
Eastern Harvest Mouse *(Reithrodontomys humulis)*
Eastern Woodrat *(Neotoma floridana)*
Fulvous Harvest Mouse (*Reithrodontomys fulvescens)*
Golden Mouse *(Ochrotomys nuttalli)*
Hispid Cotton Rat *(Sigmodon hispidus)*
Marsh Rice Rat *(Oryzomys palustris)*
White-footed Mouse *(Peromyscus leucopus)*

FAMILY MYOCASTORIDAE
Nutria *(Myocastor coypus)*

ORDER LAGOMORPHA – Lagomorphs

FAMILY LEPORIDAE
Eastern Cottontail (*Sylvilagus floridanus)*
Swamp Rabbit (*Sylvilagus aquaticus)*

E.2 BIRDS

ORDER PODICIPEDIFORMES

FAMILY PODICIPEDIDAE – Grebes
Pied-billed Grebe *(Podilymbus podiceps)*

ORDER PELECANIFORMES

FAMILY PELECANIDAE – Pelicans
American White Pelican *(Pelecanus erythrorhynchos)*
Brown Pelican *(Pelecanus occidentalis)*

FAMILY PHALACROCORACIDAE – Cormorants
Double-crested Cormorant *(Phalacrocorax auritus)*
Neotropic Cormorant *(Phalacrocorax brasilianus)*

FAMILY ANHINGIDAE – Anhingas
Anhinga *(Anhinga anhinga)*

ORDER CICONIFORMES

FAMILY ARDEIDAE – Bitterns, Herons, Egrets
American Bittern *(Botaurus lentiginosus)*
Least Bittern (*Ixobrychus exilis)*
Great Blue Heron (*Ardea herodias)*
Great Egret *(Ardea alba)*
Snowy Egret *(Egretta thula)*
Little Blue Heron *(Egretta caerulea)*
Cattle Egret *(Bubulcus ibis)*
Reddish Egret *(Egretta rufescens)*
Black-crowned Night Heron *(Nycticorax nycticorax)*
Green Heron (*Butorides virescens)*
Tricolored Heron *(Egretta tricolor)*
Yellow-crowned Night Heron *(Nyctanassa violacea)*

FAMILY CICONIDAE – Storks
Wood Stork *(Mycteria americana)*

FAMILY THRESKIORNITHIDAE – Ibises
Roseate Spoonbill *(Platalea ajaja)*
White Ibis *(Eudocimus albus)*
White-faced Ibis *(Plegadis chihi)*

ORDER ANSERIFORMES

FAMILY ANATIDAE – Waterfowl
Greater White-fronted Goose *(Anser albifrons)*
Snow Goose *(Chen caerulescens)*
Ross's Goose *(Chen rossii)*
Canada Goose (*Branta canadensis*)
Wood Duck *(Aix sponsa)*

Green-winged Teal *(Anas crecca)*
Mallard *(Anas platyrhynchos)*
Northern Pintail *(Anas acuta)*
Blue-winged Teal *(Anas discors)*
Northern Shoveler *(Anas clypeata)*
Gadwall *(Anas strepera)*
American Wigeon *(Anas americana)*
Black-bellied Whistling Duck *(Dendrocygna autumnalis)*
Ring-necked Duck *(Aythya collaris)*
Lesser Scaup *(Aythya affinis)*
Redhead Duck *(Aythya americana)*
Hooded Merganser *(Lophodytes cucullatus)*
Mottled Duck *(Anas fulvigula)*
Ruddy Duck *(Oxyura jamaicensisz)*

ORDER FALCONIFORMES

FAMILY CATHARTIDAE – VULTURES
Black Vulture *(Coragyps atratus)*
Turkey Vulture *(Cathartes aura)*

FAMILY ACCIPITRIDAE – Hawks
Osprey *(Pandion haliaetus)*
Mississippi Kite (*Ictinia mississippiensis*)
Swallow-tailed Kite *(Elanoides forficatus)*
Bald Eagle *(Haliaeetus leucocephalus)*
Northern Harrier *(Circus cyaneus)*
Sharp-shinned Hawk *(Accipiter striatus)*
Cooper's Hawk *(Accipiter cooperii)*
Red-shouldered Hawk *(Buteo lineatus)*
Broad-winged Hawk *(Buteo platypterus)*
Red-tailed Hawk *(Buteo jamaicensis)*
Swainson's Hawk *(Buteo swainsoni)*

FAMILY FALCONIDAE – Falcons
American Kestrel *(Falco sparverius)*
Crested Caracara *(Caracara cheriway)*
Merlin *(Falco columbarius)*
Peregrine Falcon *(Falco peregrines)*

ORDER GALLIFORMES

FAMILY PHASIANIDAE – Turkey
Wild Turkey *(Meleagris gallopavo)*

ORDER GRUIFORMES

FAMILY RALLIDAE – Rails & Coots
American Coot *(Fulica americana)*
Common Moorhen *(Gallinula chloropus)*
Purple Gallinule *(Porphyrio martinica)*
Sora *(Porzana Carolina)*

ORDER CHARADRIIFORMES

FAMILY CHARADRIIDAE – Plovers
Piping Plover *(Charadrius melodus)*
Killdeer *(Charadrius vociferous)*

FAMILY SCOLOPACIDAE – Sandpipers
Greater Yellowlegs *(Tringa melanoleuca)*
Lesser Yellowlegs *(Tringa flavipes)*
Upland Sandpiper *(Bartramia longicauda)*
Spotted Sandpiper *(Actitis macularia)*
Least Sandpiper *(Calidris minutilla)*
Western Sandpiper (*Calidris mauri)*
Baird's Sandpiper *(Calidris bairdii)*
American Woodcock *(Scolopax minor)*
Long-billed Dowitcher *(Limnodromus scolopaceus)*
Wilson's Snipe *(Gallinago delicate)*

FAMILY LARIDAE – Gulls & Terns
Bonaparte's Gull *(larus philadelphia)*
Laughing Gull *(Larus atricilla)*
Ring-billed Gull *(Larus delawarensis)*
Caspian Tern *(Sterna caspia)*
Forster's Tern *(Sterna forsteri)*
Least Tern *(Sterna antillarum)*
Royal Tern *(Sterna maxima)*

FAMILY GRUIDAE – Cranes
Sandhill Crane *(Grus canadensis)*

FAMILY RECURVIROSTRIDAE – Stilts
Black-necked Stilt *(Himantopus mexicanus)*

ORDER COLUMBIFORMES

FAMILY COLUMBIDAE – Pigeons
Eurasian Collared Dove *(Streptopelia decaocto)*
Inca Dove *(Columbina inca)*
Mourning Dove *(Zenaida macroura)*
White-winged Dove *(Zenaida asiatica)*
Rock Pigeon *(Columba livia)*

ORDER CUCULIFORMES

FAMILY CUCULIDAE – Cuckoos
Yellow-billed Cuckoo *(Coccyzus americanus)*

ORDER STRIGIFORMES

FAMILY STRIGIDAE – Typical Owls
Eastern Screech Owl *(Otus asio)*
Great Horned Owl *(Bubo virginianus)*
Barred Owl *(Strix varia)*

ORDER CAPRIMULGIFORMES

FAMILY CAPRIMULGIDAE – Goatsuckers
Common Nighthawk *(Chordeiles minor)*

ORDER APODIFORMES

FAMILY APODIDAE – Swifts
Chimney Swift *(Chaetura pelagica)*

FAMILY TROCHILIDAE – Hummingbirds
Buff-bellied Hummingbird *(Amazilia yacatanensis)*
Ruby-throated Hummingbird *(Archilochus colubris)*

ORDER CORACIIFORMES

FAMILY CERYLIDAE – Kingfishers
Belted Kingfisher *(Ceryle alcyon)*
Green Kingfisher *(Chloroceryle americana)*

ORDER PICIFORMES

FAMILY PICIDAE – Woodpeckers
Red-headed Woodpecker *(Melanerpes erythrocephalus)*
Red-bellied Woodpecker *(Melanerpes carolinus)*
Yellow-bellied Sapsucker *(Sphyrapicus varius)*
Downy Woodpecker (P*icoides pubescens)*
Hairy Woodpecker *(Picoides villosus)*
Northern Flicker *(Colaptes auratus)*
Pileated Woodpecker *(Dryocopus pileatus)*

ORDER PASSERIFORMES

FAMILY TYRANNIDAE – Flycatchers
Olive-sided Flycatcher *(Contopus cooperi)*
Eastern Wood Pewee *(Contopus virens)*
Acadian Flycatcher *(Empidonax virescens)*
Least Flycatcher *(Empidonax minimus)*
Eastern Phoebe *(Sayornis phoebe)*
Ash-throated Flycatcher *(Myiarchus cinerascens)*
Great Crested Flycatcher *(Myiarchus crinitus)*
Eastern Kingbird *(Tyrannus tyrannus)*
Scissor-tailed Flycatcher *(Tyrannus forficatus)*
Vermilion Flycatcher *(Pyrocephalus rubinus)*

FAMILY HIRUNDINIDAE – Swallows
Purple Martin *(Progne subis)*
Tree Swallow *(Tachycineta bicolor)*
Northern Rough-winged Swallow *(Stelgidopteryx serripennis)*
Bank Swallow *(Riparia riparia)*
Cliff Swallow *(Petrochelidon pyrrhonota)*
Barn Swallow *(Hirundo rustica)*

FAMILY CORVIDAE – Jays/Crows
Blue Jay *(Cyanocitta cristata)*
American Crow *(Corvus brachyrhynchos)*

FAMILY PARIDAE – Chickadees/Titmice
Carolina Chickadee *(Poecile carolinensis)*
Tufted Titmouse *(Baeolophus bicolor)*

FAMILY SITTIDAE – Nuthatches
Red-breasted Nuthatch *(Sitta canadensis)*
Brown-headed Nuthatch *(Sitta pusilla)*

FAMILY CERTHIIDAE – Creepers
Brown Creeper *(Certhia americana)*

FAMILY TROGLODYTIDAE – Wrens
Carolina Wren *(Thryothorus ludovicianus)*
Bewick's Wren *(Thryomanes bewickii)*
House Wren *(Troglodytes aedon)*
Winter Wren *(Troglodytes troglodytes)*
Sedge Wren *(Cistothorus platensis)*
Marsh Wren *(Cistothorus palustris)*

FAMILY REGULIDAE – Kinglets
Golden-crowned Kinglet *(Regulus satrapa)*
Ruby-crowned Kinglet *(Regulus calendula)*

FAMILY TURDIDAE – Thrushes
Eastern Bluebird *(Sialia sialis)*
Veery *(Catharus fuscescens)*
Hermit Thrush *(Catharus guttatus)*
Wood Thrush *(Catharus mustelinus)*
American Robin *(Turdus migratorius)*

FAMILY SYLVIIDAE – Gnatcatchers
Blue-gray Gnatcatcher *(Polioptila caerulea)*

FAMILY MIMIDAE – Mockingbirds/Thrashers
Gray Catbird *(Dumetella carolinensis)*
Northern Mockingbird *(Mimus polyglottos)*
Brown Thrasher *(Toxostoma rufum)*

FAMILY BOMBYCILLIDAE – Waxwings
Cedar Waxwing *(Bombycilla cedrorum)*

FAMILY LANIIDAE – SHRIKES
Loggerhead Shrike *(Lanius ludovicianus)*

FAMILY STURNIDAE – Starlings
European Starling *(Sturnus vulgaris)*

FAMILY VIREONIDAE – Vireos
White-eyed Vireo *(Vireo griseus)*
Yellow-throated Vireo *(Vireo flavifrons)*
Warbling Vireo *(Vireo gilvus)*
Blue-headed Vireo *(Vireo solitarius)*
Red-eyed Vireo *(Vireo olivaceus)*
Cassin's Vireo *(Vireo cassinii)*

FAMILY PARULIDAE – Warblers
Tennessee Warbler *(Vermivora peregrina)*
Blue-winged Warbler *(Vermivora pinus)*
Orange-crowned Warbler *(Vermivora celata)*
Yellow Warbler *(Dendroica petechia)*
Chestnut-sided Warbler *(Dendroica pensylvanica)*
Yellow-rumped Warbler *(Dendroica coronata)*
Cerulean Warbler *(Dendroica cerulea)*
Blackburnian Warbler *(Dendroica fusca)*
Yellow-throated Warbler *(Dendroica dominica)*
Pine Warbler *(Dendroica pinus)*
Black-and-white Warbler *(Mniotilta varia)*
Kentucky Warble *(Oporornis formosus)*
Mourning Warbler *(Oporornis philadelphia)*
Hooded Warbler *(Wilsonia citrina)*
Wilson's Warbler *(Wilsonia pusilla)*
Prothonotary Warbler *(Protonotaria citrea)*
Swainson's Warbler *(Limnothlypis swainsonii)*
Northern Parula *(Parula americana)*
American Redstart *(Setophaga ruticilla)*
Northern Waterthrush *(Seiurus noveboracensis)*
Louisiana Waterthrush *(Seiurus motacilla)*
Common Yellowthroat *(Geothlypis trichas)*
Yellow-breasted Chat *(Icteria virens)*
Canada Warbler *(Wilsonia canadensis)*

FAMILY EMBERIZIDAE – Towhees, Sparrows, and allies
Eastern Towhee *(Pipilo erythrophthalmus)*
Chipping Sparrow *(Spizella passerina)*
Field Sparrow *(Spizella pusilla)*
Henlow's Sparrow *(Ammodramus henslowii)*
Savannah Sparrow *(Passerculus sandwichensis)*
Le Conte's Sparrow *(Ammodramus leconteii)*
Fox Sparrow *(Passerella iliaca)*
Song Sparrow *(Melospiza melodia)*
Lincoln's Sparrow *(Melospiza lincolnii)*
Swamp Sparrow *(Melospiza georgiana)*
Vesper Sparrow *(Pooecetes gramieus)*
White-throated Sparrow *(Zonotrichia albicollis)*

White-crowned Sparrow (*Zonotrichia leucophrys)*
Dark-eyed Junco *(Junco hyemalis)*

FAMILY THRAUPIDAE – Tanagers
Summer Tanager *(Piranga rubra)*
Scarlet Tanager *(Piranga olivacea)*

FAMILY CARDINALIDAE – Cardinals, Grosbeaks & Buntings
Northern Cardinal *(Cardinalis cardinalis)*
Rose-breasted Grosbeak *(Pheucticus ludovicianus)*
Blue Grosbeak *(Guiraca caerulea)*
Indigo Bunting *(Passerina cyanea)*
Painted Bunting *(Passerina ciris)*

FAMILY ICTERIDAE – Blackbirds & Orioles
Red-winged Blackbird (*Agelaius phoeniceus)*
Eastern Meadowlark *(Sturnella magna)*
Brewer's Blackbird *(Euphagus cyanocephalus)*
Rusty Blackbird *(Euphagus carolinus)*
Great-tailed Grackle *(Quiscalus mexicanus)*
Common Grackle *(Quiscalus quiscula)*
Brown-headed Cowbird *(Molothrus ater)*
Orchard Oriole *(Icterus spurius)*
Baltimore Oriole *(Icterus galbula)*

FAMILY FRINGILLIDAE – Finches
Purple Finch *(Carpodacus purpureus)*
Pine Siskin *(Carduelis pinus)*
American Goldfinch *(Carduelis tristis)*

FAMILY PASSERIDAE – Weaver-finches
House Sparrow *(Passer domesticus)*

FAMILY MOTACILLIDAE – Pipits
American Pipit *(Anthus rubescens)*

E.3 AMPHIBIANS

ORDER CAUDATA – Salamanders

FAMILY SALAMANDRIDAE
Central Newt (*Notophthalmus viridescens louisianensis*)

FAMILY AMPHIUMIDAE
Three-toed Amphiuma (*Amphiuma tridactylum*)

FAMILY AMBYSTOMATIDAE
Marbled Salamander *(Ambystoma opacum*)

FAMILY AMPHIUMAIDAE
Three-toed Amphiuma *(Amphiuma tridactylum)*

ORDER ANURA – Frogs & Toads

FAMILY BUFONIDAE
East Texas Toad *(Bufo woodhousii velatus)*
Gulf Coast Toad *(Bufo valliceps valliceps)*
Woodhouse's Toad (*Bufo w. woodhousii*)

FAMILY HYLIDAE
Blanchard's Cricket Frog *(Acris crepitans blanchardi)*
Green Treefrog *(Hyla cinerea)*
Gray Treefrog *(Hyla versicolor)*
Squirrel Tree Frog *(Hyla squirella)*
Northern Spring Peeper *(Psuedocris crucifer crucifer)*

FAMILY MICROHYLIDAE
E. Narrow-mouthed Toad *(Gastrophryne carolinensis)*

FAMILY RANIDAE
Bullfrog *(Rana catesbeiana)*
Bronze Frog *(Rana clamitans clamitans)*
Pickerel Frog *(Rana palustris)*
Southern Leopard Frog *(Rana sphenocephala utricularia)*

E.4 REPTILES

ORDER TESTUDINES – Tortoises and turtles

FAMILY KINOSTERNIDAE
Common Musk Turtle *(Sternotherus odoratus)*

FAMILY CHELYDRIDAE
Common Snapping Turtle *(Chelydra serpentine)*
Alligator Snapping Turtle (*Macroclemys temminckii*)

FAMILY EMYDIDAE
Western Chicken Turtle (*Deirochelys reticularia miaria*)

FAMILY PSEUDEMYS
Eastern River Cooter *(Pseudymsconcinna metteri)*

FAMILY TRACHEMYS
Red-eared Slider (*Trachemys scripta elegans*)

FAMILY TRIONYCHIDAE
Texas Spiny Softshell Turtle *(Trionyx spiniferus emoryi)*

ORDER SQUAMATA – Snakes and Lizards

FAMILY IGUANIDAE – American arboreal lizards
Green Anole (*Anolis carolinensis*)

FAMILY SCINCIDAE – Skinks
Five-lined Skink (*Eumeces fasciatus*)
Broad-headed Skink (*Eumeces laticeps*)
Ground Skink (*Scincella lateralis*)

FAMILY ANGUIDAE – Lateral Fold Lizards
W. Slender Glass Lizard (*Ophisaurus attenuatus*)

FAMILY ALLIGATORIDAE – Alligators
American Alligator *(Alligator mississippiensis)*

FAMILY GEKKONIDAE – Geckos
Mediterranean Gecko *(Hemidactylus turcicus)*

SNAKES

FAMILY COLUBRIDAE – Colubrid Snakes – Advanced
Buttermilk Racer *(Coluber constrictor anthicus)*
Gulf Coast Ribbon Snake *(Thamnophis proximus orarius)*
Eastern Garter Snake *(Thamnophis sirtalis sirtalis)*
Western Worm Snake (*Carphophis amoenus vermis*)
Texas Rat Snake (*Elaphe obsoleta lindheimerii*)
Western Mud Snake (*Farancia abacura reinwardtii)*
Eastern Hog-nosed Snake (*Heterodon platirhinos*)

Speckled Kingsnake (*Lampropeltis getulua holbrooki*)
Eastern Coachwhip (*Masticophis flagellum flagellum)*
Rough Earth Snake *(Virginia striatula)*
Rough Green Snake (*Opheodrys aestivus*)
Yellow-bellied Water Snake (*Nerodia erythrogaster flavigaster*)
Broad-banded Water Snake (*Nerodia fasciata confluens*)
Diamond-backed Water Snake (*Nerodia rhombifer rhombifer)*
Gulf Crayfish Snake (*Regina rigida sinicola*)
Flat-headed Snake (*Tantilla gracilis*)
Western Ribbon Snake (*Thamnophis p. proximus*)

SNAKES (Venomous)

FAMILY VIPERIDAE – Pitviper Snakes
Timber Rattlesnake *(Crotalus horridus)*
Southern Copperhead (*Agkistrodon c. contortrix*)
Western Cottonmouth (*Agkistrodon piscivorus leucostoma*)

FAMILY ELAPIDAE – Cobras & Coral Snakes
Texas Coral Snake *(MIcrurus fulvius tener)*

E.5 FISH

ORDER SEMIONOTIFORMES – Gars

FAMILY LEPISOSTEIDAE
Spotted Gar (*Lepisosteus oculatus*)
Longnose Gar (*Lepisosteus osseus*)
Alligator Gar (*Atractosteus spatula*)

ORDER AMIIFORMES – Bowfins

FAMILY AMIIDAE
Bowfin (*Amia calva*)

ORDER CLUPEIFORMES – Ray-finned fish

FAMILY CLUDEIDAE – Herrings & Shads
Threadfin Shad *(Dorosoma petenense)*
Gizzard Shad (*Dorosoma cepedianum*)

ORDER CYPRINIFORMES

FAMILY CYPRINIDAE – Minnows or carps
Grass Carp (*Ctenopharyngodon idella*)
Red Shiner (*Cyprinella lutrensis*)
Blacktail Shiner (*Cyprinella venusta*)
Steelcolor Shiner (*Cyprinella whipplei*)
Common Carp (*Cyprinus carpio*)
Common Shiner (*Luxilus cornutus*)
Ribbon Shiner (*Lythrurus fumeus*)
Golden Shiner (*Notemigonus crysoleucas*)
Blackspot Shiner (*Notropis atrocaudalis*)
Mimic Shiner (*Notropis volucellus*)
Pugnose Minnow (*Opsopoeodus emiliae*)
Bullhead Minnow (*Pimephales vigilax*)

FAMILY CATOSTOMIDAE – Suckers
Smallmouth Buffalo (*Ictiobus bubalus*)
Blacktail Redhorse (*Moxostoma poecilurum*)

ORDER SILURIFORMES

FAMILY ICTALURIDAE – Bullhead Catfishes
Black Bullhead (*Ameiurus melas*)
Yellow Bullhead (*Ameiurus natalis*)
Blue Catfish (*Ictalurus furcatus*)
Channel Catfish (*Ictalurus punctatus*)
Flathead cCatfish (*Pylodictis olivaris*)

ORDER PERCOPSIFORMES

FAMILY APHREDODERIDAE – Pirate Perches

Pirate Perch (*Aphredoderus sayanus*)

ORDER CYPRINODONTIFORMES

FAMILY FUNDULIDAE – Topminnows
Golden Topminnow (*Fundulus chrysotus*)
Blackstripe Topminnow (*Fundulus notatus*)
Blackspotted Topminnow (*Fundulus olivaceus*)
Rainwater Killifish *(Lucania parva)*

FAMILY POECILIIDAE – Livebearers
Western Mosquitofish (*Gambusia affinis*)

ORDER PERCIFORMES

FAMILY MORONIDAE – Temperate Basses
White Bass (*Morone chyrsops*)

FAMILY CENTRARCHIDAE – Sunfish
Flier (*Centrarchus macropterus*)
Green sunfish *(Lepomis cyanellus*)
Warmouth (*Lepomis gulosus*)
Orangespotted Sunfish (*Lepomis humilis*)
Bluegill (*Lepomis macrochirus*)
Longear Sunfish (*Lepomis megalotis*)
Redear Sunfish (*Lepomis microlophus*)
Spotted Sunfish (*Lepomis punctatus*)
Bantam Sunfish (*Lepomis symmetricus*)
Largemouth Bass (*Micropterus salmoides*)
White Crappie (*Pomoxis annularis*)
Black Crappie (*Pomoxis nigromaculatus*)

FAMILY PERCIDAE – Perches
Bluntnose Darter (*Etheostoma chlorosomum*)
Slough Darter (*Etheostoma gracile*)

FAMILY SCIAENIDAE – Drums
Freshwater Drum (*Aplodinotus grunniens*)

FAMILY MUGILIDAE – Mullets
Striped Mullet *(Mugil cephalus)*

ORDER ESOCIFORMES

FAMILY ESOCIDAE – Pickerels
Redfin (Chain) Pickerel *(Esox americanus)*

E.6 BUTTERFLIES AND MOTHS

ORDER LEPIDOPTERA

FAMILY HESPERIIDAE – Skippers
Silver-spotted Skipper *(Epargyreus clarus)*
White-striped Longtail *(Chiodes catillus)*
Long-tailed Skipper *(Urbanus proteus)*
Dorantes Longtail *(Urbanus dorantes)*
Northern Cloudywing *(Thorybes pylades)*
Horace's Duskywing *(Erynnis horatius)*
Funereal Duskywing *(Erynnis funeralis)*
Wild Indigo Duskywing *(Erynnis baptisiae)*
Common Checkered-Skipper *(Pygrus communis)*
Tropical Checkered-Skipper *(Pygrus oileus)*
Swarthy Skipper *(Nastra lherminier)*
Neamathla Skipper *(Nastra neamathla)*
Clouded Skipper *(Lerema accius)*
Least Skipper *(Ancyloxypha numitor)*
Southern Skipperling *(Copaeodes minimus)*
Fiery Skipper *(Hylephila phyleus)*
Whirabout *(Polites vibex)*
Southern Broken-Dash *(Wallengrenia otho)*
Little Glassywing *(Pompeius verna)*
Sachem *(Atalopedes campestris)*
Yehl Skipper (*Poanes yehl)*
Broad-winged Skipper *(Poanes viator)*
Dukes' Skipper *(Euphyes dukesi)*
Dun Skipper *(Euphyes vestris)*
Lace-winged Roadside Skipper *(Amblyscirtes aesculapius)*
Eufala Skipper *(Lerodea eufala)*
Ocola Skipper *(Panoquina ocola)*

FAMILY LYCAENIDAE – Gossamer-winged
Juniper Hairstreak *(Callophrys gryneus)*
White-M Hairstreak *(Parrhasius melinus)*
Gray Hairstreak *(Strymon melinus)*
Red-banded Hairstreak *(Calycopis cecrops)*
Dusky-blue Groundstreak *(Calycopis isobeon)*
Ceraunus Blue *(Hemiargus ceraunus)*
Reakirt's Blue *(Hemiargus isola)*
Eastern Tailed-Blue *(Everes comyntas)*

FAMILY NYMPHALIDAE – Brush-footed
American Snout *(Libytheana carinenta)*
Gulf Fritillary *(Agraulis vanilla)*
Julia Heliconian *(Dryas Julia)*
Zebra *(Heliconius charitonius)*
Variegated Fritillary *(Euptoieta Claudia)*
Phaon Crescent *(Phycoides phaon)*
Pearl Crescent *(Phycoides tharos)*
Question Mark *(Polygonia interrogationis)*

Mourning Cloak *(Nymphalis antiopa)*
American Lady *(Vanessa virginiensis)*
Painted Lady *(Vanessa cardui)*
Red Admiral *(Vanessa atalanta)*
Common Buckeye *(Junonia coenia)*
Red-spotted Purple *(Limenitis arthemis astyanax)*
Viceroy *(Limenitis archippus)*
Goatweed Leafwing *(Anaea andria)*
Hackberry Emperor *(Asterocampa celtis)*
Tawny Emperor *(Asterocampa clyton)*
Southern Pearly Eye *(Enodia portlandia)*
Gemmed Satyr *(Cyllopsis gemma)*
Carolina Satyr *(Hermeuptychia sosybius)*
Little Wood-Satyr *(Megisto cymela)*
Monarch *(Danaus plexippus)*
Queen *(Danaus gilippus)*

FAMILY PAPILIONIDAE – Swallowtails
Pipevine Swallowtail *(Battus philenor)*
Black Swallowtail *(Papilio polyxenes)*
Giant Swallowtail *(Papilio cresphontes)*
Eastern Tiger Swallowtail *(Papilio glaucus)*
Spicebush Swallowtail *(Papilio troilus)*
Palamedes Swallowtail *(Papilio palamedes)*

FAMILY PIERIDAE – Whites & Sulphurs
Checkered White *(Pontia protodice)*
Great Southern White *(Ascia monuste)*
Falcate Orangetip *(Paramidea midea)*
Orange Sulphur *(Colias eurytheme)*
Southern Dogface *(Colias cesonia)*
Cloudless Sulphur *(Phoebis sennae)*
Large Orange Sulphur *(Phoebis agarithe)*
Little Yellow *(Eurema lisa)*
Sleepy Orange *(Eurema nicippe)*
Dainty Sulphur *(Nathalis iole)*

FAMILY NOCTUIDAE – Owlet & Miller
Spanish Moth *(Xanthopastis timais)*

FAMILY SATURNIIDAE – Wild Silk
IO Moth *(Automeris io)*
Luna Moth *(Anthera polyphemus)*

E.7 VASCULAR PLANTS

ORDER EQUISETALES

FAMILY EQUISETACEAE (Horsetails)
Scouring-rush *(Equisetum hyemale)*

ORDER HYDROPTERIDALES

FAMILY AZOLLACEAE (Water Fern)
Mosquito Fern *(Azolla caroliniana)*

FAMILY MARSILEACEAE (Pepperwort)
Water-clover *(Marsilea vestita)*

FAMILY SALVINIACEAE (Salvinia)
Kariba-weed *(Salvinia molesta)*

ORDER OPHIOGLOSSALES

FAMILY OPHIOGLOSSACEAE – Adder's Tongue
Bulbous Adder's-tongue Fern *(Ophioglossum crotalophoroides)*

ORDER POLYPODIALES

FAMILY POLYPODIACEAE – Fern
Ebony Spleenwort *(Asplenium platyneuron)*
Sensitive Fern *(Onoclea sensibilis)*
Resurrection Fern *(Pleopeltis polypodioides)*
Christmas Fern *(Polystichum acrostichoides)*
Southern Shield Fern *(Thelypteris kunthii)*
Blunt-lobed Woodsia *(Woodsia obtuse)*
Chain Fern *(Woodwaria areolata)*

FAMILY SCHIZAEACEAE – Climbing Fern
Japanese Climbing Fern *(Lygodium japonicum)*

ORDER PINALES

FAMILY CUPRESSACEAE – Cypress
Eastern Red Cedar *(Juniperus virginiana)*
Bald Cypress *(Taxodium distichum)*

FAMILY PINACEAE (Pine)
Loblolly Pine *(Pinus taeda)*

ORDER ALISMATALES

FAMILY ALISMATACEAE – Water Plantain
Creeping Burhead *(Echinodorus cordifolius)*
Giant Arrowhead *(Sagittaria montevidensis)*
Nipplebract Arrowhead *(Sagittaria papillosa*

Delta Arrowhead *(Sagittaria platyphylla)*

ORDER ALISMATALES

FAMILY HYDROCHARITACEAE – Frogbit
Hydrilla *(Hydrilla verticillata)*
American's Frog-bit *(Limnobium spongia)*

ORDER NAJADALES

FAMILY POTAMOGETONACEAE – Pondweed
Waterthread Pondweed *(Potamogeton diversifolius)*
Small Pondweed *(Potamogeton pusillus)*

ORDER ARALES

FAMILY ARACEAE – Arum
Green Dragon *(Arisaema dracontium)*

FAMILY LEMNACEAE – Duckweed
Lesser Duckweed *(Lemna aequinoctialis)*
Common Duckmeat *(Spirodela polyrrhiza)*
Small Duckmeat *(Spirodela punctata)*
Brazilian Watermeal *(Wolffia brasiliensis)*
Columbian Watermeal *(Wolffia Columbiana)*
Florida Mudmidget *(Wolffiella gladiate)*

ORDER ARECALES

FAMILY ARECACEAE – Palm
Dwarf Palmetto *(Sabal minor)*

ORDER COMMELINALES

FAMILY COMMELINACEAE – Spiderwort
Spreading Dayflower *(Commelina diffusa)*
Whitemouth Dayflower *(Commelina erecta)*
Virginia Dayflower *(Commelina virginica)*
Nakedstem Dewflower *(Murdannia nudiflora)*
Bluejacket *(Tradescantia ohiensis)*

ORDER CYPERALES

FAMILY CYPERACEAE – Sedge
Stellate Sedge *(Carex albicans* var. *australis)*
Yellowfruit Sedge *(Carex annectens)*
Goldenfruit Sedge *(Carex aureolensis)*
Southern Sedge *(Carex austrina)*
Eastern Woodland Sedge *(Carex blanda)*
Shortbeak Sedge *(Carex brevior)*
False Hair Sedge *(Carex bulbostylis)*
Carolina Sedge *(Carex caroliniana)*
Cherokee Sedge *(Carex cherokeensis)*

Hirsute Sedge *(Carex complanata)*
Prune-fruit Sedge *(Carex corrugate)*
Ravenfoot Sedge *(Carex crus-corvi)*
Thinfruit Sedge *(Carex flaccosperma)*
Frank's Sedge *(Carex frankii)*
Giant Sedge *(Carex gigantea)*
Tissue Sedge *(Carex hyaline)*
Shoreline Sedge *(Carex hyalinolepis)*
Greated Bladder Sedge *(Carex intumescens)*
Cypress Swamp Sedge *(Carex joorii)*
Leavenworth's Sedge *(Carex leavenworthii)*
Louisiana Sedge *(Carex louisianica)*
False Hop Sedge *(Carex lupuliformis)*
Sharpscale Sedge *(Carex oxylepis)*
Reflexed Sedge *(Carex retroflexa)*
Texas Sedge *(Carex texensis)*
Blunt Broom Sedge *(Carex tribuloides)*
Warty Sedge *(Carex verrucosa)*
Fox Sedge *(Carex vulpinoidea)*
Tapertip Flatsedge *(Cyperus acuminatus)*
Jointed Flatsedge *(Cyperus articulates)*
Poorland Flatsedge *(Cyperus compressus)*
Baldwin's Flatsedge *(Cyperus croceus)*
Woodrush Flatsedge *(Cyperus entrerianus)*
Redroot Flatsedge *(Cyperus erythrorhizos)*
Yellow Nutsedge *(Cyperus esculentus)*
Ricefield Flatsedge *(Cyperus iria)*
Pond Flatsedge *(Cyperus ochraceus)*
Fragrant Flatsedge *(Cyperus odoratus)*
Manyspike Flatsedge *(Cyperus polystachyos)*
Marsh Flatsedge *(Cyperus pseudovegetus)*
Pine Barren Flatsedge *(Cyperus retrorsus* var. *retrorsus)*
Nutgrass *(Cyperus rotundus)*
Tropical Flatsedge *(Cyperus surinamensis)*
Southern Flatsedge *(Cyperus thyrsiflorus)*
Green Flatsedge *(Cyperus virens)*
Smallfruit Spikerush *(Eleocharis microcarpa)*
Mountain Spikerush *(Eleocharis montana)*
Sand Spikerush *(Eleocharis montevidensis)*
Blunt Spikerush *(Eleocharis obtusa)*
Common Spikerush *(Eleocharis palustris)*
Annual Fimbry *(Fimbristylis annua)*
Slender Fimbry *(Fimbristylis autumnalis)*
Forked Fimbry *(Fimbristylis dichotoma)*
Globe Fimbry *(Fimbristylis miliacea)*
Vahl Fimbry *(Fimbristylis vahlii)*
Keeled Bulrush *(Isolepis carinata)*
Fragrant Spikesedge *(Kyllinga odorata)*
Angelstem Beaksedge *(Rhynchospora caduca)*
Starrush Whitetop *(Rhynchospora colorata)*
Shortbristle Horned Beaksedge *(Rhynchospora corniculata)*
California Bulrush *(Schoenoplectus californicus)*
Littlehead Nutrush *(Scleria oligantha)*

FAMILY POACEAE – Grass
Winter Bentgrass *(Agrostis hyemalis)*
Fall Bentgrass *(Agrostis perennans)*
Annual Silver Hairgrass *(Aira elegans)*
Carolina Foxtail *(Alopecurus carolinianus)*
Bushy Bluestem *(Andropogon glomeratus)*
Broomsedge Bluestem *(Andropogon virginicus)*
Giant Cane *(Arundinaria gigantean)*
Wild Oat *(Avena fatua)*
Common Carpetgrass *(Axonopus fissifolius)*
Little Quakinggrass *(Briza minor)*
Rescuegrass *(Bromus catharticus)*
Coastal Sandbur *(Cenchrus incertus)*
Indian Woodoat *(Chasmanthium latifolium)*
Slender Woodoat *(Chasmanthium laxum)*
Longleaf Woodoat *(Chasmanthium laxum* var. *sessiliflorum)*
Bermudagrass *(Cynodon dactylon)*
Egyptian Grass *(Dactyloctenium aegyptium)*
Needleleaf Rosette Grass *(Dichanthelium aciculare)*
Eaton's Rosette Grass *(Dichanthelium acuminatum* var. *densiflorum)*
Lindheimer Panicgrass *(Dichanthelium acuminatum* var. *lindheimeri)*
Coastal Plain Panicgrass *(Dichanthelium acuminatum* var. *longiligulatum)*
Bosc's Panicgrass *(Dichanthelium boscii)*
Variable Panicgrass *(Dichanthelium commutatum)*
Cypress Panicgrass *(Dichanthelium dichotomum)*
Openflower Rosette Grass *(Dichanthelium laxiflorum)*
Southern Crabgrass *(Digitaria ciliaris)*
Smooth Crabgrass *(Digitaria ischaemum)*
Jungle Rice *(Echinochloa colona)*
Coast Cockspur Grass *(Echinochloa walteri)*
Indian Goosegrass *(Eleusine indica)*
Virginia Wildrye *(Elymus virginicus)*
Pond Lovegrass *(Eragrostis glomerata)*
Bigtop Lovegrass *(Eragrostis hirsute)*
Teal Lovegrass *(Eragrostis hypnoides)*
Creeping Lovegrass *(Eragrostis reptans)*
Centipede Grass *(Eremochloa ophiuroides)*
Tall Fescue *(Festuca arundinacea)*
Little Barley *(Hordeum pusillum)*
Catchfly Grass *(Leersia lenticularis)*
Whitegrass *(Leersia virginica)*
Amazon Sprangletop *(Leptochloa panicoides)*
Ozark Grass *(Lomnodea arkansana)*
Perennial Ryegrass *(Lolium perenne)*
Twoflower Melicgrass *(Melica mutica)*
Nimblewill *(Muhlenbergia schreberi)*
Basketgrass *(Oplismenus hirtellus)*
Beaked Panicgrass *(Panicum anceps)*
Fall Panicgrass *(Panicum dichotomiflorum)*
Savannah Panicgrass *(Panicum gymnocarpon)*
Gaping Panicgrass *(Panicum hians)*
Redtop Panicgrass *(rigidulum)*
Switchgrass *(Panicum virgatum)*

Hilograss *(Paspalum conjugatum)*
Dallisgrass *(Paspalum dilatatum)*
Knotgrass *(Paspalum distichum)*
Field Paspalum *(Paspalum laeve)*
Rustyseed Paspalum *(Paspalum langei)*
Bahiagrass *(Paspalum notatum)*
Hairyseed Paspalum *(Paspalum pubiflorum)*
Horsetail Paspalum *(Paspalum repens* var. *fluitans)*
Thin Paspalum *(Paspalum setacuem)*
Vasey's Grass *(Paspalum urvillei)*
Carolina Canarygrass *(Phalaris caroliniana)*
Blackseed Speergrass *(Piptochaetium avenaceum)*
Annual Bluegrass *(Poa annua)*
Autumn Bluegrass *(Poa autumnalis)*
Marsh Bristlegrass *(Setaria parviflora)*
Johnsongrass *(Sorghum halepense)*
Texas Wedgescale *(Sphenopholis longiflora)*
Prairie Wedgescale *(Sphenopholis obtusata)*
Smut Grass *(Sporobolus indicus)*
St. Augustine Grass *(Stenotaphrum secundatum)*
Purpletop Tridens *(Tridens flavus* var. *flavus)*
Eastern Gamagrass *(Trisacum dactyloides)*
Broadleaf Signalgrass *(Urochloa platyphylla)*
Sprawling Signalgrass *(Urochloa reptans)*
Sixweeks Fescue *(Vulpia octoflora)*
Giant Cutgrass *(Zizaniopsis miliacea)*

ORDER JUNCALES

FAMILY JUNCACEAE – Rush
Tapertip Rush *(Juncus acuminatus)*
Leathery Rush *(Juncus coriaceus)*
Forked Rush *(Juncus dichotomus)*
Slimpod Rush *(Juncus diffusissimus)*
Common Rush *(Juncus effusus)*
Inland Rush *(Juncus interior)*
Grassleaf Rush *(Juncus marginatus)*
Poverty Rush *(Juncus tenuis)*
Roundhead Rush *(Juncus validus)*

ORDER TYPHALES

FAMILY TYPHACEAE – Cat-tail
Broadleaf Cattail *(Typha latifolia)*

ORDER LILIALES

FAMILY DIOSCOREACEAE – Yam
Air Yam *(Dioscorea bulbifera)*
Wild Yam *(Dioscorea villosa)*

FAMILY IRIDACEAE – Iris
Prairienymph *(Herbertia lahue)*

Dixie Iris *(Iris hexagona)*
Roadside Blue-eyed Grass *(Sisyrinchium langloisii)*
Annual Blue-eyed Grass *(Sisyrinchium rosulatum)*

FAMILY LILIACEAE – Lily
Meadow Garlic *(Allium canadense)*
Crowpoison *(Nothoscrodum bivalve)*
Saw Greenbriar *(Smilax bona-nox)*
Cat Greenbriar *(Smilax glauca)*
Roundleaf Greenbriar *(Smilax rorundafolia)*
Small's Greenbriar *(Smilax smallii)*
Bristly Greenbriar *(Smilax tamnoides)*

FAMILY PONTEDERIACEAE – Pickerel-weed
Common Water Hyacinth *(Eichhornia crassipes)*

ORDER ORCHIDALES

FAMILY ORCHIDACEAE – Orchid
Waterspider Bog Orchid *(Habenaria repens)*
Nodding Lady's Tresses *(Spiranthes cernua)*
Northern Slender Lady's Tresses *(Spiranthes lacera* var. *gracillis)*
October Lady's Tresses *(Spiranthes ovalis)*
Spring Lady's Tresses *(Spiranthes vernalis)*

ORDER BROMELIALES

FAMILY BROMELIACEAE – Pineapple
Small Ballmoss *(Tillandsia recurvata)*
Spanish Moss *(Tillandsia usneoides)*

ORDER ZINGIBERALES

FAMILY CANNACEAE – Canna
Indian Shot *(Canna indica)*

ORDER ASTERALES

FAMILY ASTERACEAE – Sunflower
Oppositeleaf Spotflower *(Acmella oppositifolia* var. *repens)*
Annual Ragweed *(Ambrosia artemisiifolia)*
Cuman Ragweed *(Ambrosia cumanensis)*
Great Ragweed *(Ambrosia trifida)*
Smooth White Oldfield Aster *(Aster fragilis)*
Blueweed *(Aster subulatus)*
Eastern Baccharis *(Baccharis halimifolia)*
Spanish Needles *(Bidens bipinnata)*
Sticktight *(Bidens discoidea)*
Groovestem Indian Plantain *(Cacalia plantaginea)*
Straggler Daisy *(Calyptocarpus vialis)*
Spiny Aster *(Chloracantha spinosa* var. *spinosa)*
Yellow Thistle *(Cirsium horridulum)*
Canadian Horseweed *(Conyza Canadensis)*

Goldenmane Tickseed *(Coreopsis basalis)*
Stiffleaf Scratchdaisy *(Croptilon rigidolium)*
False Daisy *(Eclipta prostrate)*
Carolina Elephantsfoot *(Elephantopus carolinianus)*
Devil's Grandmother *(Elephantopus tomentosus)*
American Burnweed *(Erechtites hieraciifolia)*
Philadelphia Fleabane *(Erigeron philadelphicus)*
Slenderleaf Fleabane *(Erigeron tenius)*
Dogfennel *(Eupatorium capillifolium)*
Blue Mistflower *(Eupatorium coelestinum)*
Yankeeweed *(Eupatorium compositifolium)*
Pink Thoroughwort *(Eupatorium incarnatum)*
White Snakeroot *(Eupatorium rugosum)*
Lateflowring Thoroughwort *(Eupatorium serotinum)*
Bushy Goldentop *(Euthamia leptocephala)*
Indian Blanket *(Gaillardia pulchella* var. *pulchella)*
Narrowleaf Purple Everlasting *(Gnaphalium falcatum)*
Spoonleaf Purple Everlasting *(Gnaphalium purpureum)*
Bitterweed *(Helenium amarum* var. *amarum)*
Camphorweed *(Heterotheca subaxillaris)*
Smallhead Cat's Ear *(Hypochaeris microcephala* var. *albiflora)*
Annual Marsh Elder *(Iva annua)*
Weedy Dwarfdandelion *(Krigia cespitosa)*
Wright's Dwarfdandelion *(Krigia wrightii)*
Canada Lettuce *(Lactuca canadensis)*
Woodland Lettuce *(Lactuca floridana)*
Climbing Hempvine *(Mikania scandens)*
Camphor Pluchea *(Pluchea camphorata)*
Wand Blackroot *(Pterocaulon virgatum)*
Bearsfoot *(Polymnia uvedalia)*
False Dandelion *(Pyrrhopappus caolinianus)*
Manystemmed False Dandelion *(Pyrrhopappus pauciflorus)*
Blackeyed Susan *(Rudbeckia hirta)*
Butterweed *(Senecio glabellus)*
Great Plains Ragwort *(Senecio tampicanus)*
Canada Goldenrod *(Solidago canadensis)*
Roughleaf Goldenrod *(Solidago rugosa)*
Field Burrweed *(Soliva sessilis)*
Spiny Sowthistle *(Sonchus asper)*
Cowpen Daisy *(Verbesina encelioides)*
Frostweed *(Verbesina virginica)*
Missouri Ironweed *(Vernonia missurica)*
Rough Cocklebur *(Xanthium strumarium)*

ORDER CALLITRICHALES

FAMILY CALLITRICHACEA – Water Starwort
Large Water-starwort *(Callitriche heterophylla)*
Nuttalls Water-starwort *(Callitriche nutallii)*
Matted Water-starwort *(Callitriche peploides)*

ORDER CAMPANULALES

FAMILY CAMPAMULACEAE – Bellflower
Cardinalflower *(Lobelia cardinalis)*
Downy Lobelia *(Lobelia puberula)*
Chickenspike *(Sphenoclea zeylanica)*
Small Venus' Looking-glass *(Triodanis perfoliata* var. *biflora)*
Clasping Venus' Looking-glass *(Triodanis perfoliata* var. *perfoliata)*

ORDER DIPSACALES

FAMILY CAPRIFOLIACEAE – Honeysuckle
Japanese Honeysuckle *(Lonicera japonica)*
American Black Elderberry *(Sambucus canadensis)*
Rusty Blackhaw *(Viburnum rufidulum)*

FAMILY VALERIANACEAE – Valerian
Beaked Cornsalad *(Valerianella radiata)*

ORDER GENTIANALES

FAMILY APOCYNACEAE – Dogbane
Climbing Dogbane *(Trachelospermum difforme)*

FAMILY ASCLEPIADACEAE – Milkweed
Aquatic Milkweed *(Asclepias perennis)*
Angularfruit Milkvine *(Matelea gonocarpos)*

FAMILY LOGANIACEAE – Logania
Yellow Jessamine *(Gelsemium sempervirens)*
Lax Hornpod *(Mitreola petiolata)*
Juniper Leaf *(Polypremum procumbens)*
Texas Pinkroot *(Spigelia loganioides)*

ORDER LAMIALES

FAMILY BORAGINACEAE – Borage
Indian Turnsole *(Heliotropium indicum)*
Fourspike Heliotrope *(Heliotropium procumbens)*
Largeseed Forget-me-not *(Myosotis macrosperma)*

FAMILY LAMIACEAE – Mint
Rough False Pennyroyal *(Hedeoma hispida)*
Henbit Deadnettle *(Lamium amplexicaule)*
Taperleaf Bugleweed *(Lycopus rubellus)*
Virginia Water Horehound *(Lycopus virginicus)*
Browne's Savory *(Micromeria brownie)*
Lemon Beebalm *(Monarda citriodora* var. *citriodora)*
Spotted Beebalm *(Monarda punctata* var. *punctata)*
Beefsteak Plant *(Perilla frutescens)*
Slender False Dragonhead *(Physostegia intermedia)*
Common Selfheal *(Prunella vulgaris)*

Lyreleaf Sage *(Salvia lyrata)*
Small Skullcap *(Scutellaria parvula)*
Shade Betony *(Stachys crenata)*
Smooth Hedgenettle *(Stachys tenuifolia)*
Wood Sage *(Teucrium canadense)*

FAMILY PHRYMACEAE – Lopseed
American Lopseed *(Phryma leptostachya)*

FAMILY VERBENACEAE – Vervain
American Beautyberry *(Callicarpa americana)*
Lantana *(Lantana camara)*
Lanceleaf Fogfruit *(Phyla lanceolata)*
Turkey Tangle Fogfruit *(Phyla nodiflora)*
Brazilian vervain *(Verbena brasiliensis)*
Canadian Vervain *(Verbena canadensis)*
Common Vervain *(Verbena officinalis)*
Gulf Vervain *(Verbena xutha)*
White Vervain *(Verbena urticifolia)*

ORDER PLANTAGINALES

FAMILY PLANTAGINACEAE – Plantain
Redseed Plantain *(Plantago rhodosperma)*
Paleseed Plantain *(Plantago virginica)*

ORDER RUBIALES

FAMILY RUBIACEAE – Madder
Common Buttonbush *(Cephalanthus occidentalis)*
Rough Buttonweed *(Diodia teres)*
Virginia Buttonweed *(Diodia virginiana)*
Stickywilly *(Galium aparine)*
Hairy Bedstraw *(Galium pilosum)*
Stiff Marsh Bedstraw *(Galium tictorium)*
Southern Bluet *(Houstonia micrantha)*
Tiny Bluet *(Houstonia pusilla)*
Partridgeberry *(Mitchella repens)*
Hale's Pentodon *(Pentodon pentandrus)*
Tropical Mexican Clover *(Richardia brasiliensis)*
Blue Fieldmadder *(Sherardia arvensis)*
Smooth False Buttonweed *(Spermacoce glabra)*

ORDER SCROPHULARIALES

FAMILY ACANTHACEAE – Acanthus
Branched Foldwing *(Dicliptera brachiata)*
Gulf Swampweed *(Hygrophila lacustris)*
Looseflower Water-willow *(Justica ovate* var. *lanceolata)*
Carolina Wild Petunia *(Ruellia carliniensis)*
Low Ruellia *(Ruellia humilis* var. *humilis)*
Limestone Wild Petunia *(Ruellia strepens)*

FAMILY BIGNONIACEAE – Trumpet Creeper
Crossvine *(Bignonia capreolata)*
Trumpet Creeper *(Campsis radicans)*
Northern Catalpa *(Catalpa speciosa)*

FAMILY LENTIBULARIACEAE – Bladderwort
Humped Bladderwort *(Utricularia gibba)*
Little Floating Bladderwort *(Utricularia radiate)*

FAMILY OLEACEAE – Olive
Eastern Swampprivet *(Forestiera acuminate)*
Upland Swampprivet *(Forestiera ligustina)*
White Ash *(Fraxinus americana)*
Pop Ash *(Fraxinus caroliniana)*
Green Ash *(Fraxinus pennsylvanica)*
Glossy Privet *(Ligustrum lucidum)*
Chinese Privet *(Ligustrum sinense)*

FAMILY SCROPHULARIACEAE – Figwort
Beach False Foxglove *(Agalinis fasciculata)*
Water Hyssop *(Bacopa monnieri)*
Disk Waterhyssop *(Bacopa rotundifolia)*
American Bluehearts *(Buchnera americana)*
Clammy Hedgehyssop *(Gratiola neglecta)*
Virginia Hedgehyssop *(Gratiola virginiana)*
Narrowleaf Paleseed *(Leucospora multifida)*
Malaysian False Pimpernel *(Lindernia crustacea)*
Yellowseed False Pimpernel *(Lindernia dubia)*
Japanese Mazus *(Mazus pumilus)*
Axilflower *(Mecardonia acuminate)*
Baby Jump-up *(Mecardonia procumbens)*
Shade Mudflower *(Micranthemum umbrosum)*
Sharpwing Monkeyflower *(Mimulus alatus)*
Texas Toadflax *(Nuttallanthus texanus)*
Nodding Beardtongue *(Penstemon laxiflorus)*
Sweetbroom *(Scoparia dulcis)*
Common Mullein *(Verbascum thapsus)*
Corn Speedwell *(Veronica arvensis)*
Purslane Speedwell *(Veronica peregrine)*

ORDER SOLANALES

FAMILY CONVOLVULACEAE – Morning Glory
Peruvian Dodder *(Cuscuta obtusiflora* var. *glandulosa)*
Carolina Ponysfoot *(Dichondra carolinensis)*
Tievine *(Ipomoea cordatotriloba)*
Small White Morningglory *(ipomoea lacunose)*
Hairy Clustervine *(Jacquemontia tamnifolia)*

FAMILY HYDROPHYLLACEAE – Waterleaf
Ovate False Fiddleleaf *(Hydrolea ovata)*
Oneflower False Fiddleleaf *(Hydrolea uniflora)*
Smallflower Baby Blue Eyes *(Nemophila aphylla)*

FAMILY POLEMONIACEAE – Phlox
Downy Phlox *(Phlox pilosa)*

FAMILY SOLANACEAE – Nightshade
Cutleaf Groundcherry *(Physalis angulata)*
Clammy Groundcherry *(Physalis heterophylla)*
Longleaf Groundcherry *(Physalis longifolia)*
False Jerusalem Cherry *(Solanum capsicastrum)*
Carolina Horsenettle *(Solanum carolinense)*
Eastern Black Nightshade *(Solanum ptycanthum)*

ORDER CARYOPHYLLALES

FAMILY AMARANTHACEAE – Amaranth
Alligatorweed *(Alternanthera philoxeroides)*
Common Waterhemp *(Amaranthus rudis)*
Spiny Amaranth *(Amaranthus spinosus)*
Slender Amaranth *(Amaranthus viridis)*

FAMILY CARYOPHYLLACEAE – Pink
Mouseear Chickweed *(Cerastium glomeratum)*
Trailing Pearlwort *(Sagina decumbens)*
Sleepy Catchfly *(Silene antirrhina)*
Common Chickweed *(Stellaria media)*
Pygmy Starwort *(Stellaria parva)*

FAMILY CHENOPODIACEAE – Goosefoot
Mexican Tea *(Chenopodium ambrosioides)*

FAMILY MOLLUGINACEAE – Carpet-weed
Lotus Sweetjuice *(Glinus lotoides)*
Green Carpetweed *(Mollugo verticillata)*

FAMILY NYCTAGINACEAE (Four-o-clock)
Cultivated Four-O'clock *(Mirabilis jalapa)*

FAMILY PHYTOLACCACEAE – Pokeweed
American Pokeberry *(Phytolacca americana)*

FAMILY PORTULACACEAE – Purlane
Virginia Springbeauty *(Claytonia virginica)*
Common Purslane *(Portulaca oleracea)*

FAMILY POLYGONACEAE – Buckwheat
Eardrop Vine *(Brunnichia ovata)*
Oriental Lady's Thumb *(Polygonum cespitosum* var. *longisetum)*
Denseflower Knotweed *(Polygonum densiflorum)*
Swamp Smartweed *(Poylgonum hydropiperoides)*
Curlytop Smartweed *(Polygonum lapathifolium)*
Pink Smartweed *(Polygonum pensylvanicum)*
Dotted Smartweed *(Polygonum punctata)*
Bushy Knotweed *(Polygonum ramosissimum)*
Hedge Smartweed *(Polygonum scandens)*

Jumpseed *(Polygonum virginianum)*
Amamastla *(Rumex chrysocarpus)*
Curly Dock *(Rumex crispus)*
Heartwing Sorrel *(Rumex hastatulus)*
Fiddle Dock *(Rumex pulcher)*

ORDER CAPPARALES

FAMILY BRASSICACEAE – Mustard
Lakecress *(Armoracia lacustris)*
Shepherd's Purse *(Capsella bursa-pastoris)*
Hairy Bittercress *(Cardamine hirsute)*
Sand Bittercress *(Cardamine parviflora* var. *arenicola)*
Virginia Pepperweed *(Lepidium virginicum)*
Sessile-flowered Yellow Cress *(Rorippa sessiliflora)*

ORDER EBENALES

FAMILY EBENACEAE – Ebony
Common Persimmon *(Diospyros virginiana)*

FAMILY SAPOTACEAE – Sapodilla
Gum Bumelia *(Sideroxylon lanuginosum)*

FAMILY SYMPLOCACEAE – Sweet-leaf
Common Sweetleaf *(Symplocos tinctoria)*

ORDER ERICALES

FAMILY ERICACEAE – Heath
Farkleberry *(Vaccinium arboreum)*

ORDER MALVALES

FAMILY MALVACEAE – Mallow
Woodland Poppymallow *(Callirhoe papaver)*
Crimsoneyed Rosemallow *(Hibiscus moscheutos)*
Scarlet Rosemallow *(Hibicus laevis)*
Turk's Cap *(Malvaviscus arboreus)*
Carolina Bristlemallow *(Modiola caroliniana)*
Cuban Jute *(Sida rhombifolia)*
Prickly Fanpetals *(Sida spinosa)*

FAMILY TILIACEAE – Linden
American Basswood *(Tilia americana* var. *americana)*
Carolina Basswood *(Tilia americana* var. *caroliniana)*

ORDER PRIMULALES

FAMILY PRIMULACEAE – Primrose
Scarlet Pimpernel *(Anagallis arvensis)*
Chaffweed *(Centunculus minimus)*
American Featherfoil *(Hottonia inflata)*

Trailing Yellow Loosestrife *(Lysimachis radicans)*
Seaside Brookweed *(Samolus valerandi* var. *parviflorus)*

ORDER SALICALES

FAMILY SALICACEAE – Willow
Eastern Cottonwood *(Populus deltoides)*
Black Willow *(Silax nigra)*

ORDER VIOLALES

FAMILY CUCURBITACEAE – Gourd
Fivelobe Cucumber *(Cayaponia quinqueloba)*
Watermelon *(Citrullus lanatus* var. *lanatus)*
Muskmelon *(Cucumis melo)*
Guadeloupe Cucumber *(Melothria pendula)*

FAMILY PASSIFLORACEAE – Passion-flower
Maypop Passionflower *(Passiflora incarnate)*
Yellow Passionflower *(Passiflora lutea)*

FAMILY VIOLACEAE – Violet
Early Blue Violet *(Viola palmata)*
Common Blue Violet *(Viola sororia* var. *sororia)*

ORDER FAGALES

FAMILY BETULACEAE – Birch
Ironwood *(Carpinus caroliniana)*
Hophornbeam *(Ostrya virginiana)*

FAMILY FAGACEAE – Beech
White Oak *(Quercus alba)*
Southern Red Oak *(Quercus falcate)*
Overcup Oak *(Quercus lyrata)*
Swamp Chestnut Oak *(Quercus michauxii)*
Water Oak *(Quercus nigra)*
Willow Oak *(Quercus phellos)*
Bottomland White Oak *(Quercus sinuata* var. *sinuate)*
Post Oak *(Quercus stellata* var. *stellata)*
Texas Red Oak *(Quercus texana)*
Live Oak *(Quercus virginiana)*

ORDER HAMAMELIDALES

FAMILY HAMAMELIDACEAE – Witch Hazel
Sweet Gum *(Liquidambar styraciflua)*

FAMILY PLATANACEAE – Plane Tree
America Sycamore *(Platanus occidentalis)*

ORDER JUGLANDALES

FAMILY JUGLANDACEAE – Walnut
Water Hickory *(Carya aquatic)*
Pignut Hickory *(Carya glabra)*
Pecan *(Carya illinoinensis)*
Black Hickory *(Carya texana)*
Black Walnut *(Juglans nigra)*

ORDER URTICALES

FAMILY MORACEAE – Mulberry
Osage Orange *(Maclura pomifera)*
Red Mulberry *(Morus rubra)*

FAMILY ULMACEAE – Elm
Hackberry *(Celtis laevigata)*
Planertree *(Planera aquatic)*
Winged Elm *(Ulmus alata)*
American Elm *(Ulmus americana)*
Cedar Elm *(Ulmus crassifolia)*

FAMILY URTICACEAE – Nettle
Smallspike False Nettle *(Boehmeria cylindrical)*
Pennsylvania Pellitory *(Parietaria pensylvanica)*
Stinging Nettle *(Urtica chamaedryoides)*

ORDER LAURALES

FAMILY LAURACEAE – Laurel
Sassafras *(Sassafras albidum)*

ORDER MAGNOLIALES

FAMILY MAGNOLIACEAE – Magnolia
Southern Magnolia *(Maggnolia grandiflora)*

ORDER NYMPHAEALES

FAMILY CERATOPHYLLACEAE – Coon-tail
Coon's Tail *(Ceratophyllum demersum)*

FAMILY NYMPHAEACEAE – Water-lily
American Lotus *(Nelumbo lutea)*
Fragrant Water Lily *(Nymphaea odorata)*

ORDER PAPAVERALES

FAMILY FUMARIACEAE – Fumitory
Smallflower Fumewort *(Corydalis micrantha* var. *australis)*

ORDER PIPERALES

FAMILY SAURURACEAE – Lizard's-tail
Lizard's Tail *(Saururus cernuus)*

ORDER RANUNCULALES

FAMILY BERBERIDACEAE – Barberry
Mayapple *(Podophyllum peltatum)*

FAMILY MENISPERMACEAE – Moonseed
Carolina Snailseed *(Cocculus carolinus)*

FAMILY RANUNCULACEAE – Buttercup
Swamp Leather Flower *(Clematis crispa)*
Bristly Buttercup *(Ranunculus hispidus* var. *nitidus)*
Spinyfruit Buttercup *(Ranunculus muricatus)*
Smallflower Buttercup *(Ranunculus parviflorus)*
Low Spearwort *(Ranunculus pusillus)*
Hairy Buttercup *(Ranunculus sardous)*

ORDER APIALES

FAMILY APIACEAE – Parsley
Hairyfruit Chervil *(Chaerophyllum tainturieri)*
Slender Celery *(Cyclospermum leptophyllum)*
Finger Dogshade *(Cynosciadium digitatum)*
American Wild Carrot *(Daucus pusillus)*
Hooker's Eryngo *(Eryngium hookeri)*
Floating Marshpennywort *(Hydrocotyle fanunculoides)*
Manyflower Marshpennywort *(Hydrocotyle umbellate)*
Whorled Marshpennywort *(Hydrocotyle verticillata)*
Mock Bishopsweed *(Ptilimnium capillaceum)*
Canadian Blacksnakeroot *(Sanicula canadensis)*
Forked Scaleseed *(Spermolepis divaricata)*
Whitenymph *(Trepocarpus aethusae)*

FAMILY ARALIACEAE – Ginseng
Hercules Club *(Aralia spinosa)*

ORDER CELASTRALES

FAMILY AQUIFOLIACEAE – Holly
Deciduous Holly *(Ilex deciduas)*
American Holly *(Ilex opaca)*
Yaupon *(Ilex vomitoria)*

FAMILY CELASTRACEAE – Staff-tree
American Strawberry Bush *(Euonymous americanus)*

FAMILY HIPPOCASTANACEAE – Buckeye
Red Buckeye *(Aesculus pavia* var. *pavia)*

ORDER CORNALES

FAMILY CORNACEAE – Dogwood
Roughleaf Dogwood *(Cornus drummondii)*
Flowering Dogwood *(Cornus florida)*
Water Tupelo *(Nyssa aquatic)*
Blackgum *(Nysaa sylvatica)*

ORDER EUPHORBIALES

FAMILY EUPHORBIACEAE – Spurge
Slender Threeseed Mercury *(Acalypha gracilens* var. *gracilens)*
Common Threeseed Mercury *(Acalypja rhomboidea)*
Virginia Threeseed Mercury *(Acalyphia virginica)*
Sacatrapo *(Caperonia palustris)*
Woolly Croton *(Croton capitatus)*
Tropic Croton *(Croton glandulosus)*
One-seed Croton *(Croton monanthogynus)*
Snow on the Prairie *(Euphorbia bicolor)*
Toothed Spurge *(Euphorbia dentate)*
Spreading Spurge *(Euphorbia humistrata)*
Spotted Spurge *(Euphorbia maculate)*
Eyebane *(Euphorbia nutans)*
Warty Spurge *(Euphorbia spathulata)*
Carolina Leaf-flower *(Phyllanthus caroliniensis)*
Birdseed Leaf-flower *(Phyllanthus pudens)*
Chamber Bitter *(Phyllanthus urinaria)*
Chinese Tallow *(Sapium sebiferum)*

ORDER FABALES

FAMILY FABACEAE – Legume
Indian Jointvetch *(Aeschynomene indica)*
Silktree/Mimosa *(Albizia julibrissin)*
Alyce Clover *(Alysicarpus vaginalis)*
Indigobush *(Amorpha fruticosa)*
White Wild Indigo *(Baptisia alba* var. *macrophylla)*
Longbract Wild Indigo *(Baptisia bracteata)*
Spurred Butterfly Pea *(Centrosema virginianum)*
Eastern Redbud *(Cercis canadensis)*
Partridge Pea *(Chamaecrista fasciculate)*
Hoary Ticktrefoil *(Desmodium canescens)*
Dillenius' Ticktrefoil *(Desmodium glabellum)*
Panicledleaf Ticktrefoil *(Desmodium paniculatum)*
Coral Bean *(Erythrina herbacea)*
Downy Milkpea *(Galactia volubilis)*
Water Locust *(Gleditsia aquatica)*
Honeylocust *(Gleditsia triacanthos)*
Japanese Clover *(Lespedeza striata)*
Black Medic *(Medicago lupulina)*
Burclover *(Medicago polymorpha)*
Powderpuff *(Mimosa strigillosa)*

Least Snoutbean *(Rhynchosia minima)*
Littleleaf Sensitive-briar *(Schranikia uncinata)*
Maryland Wild Senna *(Senna marilandica)*
Sicklepod Senna *(Senna obtusifolia)*
Coffee Senna *(Senna occidentalis)*
Rattlebush *(Sesbania drumondii)*
Coffee Bean *(Sesbania exaltata)*
Bladderpod *(Sesbania vesicaria)*
Eve's Necklace *(Sophora affinis)*
Trailing Wild Bean *(Strophostyles helvula)*
Small Hops Clover *(Trifolium dubium)*
White Clover *(Trifolium repens)*
Persian Clover *(Trifolium resupinatum)*
Louisiana Vetch *(Vicia ludoviciana)*
Pygmyflower Vetch *(Vicia minutiflora)*
American Wisteria *(Wisteria frutescens)*

ORDER GERANIALES

FAMILY GERANIACEAE – Geranium
Carolina Geranium *(Geranium carolinianum)*

FAMILY EXALIDACEAE – Wood Sorrel
Pink Woodsorrel *(Oxalis debilis)*
Slender Yellow Woodsorrel *(Oxalis dillenii)*
Violet Woodsorrel *(Oxalis violacea)*

ORDER HALORAGALES

FAMILY HALORAGACEAE – Water Milfoil
Variable-leaf Watermilfoil *(Myriophyllum heterophyllum)*
Cuteleaf Watermilfoil *(Myriophyllum pinnatum)*
Marsh Mermaidweed *(Proserpinaca palustris)*

ORDER MYRTALES

FAMILY LYTHRACEAE – Loosestrife
Valley Redstem *(Ammannia coccinea)*
Colombian Waxweed *(Cuphea carthagenensis)*
Crapemyrtle *(Lagerstroemia indica)*
Winged Loosestrife *(Lythrum alatum* var. *lanceolatum)*
Lowland Rotala *(Roala ramosior)*

FAMILY ONAGRACEAE – Evening Primrose
Wingleaf Waterprimrose *(Ludwigia decurrens)*
Cylindricfruit Primrose-willow *(Ludwigia glandulosa)*
Angelstem Primrose-willow *(Ludwigia leptocarpa)*
Mexican Primrose-willow *(Ludwigia octovalvis)*
Marsh Purslane *(Ludwigia palustris)*
Floating Primrose-willow *(Ludwigia peploides)*
Large-flower Primrose-willow *(Ludqigia grandiflora)*
Common Evening Primrose *(Oenothera biennis)*
Cutleaf Evening Primrose *(Oenothera laciniata)*

Mexican Primrose *(Oenothera speciosa)*
Hooker's Evening Primrose *(Oenothera elata* ssp. *hirsutissima)*

ORDER RHAMNALES

FAMILY RHAMNACEAE – Buckthorn
Rattan Vine *(Berchemia scandens)*
Carolina Buckthorn *(Rhamnus caroliniana)*

FAMILY VITACEAE – Grape
Peppervine *(Ampelopsis arborea)*
False Grape *(Ampelopsis cordata)*
Virginia Creeper *(Parthenocissus quinquefolia)*
Summer Grape *(Vitis aestivalis* var. *aestivalis)*
Graybark Grape *(Vitis cinerea* var. *cinerea)*
Mustang Grape *(Vitis mustangensis)*
Catbird Grape *(Vitis palmata)*
Muscadine *(Vitis rotundifolia)*

ORDER ROSALES

FAMILY ROSACEAE – Rose
Parsley Hawthorn *(Crataegus marshallii)*
Mayhaw *(Crataegus opaca)*
Littlehip Hawthorn *(Crataegus spathulata)*
Texas Hawthorn *(Crataegus texana)*
Green Hawthorn *(Crataegus viridis)*
Mock Strawberry *(Duchesnea indica)*
Loquat *(Eriobotrya japonica)*
White Avens *(Geum canadense)*
Carolina Laurelcherry *(Prunus caroliniana)*
Flatwoods Plum *(Prunus umbellate)*
Callery Pear *(Pyrus calleryana)*
Sawtooth Blackberry *(Rubus argutus)*
Rio Grande Dewberry *(Rubus riograndis)*
Reeve's Spiraea *(Spiraea cantoniensis)*

FAMILY SAXIFRAGACEAE – Saxifrage
Petiteplant *(Lepuropetalon spathulatum)*
Ditch Stonecrop *(Penthorum sedoides)*

ORDER SANTALALES

FAMILY VISCACEAE – Mistletoe
Oak Mistletoe *(Phoradendron leucarpum)*

ORDER SAPINDALES

FAMILY ACERACEAE – Maple
Ash-leaf Maple *(Acer negundo)*
Red Maple *(Acer rubrum)*

FAMILY ANACARDIACEAE – Cashew
Eastern Poison Ivy *(Toxicodendron radicans)*

FAMILY MELIACEAE – Mahogy
Chinaberry Tree *(Melia azedarach)*

FAMILY RUTACEAE – Rue
Trifoliate Orange *(Poncirus trifoliata)*
Southern Prickly Ash *(Zanthoxylum clava-herculis)*

FAMILY SAPINDACEAE – Soapberry
Balloon Vine *(Cardiospermum halicacabum)*
Weastern Soapberry *(Sapindus saponaria* var. *drummondii)*

ORDER ASPARAGALES

FAMILY AMARYLLIDACEAE – Amaryllis
Hill Country Rain Lily *(Cooperia pedunculata)*
Swamp Spiderlily *(Crinum americanum)*
Spring Spiderlily *(Hymencollis liriosme)*
Curtis' Star-grass *(Hypoxis curtissii)*
Red Spider Lily *(Lycoris radiata)*

ORDER MALPIGHIALES

FAMILY HYPERICACEAE – St. John's-Wort
Claspingleaf St. Johnwort *(Hypericum gymnanthum)*
St. Andrew's Cross *(Hypericum hypericoides)*
Dwarf St. Johnswort *(Hypericum mutilum)*
Lesser Marsh St. Johnswort *(Triadenum tubulosum)*
Greater Marsh St. Johnswort *(Triadenum walteri)*

E.8 Mussels

ORDER UNIONIDAE – Naiads, River Mussels, Unionids

FAMILY UNIONOIDA
Giant Floater (*Pyganodon grandis*)
Paper Pondshell (*Utterbackia imbecillis*)
Flat Floater (*Anodonta suborbiculata*)
Round Pearlshell (*Glebula rotundata*)
Yellow Sandshell (*Lampsilis teres*)
Pond Mussel (*Ligumia subrostrata*)
Bankclimber *Plectomerus dombevanus*
Bleufer (*Potamilus purpuratus*)
Southern Mapleleaf (*Quadrula apiculata*)
Lilliput (*Toxolasma parvus*)
Texas Lilliput (*Toxolasma texaniensis*)
Pistolgrip (*Tritogonia (Quadrula) verrucosa*)

FAMILY CORBICULIDAE
Asian Clam (invasive sp) (*Corbicula fluminea*)

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F. INTRA-SERVICE SECTION 7 BIOLOGICAL EVALUATION FORM

Originating Person:

Stuart Marcus

Telephone Number:

(936) 336-9786

Date:

August 14, 2011

I. Region: Southwest

II. Service Activity (Program):

Refuges: Trinity River National Wildlife Refuge (Trinity River NWR, refuge)

III. Pertinent Species and Habitat:

A. Listed species and/or their critical habitat within the action area:

Houston toad *(Bufo houstonensis)*

Red-cockaded woodpecker (*Picoides borealis)*

Interior least tern (*Sterna antillarum athalassos)*

Piping plover *(Charadrius melodus*

Black bear *(Ursus americanus)*

Louisiana black bear *(Ursus americanus luteolus)*

Red wolf *(Canis rufus)*

American alligator (*Alligator mississipiensis)*

Critical Habitat: No designated critical habitat has been identified within the boundaries of the Trinity River NWR

B. Proposed species and/or proposed critical habitat within the action area:

None

C. Candidate species within the action area:

Rafinesque's big-eared bat (*Corynorhinus rafinesquii)*

Sprague's pipit (*Anthus spragueii)*

Alligator snapping turtle *(Macrochelys temmickii)*

Louisiana pine snake (*Pituophis ruthenvi)*

IV. Geographic area or station name and action:

The proposed action is to implement a Comprehensive Conservation Plan for Trinity River NWR located in Liberty County, TX.

V. Location:

A. Ecoregion Number and Name:

Gulf Coast Prairies and Marshes Ecoregion

B. County and State:

Liberty, Texas

C. Section, township, and range (or latitude and longitude):

31° 42' N 96°14'W

D. Distance (miles) and direction to nearest town:

Approximately three miles east of Liberty, TX

E. Species/habitat occurrence:

- *Houston toad* – This medium-sized toad is typically associated with pine and/or oak woodland savanna with deep, loose sandy soil. The Houston toad is currently only found in one county: Bastrop County, Texas. Adults are restricted to sandy soils and prefer wooded areas interspersed with open grass. They are historically documented in coastal prairies. Within these habitats, they are never far from water and during the breeding season are located almost exclusively near ponds and rain pools. Suitable habitat for reintroduction of this toad may be found in Davis Hill State Park. This state park is juxtaposed to refuge boundaries. However, this state park is currently unmanaged. It is unknown whether this toad exists on the state park.
- *Piping plover* – This shorebird is a wintering migrant along the gulf coast. It migrates along the Trinity River corridor from July to March. It utilizes the sandy banks found along the river and on riverfront Refuge properties and may forage in Refuge mudflats.
- *Red-cockaded woodpecker* – This pineywoods woodpecker has not been located on the refuge. It is associated with northern parts of Liberty County, particularly in the pineywoods that belong to Big Thicket National Preserve.
- *Interior least tern* – Federally threatened in Texas when found within 50 miles of the coast and federally endangered when found more than 50 miles away from the coast. This bird may use the sandbars associated with the Trinity River.
- *Black bear* – There have been no credible bear sightings in Liberty County. This bear is categorized as Federally threatened by similarity of appearance to the Louisiana black bear.
- *Louisiana black bear* – There have been no credible bear sightings in Liberty County; however, it has been reliably sighted within 40 miles of Refuge borders. If the refuge acquires a habitat corridor large enough to accommodate the Louisiana black bear, the refuge may become a potential reintroduction site.

- *Red wolf* – Red wolves ranged throughout the eastern half of Texas, but their numbers and range quickly declined under pressure of intensive land use in the region. Also, early lumbering and farming practices allowed the coyote to expand its range into east Texas; hybrid offspring of interbreeding red wolves and coyotes (*Canis latrans*) more closely resembled coyotes, and the genetic identity of the red wolf was gradually suppressed. This wolf is considered extirpated.
- *American alligator* – This alligator is quite abundant in Liberty County; however, it is a State protected game species. It is considered "threatened by similarity in appearance" due to similarity to the American crocodile (*Crocodylus acutus*).

VI. Description of proposed action

The proposed action is to implement the Comprehensive Conservation Plan for the Texas Trinity River NWR over the next 15 years.

The Plan is divided into a series of goals, objectives, and strategies that will be implemented throughout the 15-year term of this Plan. Specific goals associated with the CCP are:

1. To contribute to conservation efforts and to foster the ecological integrity of the Gulf Coast Prairies and Marshes Ecoregion through proven and innovative management practices across the Refuge.
2. To conserve and restore, enhance, and protect refuge habitats by implementing appropriate management programs to benefit native flora and fauna, including threatened and endangered species and other species of concern.
3. To protect, maintain, and enhance populations of migratory birds and resident fish and wildlife, including Federal and State threatened and endangered species.
4. To develop and implement quality wildlife-dependent recreation programs that are compatible with refuge purposes and that foster enjoyment and understanding of the Refuge's unique wildlife and plant communities.
5. To provide administrative and public use facilities needed to carry out the refuge's purposes and meet management objectives.

   The overall management of the Refuge will focus on protecting and restoring native habitats to promote wildlife, while enhancing opportunities for public use, such as hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation, as well as to increase understanding and support for the refuge and the Refuge system. For detailed descriptions of goals, objectives, and strategies for the Plan, please refer to Chapter 4 of the Draft Plan.

VII. Determination of effects:

A. Explanation of effects of the action on species and critical habitats in items III: A, B, and C:

<u>Houston toad</u>

The Houston toad is not known to occur on the Refuge. None of the proposed alternatives will have any long term negative impacts on this species.

Piping plover
Piping Plovers utilize the Trinity River corridor in winter. Individuals typically arrive here July through November and most have left for the breeding grounds by mid-May.

Red-cockaded woodpecker
This species has not been documented in the county in many years and is believed to be extirpated from the state.

Interior least tern
This species may utilize sand bars within the refuge. None of the proposed alternatives will have any long-term negative impacts on this species.

Black bear and Louisiana black bear
The black bear is categorized as federally threatened by similarity of appearance and the Louisiana black bear may eventually occupy refuge habitat. None of the proposed actions will have any long-term negative impacts on either of these species.

Red wolf
The red wolf is believed to be extirpated from the State.

American alligator
None of the proposed alternatives will have any long term negative impacts on this species.

Habitat and Wildlife Management
Restoration and maintenance of bottomland hardwood forests and prairie habitat using management tools such as prescribed fire, exotic species management, planting, and harvesting native prairie seed will not have any negative impacts on any of the listed species in and around the refuge boundaries.

Public Use
The proposed increase in public use opportunities, such as additional hunting opportunities, new trails, boardwalks, and photo blinds promoting wildlife observation and wildlife photography, as well as additional programs to increase environmental education and interpretation, will not have any negative impacts on any listed species. Increased opportunities in all public use programs will be designed to avoid any potential impacts to any listed species.

Facilities/Infrastructure
The proposed increase in infrastructure, such as new trails, additional bicycle access, new signs and exhibits, and additional canoe and kayack launches, as well as new recreational vehicle sites, new administrative and maintenance facilities, and a new visitor contact station, will not have any negative impacts on any listed species. Additional opportunities in facilities and infrastructure will be designed to avoid any potential impacts to any listed species.

Overall, no significant adverse impacts to federally listed threatened and endangered species are expected to occur due to the management direction proposed in the Comprehensive Conservation Plan.

B. Explanation of actions to be implemented to reduce adverse effects:

The refuge will prohibit or restrict activities in areas where listed species occur or have the potential to occur as a specific mitigation measure protecting all listed species in and around refuge boundaries.

VIII. Effect determination and response requested: [* = optional]

A. Listed species/designated critical habitat:

Determination	Response requested
no effect to species/critical habitat	
(species/unit: Smalltooth sawfish)	_X_ ***Concurrence**
may affect, but is not likely to adversely affect species/critical habitat	
(species/unit:)	_X_ **Concurrence**
Houston toad *(Bufo houstonensis)*	
Red-cockaded woodpecker *(Picoides borealis)*	
Interior least tern (*Sterna antillarum athalassos)*	
Piping plover *(Charadrius melodus)*	
Black bear *(Ursus americanus)*	
Louisiana black bear *(Ursus americanus luteolus*)	
Red wolf *(Canis rufus)*	
American alligator *(Alligator mississipiensis)*	
may affect, and is likely to adversely affect species/critical habitat	
(species/unit: none)	___ **Formal Consultation**

B. Proposed species/proposed critical habitat:

Determination	Response requested
no effect on proposed species/proposed critical habitat	
(species/unit: n/a)	___***Concurrence**
is not likely to jeopardize proposed species/ adversely modify proposed critical habitat	___ **Concurrence**
(species/unit: n/a)	
is likely to jeopardize proposed species/ adversely modify proposed critical habitat	__ **Conference**
(species/unit: n/a)	

C. Candidate species:

Determination	**Response requested**
no effect (**species:** none)	__ ***Concurrence**
is not likely to jeopardize candidate species (**species:** Sprague's pipit)	_X_ **Concurrence**
is likely to jeopardize candidate species (**species:** none)	__ **Conference**

Appendix F. Intra-Service Section 7 Biological Evaluation Form

Signature 9-8-2011 **Date**
Refuge Manager, Trinity River NWR

IX. Reviewing ESO Evaluation:

A. Concurrence _X_ **Non-concurrence** _____

B. Formal consultation required _____

C. Conference required _____

D. Informal conference required _____

E. Remarks (attach additional pages as needed):

Signature 9/8/2011 **Date**
[Title/office of reviewing official]

X. Literature Cited

G. Wilderness Review Trinity River NWR

1.0 Introduction

Wilderness Reviews (Reviews) are a required element of Comprehensive Conservation Plans (CCPs), and each refuge must follow the review process outlined in 602 FW 1-3 and 610 FW 1-4. The process includes interagency and tribal coordination, public involvement, and National Environmental Policy Act (NEPA) compliance (610 FW 4.4 A). The purpose of the review is to identify lands and waters that merit inclusion in the National Wilderness Preservation System and recommend suitable lands for congressional designation (610 FW 4.4 A).

There are three phases to the review process: (1) inventory; (2) study; and (3) recommendation. During the inventory phase, we identify lands and waters that meet the minimum criteria for Wilderness designation (610 FW 4.4 B). Lands and waters that meet the minimum criteria for designation are called Wilderness Study Areas (WSAs). In the study phase, we assess a range of management alternatives to determine if a WSA is suitable for Wilderness designation and corresponding management or if management under an alternate set of goals and objectives is more appropriate (610 FW 4.12 A). The findings of the study phase determine whether we will recommend a WSA for designation in the final Plan. If we determine that the Refuge contains lands and/or waters that are suitable for Wilderness designation, we report the recommendation from the Director through the Secretary and the President to Congress in a subsequent Wilderness Study Report (610 FW 4.4).

The following team was assembled to perform the Trinity River NWR Wilderness Review.

Table 1. Wilderness Review Team

Team Member	Title/Affiliation	Email
Stuart Marcus	Refuge Manager	Stuart_marcus@fws.gov
Laurie Lomas	Refuge Wildlife Biologist	Laurie_lomas@fws.gov
Joseph Lujan	Biologist/Natural Resource Planner	Joseph_lujan@fws.gov

2.0 Wilderness Inventory

Section 2 (c) of the Wilderness Act states that Wilderness is an area that is "untrammeled by man, where man himself is a visitor who does not remain." The act identifies the minimum criteria that an area must meet to be eligible for Wilderness. Service policy states that we use the act's minimum criteria to identify potential Wilderness areas. These criteria include size, apparent naturalness, and outstanding opportunities for solitude or primitive recreation. Supplemental values are evaluated and documented but are not required for a WSA. The Trinity River NWR Wilderness Review Team met on January 12, 2011, to perform the inventory phase of the review.

2.1 Identification of Lands that Meet the Size Criteria

First, the team reviewed the refuge for any lands that meet the size criteria outlined by 610 FW 4.8 and described as follows:

- An area with more than 5,000 contiguous acres. State and private lands are not included in making this acreage determination.
- A roadless island of any size. A roadless island is defined as an area surrounded by permanent waters or that is markedly distinguished from the surrounding lands by topographical or ecological features (610 FW 1.5 Z).
- An area of less than 5,000 contiguous acres that is of sufficient size as to make practicable its preservation and use in an unimpaired condition, and of a size suitable for wilderness management.
- An area of less than 5,000 contiguous Federal acres that is contiguous with a designated wilderness, recommended wilderness, or area under wilderness review by another Federal wilderness managing agency such as the U.S. Forest Service, National Park Service, or Bureau of Land Management.

After reviewing refuge maps and filling in the Minimum Criteria Inventory, the team found that no areas meet the size criteria. The Refuge is within 45 miles of Houston metro and several other communities within one of the most industrialized areas of the nation. There are numerous roads scattered across the Refuge. There are no roadless areas or islands of any sufficient size as to make feasible its preservation for wilderness management.

2.2 Evaluation of the Naturalness Criteria

Section 2 (c) of the Wilderness Act defines Wilderness as an area that "…generally appears to have been affected primarily by the forces of nature with the imprint of man's work substantially unnoticeable." In addition to the size criteria, Service policy states that an inventory unit must meet the naturalness criteria to qualify as a WSA. Although the area must appear natural to the average visitor, policy does not require that the land is in a pristine historic state (610 FW 4.9 A).

During the inventory phase, the team evaluated each inventory unit for the naturalness criteria and determined that based on roads, housing, existing oil and gas infrastructure developments, and its location within one of the most industrialized areas of the Nation, none of the refuge tracts met the naturalness criteria.

2.3 Evaluation of Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation

In addition to meeting the size and naturalness criteria, an inventory unit must provide outstanding opportunities for solitude or primitive recreation to qualify as a WSA. The Wilderness Act does not define what was intended by solitude or a primitive and unconfined type of recreation. The Service, however, defines solitude as "a state of mind, a mental freedom that emerges from settings where visitors experience nature essentially free of the reminds of society, its inventions, and conventions; privacy and isolation are important components, but solitude is enhanced by the absence of distractions, such as large groups,

mechanization, unnatural noise and light, unnecessary managerial presence (such as signs), and other modern artifacts (610 FW 1.5 AA)." The Service defines primitive and unconfined recreation as "activities that provide dispersed, undeveloped recreation and do not generally require permanent facilities (610 FW 1.5 R)." According to 610 FW 4.10, an area does not need to have outstanding opportunities for both solitude and primitive recreation nor does the area need to have outstanding opportunities on every acre.

During the inventory process, the Wilderness Review Team found that none of the units within the Trinity River NWR qualified for opportunities for solitude or primitive and unconfined recreation.

3.0 Wilderness Inventory Summary

After completing the inventory phase of the Wilderness Review, the team did not find any lands that meet the minimum criteria for a Wilderness Study Area. Therefore, the team does not recommend that the Wilderness Study portion of the review be performed. This concludes the Wilderness Review process at this time. The process will be replicated in accordance with policy at the time of the next Plan revision.

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H. List of Preparers

U. S. Fish and Wildlife Service Employees

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Contributors:

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Monica Lucero	Assistant Planner
Sarah H. Ledford	STEP/GIS/Assistant Natural Resource Planner Intern

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I. Power Plants and Refineries in the Counties Surrounding Trinity River NWR

Table I-1. Power Plants

Utility	Plant Name	MegaWatt	County
Abitibi Consolidated - Sheldon	Abiitibi Consolidated Sheldon	97.2	Harris
AES Deepwater Inc	AES Deepwater	184	Harris
Air Liquide America - Pt Arthur	Port Neches Plant	38	Jefferson
Air Liquide Large Industries U S LP	Bayou Cogen Plant	300	Harris
Air Products LP	Pasadena	6.5	Harris
Air Products LP	Air Products Pt Arthur	40.6	Jefferson
BASF Corp	NAFTA Regional Olefins Complex Cogen Fac	83.2	Jefferson
Calpine Central LP	Amelia Energy Center	0	Jefferson
Calpine Central LP	Baytown Energy Center	914.6	Chambers
Calpine Corp-Texas City	Texas City power Plant	450	Galveston
Cedar Power Partners LP	Cedar Power Project	0	Liberty
Chambers Energy LP	Harris Energy Facility	0	Harris
Channel Energy Center	Channel Energy Center, Clear Lake Cogeneration	715	Harris
Clear Lake Cogeneration LP	Clear Lake Cogeneration Ltd	465.2	Harris
Cogen Lyondell	CoGen Lyondell	564	Harris
Deer Park Energy Center	Deer Park Energy Center	996	Harris
Entergy Gulf States Inc	Neches	295.8	Jefferson
Enterprise Products Optg LP	Enterprise Product Operating	25.7	Chambers
Exelon Generation Co LLC	Exelon LaPorte Generating Station	236	Harris
Exxon Mobil Refining and Supply Co	ExxonMobil Baytown Refinery	214.9	Harris
Exxon Mobil Refining and Supply Co	ExxonMobil Baytown Turbine	376.9	Harris
ExxonMobil Corp	ExxonMobil Beaumont Refinery	369.6	Jefferson
Goodyear Tire and Rubber Co	Goodyear Beaumont Chemical Plant	34.8	Jefferson
HNG Storage Co.	North Dayton Gas Storage Facility	0	Liberty
Huntsman Corp	JJCO Oxides Olefins Plant	77.2	Jefferson
Motiva Enterprises LLC	Port Arthur Refinery	150.5	Jefferson
Oxy Vinyls LP	Houston Chemical Complex Battleground	200	Harris
Oxy Vinyls LP	Deer Park Plant	111	Harris
Pasadena Cogeneration LP	Pasadena Cogeneration	815	Harris
Pasadena Paper Co LP	Pasadena Paper	14	Harris
Premcor Refining Group Inc	Port Arthur Refinery	84.6	Jefferson
Reliant Energy Channelview LP	Channelview Cogeneration Plant	918.3	Harris
Reliant Energy Renewables Inc.	Reliant Energy Renewables Atascosita	6.5	Harris
Reliant Energy Renewables Inc.	Reliant Baytown	5.2	Chambers

Utility	Plant Name	MegaWatt	County
Reliant Energy Renewables Inc.	Reliant Bluebonnet	4	Harris
Reliant Energy Renewables Inc.	Reliant Coastal Plains	5.2	Galveston
Reliant Energy Renewables Inc.	Reliant Security	3.9	Liberty
Rhodia Inc	Rhodia Houston Plant	7.5	Harris
Rice University	Rice University	7	Harris
Shell Chemical LP	Westhollow Technology	3.7	Harris
Shell Oil Co-Deer Park	Shell Deer Park	257	Harris
South Houston Green Power LP	Power Station 3	117.9	Galveston
South Houston Green Power LP	Power Station 4	191.1	Galveston
South Houston Green Power LP	Green Power 2	611	Galveston
Texas Genco II LP	Cedar Bayou	2295	Chambers
Texas Genco II LP	Deepwater	187.8	Harris
Texas Genco II LP	Greens Bayou	878.4	Harris
Texas Genco II LP	Hiram Clarke	96	Harris
Texas Genco II LP	P H Robinson	2314.5	Galveston
Texas Genco II LP	Sam Bertron	875.1	Harris
Texas Genco II LP	T H Wharton	1421.5	Harris
Texas Genco II LP	Webster San Jacinto Steam	426.3	Harris
Texas Genco II LP	Electric Station	176.4	Harris
Texas Petrochemicals Corp	Texas Petrochemicals	35	Harris
Total Petrochemicals USA Inc	Port Arthur Texas Refinery	38.4	Jefferson
Union Carbide Corp - Texas City	Texas City Plant Union Carbide	96	Galveston
Valero Refining Co - Texas City	Valero Refining Texas City	39.5	Galveston
Valero Refining Co - TX	Valero Refining Texas Houston	34.2	Harris

U.S. Fish & Wildlife Service
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www.fws.gov/southwest/refuges/texas/trinityriver/index.html

Swallow-tailed kite over Trinity River National Wildlife Refuge.
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