

National Park Service
U.S. Department of the Interior

Big Thicket National Preserve
Texas



Feral Hog Management Plan and Environmental Assessment

Within the Big Thicket National Preserve
Hardin, Jasper, Jefferson, Liberty, Orange, Polk, and Tyler Counties



November 2013

Prepared by
United States Department of the Interior • National Park Service

In 1916, Congress created the National Park Service in the Department of the Interior to:

...promote and regulate the use of the Federal areas known as national parks, monuments, and reservations...by such means and measures as to conform to the fundamental purpose of said parks, monuments, and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.
(NPS Organic Act, 16 U.S.C. § 1)

Feral Hog Management Plan and Environmental Assessment

Hardin, Jasper, Jefferson, Liberty, Orange, Polk, and Tyler Counties

Summary: The National Park Service (NPS) has prepared a Feral Hog Management Plan / Environmental Assessment (EA) for Big Thicket National Preserve (BTNP). The plan describes how feral hog populations will be managed to prevent or mitigate impacts on Preserve resources and values. The EA, prepared in compliance with the National Environmental Policy Act (NEPA), provides the decision-making framework that identifies significant issues and concerns facing Preserve management, a presentation and analysis of a reasonable range of management alternatives and their effects, and a strategy to determine long-term management of feral hog populations at BTNP.

This environmental assessment (EA) evaluates two alternatives. Alternative A examines baseline conditions under “no action.” In this case, “no action” means that BTNP would not implement a feral hog management plan, public hunting through issuance of hunting permits would be the primary means of reducing feral hog population numbers, and feral hog impacts to BTNP resources would continue in the future. Alternative B evaluates implementation of a feral hog management plan in BTNP which includes an array of management options for feral hog management in addition to continued public hunting. The following resources and other concerns were given a limited analysis but dismissed from further evaluation in this EA because they are not found in the analysis area, would not be impacted, or due to the application of mitigation measures, there would be less than measurable impacts (meaning minor or less effects): air quality, soundscapes, lightscapes, cultural resources, socioeconomic, minority and low income populations, energy resources, prime and unique farmlands, Indian trust resources, and climate change. Impacts on the geologic resources, water quality and quantity, floodplains and wetlands, vegetation (including plant species of special concern), fish and wildlife (including faunal species of special concern), visitor use and experience, Preserve operations, and introduction or promotion of non-native species in the Preserve would experience measurable impacts and consequently were carried forward for further evaluation in this EA. Alternative B is both the environmentally preferable and NPS preferred alternative.

Public Comment: If you wish to comment on the environmental assessment, you may post comments online at <http://parkplanning.nps.gov/BTNP>, or mail comments to the name and address below. These documents will be on public review for 30 days. Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment – including your personal identifying information – may be made publicly available at any time. While you may ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

Superintendent
Big Thicket National Preserve
Attn: Ms. Stephanie Burgess
6044 FM 420
Kountze, TX 77625

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ACRONYMS

The following is a list of common acronyms used throughout this document.

BTNP	Big Thicket National Preserve
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
DO	Director's Order
DOI	Department of Interior
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FR	Federal Register
GPS	Geographic Positioning System
GMP	General Management Plan
GSMNP	Great Smoky Mountains National Park
NEPA	National Environmental Policy Act
NPS	National Park Service
TPWD	Texas Parks and Wildlife Department
U.S.	United States
USACE	U.S. Army Corps of Engineers
USC	United States Code
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UTV	Utility Vehicle

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1.0 PURPOSE AND NEED FOR ACTION

Introduction

Within the United States, National Park Service (NPS) lands have been greatly affected by feral hog impacts (Singer, 1981; Vitousek *et al.* 1996). Several NPS units have implemented, or plan to implement, feral hog management strategies to protect affected natural resources; these units include but are not limited to Virgin Islands National Park, Channel Island National Park, Canaveral National Seashore, Pinnacles National Monument, Haleakala National Park, Hawaii Volcanoes National Park, Great Smoky Mountains National Park (GSMNP), Congaree National Park, and Cumberland Island National Seashore (Zengel, 2008). Since many NPS units harbor sensitive species, sensitive ecological communities, and federally listed species that are affected by feral hogs, it is imperative that proper feral hog management strategies be implemented on these federal lands.

Big Thicket National Preserve (BTNP), currently composed of over 108,208 acres in East Texas, was the first national preserve established by Congress and was set aside in 1974 to assure the preservation, conservation, and protection, of the natural, scenic, and recreational values (NPS, 1996). Numerous plant species of conservation importance are found or could likely occur within the Preserve boundaries, including the federally-listed endangered Texas trailing phlox (*Phlox nivalis* var. *texensis*) and Navasota ladies-tresses (*Spiranthes parksii*), and the rare bog coneflower (*Rudbeckia scabrifolia*), giant spiral ladies'-tresses (*Spiranthes longilabris*), Kral's yellow-eyed grass (*Xyris louisianica*), smooth indigobush (*Amorpha laevigata*), white fire-wheel (*Gaillardia aestivalis* var. *winkleri*), and over 20 species of rare orchids (NPS, 1996, Gulf Coast Network, 2010). These federally listed species and numerous rare plants and plant communities of conservation importance are negatively affected by feral hogs.

Feral hogs are free-ranging members of the Suidae family that are not native to the North American continent. Introduced into the present day United States by early European settlers in the 1500s through the escape of domestic pigs, feral pigs have naturally proliferated and spread in distribution and abundance, assisted historically by migrating settlers and more recently by translocation for hunting purposes (Conover 2007; Timmons et al. 2012). In Texas, early Spanish explorers most likely introduced hogs over 300 years ago, with later importation and release of European wild hogs known as "Russian boars" by ranchers and sportsmen for hunting. Many of these "Russian boars" escaped and interbred with feral hogs (Taylor, 2003). Feral hogs have persisted and continue to proliferate since introductions by early European settlers, and BTNP has been no exception.

Within BTNP, feral hogs have been estimated to affect up to 30,000 acres through rooting and wallowing behavior (Chavarria, 2006; Siemann *et al.* 2009). Assuming

hunter harvest data represent general feral hog population trends, feral hogs have doubled in population densities in 25 years at BTNP (Chavarria, 2006; Chavarria *et al.* 2007). Increasing hog numbers pose greater risk to BTNP resources and visitor safety. Preserve programs like Texas trailing phlox recovery efforts and longleaf pine (*Pinus palustris*) restoration are negatively impacted by hogs. Several Texas trailing phlox re-introduction plots occur within areas of relatively high feral hog activity. Longleaf pine restoration is another BTNP priority. However, feral hog damage is documented as a primary cause of seedling failure and the consequent delay of restoration efforts for many species (Lipscomb, 1989; Whitehouse, 1999; Mayer *et al.* 2000). Fire management, which is an integral part of resource management at BTNP, and longleaf pine restoration, can be difficult to implement in areas of severe hog rooting, where bare ground can prevent prescribed fires from traveling across an intended burn unit.

Purpose and Need

The purpose of this environmental assessment (EA) is to evaluate the potential effects of a feral hog management plan on various resources (e.g., natural, cultural, social, and economic resources) within and surrounding BTNP. The purpose of the proposed action, implementation of a feral hog management plan, is to protect native species and resources within BTNP. The need for the feral hog management plan is crucial as increased hog numbers and damages are affecting natural resources (e.g., direct damages to sensitive plant communities and federally listed species) and ecological processes (e.g., alteration of community dynamics through spread of invasive plant species), and pose public safety concerns (e.g., potential vector for pathogens, and safety risk to Preserve visitors). NPS must comply with federal policies on federally-listed species protection and conservation, exotic and invasive species management, and recreation, as specified in enabling legislation (16 USC § 698 [1993]; 36 CFR § 7.85; NPS, 1991; 1996).

1.1 OBJECTIVES OF TAKING ACTION

The objectives of this EA are to accurately evaluate the potential impacts to Big Thicket natural resources if a feral hog management plan is implemented. This EA was prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, regulations of the Council on Environmental Quality (CEQ) (40 CFR §1508.9), and NPS Director's Order (DO)-12 (Conservation Planning, Environmental Impact Analysis, and Decision-Making).

The objectives of the feral hog management plan are the following:

- 1) Provide for the safety of visitors, staff and volunteers;
- 2) Reduce current damage to native plants, animals and the ecological structures and functional processes upon which they are dependent caused by feral hogs;

- 3) Prevent irreparable damage to resources from feral hogs so they are available for future generations; and
- 4) Comply with policies on endangered species, exotic species, and recreation as specified in BTNP's enabling legislation.

Figure 1: Vicinity Map of Big Thicket Natural Preserve Project

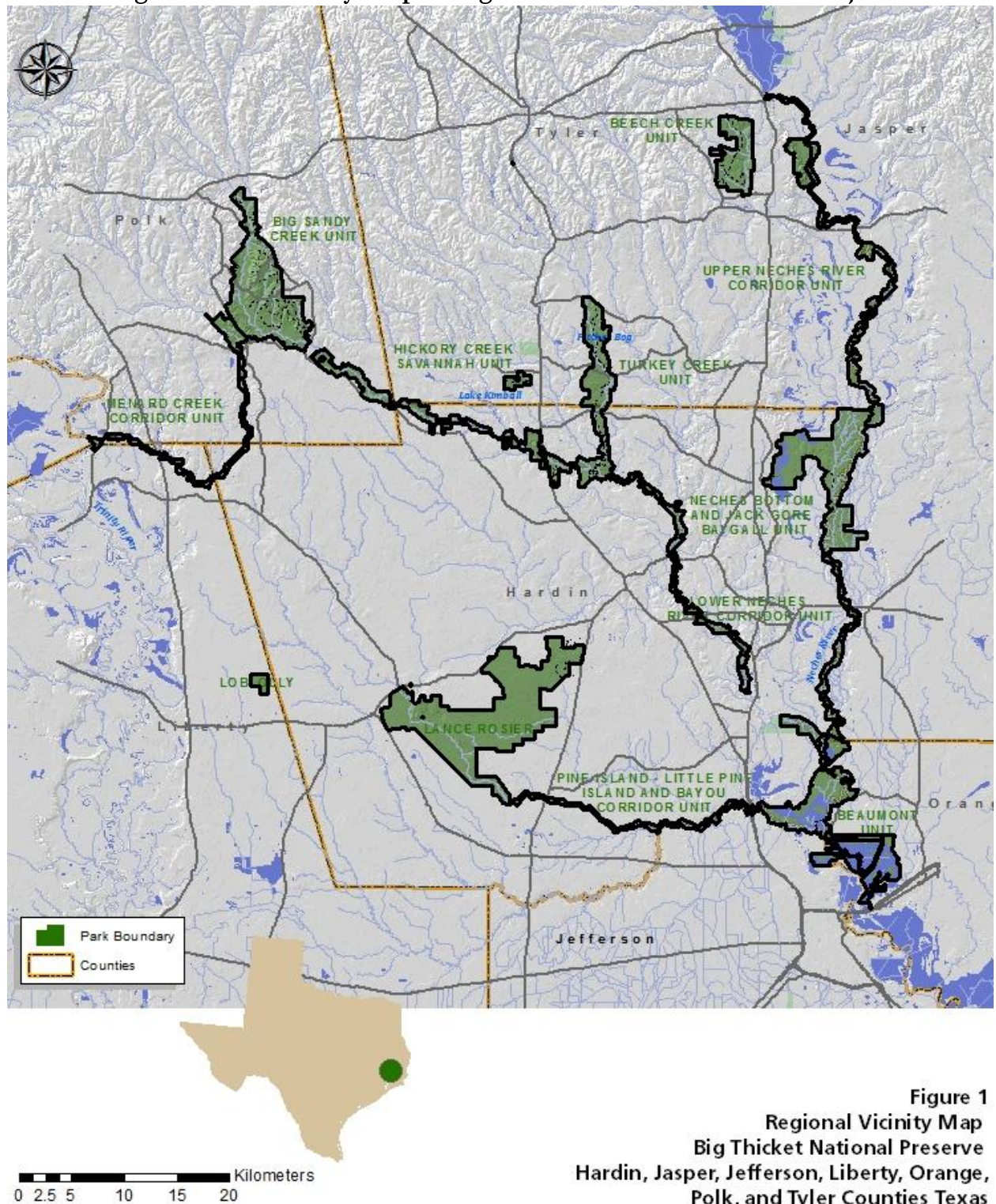


Figure 1
Regional Vicinity Map
Big Thicket National Preserve
Hardin, Jasper, Jefferson, Liberty, Orange,
Polk, and Tyler Counties Texas

1.2 SPECIAL MANDATES AND DIRECTION

Management to reduce impacts of non-native species is consistent with NPS policy to protect natural ecosystems and would be done so in compliance with existing federal, state, and NPS laws, regulations and policies.

1.2.1 NPS Organic Act and General Authorities Act

The NPS Organic Act as amended by the General Authorities Act of 1916 (16 U.S.C. § 1, *et seq.*) provides the fundamental management direction for all units of the National Park System. Section 1 of the Organic Act states, in part, that NPS shall:

“...promote and regulate the use of the Federal areas known as national parks, monuments, and reservations...by such means and measures as conform to the fundamental purpose of the said parks, monuments and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.” 16 U.S.C. § 1.

The National Park System General Authorities Act of 1970 (16 U.S.C. § 1a-1 *et seq.*) affirms that while all National Park System units remain "distinct in character," they are "united through their interrelated purposes and resources into one national park system as cumulative expressions of a single national heritage." The Act makes it clear that the NPS Organic Act and other protective mandates apply equally to all units of the system. Subsequently, the 1978 Redwood Act Amendments to the General Authorities Act further clarified Congress' mandate to NPS to protect park unit resources and values. The Amendments state, in part: “[t]he authorization of activities shall be construed and the protection, management, and administration of these areas shall be conducted in light of the high public value and integrity of the National Park System and shall not be exercised in derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress.” 16 U.S.C. § 1a-1.

Current laws and policies require the analysis of potential effects to determine whether actions would impair park unit resources. While Congress has given NPS the managerial discretion to allow certain impacts within park units, that discretion is limited by the statutory requirement (enforceable by the federal courts) that NPS must leave park unit resources and values unimpaired, unless a particular law directly and specifically provides otherwise (Management Policies 2006, § 1.4).

1.2.2 Big Thicket National Preserve Enabling Act

Congress established BTNP with the Act of October 11, 1974, Pub. L. No. 93-439, 88 Stat. 1254, codified as amended at 16 U.S.C. §§ 698-698e (2000), which designated the

Nation's first Preserve "[i]n order to assure the preservation, conservation, and protection of the natural, scenic, and recreational values of a significant portion of the Big Thicket area in the State of Texas and to provide for the enhancement and public enjoyment thereof." The authorizing legislation directs the Secretary of the Interior to administer the lands within BTNP "in a manner which will assure their natural and ecological integrity in perpetuity." The Preserve comprises 15 separate units, totaling approximately 108,208 acres (169.08 square miles).

The establishment of BTNP as a "national preserve" created a new National Park System category, which meets different criteria than other parks and recreation areas within the system. These criteria were set forth in the House of Representatives committee report (House Committee Report No. 93-676 pertaining to the establishment of BTNP and Big Cypress National Preserve), approved on the same date, as follows:

"Preserve refers more definitively to the keeping or safeguarding of something basically protected and perpetuated for an intended or stated purpose, as with the specific objectives for [BTNP] provided by this legislation. In general, national preserves will be areas of land and/or water which may vary in size, but which possess within their boundaries exceptional values or qualities illustrating the natural heritage of the Nation. Such areas would often be characterized by significant scientific values, including, but not limited to, ecological communities illustrating the process of succession, natural phenomena, or climax communities. In addition they could be characterized by a habitat supporting a vanishing, rare or restricted species; a relict flora or fauna persisting from an earlier period; or large concentrations of wildlife species. Other scientific, geologic, geomorphic or topographic values might also contribute to the purposes for which an area might be recognized.

The principal purpose of these areas should be the preservation of the natural values which they contain. They might differ, in some respects, from national parks and monuments insofar as administrative policies are concerned. Hunting, for example, subject to reasonable regulation by the Secretary, could be permitted to the extent compatible with the purposes for which the area is established. Other activities, including the extraction of minerals, oil, and gas could be permitted if such activities could be conducted without jeopardizing the natural values for which the area seeks to preserve. Management of the watershed resources might also be appropriate if that would enhance the value of the preserve as it serves other needs.

All management activities within these areas should be directed toward maintaining the natural and scientific values of the area, including the preservation of the flora and fauna and the reestablishment of the indigenous plant and animal life, if possible. Areas where scientific discoveries or historical events took place would contribute to the values of the preserve and should be managed in a manner which will maximize both the natural and historical values.

National preserves may accommodate significant recreational uses without impairing the natural values, but such public use and enjoyment would be limited to activities where, or periods when, such human visitation would not interfere with or disrupt the values which the area is created to preserve. Construction of physical facilities of any kind would be minimized and would be limited to those developments which are essential to the preservation and management of the area and the safety of the public. To the extent such facilities are deemed necessary and appropriate they would be constructed in a manner which would minimize their impact on the environment and their intrusion on the natural setting.”

1.2.3 Approved NPS Planning Documents

Approved NPS planning documents also provide a framework for determining how feral hog management actions are conducted within Preserve. The General Management Plan (GMP) is the major planning document for all National Park System units. The GMP sets forth the basic philosophy of the unit, and provides strategies for resolving issues and achieving identified management objectives required for resource management and visitor use. The GMP includes environmental analysis and other required compliance documentation. A GMP was completed for BTNP in 1980. The Preserve has prepared a new Draft GMP/EIS, which was distributed in May 2013. The GMP/EIS was put on public notice and was available for review for 60 days. The final, approved plan should start implementation in 2014.

Management of non-native species, such as feral hogs, within NPS units is further guided by NPS general management document, *Management Policies 2006*. Therein, the following direction is provided in regards to management of such species, which includes the feral hog:

- NPS will “maintain as parts of the natural ecosystems of the parks all plants and animals native to park ecosystems” and “prevent the introduction of exotic species into units of the national park system, and remove, when possible, or otherwise contain individuals or populations of these species that have already become established in parks”;
- “Exotic species are those species that occupy or could occupy park lands directly or indirectly as the result of deliberate or accidental human activities”;
- “Exotic species will not be allowed to displace native species if displacement can be prevented”;
- “All exotic plant and animal species that are not maintained to meet an identified park purpose will be managed -up to and including eradication- if (1) control is prudent and feasible, and (2) the exotic species interferes with natural processes and the perpetuation of natural features, native species or natural habitats; disrupts the genetic integrity of native species; disrupts the accurate presentation of a cultural landscape; damages cultural resources; significantly hampers the

management of park or adjacent lands; poses a public health hazard . . .; or creates a hazard to public safety”;

- “High priority will be given to managing exotic species that have, or potentially could have, a substantial impact on park resources, and that can reasonably be expected to be successfully controlled”;
- “The decision to initiate management should be based on a determination that the species is exotic”;
- “For species determined to be exotic and where management appears to be feasible and effective, superintendents should (1) evaluate the species’ current or potential impact on park resources; (2) develop and implement exotic species management plans . . . (3) consult, as appropriate, with federal, tribal, local, and state agencies as well as other interested groups; and (4) invite public review and comment, where appropriate”;
- “Programs to manage exotic species will be designed to avoid causing significant damage to native species, natural ecological communities, natural ecological processes, cultural resources, and human health and safety”;
- “[T]he Service will use scientifically valid resource information obtained through consultation with technical experts, literature review, inventory, monitoring, or research to evaluate the identified need for population management; the Service will document it in the appropriate park management plan”; and
- “[T]he Service may directly reduce the animal population by using several animal population management techniques, either separately or together. . . .includ[ing] relocation, public hunting on lands outside a park or where legislatively authorized within a park, habitat management, predator restoration, reproductive intervention, and destruction of animals by NPS personnel or their authorized agents.”

The NPS proposed action, development of a feral hog management plan, is in accordance with the goals and objectives described in the above-mentioned planning documents. During the scoping and development of the plan of operations and of this EA, the planning framework provided in BTNP’s GMP has been followed. Table 1 below summarizes many, but not all, of the statutes, regulations, executive orders, and policies that govern the management of non-native species, specifically feral hogs, in units of the National Park System.

Table 1: Current Legal and Policy Requirements

AUTHORITIES	RESOURCES AND VALUES AFFORDED PROTECTION
Statutes and Applicable Regulations	
National Park Service (NPS) Organic Act of 1916, as amended, 16 U.S.C. § 1 <i>et. seq.</i>	All resources, including air resources, cultural and historic resources, natural resources, biological diversity, human health and safety, endangered and threatened species, visitor use and

AUTHORITIES	RESOURCES AND VALUES AFFORDED PROTECTION
	experience, and visual resources
National Park System General Authorities Act, 16 U.S.C. §§ 1a-1 <i>et seq.</i>	All resources, including air resources, cultural and historic resources, natural resources, biological diversity, human health and safety, endangered and threatened species, visitor use and experience, and visual resources
NPS Omnibus Management Act of 1998, 16 U.S.C. §§ 5901 <i>et seq</i>	Any living or non-living resource
16 U.S.C. § 19jj (commonly referred to as the Park System Resource Protection Act)	Any living or non-living resource that is located within the boundaries of a unit of the National Park System, except for resources owned by a non-federal entity.
Enabling Act for Big Thicket National Preserve, 16 U.S.C., § 698a	Natural, scenic, and recreational values.
Animal Damage Control Act of 1931, as amended, 7 U.S.C. §§ 426 – 426d; 46 Stat. 1468	Control of nuisance wildlife species
Antiquities Act of 1906, 16 U.S.C. §§ 431-433; 43 CFR Part 3	Cultural (e.g., historic and archeological) and paleontological resources
Archeological Resources Protection Act of 1979, 16 U.S.C. §§ 470aa – 470mm; 18 CFR Part 1312; 32 CFR Part 229; 36 CFR Part 296; 43 CFR Part 7	Archeological resources
Endangered Species Act of 1973, as amended, 16 U.S.C. §§ 1531-1544; 36 CFR Part 13; 50 CFR Parts 10, 17, 23, 81, 217, 222, 225, 402, and 450	Plant and animal species or subspecies, and their habitat, which have been listed as threatened or endangered by the U.S. Fish and Wildlife Service (FWS) or the National Marine Fisheries Service (NMFS)
Federal Water Pollution Control Act of 1972 (commonly referred to as Clean Water Act), 33 U.S.C. §§ 1251 <i>et seq.</i> ; 33 CFR Parts 320-330; 40 CFR Parts 110, 112, 116, 117, 230-232, 323, and 328	Water resources, wetlands, and waters of the U.S
Historic Sites, Buildings, and Antiquities Act (Historic Sites Act of 1935), 16 U.S.C. §§ 461-467; 18 CFR Part 6; 36 CFR Parts 1, 62, 63 and 65	Historic sites, buildings, and objects
Lacey Act, as amended, 16 U.S.C. §§ 3371 <i>et seq.</i> ; 15 CFR Parts 10, 11, 12, 14, 300, and 904	Fish, wildlife, and vegetation
Migratory Bird Treaty Act, as amended, 16 U.S.C. §§ 703-712; 50 CFR Parts 10, 12, 20, and 21	Migratory birds

AUTHORITIES	RESOURCES AND VALUES AFFORDED PROTECTION
National Environmental Policy Act (NEPA) of 1969, 42 U.S.C. §§ 4321 <i>et seq.</i> ; 40 CFR Parts 1500-1508	The human environment (e.g. cultural and historic resources, natural resources, biodiversity, human health and safety, socioeconomic environment, visitor use and experience)
National Historic Preservation Act of 1966, as amended, 16 U.S.C. §§ 470-470x-6; 36 CFR Parts 60, 63, 78, 79, 800, 801, and 810	Cultural and historic properties listed in or determined to be eligible for listing in the National Register of Historic Places
Native American Graves Protection and Repatriation Act, 25 U.S.C. §§ 3001-3013; 43 CFR Part 10	Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony
Rivers and Harbors Act of 1899, as amended, 33 U.S.C. §§ 401 <i>et. seq.</i> ; 33 CFR Parts 114, 115, 116, 321, 322, and 333	Shorelines and navigable waterways, tidal waters, and wetlands
Safe Drinking Water Act of 1974, 42 U.S.C. §§ 300f <i>et seq.</i> ; 40 CFR Parts 141-148	Human health and water resources
National Park Service, Department of Interior; 36 CFR Parts 1, 2, and 7	Visitor use and Preserve management
Executive Orders	
Executive Order (E.O.) 11593 – Protection and Enhancement of the Cultural Environment, 36 Federal Register (Fed. Reg.) 8921 (1971)	Cultural resources
E.O. 11988 - Floodplain Management, 42 Fed. Reg. 26951 (1977)	Floodplains and human health, safety, and welfare
E.O. 11990 – Protection of Wetlands, 42 Fed. Reg. 26961 (1977)	Wetlands
E.O. 12088 – Federal Compliance with Pollution Control Standards, 43 Fed. Reg. 47707 (1978)	Natural resources and human health and safety
E.O. 12898 – Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, amended by Exec. Order No. 12948, 60 Fed. Reg. 6379 (1995)	Human health and safety
E.O. 13007–Indian Sacred Sites, 61 Fed. Reg. 26771 (1996)	Native American sacred sites
E.O. 13112 – Invasive Species, 64 Fed. Reg. 6183 (1999)	Vegetation and wildlife

AUTHORITIES	RESOURCES AND VALUES AFFORDED PROTECTION
E.O. 13186– Responsibilities of Federal Agencies to Protect Migratory Birds, 66 Fed. Reg. 3853 (2001)	Migratory birds
Policies, Guidelines and Procedures	
NPS <i>Management Policies 2006</i>	All resources, including natural resources, cultural resources, human health and safety, visitor use and experience, visual resources, and others
Department of the Interior (DOI), Departmental Manual (DM) 516 –NEPA policies	The human environment
NPS Director’s Order (DO) –12 and Handbook – National Environmental Policy Act (2001)	The human environment
NPS DO - 28 – Cultural Resource Management (1997)	Cultural, historic, and ethnographic resources
NPS 77 – Natural Resources Management Guideline (1991)	Natural resources
NPS DO 77-1 – Wetland Protection	Wetlands
NPS Special Directive 93-4 – Floodplain Management Guideline	Floodplains
Secretary of the Interior’s “Standards and Guidelines for Archeology and Historic Preservation,” 48 Fed. Reg. 44716 (1983), also published as Appendix C of NPS DO 28 – Cultural Resource Management	Cultural and historic resources
Selected Texas Laws and Regulations	
Texas Parks and Wildlife Code 1.101(4) and Texas Agriculture Code 161.001(a)[4]	Feral hogs considered exotic livestock and not a game or non-game species
TAC Title 4 Part 2 Chapter 55 Rule §§ 55.9 Feral Swine	Trapping and movement of feral swine
Texas Agriculture Code Title 6, Subtitle C, Chapter 161, Secs. 161.001, 161.0412, 161.054, 161.1375, 161.150	Definition of captive feral hogs as “exotic livestock”; regulation and registration requirements of feral swine holding facilities and movement restrictions

This EA was prepared in compliance with NEPA and its implementing regulations. The EA is being made available to the public for a 30-day review. Upon completion of this review, NPS will assess all public comments, and if necessary, modify the EA. A Finding

of No Significant Impact (FONSI) would then be issued finalizing the decision, or, if the potential for significant impacts were identified, a Notice of Intent (NOI) would be publicized in the Federal Register for preparation of an Environmental Impact Statement (EIS).

This EA evaluates specific actions to manage feral hogs in BTNP. Additional compliance may be necessary for site-specific actions where the potential for sensitive resources exists or the action is in an area or is of a nature that creates a public concern. The public would be notified of any such proposals prior to implementation.

1.3 ISSUES AND IMPACT TOPICS EVALUATED

Issues and concerns affecting this proposal were identified from past NPS planning efforts at this Preserve and other National Park System units (including several parks that are planning or implementing feral hog management), environmental groups, and input from other state and federal agencies and the public through scoping, as further described in section 4. Issues were identified for both the no action and the action alternative. For the no action alternative, general issues include feral hog damage to native plants, animals, and the ecological structures and functional processes upon which they are dependent; irreparable damage to resources so that they are unavailable for future generations; and detrimental effects of continued feral hog activity on both visitor use and experience and Preserve operations. General issues identified for the action alternative are related to management activities and include negative impacts to natural and recreation resources, such as vegetation trampling, non-target species capture, temporary trail closures, and increased labor demand on BTNP staff. Positive effects to resources should result from the reduction of negative feral hog impacts under the action alternative, and these benefits should offset and exceed anticipated negative effects under this alternative for all resources or issues except for Preserve operations. Potential issues under both the no action and the action alternative include compliance with policies on endangered species, exotic species, and multiple-use recreation, as specified in enabling legislation for BTNP.

Specific impact topics were developed to focus discussion of environmental consequences, and to allow comparison of the impacts of each alternative. These impact topics were identified based on federal laws, regulations, and executive orders, as well as NPS *Management Policies 2006* and NPS knowledge of limited or easily affected resources. Impact topics that are carried forward for further analysis in this environmental assessment are those where the no action or the action alternative may have a measurable effect, defined as “moderate” or greater intensity (as described in section 1.4). There were eight impact topics retained for further analysis. Some impact topics were dismissed from further consideration when the environmental effects were estimated to not be measurable. A brief rationale for the selection of each impact topic is given below.

Geologic Resources (includes Soils, Bedrock, Streambeds, etc.): According to *Management Policies 2006*, NPS will preserve and protect geologic features and natural processes from disturbances and “will actively seek to understand and preserve the soil resources of parks, and to prevent, to the extent possible, the unnatural erosion, physical removal, or contamination of the soil or its contamination of other resources.” Feral hog behavior, especially rooting, can result in disturbance to geologic resources, especially soils and streambeds. The action alternative would include activities that may disturb geologic resources, such as increased foot traffic in the backcountry. A reduction in the BTNP feral hog population under the preferred action would lessen the negative impacts of these animals on geologic resources, having a positive effect. Therefore, geologic resources will be addressed as an impact topic in this EA.

Water Quality and Quantity: NPS policies require protection of water quality consistent with the Clean Water Act. The purpose of the Clean Water Act is to “restore and maintain the chemical, physical, and biological integrity of the nation’s waters.” To enact this goal, the U.S. Army Corps of Engineers (USACE) has been charged with evaluating federal actions that result in potential degradation of waters of the U.S. and issuing permits for actions consistent with the Clean Water Act. The U.S. Environmental Protection Agency (EPA) also has responsibility for oversight and review of permits and actions, which affect waters of the U.S. Feral hogs can impact water quality by altering erosion/sedimentation rates, changing flow paths, introducing bacteria and fecal coliforms, and through various other mechanisms. The proposed action would include activities that may affect water quality, such as sedimentation caused by soil disturbance during limited vehicular access or the placement of traps, blinds, or fencing. A reduction in the BTNP feral hog population under the action alternative would lessen the negative impacts of these animals on water quality, having a beneficial effect. Therefore, water quality and quantity will be addressed as an impact topic in this EA.

Floodplains and Wetlands: Executive Order (EO) 11988 “Floodplain Management” requires all federal agencies to avoid construction within the 100-year floodplain unless no other practicable alternative exists. NPS guided by the *Management Policies 2006* and DO 77-2 *Floodplain Management* will strive to preserve floodplain values and minimize hazardous floodplain conditions.

EO 11990 “Protection of Wetlands” requires federal agencies to avoid, where possible, negative impacts to wetlands. Further, Section 404 of the Clean Water Act authorizes USACE to prohibit or regulate, through a permitting process, discharge of dredged or fill material or excavation within waters of the U.S. NPS policies for wetlands as stated in *Management Policies 2006* and DO-77-1 *Wetlands Protection*, strive to prevent the loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands.

Feral hogs can impact floodplain and wetland habitats, although floodplain impacts by hogs do not include those specified in EO 11988. The proposed action would include

activities that may affect floodplains and wetlands, such as trampling of vegetation or soil compaction due to pedestrian or vehicular traffic, or the placement of traps, blinds, stands, or fencing. A reduction in the BTNP feral hog population under the action alternative would lessen the negative impacts of these animals on floodplains and wetlands, having a positive effect. Therefore, floodplains and wetlands will be addressed as an impact topic in this EA.

Vegetation (includes Rare & Unusual Vegetation and Plant Species of Special Concern): The National Environmental Policy Act (42 U.S.C. 4321 et seq.) calls for an examination of the impacts a proposed action may have on all components of affected ecosystems. *Management Policies 2006* states NPS will preserve and maintain all plant species native to the naturally evolving park unit ecosystems by preserving and restoring the abundances, diversity, dynamics, habitats, distributions, and natural processes of native plants.

Additionally, Section 7 of the Endangered Species Act requires all federal agencies to consult with the U.S. Fish and Wildlife Service (USFWS) to ensure that any action authorized, funded, or carried out by the agency does not jeopardize the continued existence of federally listed species or designated critical habitats. *NPS Management Policies 2006* and *DO-77 Natural Resources Management Guidelines* require NPS to examine the impacts on federal candidate species, as well as state-listed endangered, threatened, candidate, rare, declining, and sensitive species.

Feral hog activity can impact vegetation communities as well as populations of individual species, including species of special concern, through disturbance, herbivory, spread of non-native species, and other mechanisms. The proposed action would include activities that may affect vegetation, such as trampling or clearing due to pedestrian or vehicular access and during the placement of traps, blinds, stands, or fencing. A reduction in the BTNP feral hog population under the action alternative would lessen the negative impacts of these animals on vegetation, having a positive effect on the resource. Therefore, vegetation will be addressed as an impact topic in this EA.

Fish and Wildlife (includes Species of Special Concern, Unique or Important Wildlife or Wildlife Habitat, and Unique or Important Fish or Fish Habitat): *Management Policies 2006* states that NPS will preserve and maintain animals native to the naturally evolving park unit ecosystems by preserving and restoring the abundances, diversity, dynamics, habitats, distributions, and natural processes of native animals. BTNP hosts a large diversity of wildlife: about 60 mammal species, 90 reptile and amphibian species, more than 1,800 invertebrates, and almost 100 fish species.

Feral hog activity can impact fish and wildlife communities and species' populations, including species of special concern, through disturbance, herbivory, predation, spread of non-native species, competition, disease, and other mechanisms. The proposed action would include activities that may affect fish and wildlife resources, such as the

accidental trapping of non-target species and disturbances (pedestrian or vehicular traffic, dog activity, noise, and fencing) that cause avoidance behavior or displacement of individuals. A reduction in the BTNP feral hog population under the action alternative would lessen the negative impacts of these animals on fish and wildlife, having a positive effect. Therefore, fish and wildlife will be addressed as an impact topic in this environmental assessment (see also Vegetation, where regulations for species of special concern are addressed).

Visitor Use and Experience (includes Recreation Resources, Visitor Experience, Aesthetic Resources, etc.): NPS *Management Policies 2006* states that the fundamental purpose of all National Park System units is for the enjoyment of unit resources. NPS is committed to providing appropriate, high-quality opportunities for visitors to enjoy the parks, preserves, and other units, and will provide opportunities specifically suited for the natural and cultural resources found within each area. The enabling legislation for BTNP allows for hunting, in addition to the typical range of opportunities found in natural areas.

The presence of feral hogs in BTNP and signs of their disturbance can affect visitor use and experience, with the type and intensity of the effect dependent on the visitor and their perspective on feral hogs. The proposed action would include activities that may affect visitor use and experience, such as the temporary closure of certain Preserve areas during directed shooting activities or when using dogs, the potential for disturbance during the use of dogs, and the impacts of trap placement or fencing on aesthetics. A reduction in the BTNP feral hog population under the action alternative would negatively affect some visitors but would generally lessen the negative impacts of these animals on most visitor uses and experiences, producing a positive effect. Therefore, visitor use and experience will be addressed as an impact topic.

Preserve Operations: BTNP has a relatively large land base in relation to its small permanent staff. Feral hog disturbance negatively affects BTNP operations by impeding activities, such as restoration projects and removal of invasive species, which results in added labor and capital costs. A reduction in the BTNP feral hog population under the proposed action would lessen the negative impacts of these animals on Preserve operations, having a positive effect. However, implementation of the proposed feral hog management plan would also affect resource management and maintenance responsibilities of BTNP staff, necessitating both increased labor and capital costs that may limit allocation of these resources to other activities. Therefore, Preserve operations will be addressed as an impact topic in this EA.

Introduce or Promote Non-Native Species (Plant or Animal): EO 13112 “Invasive Species” requires that federal agency whose actions may affect the status of invasive species, to the extent practicable and permitted by law, identify these actions; take corrective action (when appropriations available and within budget); and typically not authorize, fund, or carry out actions that may promote the introduction or spread of invasive species. Additionally, *Management Policies 2006* states that NPS will “maintain

as parts of the natural ecosystems of the parks all plants and animals native to [these] ecosystems” and “prevent the introduction of exotic species into units of the national park system, and remove, when possible, or otherwise contain individuals or populations of these species that have already become established in parks.”

Feral hogs are destructive non-native species that also promote the introduction and spread of other such species. The proposed action directly proposes to remove a non-native species—the feral hog—but also includes activities that may introduce or promote other non-native species, such as soil and vegetation disturbance from pedestrian or vehicular traffic, trap placement, and installation of blinds, stands, or fencing. A reduction in the BTNP feral hog population under the action alternative would have a positive effect by lessening the negative impacts caused by these animals through their introduction or promotion of other non-native species. Therefore, introduction of non-native species will be addressed as an impact topic in this EA.

1.4 ISSUES AND IMPACT TOPICS ELIMINATED FROM FURTHER ANALYSIS

In this section, and later in section 3 of this EA, NPS takes a “hard look” at all potential impacts by considering the direct, indirect, and cumulative effects of both the no action and the proposed action on the environment, along with connected, cumulative and similar actions. Impacts are described in terms of context and duration. The context or extent of the impact may be localized, widespread, or regional. Localized impacts are defined herein as those spatially restricted to a limited area that can be easily delineated or specified; whereas, widespread impacts occur at a broader spatial scale defined as throughout BTNP and potentially extending into adjacent lands. Regional impacts would occur throughout BTNP and adjacent lands, but also exhibit effects throughout the Pineywoods. The duration of impacts is described as short-term, less than or equal to three years in duration, or long-term, extending more than three years. The intensity and type of impact is described as negligible, minor, moderate, or major, and as positive or negative. NPS equates “major” effects as “significant” effects. The identification of “major” effects would trigger the need for an environmental impact statement (EIS). Where the intensity of an impact could be described quantitatively, the numerical data is presented; however, most impact analyses are qualitative and use best professional judgment in making the assessment. The use of the four impact intensity levels provides a “hard look” to NPS decision-makers, and enables them to evaluate the impacts in an objective fashion.

NPS defines “measurable” impacts as moderate or greater effects. It equates “no measurable effects” as minor or less effects. “No measurable effect” is used by NPS in determining if a categorical exclusion applies or if impact topics may be dismissed from further evaluation in an EA or EIS. The use of “no measurable effects” in this EA pertains to whether NPS dismisses an impact topic from further evaluation in the EA.

The reason NPS uses “no measurable effects” to determine whether impact topics are dismissed from further evaluation is to concentrate on the issues that are truly significant to the action in question, as required by CEQ regulations at 1500.1(b), rather than amassing needless detail.

In this section of the EA, NPS provides a limited evaluation and explanation as to why some impact topics are not evaluated further in the EA. Impact topics are dismissed from further evaluation in this EA if:

- they do not exist in the analysis area;
- they would not be affected by the proposal, or the likelihood of impacts are not reasonably expected; or
- through the application of mitigation measures, or otherwise, there would be minor or less effects from the proposal, and there is little controversy on the subject or reasons to otherwise include the topic.

Due to there being no effect or no measurable effects, there would either be no contribution towards cumulative effects or the contribution would be low. For each issue or impact topic presented below, if the resource is found in the analysis area or the issue is applicable to the proposal, then a limited analysis of direct and indirect, and cumulative effects is presented if appropriate (e.g., an effect is anticipated).

Air Quality: Section 118 of the Clean Air Act, as amended (33 U.S.C. 7401 et seq.) requires each park unit to meet all federal, state, and local air pollution standards. BTNP is classified as a Class II clean air area under the 1977 amendments to the Clean Air Act (42 U.S.C. 7401 et seq.), specifically the Prevention of Significant Deterioration (PSD) provisions. Under Class II, modest increases in air pollution are allowed beyond baseline levels for sulfur dioxide, nitrogen dioxide, and particulate matter, provided that the National Ambient Air Quality Standards established by the Environmental Protection Agency are not exceeded. Feral hogs are not known to directly impact air quality, and as such, the no action alternative should have no effect on this resource. The action alternative would include activities having only a negligible negative effect on air quality, such as localized emissions from vehicle exhaust. These impacts would be short-term, direct, and localized, and would negligibly contribute to cumulative effects. Therefore, air quality has been dismissed from further analysis in this document.

Soundscapes: In accordance with *NPS Management Policies 2006* and DO-47 *Soundscape Preservation and Noise Management*, an important component of NPS’s mission is the preservation of natural soundscapes associated with National Park System units. Impacts to the natural soundscape are not anticipated under the no action alternative but could occur from certain aspects of the proposed action (e.g., firearm discharge, dog barking, vehicle operation). Mitigation measures (e.g., use of sound suppressed firearms) described in section 2.2 would minimize proposed-action effects on soundscapes. These impacts would be direct and minor in intensity with localized

extent. Therefore, this topic has been dismissed from further analysis in this document.

Lightscares: In accordance with *Management Policies 2006*, NPS strives to preserve natural ambient lightscares, which are natural resources and values that exist in the absence of human caused light. BTNP strives to limit the use of artificial outdoor lighting to that which is necessary for basic safety requirements. Both the no action and the action alternative would have no effect on lightscape management, and therefore, this topic has been dismissed from further analysis in this document.

Cultural Resources: Cultural resources include archeological resources, prehistoric/historic structures, cultural landscapes, ethnographic resources, and museum collections. Under *Management Policies 2006*, DO-28 *Cultural Resource Management*, and DO-24 *Museum Collections Management*, NPS is charged to protect and manage cultural resources in its custody through effective research, planning, and stewardship and in accordance with these policies and guidelines. These resources are also afforded state and federal protection and management guidelines under Section 106 of the National Historic Preservation Act, as amended in 1992 (16 USC 470 et seq.), EO 13007, and other applicable laws.

Effects to archeological resources are anticipated under both alternatives and include minor negative impacts from feral hog activity, especially rooting, under the no action alternative, and negligible negative impacts but minor positive effects from management activities under the proposed action (i.e., reduction of feral hog impacts). Mitigation measures (e.g., avoidance of known sites, cultural resource surveys, etc.) described in section 2.2 (Protection of Cultural Resources) would minimize proposed-action effects on archeological resources. Because anticipated impacts to archeological resources are minor or less, cultural resources were dismissed from further analysis in this document.

Socioeconomics: BTNP contributes to the local economy by adding revenue, taxes, and employment related to the acquisition of services, supplies, and materials needed to administer and operate the Preserve. In addition, tourism-related expenditures contribute to the local economy and also create jobs to support tourism. Whereas the no action alternative would likely have no effect on the local economy, the proposed action would negligibly impact local businesses or other entities through potential impacts to visitorship and employment. Mitigation measures described in section 2.2 (Protection of Visitor Use and Experience) would minimize proposed-action effects on soundscapes. These impacts would be negligible and not of any measurable or perceptible consequence. Therefore, this topic was dismissed from further analysis in this EA.

Minority and Low Income Populations: EO 12898 “Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations” requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and negative human health or environmental effects of their programs and policies on minorities and low income

populations and communities. Hunting has and continues to be an important cultural resource for sustenance and recreation in communities surrounding BTNP. Harvest of feral hogs within the Preserve may serve as an important food source for minority and low income populations in the surrounding areas. As such, management activities that would affect feral hog populations could disproportionately affect these individuals. The no action alternative would have no effect on minority and low income populations. Impacts to these populations could occur under the proposed action but, if present, would be negligible in intensity and could include both negative (e.g., decreased hog population) and positive (e.g., improved animal quality and health, health monitoring, etc.) impacts. Minority and low income populations would still be allowed to hunt feral hogs during the public general hunting and extended hog seasons under the action alternative. Because anticipated impacts are negligible, this topic was dismissed from further analysis in the EA.

Energy Resources: The Big Thicket is an area of Texas that has been historically utilized for oil and gas exploration. Oil and gas resources under BTNP are non-federally owned. The oil and gas resources beneath the Neches River and navigable reaches of Pine Island Bayou are owned by the State of Texas. Over 220 wells have been drilled within the boundaries of BTNP. Most of the wells have been plugged and were abandoned prior to 1974 before the Preserve was established. An inventory conducted by NPS in the mid-1980s revealed that 125 well pads, 15 miles of access roads, and 64 miles of pipelines are within BTNP. As of 2011, there were 11 non-federal oil and gas surface operations within the Preserve, including 8 wells and associated production facilities, 2 saltwater disposal wells, a flowline and tank battery, and an access road that led to directional drills outside of BTNP. There are 71 oil and gas pipeline segments crossing BTNP and transported products consist of saltwater, crude oil, natural gas, liquid petroleum gas, and natural gas liquids. Both the no action and the action alternative would have no effect on energy resources, and therefore, this topic has been dismissed from further analysis in this document.

Prime and Unique Farmlands: The Farmland Protection Policy Act of 1981, as amended, requires federal agencies to consider negative effects to prime and unique farmlands that would result in the conversion of these lands to non-agricultural uses. Prime or unique farmland is classified by the U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service. Prime farmland is defined as land that has the best combination of physical and characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses. Unique farmland is defined as land other than prime farmland that can produce high value and fiber crops, such as fruits, vegetables, and nuts. There are no prime or unique farmlands designated in BTNP; thus this topic was dismissed from further analysis.

Indian Trust Resources: Secretarial Order 3175 requires that any anticipated impacts to Indian trust resources from a proposed project or action by the Department of Interior agencies be explicitly addressed in environmental documents. The federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the

U.S. to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes. BTNP is a public holding, is not considered Indian trust resources, and does not have any designated Indian trust resources. Therefore, Indian trust resources was dismissed as an impact topic for further analysis.

Climate Change: Climatologists are unsure about the long-term results of global climate change; however, it is clear that the planet is experiencing a warming trend that affects ocean currents, sea levels, polar sea ice, and global weather patterns (IPCC, 2007). Potential future changes in plant communities are anticipated from predicted climate change, as individual plant species respond to large and small-scale changes in temperature and precipitation, the fertilizing effect of increased carbon dioxide, and changing patterns of interspecific competition, disturbance, and other interactions (Shafer *et al.* 2001; Walther *et al.* 2002; Parmesan and Yohe, 2003). Likewise, climate change, both directly and indirectly, will drive changes in the distribution of animal species, as some species acclimate in place to new conditions, many migrate to offset habitat shifts, and others, especially range-restricted species or where barriers to migration occur, will decline (Root *et al.* 2003; Parmesan, 2006). Many scenarios have been developed and modeled in an attempt to quantify future climate change and effects on the distribution of vegetative communities (e.g., Cramer *et al.* 2001). However, at this time, the models are not precise enough to address increases in temperature and water stress over the short duration of the planning period and the small extent of the project area.

Native communities differ in their resilience (Holling, 1973), or ability to withstand, climate change without substantial changes in structure and processes. Reduction in the resilience of native communities often results from modification of the natural disturbance cycle, changes to community structure (e.g., species composition, diversity, abundance, size, etc.), and processes (biological, physical, and chemical) (Folke *et al.* 2004). Feral hog impacts to native ecological communities in BTNP could affect the resiliency of these systems in the face of climate change, such that the no action alternative would have minor negative effects and the proposed action would have negligible negative (e.g., vehicle emissions) and minor positive (e.g., increased ecosystem resiliency through reduction in feral hog damage). Because anticipated impacts are minor or less, this topic was dismissed from further analysis.

2.0 ALTERNATIVES

The CEQ defines reasonable alternatives as those alternatives or options that are economically and technically feasible. Alternatives that could not be implemented if they were chosen, or do not resolve the need for action and fulfill NPS's objectives by taking action, were eliminated from further evaluation. This document examines a range of reasonable alternatives, as required under Section 1502.14 of the CEQ regulations.

Two alternatives are described and evaluated in this EA: Alternative A, no action, and Alternative B, Implement a Feral Hog Management Plan. Alternatives considered but dismissed from further analysis are described and the reasons for dismissing them are given. Analyses for selecting the environmentally preferable alternative and NPS preferred alternative are also provided. This section concludes with three (3) summary tables comparing the two alternatives.

2.1 ALTERNATIVE A: NO ACTION

Under the guidelines of NEPA and CEQ Regulations (40 CFR 1500-1508), a "no action" alternative "may be thought of in terms of continuing with the present course of action until that action is changed." The no action alternative is required under NEPA and establishes a baseline for comparing the present management direction and environmental consequences of the action alternative. Under Alternative A, no action, BTNP would maintain the status quo with regards to feral hog management. Public hunting through issuance of hunting permits would be the primary means of reducing feral hog population numbers in the Preserve. Current management for control of feral hogs in BTNP includes permitted recreational hunting during the State of Texas's white-tailed deer archery-only season through general season and a subsequent hog-only extended season (lasting up to 3 months). The Preserve staff may also euthanize individual hogs by shooting them if they pose an imminent threat to public safety (e.g., charging visitors on trail). Currently, with the exception of the techniques listed above, the Preserve staff do not use any of the other methods listed in Alternative B to control feral hogs. As has been discussed in the introduction, the hog population is growing rapidly despite current control efforts.

2.2 ALTERNATIVE B: IMPLEMENT A FERAL HOG MANAGEMENT PLAN

Under this alternative, a feral hog management plan would be implemented with the goal of reducing natural resources and visitor use and experience impacts associated with hogs. The preferred alternative would include a range of management measures that would be employed on a site- and season-specific basis. Public hunting would continue, as discussed under the no action alternative. In addition, NPS personnel or their authorized agents would trap and/or shoot feral hogs in target areas within the Preserve. Authorized agents could include NPS employees or employees of other

federal agencies (e.g., USDA APHIS), state employees (e.g., TPWD), or private contractors for whom certain specified activities are permitted in BTNP under the feral hog management program, as approved by the Preserve superintendent. Authorized agents would be required to undergo training and adhere to management and safety protocols. This alternative could include radio-tracking a limited number of trapped and released hogs (“Judas hogs”) to assist with the directed shooting program. Trained dogs could be used to aid in the tracking and shooting of hogs. Where necessary and appropriate, protection of important areas from hog damage could include limited and localized installation of exclosure fencing. Additional activities under this alternative would include coordination with adjacent landowners/users; an interpretative program with dissemination of public information and education concerning feral hog management; and monitoring and research activities. The proposed feral hog management plan is presented below by individual action or activity headings.

Directed Trapping Program (Live-Capture): Use of traps for hog management within BTNP would be limited to live-capture traps; kill-traps and snares would not be used. Several portable, lightweight, cage traps, as well as corral traps, would be built or purchased. Trap designs and placement techniques implemented would follow and adapt methods that have proven effective elsewhere for feral hogs (NPS, 1993; Barrett and Birmingham, 1994; West *et al.* 2009; Lewis *et al.* 2011a-d). Intense trapping programs have been used to substantially reduce feral hog populations, with Choquenot *et al.* (1993) reaching reductions of 80% to 90%. However, some individuals are resistant to trapping and may avoid traps; thus trapping alone is unlikely to be the most effective approach (West *et al.* 2009). Trapping could be successful, particularly at the beginning of a hog management effort and at times when wild food availability is limited (outside of the peak late summer and fall fruit and mast season or during years with poor acorn and forage production) (Barrett and Birmingham, 1994). Certain areas in BTNP may not be conducive to trapping due to landscape constraints. It is expected that trapping would be used early in the management effort, especially in areas where direct shooting is not feasible due to safety concerns or other reasons. Trapping would be discontinued or used less frequently if trapping success was poor or if capture rates declined substantially. Signs of increase in hog numbers or disturbance could trigger a return to trapping efforts. Trapping could also be used on a limited basis in support of other management efforts described below, which could include trapping hogs to fit them with radio collars (and then administering a contraceptive or sterilizing them, if practicable, followed by release) or to collect blood samples for disease testing.

Lightweight portable traps that could be transported by hand or on a small trail cart (pushed or pulled by hand) would mainly be used in remote areas, with corral traps also used in more accessible locations. Trucks and utility vehicles (UTVs) could be used for access and transport of traps, where vehicles are currently approved for use and where access was possible without expanding or altering existing dirt roads, trails, and rights-of-way. Motorboats would be used for access and transport of traps along the Neches River and other waterways accessible by motorboat where allowed. Johnboats, canoes, or other such watercraft with or without electric motors could also be used to transport

traps within BTNP (such as along bayous and internal creek segments). During placement and operation of all traps, care would be taken to avoid disturbance of vegetation and soils to the greatest extent possible. All traps would be placed so they were out of sight from designated visitor use areas, such as the visitor center, parking areas, trails (e.g., Turkey Creek Trail, Big Sandy Creek Horse/Bike Trail, Bird Watcher's Trail, etc.), boardwalks, Village Creek, the Neches River, and any other common visitor use areas. Traps would also be placed so as not to disturb known cultural sites. Once a trap was no longer actively in use in an area, it would be removed unless there were plans to use the trap in the future at the same location.

NPS personnel or their authorized agents would conduct trapping. Traps would be placed and set in areas showing recent hog activity. Traps would be baited with sour corn mash, which is reported to attract hogs but not other non-target species such as deer (West *et al.* 2004). Similar or equivalent baits could be used as well, such as livestock cubes, other sour grains, and commercially available baits (e.g., Lewis *et al.* 2011b) with emphasis placed on baits that minimize attraction of non-target species. Traps would be inspected within a minimum of 24 hours after they were set and at a minimum of 24 hour intervals thereafter. Non-target wildlife captured in traps would be released immediately upon discovery. Escape holes for smaller non-target species would be included in the tops of cage traps during construction, by design, or through modification.

Shooting is the only practical method available for humanely euthanizing trapped feral hogs under field conditions (NPS, 1993). Captured hogs would be humanely killed as quickly and painlessly as possible by a firearm shot directly to the brain, rendering instant unconsciousness and in compliance with the American Veterinary Medical Association's (AVMA) Guidelines for Euthanasia of Animals (2013). Firearms used for euthanizing captured hogs could include rifles, shotguns, or handguns of appropriate caliber and bullet weight for feral hogs. Shotguns or handguns would likely be more appropriate for use with captured animals. Sound suppression of firearms would be used to reduce dispersal of hogs from trapping areas and to limit noise disturbance to visitors using other parts of BTNP. Live capture, transport, and release of hogs to other lands is not possible due to the threat of spreading serious diseases to other hog populations, livestock, and humans. Swine brucellosis and pseudorabies have been documented for feral hog populations throughout Texas (Texas Animal Health Commission [TAHC], 2013a, 2013b). Hogs captured in traps and killed would be moved away from the trap area and left in the field. Final disposition of hogs is described in more detail below under a separate heading.

Trap records would be kept up to date and include information such as a trap identification number; the type of trap; bait type; dates and types of trap repairs or modifications; trap placement location(s) (recorded by GPS); habitat type where trap placed; the number of days and dates the trap was set in each location; the dates and times that set traps were checked; the number of hogs captured by date and location; the disposition of hogs captured (killed; radio-collared, etc.); and the names and affiliations

of personnel conducting trapping. Basic biological data would also be collected on each captured hog (described below under research and monitoring).

NPS-approved training and certification in wildlife control and firearm use would be required for personnel conducting trapping. Additional firearm training specifications are detailed in the next section. Personnel conducting trapping would also be required to periodically review this document and feral hog management guidelines for other parks.

Directed Shooting Program: Direct reduction of feral hogs by shooting would be the main hog management activity used within and throughout BTNP (shooting would not be conducted outside Preserve boundaries). Shooting would be conducted on a sustained basis over an indefinite time-period. Effort may change over time as the feral hog population fluctuates, with greater effort expended at times when hog numbers were high, signs of hog disturbance were more abundant, or program effectiveness were higher than average (i.e., more hogs harvested per unit of labor). NPS personnel or their authorized agents would conduct shooting of feral hogs. Shooting would be conducted while stalk hunting on foot, from ground blinds, and from temporary tree stands. Only temporary, portable blinds and tree stands that could be transported as a backpack unit or on a small trail cart (pushed or pulled by hand) would be used in remote areas. Trucks and UTVs would be used for access and transport where these vehicles are currently approved for use. Motorboats would be used for access along the Neches River and other waterways where motorboat access is allowed. Motorized (electric) or non-motorized canoes, small johnboats, or other such watercraft could also be used within the Preserve. Blinds and tree stands would only be left in place over a few days and then would be moved for use elsewhere or removed from the field if not in use. Baiting could be used in combination with shooting to attract hogs to blinds or tree stands. Baits could include sour corn mash, shell corn, or other appropriate baits, such as livestock cubes, sour grain, and commercially available baits (e.g., Lewis *et al.* 2011b) with emphasis placed on baits that minimize attraction of non-target species. Unused bait would be collected and removed from the field. Management personnel could set up primitive low-impact campsites when operating in remote areas over a several day period. No fastening devices, nails, screws, stakes, wire, rope or other human-made materials would be left in the field. When feasible, shell casings would also be collected and removed from the field after firearm use.

All personnel involved with shooting would be required to obtain NPS-approved wildlife control and firearms training and certification. Firearms training and qualification would be conducted on a semi-annual basis, by way of a training and qualification program, using an approach similar to and likely adapted from the program used at GSMNP. Program specific firearm safety guidelines would also be developed and reviewed periodically. Personnel conducting shooting would also be required to periodically review this document and feral hog management guidelines for other parks. Personnel conducting shooting would be monitored for firearm safety violations. Violations would result in immediate removal of personnel from hog

management responsibilities and reprimand up to and including immediate termination.

Shooting areas would be defined in a planning setting prior to conducting operations. Shooting would be closely coordinated with law enforcement, maintenance, fire management, and interpretation personnel to ensure maximum safety. In some cases, visitor use areas could be closed during shooting operations for safety purposes. Notice of feral hog management activities and closure areas will be posted at the visitor center and in the field, using signage, trail and boardwalk barriers, and other appropriate means. Any animals that were wounded and not immediately killed would be pursued, located, and killed as quickly and humanely as possible. If a wounded or potentially wounded animal could not be located during the same day of operations, the area would be returned to and searched until the animal is located.

Shooting operations could be focused at certain times in highly sensitive areas thought to be at greater risk of impact by hogs. Effort could also be focused in areas where hog sign is more abundant or where greater numbers of hogs are known to occur. Although shooting effort could be focused in certain places at certain times, shooting could be carried out throughout the Preserve, except where limited by safety constraints. Firearms used to shoot feral hogs during direct reduction would include rifles or shotguns of appropriate caliber and bullet weight for harvest of feral pigs. Waithman (2001) advises that such centerfire rifle cartridges should have at least 800 foot-pounds of energy remaining at 100 yards for lighter weight feral hogs (50 to 90 pounds) and, for heavier feral hogs (over 90 pounds), at least 1,200 foot-pounds of energy remaining at 100 yards. This assumes reasonably accurate bullet placement, and bullets at least .24 (6 mm) caliber, and weighing a minimum of 100 grains. Similar energy standards by pig size are recommended for shotgun cartridges but as determined at 50 yards. BTNP, at the recommendation of veterinary staff, would use bullets at least .30 caliber to ensure a humane kill of the animal. All ammunition would be lead-free.

Rifles may be more appropriate and effective during late fall, winter, and early spring when visual range is greater because understory vegetation is reduced and trees are in leaf-off condition. Shotguns may be more appropriate during other times of year, especially when stalking feral hogs on foot in heavy cover. Handguns could be carried by management personnel but would not be used for direct reduction, only for shooting hogs captured in traps and as a safety backup during shooting activities. Shooting may be conducted during day or night depending on hog behavior and activity, directed shooting effectiveness, and safety considerations. The majority of shooting operations would take place outside main visitor use periods, such as very early in the morning, late in the evening, and at night. Rifles could be fitted with telescopic scopes for use during daytime hunting. Night-vision/thermal technologies (e.g., goggles, binoculars, and scopes) and spotlights could be used for early morning, late evening, and night hunting. Sound suppressed rifles and other sound suppression or silencing devices would be used if such devices exist for the type of firearm being used. The purpose of sound suppressed firearms would be to reduce dispersal of hogs from directed shooting areas and to limit noise disturbance to visitors using other parts of BTNP. Killed hogs would

be moved away from visitor use areas and surface waters and left in the field. More detail on the final disposition of hogs is described below under a separate heading.

Hog shooting records would be kept up to date and will include information such as: area of operation (defined on a map), date and time periods of active operations, total number of active operation hours, type of shooting conducted (stalk, blind, or stand), type of firearm used, number of personnel involved and time spent each, approximate distance or area covered (if on foot), habitat type(s) covered, any sensitive resources in area and relation to shooting effort, number of firearm discharges, number of hogs shot, disposition of hogs shot (killed, wounded and fled, etc.), locations of killed hogs (recorded by GPS), habitat type where hog killed, and names and affiliations of personnel conducting shooting. Basic biological data would also be collected on each killed hog (described below under research and monitoring).

“Judas Hog” Tracking/Radio-Telemetry: Radio-telemetry could be used in conjunction with shooting and trapping activities or for research and monitoring purposes. Trapping would be used to capture hogs to fit with radio collars. A small number of radio-collared hogs could be released and tracked to assist in locating remote hog aggregation areas, where shooting or trapping would take place. This method is sometimes referred to as a “Judas hog” technique, and is often used to locate hogs in advanced stages of a management program, when animals are more difficult to find or are less numerous (Taylor and Katahira, 1988; White and Garrott, 1990). This approach has been used with success in the U.S. (Wilcox *et al.* 2004; McCann and Garcelon, 2008) and Australia (McIlroy and Gifford, 1997; Australian Wildlife management Society, 2006). In addition to the use of “Judas hogs”, radio-collars and tracking could be used for research and monitoring purposes, to investigate hog movement patterns, habitat preferences, and home range sizes, and to calculate population estimates in support of the feral hog management program. The number of radio-collared hogs would be limited to the number needed to provide adequate statistical replication to address the research or monitoring question(s) being addressed.

Fitting of hogs with radio collars would require that trapped animals be restrained and immobilized using a fast, safe, effective, and humane method. The method that best meets these criteria is chemical sedation. A standard large-animal restraint and immobilization drug such as Telazol would be used. If Telazol were used, Rompun would be used as well to reduce nausea. Other substances in standard practice for wildlife management and research purposes would also be acceptable. Sedated hogs would be kept in the shade and wetted down as needed to avoid overheating. Sedatives would be administered by intramuscular injection using a jab stick, blow gun, or CO₂ pistol while the animal was still within the trap. NPS employees participating in this component of the management program would be required to complete a wildlife immobilization practitioner course. Many drugs used for wildlife management are listed as Class II substances; therefore, all use and storage guidelines specified by the U.S. Drug Enforcement Administration would be strictly followed. Sedation and immobilization drugs would be stored in a locked safe. Records would be maintained to include the

date, amount, purpose, and signatures for each withdrawal of these materials.

Prior to release, radio-collared hogs would be administered a contraceptive or sterilized if practicable, as recommended by McCann and Garcelon (2008) from experience in Pinnacles National Monument. No fertility control agent is registered by the EPA for use on feral hogs in the U.S, although investigational studies suggest suitability of several approaches, the use of which is restricted and would be subject to approval by federal and state regulatory agencies (Killian *et al.* 2006; Miller *et al.* 2006). The immunocontraceptive vaccine GonaCon™ has been demonstrated to be successful in domestic and feral hog fertility control (Miller *et al.* 2003 and 2006; Killian *et al.* 2006; Massei *et al.* 2012). Surgical sterilization would not be used for fertility control.

Use of Dogs: Tracking dogs could be used as a tool to support the “Directed Shooting Program.” Well-trained and experienced tracking dogs can be extremely cost effective when seeking to remove a small number of remaining, trap-shy individuals (often large boars); in removing a large number of individuals in a short time period; where population densities are high; and where other approaches are not suitable (Littauer, 1993; Caley and Ottley, 1995; Choquenot *et al.* 1996; State of Hawaii, 2007; Campbell and Long, 2009; Mayer *et al.* 2009). The approach is best used as part of an integrated management program (Campbell and Long, 2009), but can be used alone, and has been implemented successfully, or included in management plans for future use, at numerous other National Park System units (e.g., Hawaii Volcanoes National Park [Katahira *et al.* 1993], Virgin Islands National Park [NPS, 1993], etc.) and state parks (Annadel State Park, CA [Barrett *et al.* 1988]). Use of dogs would be considered for locating and tracking hogs where other alternatives have failed or become ineffective. The removal of residual hogs from remote densely vegetated locations would possibly require the use of trained tracking dogs.

The effectiveness of using trained dogs for feral hog management depends largely on the skills of the hunters and dogs involved (McIlroy and Saillard, 1989; Mapston, 2004). BTNP would procure qualified contractors through a competitive bid process to conduct feral hog management using trained dogs. Use of trained dogs and handlers would limit potential effects on non-target species, visitor use and experience, and adjacent landowners, as well as minimize the likelihood of dogs being injured or lost (and subsequently becoming feral if not recovered). As discussed for the “Directed Shooting Program,” all contractors would be required to obtain NPS-approved wildlife control and firearms training and certification. Measures would also be implemented to avoid and minimize conflicts with Preserve users. Vehicular access by contractors would be allowed in permissible areas for NPS personnel and authorized agents, as previously discussed. Program specific safety guidelines for use of dogs would also be developed and reviewed periodically by NPS personnel and their authorized agents. Compliance with AVMA Animal Welfare Principles (2011) and other standards specified in their contract for the humane treatment of their dogs would be required. Guidelines could also include dog-control measures (e.g., tracking collars, display of

competence, leashing requirements, etc.), dog protection measures (e.g., cut vests, cut collars, venomous snake bite response protocol, provision of first aid veterinary kit at all times in the field, etc.), and additional measures to prevent conflict with BTNP user groups. Contractors would be monitored for safety and guideline violations. Violations would result in immediate removal of personnel from hog management responsibilities and reprimand up to and including immediate termination of contract.

Final Disposition: According to NPS *Management Policies 2006*, “[w]here animal populations are reduced, destroyed animals may be left in natural areas of the park to decompose unless there are human safety concerns regarding attraction of potentially harmful scavengers to populated sites or trails or other human health and sanitary concerns associated with decomposition.” Hogs that are killed would be left in the field to decompose on the ground surface without burial. Care would be taken when handling dead hogs to avoid contact with body fluids. All killed hogs would be moved out of view and at least 200 feet from visitor use areas such as hiking trails, boardwalks, canoe trails, parking areas, the visitor center, and other such areas. Killed hogs would also be moved at least 200 feet away from the banks of relatively permanent surface waters. When near trapping areas, killed hogs would be moved away as needed to avoid trap aversion.

Additionally, feral hog disposition may include donation to organizations in order to allow provision of the meat for human consumption (e.g., programs for the homeless, prisoners, or other charitable entities). Procedures for donation, handling, and processing would be in compliance with state and federal regulations.

At least a minimum amount of biological data would be collected from each dead animal (described below under “Research and Monitoring”). Collection of additional data by researchers could also occur; including collection of samples from carcasses (blood samples, tissue samples, gut contents, etc.).

Protective Fencing: Fencing could be used in small selected areas to protect highly sensitive resources at imminent risk of damage by hogs. Highly sensitive resources could include species of special concern (rare and imperiled plants for instance) and cultural sites listed or eligible for the National Register. This approach has proven effective for hog exclusion in BTNP (Siemann *et al.* 2009) and elsewhere (Barrett *et al.* 1988; Anderson and Stone, 1993; Katahira *et al.* 1993; Choquenot *et al.* 1997; Kuiters and Slim, 2002; Wilcox *et al.* 2004). Material and maintenance costs for this approach are high and should be considered (VerCauteren *et al.* 2005), especially given that the technique only provides a short-term solution to damage control (Conover, 2002). Fencing would be used only in cases where hog impacts could result in irreversible damage or loss of a resource, and where fencing could effectively protect the resource. Fencing would also be limited to areas where installation would cause less damage than hog impacts to BTNP resources. A limited number of small fencing exclosures could also be used for research and monitoring purposes, especially if the data collected would be used to address hog management decisions or other critical resource

management needs (e.g., Siemann *et al.* 2009). Research and monitoring exclosures would typically be limited to the size and number needed to provide adequate statistical replication to address the research or monitoring question(s) being addressed. All research and monitoring exclosures would be sited so they would not be seen from major visitor use areas (trails, visitor center, parking areas, Neches River, etc.). Fencing to protect sensitive resources would be out of view of visitors to the greatest extent possible.

Fences would be constructed of chain-link fencing or “hog wire” with metal posts. Posts would be buried or driven into the ground with minimum or no use of cement. Fence height would be 32-39 inches, preventing hog use but allowing passage of native white-tailed deer (*Odocoileus virginianus*). The bottom of the fence would be buried by several inches, which has proven effective in restricting feral hogs (Tilley, 1973). Alternatively, the fencing material used could be slightly longer than the height of the fence so it would lay flat or nearly flat on the ground projecting outward from the area to be protected (proving a fence “skirt” at the base of the upright fence). The method that causes the least disturbance to a particular area while effectively excluding hogs would be chosen. During fence installation, care would be taken to avoid vegetation, ground surface, and soil disturbance to the greatest degree possible. Fencing would not be installed in environmentally sensitive areas, such as where surface water flow would be interrupted or where other hydrologic alterations would be likely (e.g., fencing would not be constructed across creeks or areas of channelized flooding). Moreover, fencing would not be installed in areas where cultural resources would be impacted by construction, as determined by completion of a cultural resource inventory or by reference to previous surveys of that area.

Fencing would be inspected periodically for damage and maintained regularly. In addition to periodic inspections, fencing would be examined following severe storms where tree fall would be likely, and following flood events. Any breaches in fencing would be repaired quickly. In cases where fencing at a site was no longer needed for resource protection, fencing proved ineffective at a site, or regular inspection and repair could not be maintained, fencing would be removed from the field. Records for fencing would be kept, including: installation, inspection, repair, and removal activities, descriptions, and dates; GPS locations of all fencing; explanation of the need for fencing in the area; the resource to be protected; the type and degree of hog disturbance or impact; descriptions of fencing damages and causes; the effectiveness of hog exclusion, and other variables.

Coordination with Adjacent Landowners/Users: Coordination with adjacent landowners and users would be conducted to inform them of feral hog management goals and activities at BTNP; to exchange information on hog abundance, movement patterns, levels of disturbance, and hog management; to encourage the removal of hogs from adjacent lands; and to discourage activities that could result in hog introductions to the Preserve (e.g., escaped livestock). Coordination with adjacent landowners and users could extend beyond immediately adjacent properties to include coordination and

information exchange with other large land management entities in the vicinity.

Public Information and Education: Public awareness of the feral hog management program would be promoted whenever possible. NPS personnel would work with community leaders to maintain communication and resolve any actual or perceived issues regarding the feral hog management program as quickly as possible. Foreseeable potential concerns are diverse, but could include those of adjacent landowners pertaining to safety, trespass, or feral hog abundance; visitor worries about health and safety, and other general issues. Information on the feral hog management program would be regularly conveyed to Preserve visitors. BTNP would promote an interpretive education program that informs the general public on feral hogs, their impacts on native ecosystems, and the feral hog management program. Media could include use of posters, articles in news bulletins, bulletin board fliers, exhibits, signs, brochures, PowerPoint or video presentations, and other publicity. Relationships would be developed with hunters, private landowners, researchers, and other members of the public. When requested, presentations to the general public, universities, schools, hunting clubs, conservation groups, and others should be given. Press opportunities should also be used to circulate factual information on non-native feral hogs and the management program to the public. Emphasis would be placed on the importance of the human component of invasive species and the strategies that landowners may use to decrease hogs on their own property. Information on hog biology, impacts, and the management program would also be presented to BTNP and other NPS employees on a regular basis to maintain organization-wide knowledge and consistency.

Monitoring and Research: Information to be recorded for each hog collected would include at a minimum:

- an identification/tracking number;
- collection date and time;
- collection location;
- estimated level of hog activity or sign in the area (high, medium, or low);
- collection method (trap, shot, use of tracking dogs, other);
- life stage (piglet = <15 lbs, juvenile = 15 to 60 lbs, adult = 60+ lbs);
- physical condition of animal (poor, fair, good, excellent);
- sex (male, female, unknown);
- actual or estimated weight;
- coat color and pattern (black, reddish brown, black with white shoulder-band, etc.);
- animal appearance (long-term feral/hybrid, short-term feral, domestic escapee);
- reproductive state for females (pregnant, lactating, unknown, n/a);
- any other special or significant markings or attributes;
- number, size range, and markings of any other hogs encountered with collected animal;
- disposition of animal (killed or radio-collared and released); and
- description of samples taken (blood, tissue, etc.).

In addition, pending coordination with USDA Veterinary Services, university researchers, or other appropriate organizations, blood samples would be taken from an adequate number of collected animals during the first year of the management effort to be tested for swine brucellosis, pseudorabies, or other pertinent diseases, following standardized sample collection and safety precautions prescribed by the USDA, NPS, and other appropriate authorities. After the first year of the hog management program, disease monitoring would be repeated periodically based on further coordination with USDA and others. Blood sampling results will be reported to the TAHC and the USDA for their records of potential livestock or human health threats in the area. In addition to blood sampling, evaluation of stomach contents may be completed for a subsample of collected animals.

Independent researchers wishing to make use of collected animals for research and monitoring purposes could collect additional information or samples from carcasses for research and monitoring purposes (blood samples, tissue samples, hair samples, gut contents, body measurements, etc.). Additional research and monitoring activities making use of collected animals in cooperation with NPS and the feral hog management program would be strongly encouraged.

Feral hog disturbance monitoring would be used to assess levels of hog activity, determine management effort, assist in prioritizing trapping and shooting operations, and to evaluate the effectiveness of the management program. Monitoring could be conducted based on techniques previously used at BTNP (Chavarria, 2006) or methods in use at other NPS units or by other entities and adapted for BTNP. Various rooting and wallowing indices based on line or belt transects, monitoring plots, or walking transects could be appropriate. Once established and tested, monitoring methods should be applied consistently in order to track changes in disturbance levels over time and in relation to management activities.

Other research and monitoring conducted in support of the feral hog management program could include the following efforts: hog population estimates and monitoring, hog natural history studies, radio-tracking studies, habitat studies, food availability studies, studies on alternative or refined hog management techniques, monitoring of hog disturbance or other impacts on native ecosystems and species, and other efforts on pertinent topics. Methods to efficiently estimate and monitor hog population dynamics, and studies on hog disturbance or impacts focusing on native vegetation, soils, and aquatic habitats, such as small creeks, could be particularly valuable.

MITIGATION MEASURES OF THE PREFERRED ALTERNATIVE

Protection of Soils and Vegetation: Only lightweight portable cage traps, corral traps, tree stands, and blinds would be used in most areas. Likewise, use of fencing would be restricted to small areas where their use is critical for the protection of highly sensitive resources. Movement of materials by vehicle (truck or UTV) would be restricted to

areas where their use is already approved, with no expansion or alteration of existing roads, trails, or rights-of-way. During placement and installation of traps, stands, blinds, and fences, care would be taken to avoid and minimize disturbance of vegetation and soils. Any backcountry camps would follow “Leave No Trace” principles, using only primitive, temporary, low impact materials and methods that would be removed after use leaving no long-term signs of disturbance. Feral hogs euthanized in remote locations would be left to decompose in place, and would not be buried or covered with soil, limiting soil disturbance and returning nutrients to the soil. If unintended soil or vegetation disturbance did occur, soils would be re-contoured and the area seeded or planted with native species as necessary.

Protection of Wildlife and Species of Special Concern: None of the methods or actions planned would intentionally result in negative effects or impacts on native, non-target wildlife, and the probability of unintentional impacts has been minimized. Snares, other kill-traps, poisons, and toxicants would not be used. Non-target wildlife captured in traps would be immediately released upon discovery, and traps would be checked within a maximum of 24 hours after they have been set and at 24 hour intervals thereafter. Escape holes for smaller native species would also be built into the tops of cage traps. Fencing would be of a height that does not restrict movement of white-tailed deer. Bait selection would evaluate the potential for attraction and bycatch of non-target species, and incorporate techniques or baits (e.g., sour grain) to reduce this risk where feasible and appropriate. All unused bait would be removed from the field to avoid attracting or habituating native wildlife. Only trained dogs handled by qualified contractors would be used, only where necessary and following strict guidelines in order to avoid increasing the feral dog population and to minimize the possible harassment of native wildlife by hunting dogs. Captured hogs would not be relocated and released, limiting the introduction of non-native wild hogs to other properties and preventing the spread of wildlife disease. In order to protect scavenger populations, all ammunition will be lead free.

Impacts to species of special concern, particularly plants, would be avoided or minimized by the same means described above for protection of vegetation and soils, with care taken to limit disturbance during the transport, installation and removal of traps, fences, and related activities. In addition, review of known locations of species of special concern would be conducted when planning the placement of traps, fencing, and other equipment. NPS personnel and authorized agents involved with the feral hog management plan would be made aware of known locations of species of special concern, and would be advised on recognizing such species that could be affected by feral hog management activities. If these species were found during placement of traps or fences, placement activities would be temporarily stopped and plans reevaluated. In most cases, traps and research exclosures could simply be moved to a comparable nearby location or reconfigured so that species of special concern would not be disturbed. For exclosures intended to protect a specific sensitive resource, more detailed planning would be conducted if potential concerns were identified for species of special concern. In such a case, planning would include consultation with resource

experts and appropriate federal and state agencies. A localized field survey for species of special concern would also be conducted, if needed. In most cases, placement of fencing near the location of such species would be intended to protect the resource from feral hog disturbance. Fencing would only be used in areas with these species if the impacts of hog damage would be substantially greater than impacts associated with the installation of protective fencing.

Protection of Cultural Resources: Traps, fencing, and other equipment would be placed to avoid impacts to cultural resources. Review of known cultural resource locations would be conducted when planning the placement of traps, fencing, and other equipment. Where installation of fencing is proposed and past surveys have not been completed, a localized cultural resource inventory would be completed for the site. Additionally, NPS personnel and authorized agents involved with the feral hog management program would be made aware of known cultural resource sites, and would be advised on recognizing potential cultural resources that could be encountered in the field. If potential cultural resources were found during placement of traps or fences, placement activities would be temporarily stopped and plans reevaluated. In most cases, traps and research exclosures could simply be moved to a comparable nearby location where cultural resources would not be disturbed. For exclosures intended to protect a specific sensitive resource, more detailed planning would be conducted if potential cultural resource impacts were identified. In such scenarios, planning would include consultation with NPS, the State Historical Preservation Officer, and the tribes. In most cases, placement of fencing near a cultural resource site would be intended to protect the resource from feral hog disturbance. Fencing would only be used in such areas if the impacts of hog damage would be substantially greater than impacts associated with the installation of protective fencing.

Protection of Water Quality and Quantity, Wetlands and Floodplains: Fences would not be used in areas where streams or other channelized flows are present, to avoid the retention of flood debris and the alteration of water movement. Collected hogs would also be moved at least 200 feet away from the banks of streams, bayous, lakes, and the Neches and Trinity rivers to protect water quality. Other potential impacts to water resources, wetlands, and floodplains would be avoided and minimized by the same means described above for protection of vegetation and soils, with care taken to limit disturbance during the transport, installation and removal of traps, fences, and other related activities.

Protection of Visitor Use and Experience, and Preserve Operations: Public information and education activities will be conducted to inform BTNP visitors and others about feral hogs and hog management activities taking place in the Preserve. Coordination with adjacent landowners and managers would serve the purpose of raising awareness with BTNP neighbors. Shooting operations would be planned and coordinated with NPS Law Enforcement, Fire Management, Interpretive, and Maintenance personnel, resulting in increased safety for BTNP personnel and visitors. Temporary closures of small portions of the Preserve would be conducted if necessary

to protect visitor safety. The majority of shooting activity would likely take place outside main visitor use time-periods (during very early morning, late evening, and at night). Firearms training and qualification would be required for all NPS personnel and their authorized agents participating in trapping and shooting activities, including use of tracking dogs and subsequent humane euthanasia. Firearm use would be monitored with violations resulting in severe penalties including immediate dismissal. Sound suppression of firearm discharges would be used whenever possible to limit disturbance to BTNP visitors and neighbors. Collected animals would be moved out of sight and at least 200 feet away from all main visitor use areas. Traps, fencing, and other materials would also be placed out of visitor sight to the greatest degree possible. Any research or monitoring exclosures would be placed out of visitor sight and at least 200 feet from visitor use areas. Fencing materials would be colored to blend in with the surrounding environment. Captured hogs would not be relocated and released, preventing the spread of disease. Personnel taking blood samples or handling blood samples during disease monitoring would use latex or nitrile gloves, eye protection, and any other methods necessary to prevent contact with hog bodily fluids. Veterinary waste associated with disease monitoring would be disposed of properly following USDA guidelines. USDA Wildlife Services personnel and other contractors may also be used for hog management.

2.3 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER ANALYSIS

Several alternative feral hog management methods were considered during the planning process; however, these management methods were considered but eliminated from detailed analysis for the reasons described below.

Trapping by Use of Snares: Use of snares and trapping methods other than live-capture traps was eliminated from further analysis due to concern that non-target wildlife could be negatively affected by these methods. Additionally, such methods could require constant monitoring; could be infeasible due to resource/labor requirements; and would result in the inhumane euthanasia of wildlife (State of Hawaii, 2007; Campbell and Long, 2009; West *et al.* 2009).

Chemical Sterilization (Population Level): Contraceptives or sterilization could be a low-impact means to reduce or limit non-native hog populations; however, no effective or feasible means of chemical sterilization or contraception at the population level are currently available for feral hogs (Campbell and Long, 2009; West *et al.* 2009). Furthermore, chemical sterilization may control population growth to some extent, but it would not abate the negative impacts to resources by sterilized hogs. Therefore, this alternative was eliminated from further analysis. If effective chemical sterilization and contraceptive technologies for controlling non-native wild hogs at the population level are developed in the future, this method could be re-evaluated.

Use of Poisons/Toxicants: Use of poisoning agents or toxicants was eliminated from further analysis due to the concern that native non-target wildlife could be negatively affected (Campbell and Long, 2009). At present, no licensed chemicals are legal for poisoning hogs in the U.S., which also currently limits the technical feasibility of this method (West *et al.* 2009).

Aerial Gunning: Although proven effective in feral hog management in more open areas of state (West *et al.* 2009; Campbell *et al.* 2010), the dense canopy cover across most of BTNP makes this method technically infeasible (Hone, 1983; Mapstron, 2004). High costs and requisite safety measures for this method were also determined prohibitive (Littauer, 1993; Saunders, 1993).

Large-Scale or Preserve-Wide Fencing: Fencing the perimeter of BTNP or large areas within the Preserve to conduct fenced-zone removal of hogs and to prevent or reduce movement of hogs into BTNP was eliminated from further analysis due to impacts to visitor experience; potential alterations that fencing could have on the natural movement of water, sediments, flood debris, native biota, and other flows and processes within and through the Preserve; the frequent and severe damage that flooding would cause to fences; and the prohibitive cost of installation and maintenance.

Biological Controls: The use of biological controls, such as the reintroduction of extirpated predators, was eliminated from further analysis due to lack of feasibility.

2.4 ENVIRONMENTALLY PREFERABLE ALTERNATIVE

According to the CEQ regulations implementing NEPA (43 CFR 46.30), the environmentally preferable alternative is the alternative “that causes the least damage to the biological and physical environment and best protects, preserves, and enhances historical, cultural, and natural resources. The environmentally preferable alternative is identified upon consideration and weighing by the Responsible Official of long-term environmental impacts against short-term impacts in evaluating what is the best protection of these resources. In some situations, such as when different alternatives impact different resources to different degrees, there may be more than one environmentally preferable alternative.”

The environmentally preferable alternative for feral hog management in BTNP is based on these national environmental policy goals. Under Alternative A, no action, BTNP would maintain the status quo with regards to feral hog management. Public hunting through issuance of hunting permits would be the primary means of reducing feral hog population numbers in BTNP in addition to Preserve staff also euthanizing individual hogs if they pose an imminent threat to public safety (e.g., charging visitors on trail). Negative impacts to BTNP resources from feral hog activities would likely continue at current levels and perhaps increase in intensity over time.

NPS has determined that the environmentally preferable alternative is Alternative B (Implement a Feral Hog Management Plan) because it would provide the greatest protection of the area and BTNP resources and values. Alternative B would:

- Reduce the impacts of feral hogs on natural and cultural resources;
- Improve the safety, healthfulness, and aesthetics of the surroundings;
- Reduce risks to public health and safety; and
- Provide better protection of natural and cultural resources for future generations.

To a greater extent than the other alternatives, Alternative B would reduce the impacts of feral hogs on natural resources and visitor use and experience while protecting and restoring BTNP resources and values. Therefore, Alternative B is the environmentally preferable alternative.

2.5 NATIONAL PARK SERVICE PREFERRED ALTERNATIVE

No new information came forward from public scoping or consultation with other agencies to necessitate the development of any new alternatives, other than those described and evaluated in this document. The environmentally preferable alternative is

Alternative B because it surpasses Alternative A in realizing the full range of national environmental policy goals as stated in §101 of NEPA. Therefore, Alternative B is also considered the NPS preferred alternative. For the remainder of the document, Alternative B will be referred to as the preferred alternative.

2.6 SUMMARY OF ALTERNATIVES

The following tables assess the extent to which each alternative meets the objectives in taking action, summarize actions of each alternative, and summarize impacts of each alternative (see Table 2: Extent that Each Alternative meets Objectives, Table 3: Summary of Actions of Each Alternative, and Table 4: Summary of Impacts of Each Alternative, respectively).

Table 2: Extent that Each Alternative Meets Objectives

OBJECTIVES	DOES ALTERNATIVE A: NO ACTION MEET OBJECTIVE?	DOES ALTERNATIVE B: PREFERRED ALTERNATIVE MEET OBJECTIVE?
Reduce current damage to native plants, animals and the ecological structures and functional processes upon which they are dependent	No Feral hog damage to native plants, animals, and the ecological structures and functional processes upon which they are dependent would continue at current levels and likely increase in the future.	Yes The Feral Hog Management Plan would be conducted within BTNP meeting this objective, with the application of mitigation measures to meet other objectives.
Provide for the safety of visitors, staff and volunteers	No Feral hogs would continue to threaten the safety of visitors, staff, and volunteers through potential physical conflict and spread of disease.	Yes The Feral Hog Management Plan would be conducted within BTNP reducing the threat of feral hogs on safety, with the application of mitigation measures to minimize safety risks from management actions.
Prevent irreparable damage to resources so they are available for future generations	No Irreparable damage to resources in BTNP by feral hogs would continue at current levels and likely increase in the future.	Yes The Feral Hog Management Plan would be conducted within BTNP meeting this objective, with the application of mitigation measures to meet other objectives.
Comply with policies on endangered species, exotic species, and multiple-use recreation as specified in enabling legislation	No Feral hogs would continue to negatively impact endangered species, remain a pervasive exotic species, and degrade visitor use and experience.	Yes The Feral Hog Management Plan would be conducted within BTNP to reduce the negative impacts of the feral hog, an exotic species, on endangered species and visitor use and experience

Table 3: Summary of Actions of Each Alternative

PHASE (ACTION)	ALTERNATIVE A: NO ACTION	ALTERNATIVE B: PREFERRED ALTERNATIVE
Public Hunting (General Season)	X	X
Extend Public Hog Season Until the end of February	X	X
Directed Trapping Program implemented by NPS personnel or authorized agents (live-capture traps)		X
Directed Shooting Program implemented by NPS personnel or authorized agents		X
Use of "Judas Hog" Tracking Approaches by NPS personnel or authorized agents		X
Use of Dogs by NPS personnel or authorized agents		X
Limited and Localized Use of Protective Fencing		X
Coordination with Adjacent Landowners/Users		X
Public Information and Education		X
Monitoring and Research		X

Table 4: Summary of Impacts of Each Alternative

IMPACT TOPICS	ALTERNATIVE A NO ACTION	ALTERNATIVE B Preferred Alternative
Geologic Resources	Under Alternative A, BTNP would not implement a feral hog management plan, resulting in continued negative feral hog impacts and threats to geologic resources. Direct impacts from hog behavior (e.g., rooting and wallowing) would be widespread, both short- and long-term, and cause moderate negative effects. No action impacts would contribute moderate negative effects to cumulative impacts on geologic resources. Cumulative impacts would be negative, widespread, and moderate over the long-term.	Implementation of a feral hog management plan under the preferred alternative would result in negligible, short-term, and highly localized disturbance to geologic resources (e.g., direct soil compaction, erosion, and excavation) associated with pedestrian and limited vehicular access and the placement of traps, protective fencing, blinds, and stands. Moderate positive effects that would be long-term and widespread would result from the removal of feral hogs and the reduction of negative impacts to geologic resources caused by the species. The preferred alternative would contribute negligibly to cumulative negative impacts on geologic resources in BTNP but result in cumulative positive effects and the minimization of net negative effects over the long-term throughout the Preserve.

IMPACT TOPICS	ALTERNATIVE A NO ACTION	ALTERNATIVE B Preferred Alternative
Water Quality and Quantity	Under Alternative A, BTNP would not implement a feral hog management plan, resulting in continued negative feral hog impacts and threats to water quality and quantity, such as directly through sedimentation and contamination and indirectly through alteration of microbial and aquatic invertebrate communities. Negative impacts from hog behavior would be direct and indirect, long-term, both localized and widespread, and moderate in intensity. No action impacts would contribute minor to moderate negative effects to cumulative impacts on water quality and quantity. Cumulative impacts would be negative, widespread, and moderate over the long-term.	Implementation of a feral hog management plan under the preferred alternative would result in negligible, short-term, and highly localized disturbance to water quality (e.g., sedimentation) associated with pedestrian and limited vehicular access and the placement of traps, protective fencing, blinds, and stands. Moderate positive effects that would be long-term and widespread would result from the removal of feral hogs and the reduction of negative impacts to water quality and quantity caused by the species. The preferred alternative would contribute negligibly to cumulative negative impacts on water quality and quantity in BTNP but result in cumulative positive effects and the minimization of cumulative negative effects over the long-term throughout the Preserve.

IMPACT TOPICS	ALTERNATIVE A NO ACTION	ALTERNATIVE B Preferred Alternative
Floodplains and Wetlands	Under Alternative A, BTNP would not implement a feral hog management plan, resulting in continued negative feral hog impacts and threats to floodplains and wetlands. Negative impacts would be moderate in intensity, long-term in duration, localized to widespread, and both direct and indirect. No action impacts would contribute moderate negative effects to cumulative impacts on floodplains and wetlands. Cumulative impacts would be negative, widespread, and moderate over the long-term.	Implementation of a feral hog management plan under the preferred alternative would result in negligible, short-term, and highly localized disturbance to floodplains and wetlands (e.g., soil compaction, vegetation trampling or removal, erosion, and sedimentation) associated with pedestrian and limited vehicular access and the placement of traps, protective fencing, blinds, and stands. Moderate positive effects that would be long-term and widespread would result from the removal of feral hogs and the reduction of negative impacts to floodplain and wetland resources caused by the species. The preferred alternative would contribute negligibly to cumulative negative impacts on floodplains and wetlands in BTNP but result in cumulative positive effects and the minimization of cumulative negative effects over the long-term throughout the Preserve.

IMPACT TOPICS	ALTERNATIVE A NO ACTION	ALTERNATIVE B Preferred Alternative
Vegetation (includes Rare and Unusual Vegetation and Plant Species of Special Concern)	Under Alternative A, BTNP would not implement a feral hog management plan, resulting in continued negative feral hog impacts and threats to vegetation resources. Negative impacts would be both direct and indirect, moderate in intensity, widespread, and considered long-term. No action impacts would contribute moderate negative effects to cumulative impacts on vegetation resources. Cumulative impacts would be negative, widespread, and moderate over the long-term.	Implementation of a feral hog management plan under the preferred alternative would result in negligible, short-term, and highly localized disturbance to vegetation resources (e.g., vegetation trampling or removal) associated with pedestrian and limited vehicular access and the placement of traps, protective fencing, blinds, and stands. Moderate positive effects that would be long-term and widespread would result from the removal of feral hogs and the reduction of negative impacts to vegetation resources caused by the species. The preferred alternative would contribute negligibly to cumulative negative impacts on vegetation resources in BTNP but result in cumulative positive effects and the minimization of cumulative negative effects over the long-term throughout the Preserve.
Fish and Wildlife (includes Species of Special Concern, Unique or Important Wildlife or Wildlife Habitat, and Unique or Important Fish or Fish Habitat)	Under Alternative A, BTNP would not implement a feral hog management plan, resulting in continued negative feral hog impacts and threats to vegetation resources. Negative impacts would be both direct and indirect, moderate in intensity, widespread, and considered long-term. No action impacts would contribute moderate negative effects to cumulative impacts on fish and wildlife resources. Cumulative impacts would be negative, widespread, and moderate over the	Implementation of a feral hog management plan under the preferred alternative would result in negligible, short-term, and highly localized disturbance to fish and wildlife resources (e.g., avoidance behavior and displacement) associated with pedestrian and limited vehicular access, the placement of traps, protective fencing, blinds, and stands, trapping of non-target species, the discharge of firearms, and the use of dogs. Moderate positive effects that would be long-term and widespread would result from the removal of feral hogs and the reduction of negative impacts to fish and wildlife resources caused by the species.

IMPACT TOPICS	ALTERNATIVE A NO ACTION	ALTERNATIVE B Preferred Alternative
	long-term.	The preferred alternative would contribute negligibly to cumulative negative impacts on fish and wildlife resources in BTNP but result in cumulative positive effects and the minimization of cumulative negative effects over the long-term throughout the Preserve.
Visitor Use and Experience (includes Recreation Resources, Visitor Experience, Aesthetic Resources, etc.)	Under Alternative A, BTNP would not implement a feral hog management plan, resulting in continued negative feral hog impacts and threats to visitor use and experience. No action impacts would be widespread, long-term, and range in intensity from minor to moderate positive effects to moderate negative effects, dependent on the particular viewpoint of the visitor. Net effects to visitor use and experience under the no action alternative would be long-term, moderate negative impacts, which would contribute to past, present, and future negative cumulative impacts on this resource.	Implementation of a feral hog management plan under the preferred alternative would result in negligible, short-term, and highly localized direct disturbance to visitor use and experience (e.g., avoidance behavior and displacement) associated limited vehicular access, the placement of traps, protective fencing, blinds, and stands, the temporary closure or access restrictions of areas during feral hog management activities. Some visitors (e.g., public hunters for feral hogs in BTNP, wildlife viewers seeking feral pigs, etc.) would incur minor to moderate indirect negative effects due to the reduction in the density of feral pigs under the preferred alternative; whereas, other users, such as hunters seeking species other than feral hogs, could benefit. Moderate positive benefits that would be long-term and widespread would result for most users from the removal of feral hogs and the reduction of negative impacts to visitor use and experience caused by the species. The preferred

IMPACT TOPICS	ALTERNATIVE A NO ACTION	ALTERNATIVE B Preferred Alternative
		alternative would contribute minor to moderate negative impacts on some users but moderate positive effects to most users over the long-term, minimizing negative cumulative effects to visitor use and experience within the Preserve.
Preserve Operations	Under Alternative A, BTNP would not implement a feral hog management plan, resulting in continued negative feral hog impacts and threats to Preserve operations. Negative impacts would result in decreased effectiveness of other resource management activities and have consequent negative effects on the allocation of staff time, operational resources, and budgets. No action impacts would contribute long-term, widespread, moderate negative effects to cumulative impacts on Preserve operations. Cumulative impacts would be negative, widespread, and moderate over the long-term.	Implementation of a feral hog management plan under the preferred alternative would result in short-term, moderate negative effects on Preserve operations due to increased demand on existing equipment, an expanded resource management program, increased need for specialized personnel training and certification, and other needs and adaptations associated with a major resource management effort. Demands on other BTNP programs and operations would also occur. The preferred alternative would contribute short-term negative impacts of moderate intensity to the cumulative effects of past, present, and foreseeable future operations and management activities on Preserve operations. Some minor benefits would reduce these negative impacts and result from the reduction of feral hog damage to Preserve operations.

IMPACT TOPICS	ALTERNATIVE A NO ACTION	ALTERNATIVE B Preferred Alternative
Introduce or Promote Non-Native Species (Plant or Animal)	Under Alternative A, BTNP would not implement a feral hog management plan, resulting in continued negative feral hog impacts and threats to native communities from this non-native species and further introduction or promotion of other non-native species. Negative impacts would be both direct and indirect, moderate in intensity, widespread, and considered long-term. No action impacts would contribute moderate negative effects to cumulative impacts native communities through the introduction or promotion of non-native species. Cumulative impacts would be negative, widespread, and moderate over the long-term.	Implementation of a feral hog management plan under the preferred alternative would result in negligible, short-term, and highly localized disturbance to native communities (e.g., soil compaction, erosion, vegetation trampling and removal) associated with pedestrian and limited vehicular access, the placement of traps, protective fencing, blinds, and stands. This alternative is intended to reduce impacts from non-native species, specifically by targeted removal of the non-native feral hog, and indirectly by reducing the facilitation of other non-native species by feral hogs. The preferred alternative would result in moderate positive effects and a net positive impact on native communities over the long-term. It would contribute negligibly to cumulative negative impacts but would provide moderate positive effects by reducing the negative impacts of feral hogs on BTNP resources over the long-term.

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Introduction

NEPA requires that federal agencies, before taking an action, discuss the environmental impacts of that action, feasible alternatives to that action, and any negative environmental effects that cannot be avoided if the preferred alternative is implemented. This section of the EA first describes the existing environment followed by the potential environmental impacts of implementing each of the alternatives (i.e., the no action alternative and the preferred alternative). These impacts provide a basis for comparing the advantages and disadvantages of the alternatives.

This analysis of environmental consequences consists largely of a qualitative assessment of the effects of the alternatives with respect to eight impact topics. The first part of this section discusses the methodology used to identify impacts and includes definitions of terms. The impact topics are then analyzed with reference to each of the alternatives. The discussion of each impact topic includes a description of the positive and negative effects of the alternatives, a discussion of cumulative effects, if any, and a conclusion. The area of evaluation for effects includes the entire BTNP but could extend to boundaries outside of BTNP for certain resources and as requisite for cumulative impacts analysis. For the analyses, NPS considered the mitigation measures described in section 2 of this assessment.

Methodology

During scoping, it was determined that the following topics would be carried forward for analysis:

- Geologic Resources (includes soils, bedrock, streambeds, etc.)
- Water Quality and Quantity
- Floodplains and Wetlands
- Vegetation (includes Rare and Unusual Vegetation, and Plant Species of Special Concern)
- Fish and Wildlife (includes Species of Special Concern, Unique or Important Wildlife or Wildlife Habitat, and Unique or Important Fish or Fish Habitat)
- Visitor Use and Experience (includes Recreation Resources, Visitor Experience, Aesthetic Resources, etc.)
- Preserve Operations
- Introduce or Promote Non-Native Species (Plant or Animal)

This chapter is organized by impact topic. Under each impact topic, the affected

environment is described, the methodology for assessing impacts is presented, the possible impacts under each alternative are given, a cumulative impact analysis is provided and a conclusion is stated. The conclusion summarizes all major findings.

This section describes direct, indirect and cumulative impacts under the two alternatives. The methodology for resource impact assessments generally follows direction provided in the CEQ Regulations for Implementing the National Environmental Policy Act, Parts 1502 and 1508. Impacts are described in terms of type, context, duration and intensity. Impacts can be positive and/or negative. Unless otherwise stated, impacts are assumed to be negative. The context or extent of the impact may be localized or widespread, extending beyond BTNP for certain resources and in the evaluation of cumulative impacts. The duration of impacts could be short-term, lasting less than or equal to three years, or long-term, extending more than three years. The intensity of impact is described as negligible, minor, moderate, or major. Where the intensity of an impact can be described quantitatively, the numerical data are presented. However, most impact analyses are qualitative.

Context: Each impact topic addresses effects on resources inside and, where appropriate, outside BTNP to the extent those effects are traceable to the actions set forth in the alternatives. Localized impacts are defined herein as those spatially restricted to a limited area that can be easily delineated or specified; whereas, widespread impacts occur at a broader spatial scale defined as throughout BTNP and potentially extending into adjacent lands. Regional impacts would occur throughout BTNP and adjacent lands, but also exhibit effects throughout the Pineywoods.

Duration and Intensity of Impacts: Impacts are analyzed in terms of their intensity (negligible, minor, moderate, or major) and duration (short- or long-term, as described above). The criteria used to define the intensity of impacts associated with the analysis are presented individually under each topic.

Impact Type: Unless otherwise noted, impacts would be negative. CEQ regulations and NPS's *Conservation Planning, Environmental Impact Analysis and Decision-Making* (DO-12) call for a discussion of the appropriateness of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact (e.g., reducing the intensity of an impact from major to moderate or minor). The preferred alternative assumes that NPS personnel or authorized agents would apply mitigation measures to minimize or avoid impacts. If appropriate mitigation measures were not applied, the potential for resource impacts would increase and the magnitude of those impacts would rise.

Direct versus Indirect Impacts: Direct effects would be caused by an action and would occur at the same time and place as the action. Indirect effects would be caused by the action and would be reasonably foreseeable but would occur later in time, at another place, or to another resource.

Cumulative Impacts: This section also assesses cumulative impacts. CEQ regulations, which guide the implementation of NEPA, require the assessment of cumulative impacts in the decision-making process for federal actions. Cumulative impacts are defined as:

“... the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (Federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.” 40 CFR 1508.7.

The cumulative impacts analyzed in this document consider the incremental effects of the alternatives in conjunction with past, current, and future actions at and nearby BTNP. Cumulative impacts were determined by combining the effects of a given alternative with other past, present, and reasonably foreseeable future actions. The impact analysis and conclusions are based on information available in the literature, data from NPS studies and records, and information provided by experts within the NPS and other agencies. Unless otherwise stated, all impacts are assumed to be direct and long-term.

The following projects, plans, or actions were identified as related to the purpose of conducting the cumulative effects analysis:

Resource Management Plan (1996): The Resources Management Plan provides goals for BTNP that address preserving resources of the Preserve, providing for the public enjoyment and visitor experience, perpetuating cultural resources and enhancing recreational opportunities managed by partners, and ensuring organizational effectiveness.

Fire Management Plan (reviewed 2013): Wildland fire has historically played an important part of the area’s ecosystem. Its effects on vegetation and wildlife have always weighed heavily on the region’s natural processes. The Fire Management Plan for BTNP will be a detailed program of action to implement a prescribed fire program and manage wildland fire. This plan is the primary reference for conducting all fire management activities and is intended to help achieve the resource management objectives as presented in the resource management plan and follow NPS Management Policies. Protection of life (employee and public), property, cultural resources, the perpetuation of natural resources and their associated processes, and protection of cultural and historic scenes are the highest priorities for the plan. This plan is based on a strategy to use prescribed burns and mechanical methods to remove excess fuel from the system, which would reduce the likelihood of major wildfires and would also provide benefits to fire dependent native vegetation and wildlife in the area.

BTNP has completed a Fire Management Plan Environmental Assessment that accesses the potential impact from the inclusion of herbicides as an additional fuel treatment method. The Fire Management Plan is scheduled to be rewritten in the winter of 2013-

2014 following the release of decision document for this assessment.

Oil and Gas Management Plan (2006): The 2006 Oil and Gas Management Plan for BTNP was prepared for the purpose of guiding the management of activities associated with the exploration and development of nonfederal oil and gas within the Preserve over the next 15 to 20 years. The Oil and Gas Management Plan identifies those BTNP resources and values most sensitive to oil and gas exploration and development disturbance, and defines impact mitigation requirements to protect such resources and values. In order to protect BTNP resources and values, the plan establishes performance standards for oil and gas exploration and development, and it provides pertinent information to oil and gas owners and operators to facilitate compliance with applicable regulations (NPS, 2005). As of 2005, BTNP assumed up to 40 new wells could be developed over the next 15 to 20 years.

Draft General Management Plan (2013): NPS has started an interactive planning process to develop a vision for the future of BTNP. This process would result in a General Management Plan that would articulate the long-term vision that would guide management of the preserve for the next 15 to 20 years. A general management plan is the broadest level of planning in NPS. The general management plan lays the groundwork for the more detailed planning and day-to-day decision-making that will follow. The BTNP Draft General Management Plan prescribes the resource conditions and visitor experiences that are to be achieved and maintained over the next 15 to 20 years (74 FR 2614). Actions arising from this plan have the potential to increase resource protection and improve visitor use/experience.

The following past, present, and future actions were also considered in the analysis of cumulative impacts:

- Industry discharges from paper mills and refineries, which may include metals, organic materials, hydrocarbons and variations in pH and temperature, enter into tributaries that flow directly into the Neches River;
- Improper design, maintenance, or operation of private septic tanks results in the discharge of pollutants into the bayou connected to the Neches River;
- Logging within BTNP, which is a past use that largely eliminated old growth forests and created canals which affect drainage, altering the natural sheet flow of water;
- On-going conversion of agricultural and forest lands in this region to housing and other development due in part to population shifts from rural areas to urban regions coupled with limited powers afforded to the counties by the State of Texas to control land use beyond protecting public safety and environment (i.e. protecting drinking water supplies);
- Implementation of an Environmental Flows Law by Texas Commission on Environmental Quality, which will be required for every dam, to allow flows to maintain natural hydrologic regimes important for wildlife, riparian vegetation, and water quality;
- The planned USACE Sabine-Neches Waterway Improvement Project, which is

- intended to improve navigation and provide for larger vessels to use the channel. Among other actions, the project includes deepening the channel and extending the channel by over 13 miles; and
- Expanded refineries and a chemical processing plant planned to come online in the near future.

3.1 IMPACTS ON GEOLOGIC RESOURCES

3.1.1 Affected Environment

The Preserve lies within the Flatwoods and Lower Coastal Plain geographic areas of southeast Texas. The topography is nearly level in the southern part to gently rolling in the northern part of BTNP. Slopes in the Flatwoods Area (Beaumont and Lance Rosier Units) are generally less than one percent. Slopes in the Lower Coastal Plain Area (Jack Gore Baygall/Neches Bottom, Turkey Creek, Big Sandy Creek and Beech Creek Units) are generally one to three percent, and range from 0.5 to 12 percent. Elevation generally rises to the north and west from 5 feet (above mean sea level) in the Beaumont Unit to 365 feet at the northern tip of the Big Sandy Creek Unit and 215 feet at the northern edge of the Beech Creek Unit. Although the units of BTNP vary widely in topography, soils, and size, most are situated along water corridors in upland settings, or a combination of both.

The geology in the area of BTNP primarily consists of Pleistocene and Holocene-aged sedimentary deposits. These thick non-marine fluvial, deltaic, and nearshore marine deposits are exposed at the surface in a series of linear “bands” that run parallel to the coast, decreasing in age seaward (Williamson *et al.* 1990). Formations in increasing age include the Beaumont Formation (less than 125,000 years old), Pleistocene-aged Montgomery and Bentley formations (also mapped as Upper and Lower Lissie formations, respectively), and the older Pleistocene-aged (possibly Pliocene) deposit, the Willis Formation, which underlies the Big Sandy Creek and Beech Creek Units of BTNP. The southern part of BTNP is underlain by the Montgomery and Beaumont Formations.

Pedogenesis, or the formation of soils, in BTNP occurred during the Pleistocene (1.8 million to 10,000 years ago) and Holocene (10,000 years ago to present day). Present day soils developed upon the Pleistocene-aged Willis, Bentley, and Montgomery Formations and on the Pleistocene- to Holocene- aged Deweyville Formation and Quaternary Alluvium. Quaternary Alluvium is thickest within the major active drainages: the Neches and Trinity Rivers. The Deweyville Formation, underlying the Alluvium is also associated with river and stream drainages. Most soils in the Preserve developed on the Bentley and Montgomery formations. These formations are exposed at the surface in approximately 70 percent of BTNP.

Soils formed in floodplains range in texture from loamy to clayey, and occur in the landscape on old oxbows to moderately well-drained natural levees adjacent to stream channels. Upland soils are generally loamy to sandy in texture and are found on a wide variety of landscapes. Immediately above the floodplains are sandy point bar deposits and low, mounded terraces. Deshotels (1978) described 46 soils (mapping units) in BTNP.

The soils within BTNP are characteristic of those developed under a mild climate, with abundant rainfall, in a mixed conifer-deciduous forest. Two broad categories of soils are found: a highly leached, acidic, sandy to loamy textured soil with a lower less-permeable zone of clay accumulation; and a more clayey textured, less permeable soil that is subject to either high water tables or periods of extensive flooding. The latter soils shrink and swell with changes in seasonal moisture. In general, the sandier soils tend to occur in uplands, and clayey textured soils are found in swales, lowlands, floodplains, and wetlands. Unique soil features known as “sand mounds” are found primarily in the Lance Rosier and Jack Gore Baygall units.

3.1.2 Intensity Level and Duration Definitions

The thresholds of change for the intensity of an impact are defined as follows:

- Negligible:** Impacts would result in a change to geologic resources, but the change would be so slight that it would not be of any measurable or perceptible consequence.
- Minor:** Impacts would result in a detectable change to geologic resources, but the change would be small and of little consequence and would be expected to be short-term and localized. Mitigation measures, if needed to offset negative effects, would be relatively simple and likely successful.
- Moderate:** Impacts would result in a change to geologic resources that would be measurable, long-term, and localized or widespread. Mitigation measures would likely be needed to offset negative effects and could be extensive, but would likely be successful.
- Major:** Impacts would result in a change to geologic resources that would be measurable and result in substantial consequences on a regional scale for long periods or be permanent. Extensive mitigation measures would be needed to offset any negative effects, and their success would not be guaranteed.

Definition of impact duration for geologic resources includes short-term and long-term impacts. Short-term impacts are defined as those from which the resource recovers in three years or less. Long-term impacts are defined as those from which the resource takes more than three years to recover.

3.1.3 Impacts on Geologic Resources under Alternative A, No Action

The no action alternative would result in continuing feral hog impacts and threats to natural resources including geologic resources. Feral hog impacts to geologic resources would mainly occur to soils and streambeds. Soil and streambed impacts due to hog behavior such as rooting and wallowing would be considered moderate and vary depending on the location and type of soil present in a disturbed area (Mapston, 2004). Impacts would be widespread, occurring throughout BTNP and into adjacent areas. Soil and streambed impacts associated with hogs can include soil erosion (particularly along streams; Sierra, 2001), soil contamination of streams, soil compaction, changes in soil bulk density and building processes (Ford and Grace, 1998), soil oxidation in areas with highly organic or peat soils (resulting in soil loss), changes in soil nutrient dynamics and other biogeochemical properties (Singer *et al.* 1984), effects on soil biota (Mohr *et al.* 2005), and numerous other effects. (Patten, 1974; Singer *et al.* 1984; Stone and Keith, 1987; Vtorov, 1993; Barrett and Birmingham, 1994; Cushman *et al.* 2004; Kaller and Kelso, 2006). In some cases, single or individual hog disturbance events could have short-term effects, while in other cases long-term effects would result. Overall, due to the widespread and recurring nature of hog disturbance activities, impacts to geologic resources would be considered long-term.

3.1.3.1 Cumulative Impacts, Alternative A

Effects from past, present, and foreseeable oil and gas operations and associated infrastructure (e.g., compressors, flowlines), transpreserve oil and gas pipelines, new drilling and production wells, past forestry operations, authorized Preserve activities (e.g., fire management, trail and road maintenance, restoration, visitor use, etc.), unauthorized activities (e.g., offroad vehicle trespass), and natural processes (e.g., hurricane, flood, and wildfire effects) in BTNP could contribute to negative cumulative impacts on geologic resources. Preserve management and protections provided to geologic resources under current laws, regulations and policies are expected to result in the conservation of these resources, and the natural processes that maintain and improve them to some extent, resulting in positive cumulative effects.

However, the no action alternative would contribute moderate negative effects to cumulative impacts on geologic resources. The no action alternative in combination with the past, present, and foreseeable future actions would result in net negative cumulative negative impacts on geologic resources that are expected to be widespread and moderate over the long term under the no action alternative.

3.1.3.2 Conclusion, Alternative A

Under the no action alternative, impacts to geologic resources would be moderate, long-term, and negative. Cumulative effects under this alternative would be moderate negative impacts over the long term.

3.1.4 Impacts on Geologic Resources under Alternative B, Preferred Alternative

Under Alternative B, the preferred alternative, negative impacts to geologic resources would be negligible, short-term, and highly localized substrate disturbance (e.g., direct soil compaction, erosion, and excavation) associated with limited pedestrian and vehicular access (e.g., trucks, UTVs, boats) and the placement of traps, protective fencing, blinds, and stands. The minimization and avoidance of geologic resource impacts have been addressed for these activities through mitigation measures, as described in section 2. This alternative is intended to reduce geologic resource impacts associated with hog disturbance, resulting in moderate positive effect and a net positive impact on geologic resources.

3.1.4.1 Cumulative Impacts, Alternative B

Impacts from past, present, and reasonably foreseeable actions would be identical to those identified for Alternative A. Alternative B, the preferred alternative, would contribute negligibly to cumulative negative impacts on geologic resources in BTNP, as discussed above, but provide moderate positive effects by reducing the negative impacts of feral hogs on geologic resources. Cumulative positive effects and minimization of net negative effects over the long-term are expected because of protections provided for geologic resources in BTNP under Alternative B.

3.1.4.2 Conclusion, Alternative B

Under Alternative B, the preferred alternative, negative impacts to geologic resources would be negligible, short-term, highly localized, and intended to reduce soil and streambed impacts caused by feral hogs. Positive impacts would be moderate and result in net positive impacts compared to the no action alternative. Cumulative benefits to geologic resources under the preferred alternative would minimize the net negative negative effects of other past, present, and foreseeable actions in BTNP.

3.2 IMPACTS ON WATER QUALITY AND QUANTITY

3.2.1 Affected Environment

Water is an abundant resource in BTNP. Most BTNP units either contain or are adjacent to high-order, perennial streams. In fact, six of the existing 15 management units are river/stream corridor units. All units of BTNP are located within the watershed or basin of the Neches River, except for the Menard Creek Corridor Unit

which is in the Trinity River basin. Major features include the Neches and Trinity rivers, Beech Creek, Big Sandy Creek, Turkey Creek, Village Creek, Little Pine Island Bayou, Pine Island Bayou, Menard Creek, and numerous lakes.

In addition to these major river/stream reaches, BTNP contains a wide variety of minor hydrologic features: floodplains, sloughs, oxbows, baygalls, acid bogs, and low-order tributary streams. The origin and occurrence of practically all of these features is strongly affected by the surface and subsurface geology, which are greatly interrelated. Furthermore, the occurrence and movement of groundwater within the Big Thicket area is heavily influenced by both the structure and the lithology of the local bedrock. The sedimentary formations exposed at the surface also tend to be separated by low cuestas, or scarps, which strongly affect drainage.

General conclusions drawn from studies and monitoring data are that the quality of water resources of BTNP is fair to excellent, although in some areas water quality has degraded with respect to particular parameters (Harrel, 1985; Flora, 1984, 1985; Hughes, 1987; Hall and Bruce, 1996). Degradation has likely been caused to some degree by human activities such as residential development, agricultural activities, logging operations, and oil and gas development within and up drainage of the Preserve. Parameters of concern have included fecal coliform, low dissolved oxygen levels, high concentrations of metals, increased salinity, and in at least one case, a dioxin advisory. In addition to these concerns, a number of state water quality standard violations have been recorded within BTNP.

Water quality impacts are analyzed below, however because neither alternative would result in impacts to water quantity, the topic has been dismissed from further analysis.

3.2.2 Intensity Level Definitions

The thresholds of change for the intensity of an impact are defined as follows:

- Negligible:** Impacts would result in a change to water quality or quantity, but the change would be so slight that it would not be of any measurable or perceptible consequence.
- Minor:** Impacts would result in a detectable change to water quality or quantity, but the change would be small and of little consequence and would be expected to be short-term and localized. Mitigation measures, if needed to offset negative effects, would be relatively simple and likely successful.
- Moderate:** Impacts would result in a change to water quality or quantity that would be measurable, long-term, and localized or widespread. Mitigation measures would likely be needed to offset negative effects and could be extensive, but would likely be successful.

Major: Impacts would result in a change to water quality or quantity that would be measurable and result in substantial consequences on a regional scale for long periods or be permanent. Extensive mitigation measures would be needed to offset any negative effects, and their success would not be guaranteed.

Definition of impact duration for water quality or quantity includes short-term and long-term impacts. Short-term impacts are defined as those from which the resource recovers in three years or less. Long-term impacts are defined as those from which the resource takes more than three years to recover.

3.2.3 Impacts on Water Quality or Quantity under Alternative A, No Action

The no action alternative would result in continuing feral hog impacts and threats to water quality or quantity, with indirect effects to other resources, such as floodplains, wetlands, and aquatic flora and fauna. Water resource impacts associated with hogs would be considered moderate, long term, and would occur on a localized to widespread scale (throughout BTNP and adjacent areas within affected watersheds), depending on the characteristics of the resource and impact involved. Water resource impacts associated with hogs include increased stream bank and floodplain erosion (Taylor, 2003), sediment contamination of surface waters and wetlands, fecal contamination of surface waters (Stevens, 1996; Kaller *et al.* 2007), impacts to hydric soils, impacts to wetland plants (Engeman *et al.* 2007), impacts to microbial communities, aquatic invertebrates, and wildlife (Kaller and Kelso, 2006; Kaller *et al.* 2007), and additional indirect impacts to related resources.

3.2.3.1 Cumulative Impacts, Alternative A

Impacts from past, present, and foreseeable industry outfalls from paper mills and refineries, pollutants from private septic tanks and other non-point pollution (e.g., adjacent land uses such as forestry, ranching, agriculture, and residential development, illegal dumping, etc.), dams and channelization, non-federal oil and gas development, authorized Preserve activities (e.g., fire management, trail and road maintenance, restoration, visitor use, etc.), unauthorized activities (e.g., offroad vehicle trespass, illegal dumping), natural processes (e.g., flooding, hurricanes, wildfires), and the USACE Sabine-Neches Waterway Improvement Project outside the Preserve could contribute to cumulative effects on water quality or quantity within BTNP.

Preserve management and protections provided to water quality or quantity under current laws, regulations and policies are expected to result in the conservation of those resources, and the natural processes that maintain and improve them to some extent, resulting in positive cumulative effects. However, the no action alternative would contribute minor to moderate negative effects to cumulative impacts on water quality or quantity. Consequently, overall negative cumulative impacts on water quality or

quantity are expected with the contribution to cumulative impacts widespread and moderate over long term under the no action alternative.

3.2.3.2 Conclusion, Alternative A

Under the no action alternative, impacts to water quality or quantity would be moderate, long-term, and negative. Individual impacts would be primarily localized; however, collectively, these impacts would increase in scale and be widespread throughout BTNP. The no action alternative would contribute moderate, long-term negative impacts, resulting in a minor to moderate cumulative effect on water quality or quantity.

3.2.4 Impacts on Water Quality or Quantity under Alternative B, Preferred Alternative

Under Alternative B, the preferred alternative, negative impacts to water quality or quantity would be negligible, short-term, and highly localized disturbance associated with limited vehicular access and the placement of traps, protective fencing, blinds, and stands. Potential alteration of surface water flow associated with exclosures and retention of flood debris would be avoided by not implementing fencing in environmentally sensitive areas, such as within streams or where other channelized flows are present. The minimization and avoidance of impacts to water quality or quantity have been addressed for these activities through mitigation measures, as described in section 2. This alternative is intended to reduce impacts associated with feral hogs, resulting in moderate positive impacts and a net positive effect on water quality or quantity.

3.2.4.1 Cumulative Impacts, Alternative B

Impacts from past, present, and reasonably foreseeable actions would be identical to those identified for Alternative A. Alternative B, the preferred alternative, would contribute negligibly to cumulative negative impacts on water quality or quantity in the Preserve, as discussed above, but provide moderate positive effects by reducing the negative impacts of feral hogs on water quality or quantity. Cumulative positive effects over the long-term are expected because of protections provided for water quality or quantity in BTNP under Alternative B.

3.2.4.2 Conclusion, Alternative B

Under Alternative B, the preferred alternative, negative impacts to water quality or quantity would be negligible, short-term, highly localized, and intended to reduce water resource impacts caused by feral hogs. Positive impacts would be moderate and result

in net positive impacts, compared to the no action alternative, that reduce cumulative impacts on water quality or quantity.

3.3 IMPACTS ON FLOODPLAINS AND WETLANDS

3.3.1 Affected Environment

Area topography, soils, and climate all combine to produce a unique flood regime in southeast Texas. Intense storms result in large magnitude runoff events; however, flood peaks are attenuated by broad flat valleys that produce slow-moving, long-duration floods. In the southern part of BTNP, the land surface is nearly level and slopes are generally less than one percent. In addition, the high clay and silt content of soils in the area is a major factor contributing to the accumulation of surface runoff.

Floodplains comprise roughly 50 percent of BTNP, and most of the Preserve's wetlands are located within floodplains. Similarly, the water corridor units and riparian corridors are located in floodplains and consist primarily of floodplain forests, which are ecologically significant. Most riparian corridors in BTNP lie within the 100-year floodplain, and are also referred to as riparian wetlands, bottomland hardwood forests, and floodplain forests. Such forests broadly occur throughout BTNP wherever creeks, rivers, or sloughs are found.

Wetlands comprise at least 40 percent of BTNP, according to National Wetlands Inventory Data (1987), and can be classified in three systems: palustrine, riverine, and lacustrine wetlands (Cowardin *et al.* 1979). Granted, not all wetlands within BTNP have been mapped and these data may exclude certain habitat types, specifically wet pine savanna and wet flatwoods, or particular communities therein that function ecologically as wetlands. Nonetheless, the majority of wetlands in BTNP fall within the palustrine system: nontidal wetlands dominated by trees, shrubs, or persistent emergents, as well as some small, unvegetated features. Palustrine emergent wetlands of the Preserve contain nonwoody aquatic plants, such as rushes (*Juncus* spp.), arrowheads (*Sagittaria* spp.), sedges (*Carex* spp.), grasses, vines, pitcherplant (*Sarracenia alata*), and other hydrophytic plants.

Palustrine forested and scrub-shrub wetlands are characteristic of floodplains with a dominance of woody vegetation, including baldcypress (*Taxodium distichum*), tupelo gum (*Nyssa aquatic*), black gum (*Nyssa sylvatica*), oaks (*Quercus* spp.), river birch (*Betula nigra*), sweetgum (*Liquidambar styraciflua*), sweetbay (*Magnolia virginiana*), sycamore (*Platanus occidentalis*), American hornbeam (*Carpinus caroliniana*), baygall holly (*Ilex coriacea*), red maple (*Acer rubrum*), and red bay (*Persea borbonia*). These features also contain some nonwoody vegetation in the understory, such as grasses, vines, mosses, and other hydrophytes.

Palustrine unconsolidated bottom wetlands are characterized by less vegetation (<30%) that when present includes species similar to those found in palustrine forested, scrub-shrub, and emergent wetlands. These wetlands are essentially small, shallow ponds within BTNP.

The riverine system consists of wetlands and deepwater habitats with stream channels, and within the Preserve includes unconsolidated bottom and unconsolidated shore subclasses. Riverine wetlands in BTNP are primarily associated with the Neches River corridor, as well as Little Pine Island Bayou and Pine Island Bayou.

Lacustrine wetlands (larger than 20 acres) are limited in the Preserve and occur in topographic depressions or dammed river channels. Within BTNP, the diverse wetland types exhibit differing biological, physical, and chemical conditions that result in their provision of habitat for a varying diversity of organisms, ranging from aquatic invertebrates to wildlife species, of which include many unique and rare plant and animal species and assemblages.

3.3.2 Intensity Level Definitions

The thresholds of change for the intensity of an impact are defined as follows:

Negligible: Impacts would result in a change to floodplains and wetlands, but the change would be so slight that it would not be of any measurable or perceptible consequence.

Minor: Impacts would result in a detectable change to floodplains and wetlands, but the change would be small and of little consequence and would be expected to be short-term and localized. Mitigation measures, if needed to offset negative effects, would be relatively simple and likely successful.

Moderate: Impacts would result in a change to floodplains and wetlands that would be measurable, long-term, and localized or widespread. Mitigation measures would likely be needed to offset negative effects and could be extensive, but would likely be successful.

Major: Impacts would result in a change to floodplains and wetlands that would be measurable and result in substantial consequences on a regional scale for long periods or be permanent. Extensive mitigation measures would be needed to offset any negative effects, and their success would not be guaranteed.

Definition of impact duration for floodplains and wetlands includes short-term and long-term impacts. Short-term impacts are defined as those from which the resource recovers in three years or less. Long-term impacts are defined as those from which the resource takes more than three years to recover.

3.3.3 Impacts on Floodplains and Wetlands under Alternative A, No Action

The no action alternative would result in continuing feral hog impacts and threats to floodplains and wetlands. Floodplain and wetland impacts associated with hogs would be considered moderate, long term, and would occur on a local to widespread scale (throughout BTNP and into adjacent areas within affected watersheds), depending on the characteristics of the resource and impact involved. Floodplain and wetland impacts associated with hogs include increased stream bank and floodplain erosion, sediment contamination of surface waters and wetlands, fecal contamination of surface waters, impacts to hydric soils, impacts to wetland plants and wildlife, and other impacts, as previously discussed under “Geologic Resources” and “Water Quality and Quantity”, and later under “Vegetation” and “Fish and Wildlife”. Because BTNP is prevalently comprised of floodplain and wetland habitats and was established for the protection of these specific resources, most natural resource impacts, including those described for Geologic Resources, Vegetation, Fish and Wildlife, (and Species of Special Status therein), and Water Quality or Quantity, collectively translate to direct and indirect floodplain and wetland impacts at the broad scale and result in an overall reduction of ecosystem functionality within BTNP.

3.3.3.1 *Cumulative Impacts, Alternative A*

The cumulative impacts on floodplains and wetlands within BTNP and affected watersheds include past, present, and foreseeable effects from adjacent land uses (e.g., ranching, agriculture, forestry, residential development, road building, non-point source and industrial point source pollution), publicly owned facilities (water impoundments, water diversion structures, and sewage treatment), non-federal oil and gas development, non-native species, authorized Preserve activities (e.g., fire management, trail and road maintenance, restoration, visitor use, etc.), unauthorized activities (e.g., offroad vehicle trespass, illegal dumping), and natural processes (e.g., flooding, hurricanes).

BTNP management and protections provided to floodplains and wetlands under current laws, regulations and policies are expected to result in the conservation of those resources, and the natural processes that maintain and improve them to some extent, resulting in positive cumulative effects. However, the no action alternative would contribute long term, widespread moderate negative effects to cumulative impacts on floodplains and wetlands. Consequently, net negative cumulative impacts on floodplains and wetlands are expected to be widespread and moderate over long term under the no action alternative.

3.3.3.2 Conclusion, Alternative A

Under the no action alternative, impacts to floodplains and wetlands would be moderate, long-term, and negative. The no action alternative would contribute moderate, long-term negative impacts, resulting in a moderate cumulative effect on floodplains and wetlands.

3.3.4 Impacts on Floodplains and Wetlands under Alternative B, Preferred Alternative

Under Alternative B, the preferred alternative, negative impacts to floodplains and wetlands would be negligible, short-term, and highly localized. Direct disturbance would result from limited pedestrian and vehicular access and the placement of traps, protective fencing, blinds, and stands. These activities would result in alteration of floodplain and wetland structure or function through direct and indirect impacts, such as soil compaction, vegetation trampling or removal, erosion, and sedimentation. Potential alteration of floodplain and wetland hydrology, such as surface water flow, associated with exclosures and retention of flood debris would be avoided by not placing fencing in environmentally sensitive areas, such as where streams or other channelized flows are present. The minimization and avoidance of impacts to floodplains and wetlands have been addressed for these activities through mitigation measures, as described in section 2. This alternative is intended to reduce impacts associated with feral hogs, resulting in moderate positive impacts and a net positive effect on floodplains and wetlands.

3.3.4.1 Cumulative Impacts, Alternative B

Impacts from past, present, and foreseeable actions would be identical to those identified for Alternative A. Alternative B, the preferred alternative, would contribute negligibly to cumulative negative impacts on floodplains and wetlands in BTNP and adjacent affected watersheds, as discussed above, but provide moderate positive effects by reducing the negative impacts of feral hogs on floodplains and wetlands. Cumulative positive effects over the long-term are expected because of protections provided for floodplains and wetlands in the Preserve under Alternative B.

3.3.4.2 Conclusion, Alternative B

Under Alternative B, the preferred alternative, impacts to floodplains and wetlands would be negligible, short-term, highly localized, and intended to reduce resource impacts caused by feral hogs. Contribution of this alternative to cumulative negative impacts on floodplains and wetlands would be negligible with net positive effects over the long-term expected, compared to the no action alternative.

3.4 IMPACTS ON VEGETATION

Evaluation of impacts on Vegetation is also inclusive of the resource categories Rare and Unusual Vegetation and Species of Special Concern (Plants).

3.4.1 Affected Environment

According to *Management Policies 2006*, NPS strives to maintain all components and processes of naturally evolving park unit ecosystems, including the natural abundance, diversity, and ecological integrity of plants.

Vegetation is a fundamental component of the biological diversity of BTNP, with over 1,300 species of trees, shrubs, forbs, and grasses believed to grow within its boundaries. Diverse environmental factors, including geography, climate, and soil, contribute to the botanical diversity of the Big Thicket. Often called a “biological crossroads,” the Big Thicket lies at an ecotonal boundary between forests to the east and prairies to the west. Moderated by warm Gulf breezes, the climate of the region is sub-tropical with relatively high levels of rainfall that are evenly distributed throughout the year. Rainfall begins to drop off quickly only a short distance to the west, and this sudden transition partly explains why the Big Thicket is the farthest western extent of many eastern plant species. The interplay of geography, climate, and soils causes abrupt transitions in vegetation communities.

According to the vegetation classification by Marks and Harcombe (1981), plant communities characteristic of BTNP and the vicinity can be differentiated and named based on physiographic position (upland, slope, floodplain, and flatland) and community physiognomy or structure (forest, savanna, or shrub thicket), normally combined with important tree descriptors (e.g., pine, oak, hardwood). Upland vegetation types include Upland Pine Forest, Sandhill Pine Forest, and Wetland Pine Savanna, and are strongly influenced by fire and edaphic (soil) conditions. The slope community includes three distinct vegetation types: Upper Slope Pine Oak Forest, Middle Slope Oak-Pine Forest, and Lower Slope Hardwood Pine Forest. The transition from dry to mesic (moist) soil conditions generally results in a shift from upland forest communities to slope communities, with a transition in the prevalence of different species. Floodplain vegetation communities generally occur along river and creek floodplains throughout BTNP, and include four vegetation types: Floodplain Hardwood Pine Forest, Floodplain Hardwood Forest, Wetland Baygall Shrub Thicket, and Swamp Cypress Tupelo Forest. According to data collected by Marks and Harcombe in 1978 and presented by NPS (2006a), the predominant vegetation types of BTNP at that time were Lower Slope Hardwood Pine Forest (29,522 acres) and Floodplain Hardwood Forest (23,251 acres), with Upper Slope Pine Oak Forest (10,342 acres) and Flatland Hardwood Forest (8,165 acres) also common. Sandhill Pine Forest (132 acres) was the rarest plant community in BTNP.

Given the diversity and uniqueness of plant communities found within BTNP, it is not surprising that numerous plant species of special concern are known to occur or likely to occur within the Preserve. These species are state and/or federally listed, or candidates for listing, as endangered or threatened, as presented in Appendix B. Plant species include the federally-endangered Texas trailing phlox (*Phlox nivalis* subsp. *texensis*), which is known to occur, and Navasota ladies-tresses (*Spiranthes parksii*), which is likely to occur, in addition to the federal candidate species Neches River rose-mallow (*Hibiscus dasycalyx*), which has been documented in BTNP.

3.4.2 Intensity Level Definitions

The thresholds of change for the intensity of an impact are defined as follows:

- Negligible:** Impacts would result in a change to native vegetation, their habitats, or the natural processes sustaining them, but the change would be so slight that it would not be of any measurable or perceptible consequence.
- Minor:** Impacts would result in a detectable change to native vegetation, their habitats, or the natural processes sustaining them, but the change would be small and of little consequence and would be expected to be short-term and localized. Mitigation measures, if needed to offset negative effects, would be relatively simple and likely successful.
- Moderate:** Impacts would result in a change to native vegetation, their habitats, or the natural processes sustaining them, and the change would be measurable, long-term, and localized or widespread. Mitigation measures would likely be needed to offset negative effects and could be extensive, but would likely be successful.
- Major:** Impacts would result in a change to native vegetation, their habitats, or the natural processes sustaining them, and the change would be measurable and result in substantial consequences on a regional scale for long periods or be permanent. Extensive mitigation measures would be needed to offset any negative effects, and their success would not be guaranteed.

Definition of impact duration for vegetation includes short-term and long-term impacts. Short-term impacts are defined as those from which the resource recovers in three years or less. Long-term impacts are defined as those from which the resource takes more than three years to recover.

3.4.3 Impacts on Vegetation under Alternative A, No Action

The no action alternative would result in continuing feral hog impacts and threats to natural resources including vegetation. Vegetation impacts caused by hogs would be

considered moderate in intensity. Impacts would be widespread, occurring throughout BTNP. In short, hog activity can directly impact vegetation communities and plant species populations through disturbance associated with rooting, digging, rubbing, wallowing, trampling, and use of game trails (Whitehouse, 1999; Mayer *et al.* 2000; Campbell and Long, 2009); destruction or alteration of habitat; selective herbivory (consumption of mature plants, seedlings, saplings, leaves, stems, roots, flowers, fruit, seeds, etc.) (Huff, 1977; Sweitzer and Van Vuren, 2002; Sweeney *et al.* 2003; Siemann *et al.* 2009), and other mechanisms. Indirect effects include the spread and facilitation of non-native plants (Diong, 1982; Simberloff and VonHolle, 1999; Peters, 2001; Cushman *et al.* 2004; Siemann *et al.* 2009), which compete with or exclude native species; changes in disturbance frequency and intensity (Siemann *et al.* 2009), nutrient cycling and productivity (Singer *et al.* 1984; Siemann *et al.* 2009), litter dynamics (Singer *et al.* 1984); reduced recruitment (Ralph and Maxwell, 1984; Ickes *et al.* 2001, 2003, 2005; Siemann *et al.* 2009), plant diversity and resiliency, and other structural or functional impacts. These impacts could affect both common plant species and species of special concern. In some cases, a single or individual hog activity could have short-term effects due to the low intensity of impact and/or the quick recovery of the resource (e.g., revegetation or vegetative recovery of trampled areas in less than 3 years); while in other cases effects would be long-term due to high intensity of impact and/or the slow recovery of the resource (e.g., soil compaction due to wallowing prevents revegetation for over 3 years). Overall, due to the widespread and recurring nature of hog activities, vegetation impacts would be considered long-term.

3.4.3.1 Cumulative Impacts, Alternative A

Effects from past, present, and foreseeable oil and gas operations and associated infrastructure (e.g., compressors, flowlines), transpreserve oil and gas pipelines, new drilling and production wells, past forestry operations; authorized Preserve activities (e.g., fire management, trail and road maintenance, restoration, visitor use, etc.), unauthorized activities (e.g., offroad vehicle trespass), natural processes (e.g., hurricane, flood, wildfire, pest/pathogen effects) and non-native species in BTNP could contribute cumulative impacts on vegetation resources. In addition, indirect effects to vegetation from impacts to other natural resources, such as geologic resources, water quality or quantity, floodplains and wetlands, and non-native species, would contribute to cumulative impacts on vegetation. BTNP management and protections provided to native vegetation under current laws, regulations and policies are expected to result in the conservation of those resources, and the natural processes that maintain and improve them to some extent, resulting in positive cumulative effects.

However, the no action alternative would contribute moderate negative effects to cumulative impacts on vegetation resources. The no action alternative in combination with the past, present, and foreseeable future actions would result in net negative cumulative impacts on vegetation that are expected to be widespread and moderate over the long term under the no action alternative.

3.4.3.2 Conclusion, Alternative A

Under the no action alternative, impacts to vegetation would be moderate, long-term, and negative. Contribution of these moderate, long-term negative impacts to past, present, and future impacts, would result in moderate cumulative negative effects on vegetation.

3.4.4 Impacts on Vegetation under Alternative B, Preferred Alternative

Under Alternative B, the preferred alternative, negative impacts to vegetation would be negligible, short-term, highly localized direct disturbance (e.g., vegetation trampling or removal) associated with limited vehicular access and the placement of traps, protective fencing, blinds, and stands. The minimization and avoidance of vegetation resource impacts, including impacts to species of special concern, have been addressed for these activities through mitigation measures, as described in section 2. This alternative is intended to reduce impacts associated with feral hogs, resulting in moderate positive impacts and a net positive effect on vegetation.

3.4.4.1 Cumulative Impacts, Alternative B

Impacts from past, present, and foreseeable actions would be identical to those identified for Alternative A. Alternative B, the preferred alternative, would contribute negligibly to cumulative negative impacts on vegetation in BTNP, as discussed above, but provide moderate positive effects by reducing the negative impacts of feral hogs on vegetation. Cumulative positive effects over the long-term are expected because of protections provided for vegetation in BTNP under Alternative B.

3.4.4.2 Conclusion, Alternative B

Under Alternative B, the preferred alternative, impacts to vegetation would be negligible, short-term, highly localized, and intended to reduce resource impacts caused by feral hogs. Contribution of this alternative to cumulative negative effects on vegetation would be negligible and would be offset by moderate positive effects over the long-term, compared to the no action alternative, which would reduce cumulative impacts on vegetation resources from other past, present, and future actions.

3.5 IMPACTS ON FISH AND WILDLIFE

Evaluation of impacts on Fish and Wildlife is also inclusive of the resource categories Species of Special Concern (Fish and Wildlife), Unique or Important Wildlife or Wildlife Habitat, and Unique or Important Fish or Fish Habitat.

3.5.1 Affected Environment

The Big Thicket region has long been recognized for possessing a diverse array of fauna and flora. It is within the Austroriparian Biotic Province of Texas, as described by Blair (1950). BTNP provides habitat for plant and animal species of the Southeast swamps, Pineywoods forest, Post Oak Savannah, Great Plains, Southwest deserts, and the Coastal Prairie. The abundant and diverse vegetation of the Preserve supports aquatic and terrestrial habitats for a variety of fish and wildlife.

Of the 181 mammals listed for Texas, 60 are either documented or believed to inhabit BTNP. Several large species are now extirpated in Big Thicket due to a variety of factors including habitat destruction and overhunting. These include the jaguar (*Panthera onca*), ocelot (*Leopardus pardalis*), red wolf (*Canis rufus*), and the Louisiana subspecies of the American black bear (*Ursus americanus luteolus*). Although occasional sightings of black bears have been reported near BTNP, no populations are believed to be reproducing in East Texas.

Birds are the most visible and diverse group of vertebrate fauna found in BTNP, with 295 species confirmed present or probably present in the Preserve, and 8 species unconfirmed (Gulf Coast Network, 2010). Of these, 74 species breed within BTNP, and 60 species are common (15 species) or abundant (45 species) (Gulf Coast Network, 2010). BTNP lies on a major migratory flyway, and many species of birds are transient during spring and fall migrations. Birds found in Big Thicket predominantly consist of three categories: passerines (including many neotropical songbirds), raptors, and waterfowl. The abundance and variety of birds in BTNP contribute to one of the favorite visitor activities, bird watching.

Approximately 52 species of reptiles (34 species) and amphibians (17 species) are confirmed present or probably present within BTNP, with an additional 36 species unconfirmed (23 reptiles and 13 amphibians) (Gulf Coast Network, 2010). The most diverse group of reptiles in BTNP is snakes. Other types of reptiles present include skinks, lizards, turtles, and the American alligator. Three types of amphibians, including frogs, toads, and salamanders, inhabit BTNP.

Fish species of BTNP have been heavily inventoried, with 92 confirmed species, an additional 6 species probably present, and 13 species unconfirmed (Gulf Coast Network, 2010). In small tributaries, the most abundant species of fish include minnows, darters, bass (*Micropterus* and *Morone* spp.), and bullhead catfish (*Ameiurus* spp.). This pattern shifts in larger tributaries, which are dominated by channel, blue, and flathead catfish (*Ictalurus punctatus*, *Ictalurus furcatus*, and *Pylodictis olivaris*,

respectively); sunfishes (*Lepomis* spp.); largemouth and spotted bass (*Micropterus salmoides* and *M. punctulatus*, respectively); and crappie (*Pomoxis* spp.).

Invertebrate diversity is exceptionally high in BTNP. Inventory of Lepidoptera (butterflies, moths, and skippers) has documented over 1,800 species (Bordelon and Knudson, 1999), which is believed to be the greatest species diversity of the order in the contiguous U.S. In aquatic environments, insects and mussels are the most thoroughly documented taxonomic groups. Comprehensive inventories in the Village Creek drainage have documented 249 species of common macroinvertebrates, including dragonflies (order Odonata), caddisflies (order Trichoptera), mayflies (order Ephemeroptera), and stoneflies (order Plecoptera). Thirty-four species of mussels, including the Texas heelsplitter (*Potamilus amphichaenus*) and sandbank pocketbook (*Lampsilis satura*) live in the Lower Neches River watershed (Howells *et al.* 1996). This portion of the watershed includes most of the units of BTNP.

Given the diversity of habitat types and fish and wildlife species found within BTNP, it is not surprising that numerous fish and wildlife species of special concern that are state and/or federally listed as endangered or threatened are known to occur or likely to occur within the Preserve. Among these species are the federally-endangered red-cockaded woodpecker (*Picoides borealis*) and numerous state-listed species, such as Bachman's sparrow (*Aimophila aestivalis*), swallow-tailed kite (*Elanoides forficatus*), wood stork (*Mycteria americana*), Rafinesque's big-eared bat (*Corynorhinus rafinesquii*), and Louisiana pigtoe (*Pleurobema riddellii*). These species are presented in Appendix B.

3.5.2 Intensity Level Definitions

The thresholds of change for the intensity of an impact are defined as follows:

- Negligible:** Impacts would result in a change to a population or individuals of a native fish or wildlife species or their habitat, but the change would be short-term, and well within the range of natural fluctuations. The change would be so slight that it would not be of any measurable or perceptible consequence.
- Minor:** Impacts would result in a detectable change to a population or individuals of a native species of fish or wildlife or their habitat, but the change would be small and of little consequence and would be expected to be short-term and localized. Mitigation measures, if needed to offset negative effects, would be relatively simple and likely successful.
- Moderate:** Impacts would result in a change to a population or individuals of a native species of fish or wildlife or their habitat that would be measurable, long-term, and localized or widespread, with consequences at the population

level. Mitigation measures would likely be needed to offset negative effects and could be extensive, but would likely be successful.

Major: Impacts would result in a change to a population or individuals of a fish or wildlife species or their habitat that would be measurable and result in substantial consequences on a regional scale for long periods or be permanent. Extensive mitigation measures would be needed to offset any negative effects, and their success would not be guaranteed.

Definition of impact duration for fish and wildlife includes short-term and long-term impacts. Short-term impacts are defined as those from which the resource recovers in three years or less. Long-term impacts are defined as those from which the resource takes more than three years to recover.

3.5.3 Impacts on Fish and Wildlife under Alternative A, No Action

The no action alternative would result in continuing feral hog impacts and threats to natural resources including fish and wildlife. Fish and wildlife impacts caused by hogs would be considered moderate. Impacts would be widespread, occurring throughout BTNP. Hog activity can impact fish and wildlife, including species of special concern, through direct disturbance; destruction or alteration of habitat (Singer *et al.* 1984); predation (e.g., birds [Thompson, 1977; Tolleson *et al.* 1993; Rollings and Carroll, 2001; Cuthbert, 2002; Shaefer, 2004]; reptiles [Fordham *et al.* 2006]; small mammals, salamanders, frogs, fish, crabs, snakes turtles, and white-tailed deer fawns [Lucas, 1977; Hellgren, 1993; Taylor and Hellgren, 1997; Jolley, 2007; Jolley *et al.* 2010]); competition for limited resources (e.g., mast [Henry and Conley, 1972; Belden and Frankenberger, 1989; Yarrow and Kroll, 1989; Focardi *et al.* 2000; Siemann *et al.* 2009] and forage [Howe *et al.* 1981]); spread of diseases and parasites (Hanson and Karstad, 1959; Sweeney *et al.* 2003); and dispersal of non-native plants (Diong, 1982; Cushman *et al.* 2004; Siemann *et al.* 2009). Overall, due to the widespread presence of hogs and the recurring nature of their activities, impacts to fish and wildlife species would be considered long-term.

3.5.3.1 Cumulative Impacts, Alternative A

Effects from past, present, and foreseeable oil and gas operations and associated infrastructure (e.g., compressors, flowlines), transpreserve oil and gas pipelines, new drilling and production wells, past forestry operations; authorized Preserve activities (e.g., fire management, trail and road maintenance, restoration, visitor use, etc.), unauthorized activities (e.g., offroad vehicle trespass), natural processes (e.g., hurricane, flood, wildfire, pest/pathogen effects) and non-native species in BTNP could contribute cumulative impacts on fish and wildlife resources. Direct impacts to other natural resources, such as air quality, geologic resources, water quality or quantity, floodplains

and wetlands, soundscapes, vegetation, and non-native species, would also result in indirect negative effects on fish and wildlife. These indirect effects would further contribute to cumulative impacts on the resource. Preserve management and protections provided to native fish and wildlife, and additionally geologic, water, and vegetation resources as well as floodplains and wetlands, under current laws, regulations, and policies are expected to result in the conservation of fish and wildlife resources and the natural processes that maintain and improve them to some extent, resulting in positive cumulative effects.

However, the no action alternative would contribute moderate negative effects to cumulative impacts on fish and wildlife resources. The no action alternative in combination with the past, present, and foreseeable future actions would result in net negative cumulative impacts on fish and wildlife that are expected to be widespread and moderate over the long term under the no action alternative.

3.5.3.2 Conclusion, Alternative A

Under the no action alternative, impacts to fish and wildlife would be moderate, long-term, and negative. Contribution of these moderate, long-term negative impacts to past, present, and future impacts, would result in moderate cumulative negative effects on fish and wildlife.

3.5.4 Impacts on Fish and Wildlife under Alternative B, Preferred Alternative

Under Alternative B, the preferred alternative, negative impacts to fish and wildlife would be negligible, short-term, highly localized direct disturbance associated with pedestrian and limited vehicular access; the placement of traps, protective fencing, blinds, and stands; trapping of non-target species; potential harassment of non-target species by trained dogs; and noise (e.g., dogs barking, firearm discharge). The minimization and avoidance of fish and wildlife resource impacts, including impacts to species of special concern, have been addressed for these activities through mitigation measures, as described in section 2. This alternative is intended to reduce impacts associated with feral hogs, resulting in moderate widespread and long-term positive impacts with a net positive effect on fish and wildlife resources.

3.5.4.1 Cumulative Impacts, Alternative B

Impacts from past, present, and foreseeable actions would be identical to those identified for Alternative A. Alternative B, the preferred alternative, would contribute negligibly to cumulative negative impacts on fish and wildlife in BTNP, as discussed above, but provide moderate positive effects by reducing the negative impacts of feral hogs on fish and wildlife resources. Cumulative positive effects over the long-term are

expected because of protections provided for fish and wildlife in BTNP under Alternative B.

3.5.4.2 Conclusion, Alternative B

Under Alternative B, the preferred alternative, negative impacts to fish and wildlife would be negligible, short-term, highly localized, and intended to reduce resource impacts caused by feral hogs. Contribution of this alternative to cumulative negative effects on fish and wildlife would be negligible and would be offset by moderate positive effects over the long-term, compared to the no action alternative, which would reduce cumulative impacts on fish and wildlife resources from other past, present, and future actions.

3.6 IMPACTS ON VISITOR USE, HEALTH AND SAFETY, AND EXPERIENCE

3.6.1 Affected Environment

According to NPS's *Management Policies 2006*, the enjoyment of park resources and values by people is part of the fundamental purpose of all park units. NPS is committed to providing appropriate, high quality opportunities for visitors to enjoy the parks, and would maintain within the parks an atmosphere that is open, inviting, and accessible to every segment of society. NPS would provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in the parks. Additionally, guidance states that park managers should strive to protect human life, by providing injury free visits and a safe and healthful environment for visitors and employees. NPS policy regarding public health and safety is that the saving of human life will take precedence over all other management actions.

BTNP offers many visitor use options, ranging from very active recreational pursuits to more passive enjoyment of nature. Visitor use areas include day use areas, hiking trails, canoe routes, and birding hot spots. BTNP maintains 9.5 miles of dirt and gravel roadways, the Big Thicket Information Station (located at the southern end of the Turkey Creek Unit), and the Big Thicket Visitor Center (located at the intersection of Hwy 69 and Farm-to-Market 420). Visitor use is highest in the spring, light in summer, moderate in fall, and light in winter. Yearly visitation to BTNP during the period of 1981 to 2011 averaged 80,500 visitors with approximately 137,700 visitors in 2011 alone. While the majority of visitor use is regional, the visitor registration log found at BTNP's information station shows all 50 states and at least 20 countries are represented annually.

A large portion of the visitor use within BTNP occurs in the form of hunting and fishing, the continued allowance of which was mandated by BTNP's enabling legislation.

Hunting and fishing is scattered throughout the units of the Preserve. Since 1979, approximately 2,000 permits have been issued annually for hunting, and approximately 12 permits for trapping have been issued annually within the Preserve. Hunting and trapping in BTNP is allowed by permits that are available at the Visitor Center on a first-come, first-served basis. Permitted hunters may hunt in one of the following open units: Big Sandy Unit, Beech Creek Unit, Lance Rosier Unit, Beaumont Unit, and areas in the Neches Bottom/Jack Gore Baygall Unit. A total of 47,400 acres in these units are open to hunting. Hunting season generally begins October 1 and continues through January 15 each year, with an extended hog-only season may last until February 29. These dates will vary from hunting season to season due to State of Texas hunting regulations and BITH hunting permit restrictions. The State of Texas seasons and bag limits are followed during this period. While applying general Texas hunting regulations, the superintendent applies additional restrictions to hunters in order to protect BTNP resources and provide for additional hunter and visitor safety. Hunting areas are not generally closed to public use during hunting season, but backcountry camping is not permitted in areas open to hunting during hunting season. During the 2012–2013 season (October to January), 6,884 trips were made by hunters into hunting areas. Hunters harvested 178 deer, 3,225 squirrels, 404 hogs, 100 rabbits, and 146 waterfowl.

Trapping of furbearers is permitted in the Lance Rosier Unit, the Beaumont Unit, and in areas of the Neches Bottom/Jack Gore Baygall Unit, a total of 35,000 acres. As with hunting, State of Texas regulations apply and the superintendent applies additional restrictions to trappers in order to protect Preserve resources and provide for additional visitor safety. During the 2012–2013 season (December to January), ten trapping permits were issued and six were returned. Hunters harvested 8 raccoons, 12 opossums, 4 grey foxes, and two red foxes. No otters, mink, beaver, nutria or bobcat were harvested.

Component resources that can influence visitor use and experience include recreational resources, visual quality, “natural sounds” or “natural quiet” (e.g., naturally occurring sounds of winds aloft in the trees, calling birds, still/quiet nights, etc.), human health and safety, and solitude.

3.6.2 Intensity Level Definitions

The thresholds of change for the intensity of an impact are defined as follows:

Negligible: Visitors would not be affected or changes in visitor use and/or experience would be below or at the level of detection. Any effects would be short-term. The visitor would not likely be aware of the effects associated with the alternative, or only a few visitors would be impacted.

Minor: Changes in visitor use and/or experience would be detectable although the changes would be slight and likely short-term and localized. The visitor

would be aware of the effects associated with the alternative, but effects would be slight.

Moderate: Changes in visitor use and/or experience would be readily apparent and likely long-term. The visitor would be aware of the effects associated with the alternative and would likely be able to express an opinion about the changes.

Major: Changes in visitor use and/or experience would be readily apparent and have important long-term consequences. The visitor would be aware of the effects associated with the alternative and would likely express a strong opinion about the changes.

Definition of impact duration for visitor use and experience includes short-term and long-term impacts. Short-term impacts are defined as those that last for three years or less. Long-term impacts are defined as those that last for more than three years.

3.6.3 Impacts on Visitor Use and Experience under Alternative A, No Action

The no action alternative would result in continuing feral hog impacts on visitor use and experience, at least for a subset of the visitor population. Substrate and vegetation disturbance caused by non-native wild hogs is readily apparent to BTNP's visitors along hiking trails, boardwalks, floodplains, and waterways, and is frequently commented upon. Additionally, feral hogs pose a threat to human health and safety due to their potentially aggressive behavior towards humans, potential human injury from vehicular collision with feral hogs, and through the transmission of disease (e.g., ungulate fever) (Campbell and Long, 2009; West *et al.* 2009). Though, some other visitors may consider abundant sign and sightings of hogs a positive experience, particularly visitors interested in viewing large wildlife species and a subset of visitors interested in sport hunting for the species. Conversely, some visitors may be neutral to or unaware of feral hog presence in BTNP. A portion of visitors having positive or neutral experiences relative to feral hogs may not realize that they are a non-native species that can negatively impact natural areas and native flora and fauna.

Impacts to visitor use and experience under the no action alternative would thus be considered to result in minor to moderate positive effects to moderate negative effects, depending on the particular viewpoint of the visitor. Stable to potentially increasing feral hog densities in BTNP would provide minor to moderate positive impacts to public hunters and wildlife viewers pursuing feral hogs in BTNP. Conversely, the no action alternative would result in moderate negative effects for most users (who pursue enjoyment of non-feral hog related resources, such as native vegetation and wildlife) and some public hunters of BTNP (e.g., those pursuing other game animals impacted by feral hogs). Impacts to visitor use and experience would be considered widespread, occurring throughout BTNP. Overall, due to the widespread and recurring nature of hog disturbance activities, impacts would be considered long term.

3.6.3.1 Cumulative Impacts, Alternative A

Effects from past, present, and foreseeable oil and gas operations and associated infrastructure (e.g., compressors, flowlines), transpreserve oil and gas pipelines, new drilling and production wells, past forestry operations; authorized Preserve activities (e.g., fire management, trail and road maintenance, restoration, visitor use, etc.), unauthorized activities (e.g., offroad vehicle trespass), and natural processes (e.g., hurricane, flood, wildfire, etc.) in BTNP could contribute cumulative impacts on visitor use and experience.

BTNP management and protections provided to this resource under current laws, regulations and policies are expected to result in the conservation of those resources, and the natural processes that maintain and improve them to some extent, resulting in positive cumulative effects. Additionally, stable to increasing feral hog densities under the no action alternative would contribute minor to moderate positive effects to cumulative impacts on this resource for some users. Conversely, for most visitors, the no action alternative would contribute moderate negative effects to cumulative impacts on visitor use and experience in BTNP. Contribution to cumulative effects would be long term and widespread throughout BTNP.

3.6.3.2 Conclusion, Alternative A

Under the no action alternative, impacts to visitor use and experience would vary by user group and include minor to moderate positive effects to public hunters and wildlife viewers pursuing feral hogs in BTNP and moderate negative effects to most users (who pursue enjoyment of non-feral hog related resources, such as native vegetation and wildlife) and some public hunters of BTNP (e.g., those pursuing other game animals impacted by feral hogs). Net effects to visitor use and experience under the no action alternative would be long-term, moderate negative impacts, which would contribute to past, present, and future cumulative impacts on this resource..

3.6.4 Impacts on Visitor Use and Experience under Alternative B, Preferred Alternative

Under Alternative B, the preferred alternative, direct negative impacts to visitor use and experience would be minor, short-term, localized disturbance associated with limited vehicular access; the placement of traps, protective fencing, blinds, and stands; and temporary closures or access restrictions of areas during feral hog management activities. The minimization and avoidance of impacts to visitor use and experience have been addressed for these activities through mitigation measures, as described in section 2. Some visitors (e.g., public hunters for feral hogs in BTNP, wildlife viewers

seeking feral pigs, etc.) would incur minor to moderate indirect negative effects due to the reduction in the density of feral pigs under the preferred alternative; whereas, other users, such as hunters seeking different species than feral hogs, could receive moderate benefits. This alternative is intended to reduce direct and indirect impacts to visitor use and experience associated with feral hogs, resulting in moderate positive impacts for most users and a net positive effect on this resource.

3.6.4.1 Cumulative Impacts, Alternative B

Impacts from past, present, and foreseeable actions would be identical to those identified for Alternative A. Alternative B, the preferred alternative, would result in minor, short-term, and localized direct negative effects, as well as long term moderate indirect positive impacts to most users and minor to moderate indirect negative effects to other users, which would contribute to cumulative impacts on visitor use and experience in BTNP, as discussed above. This alternative would provide net positive cumulative effects by reducing the long-term negative impacts of feral hogs on visitor use and experience.

3.6.4.2 Conclusion, Alternative B

Under Alternative B, the preferred alternative, direct negative impacts to visitor use and experience would be minor, short-term, localized, and intended to reduce resource impacts caused by feral hogs. Indirect impacts would be of moderate intensity and positive to most users over the long-term but also include minor to moderate negative effects to other users. Overall, the preferred alternative would provide net positive cumulative effects, compared to the no action alternative, by reducing the long-term negative impacts of feral hogs on visitor use and experience.

3.7 IMPACTS ON PRESERVE OPERATIONS

3.7.1 Affected Environment

Preserve operations include changes that may affect the current facilities or that may require a new level of maintenance or staffing. BTNP's General Management Plan identifies three management zones: natural, development, and special use zones. Most of the Preserve is included in the natural zone, which places management emphasis on conservation of natural resources and processes while providing for uses that do not negatively affect these resources and processes. The development zone defines and limits areas in BTNP that may be used for certain types of development to serve the needs of Preserve management and the public. Design and environmental factors are fully considered before development plans are implemented. Present development

includes the maintenance and meeting facility, Big Thicket Information Station, Big Thicket Visitor Center, Turkey Creek Ranch House, and day-use areas. For all operations in the natural zone, appropriate mitigation measures under Current Legal and Policy Requirements (Table 1) would necessitate remediation of any environmental damage and reclamation of the disturbed area.

3.7.2 Intensity Level Definitions

The thresholds of change for the intensity of an impact are defined as follows:

Negligible: Preserve operations would not be affected or the effect would be so slight that it would not be of any measurable or perceptible consequence.

Minor: Impacts would result in a detectable change to Preserve operations, but the change would be small and of little consequence and would be expected to be short-term and localized. Mitigation measures, if needed to offset negative effects, would be relatively simple and likely successful.

Moderate: Impacts would result in a change to Preserve operations that would be readily apparent, be long-term, and would result in substantial change in Preserve operations in a manner noticeable to staff and public. Mitigation measures would probably be needed to offset negative effects and could be extensive, but would likely be successful.

Major: Impacts would result in a change to Preserve operations that would be readily apparent and long-term, and would result in a substantial change in Preserve operations in a manner noticeable to staff and the public and be markedly different from existing operations. Mitigation measures to offset negative effects would be needed, would be extensive, and their success could not be guaranteed.

Definition of impact duration for Preserve operations includes short-term and long-term impacts. Short-term impacts are defined as those that occur only during the treatment effect/action period. Long-term impacts are defined as those that occur after the treatment effect/action period.

3.7.3 Impacts on Preserve Operations under Alternative A, No Action

The no action alternative would result in moderate negative impacts to Preserve operations that are widespread and long-term. Feral hog impacts to BTNP resources evaluated under the no action alternative in this EA would result in decreased effectiveness of other resource management activities (e.g., longleaf pine restoration, prescribed burning, and exotic plant control) and have consequent negative effects on the allocation of staff time, operational resources, and budgets.

3.7.3.1 Cumulative Impacts, Alternative A

Effects from past, present, and foreseeable oil and gas operations and associated infrastructure (e.g., compressors, flowlines), transpreserve oil and gas pipelines, new drilling and production wells, past forestry operations; authorized Preserve activities (e.g., fire management, trail and road maintenance, restoration, visitor use, etc.), unauthorized activities (e.g., offroad vehicle trespass), and natural processes (e.g., hurricane, flood, wildfire, etc.) in BTNP could contribute cumulative impacts on Preserve operations.

The no action alternative would contribute moderate negative effects to cumulative impacts on Preserve operations. The no action alternative in combination with past, present, and foreseeable future actions would result in net negative cumulative impacts on Preserve operations that are expected to be widespread and moderate over the long term under the no action alternative.

3.7.3.2 Conclusion, Alternative A

Under the no action alternative, impacts to Preserve operations would be moderate, long-term, and negative. Contribution of these moderate, long-term negative impacts to past, present, and future impacts, would result in moderate cumulative negative effects on Preserve operations.

3.7.4 Impacts on Preserve Operations under Alternative B, Preferred Alternative

Impacts to Preserve operations would be moderate negative and minor positive effects for the preferred alternative. Negative effects would include increased demand on personnel; increased demand on existing equipment; an expanded resource management program; increased need for specialized personnel training and certification; and other needs and adaptations associated with a major resource management effort. Demands on other Preserve programs and operations would likely occur as well, including law enforcement, maintenance, public education, interpretation, public relations, and administration. Although feral hog management activities would be conducted over the long-term, impacts would be considered short term relative to the duration of the treatment action (threats would not continue beyond the duration of the treatment action). Mitigation has been addressed for impacts to Preserve operations under section 2, including: the possible participation by USDA Wildlife Service agents. Allocation of funding for personnel (e.g., contractors), equipment, and supplies could be necessary to fully implement the hog management program, and would be required to sustain it over the long-term. Minor positive effects would arise through the reduction of feral hog impacts on Preserve operations, such as restoration projects and infrastructure maintenance, under the preferred alternative.

This alternative is intended to reduce negative impacts to other Preserve resources identified in this assessment.

3.7.4.1 Cumulative Impacts, Alternative B

Actions contributing to cumulative effects for this resource include all past, present, and foreseeable future BTNP operations and management activities in relation to activities discussed above under the no action alternative. Alternative B, the preferred alternative, in combination with past, present and reasonably foreseeable future actions, would contribute short-term, direct, negative impacts of moderate intensity to cumulative effects on Preserve operations. Minor positive impacts would slightly reduce these negative effects.

3.7.4.2 Conclusion, Alternative B

Impacts to Preserve operations under this alternative would be moderate, short-term, and intended to reduce negative impacts to other BTNP resources caused by feral hogs. Contribution of this alternative to cumulative negative effects on Preserve operations would be moderate and short-term, and while increasing cumulative impacts on Preserve operations, would decrease negative cumulative impacts to numerous BTNP resources and have minor benefits to some Preserve operations compared to the no action alternative.

3.8 IMPACTS ON NON-NATIVE SPECIES

3.8.1 Affected Environment

Section 4.4 of *NPS Management Policies 2006* addresses biological resource management, including management of native plants and animals. This policy states that NPS will maintain all native plants and animals as parts of the natural ecosystems of parks. BTNP promotes management practices to limit potential impacts to native plants and animals, to protect sensitive vegetation and fish and wildlife resources, and to prevent or limit invasive species.

Non-native species of known occurrence within BTNP include 141 taxa: 2 birds, 6 mammals (including feral hogs), 1 reptile, and 132 vascular plant species (Gulf Coast Network, 2010). Based on the Invasive Species Impact Rank system (Morse *et al.* 2004), which quantifies impact to native species and natural biodiversity, 14 of the non-native vascular plant species known to occur in BTNP have rankings considered “high” (Gulf Coast Network, 2010). Such plant species include tallowtree (*Triadica sebifera*), common water hyacinth (*Eichhornia crassipes*), large flower primrose-willow (*Ludwigia grandiflora*), English ivy (*Hedera helix*), Johnsongrass (*Sorghum halepense*), Japanese honeysuckle (*Lonicera japonica*), and others. Of the invasive species present in BTNP,

the greatest disturbance to Preserve resources has been recorded from feral hogs (e.g., Chavarria, 2006). As previously discussed under respective resource sections, feral hogs have had and continue to have a detrimental, and in some locations potentially irreversible, impact on BTNP resources.

3.8.2 Intensity Level Definitions

The thresholds of change for the intensity of an impact are defined as follows:

Negligible: Impacts would result in disturbance to native species, ecological communities, and/or the resource conditions and functions thereof, but the change would be so slight that it would not be of any measurable or perceptible consequence, such that it would not promote the introduction, continued existence, or spread of non-native species.

Minor: Impacts would result in a detectable change to native species, ecological communities, and/or the resource conditions and functions thereof, but the change would be small and of little consequence and would be expected to be short-term and localized, such that it would not promote the introduction, continued existence, or spread of non-native species. Mitigation measures, if needed to offset negative effects, would be relatively simple and likely successful.

Moderate: Impacts would result in a change to native species, ecological communities, and/or the resource conditions and functions thereof that would be measurable, long-term, and localized or widespread, such that they could likely promote the introduction, continued existence, or spread of non-native species. Mitigation measures would likely be needed to offset negative effects and could be extensive, but would likely be successful.

Major: Impacts would result in a change to native species, ecological communities, and/or the resource conditions and functions thereof that would be measurable and result in substantial consequences on a regional scale for long periods or be permanent. Impacts would promote the introduction, continued existence, or spread of non-native species. Extensive mitigation measures would be needed to offset any negative effects, and their success would not be guaranteed.

Definition of impact duration for introduction or promotion of non-native species includes short-term and long-term impacts. Short-term impacts are defined as those from which the affected resource recovers in three years or less. Long-term impacts are defined as those from which the affected resource takes more than three years to recover.

3.8.3 Impacts on Non-Native Species under Alternative A, No Action

The no action alternative would result in the continued existence and likely increase of the non-native feral hog in BTNP. Feral hog impacts and threats to natural resources through direct and indirect effects (as previously discussed) would continue. Impacts would be widespread, occurring throughout BTNP. Disturbance of native ecological communities by feral hogs, and alteration of disturbance cycles (Mack and D'Antonio, 1998) could disrupt abiotic and biotic resources and processes (Vitousek *et al.* 1996), alter plant community structure and species composition, and reduce ecosystem resiliency so as to increase vulnerability to invasion by other non-native plant and animal species (Cushman *et al.* 2004). Feral hog disturbance has been observed and will continue to facilitate invasion of non-native species, such as Chinese tallow tree, in BTNP (Siemann *et al.* 2009). Feral hogs may even function as seed dispersers for some invasive plants (Diong, 1982). Moderate negative effects to native communities that are long-term and widespread would occur under the no action alternative due to the direct damage by feral hogs (a non-native species) and introduction and/or promotion of non-native species by feral hog impacts to natural resources.

3.8.3.1 Cumulative Impacts, Alternative A

Effects from past, present, and foreseeable oil and gas operations and associated infrastructure (e.g., compressors, flowlines), transpreserve oil and gas pipelines, new drilling and production wells, past forestry operations; authorized Preserve activities (e.g., fire management, trail and road maintenance, restoration, visitor use, etc.), unauthorized activities (e.g., offroad vehicle trespass), and natural processes (e.g., hurricane, flood, wildfire, pest/pathogen effects) in BTNP could contribute to cumulative impacts on native communities through the introduction or promotion of non-native species. Impacts to native communities by non-native species would result from indirect impacts to natural resources collectively, as previously discussed individually for geologic resources, water quality or quantity, floodplains and wetlands, vegetation, wildlife, and inclusively species of special concern. BTNP management and protections provided to native species and communities, and the required control and management of non-native species under current laws, regulations, and policies are expected to result in the conservation of these resources, and the natural processes that maintain and improve them to some extent, resulting in positive cumulative effects.

However, the no action alternative would contribute moderate negative effects to cumulative impacts on native communities through the continued impacts from non-native feral hogs and its introduction or promotion of other non-native plant and animal species. The no action alternative in combination with the past, present, and foreseeable future actions would result in net negative cumulative negative impacts on native communities through introduction and/or promotion of non-native species, the

effects of which are expected to be widespread throughout BTNP and moderate over the long term under the no action alternative.

3.8.3.2 Conclusion, Alternative A

The no action alternative would have moderate, long-term, negative effects on native communities through the introduction or promotion of non-native species. Contribution of these moderate, long-term negative impacts to past, present, and future impacts, would result in moderate cumulative negative effects on native communities through the introduction or promotion of non-native species.

3.8.4 Impacts on Non-Native Species under Alternative B, Preferred Alternative

Under Alternative B, the preferred alternative, negative impacts to native communities through the introduction or promotion of non-native species would be negligible, short-term, and highly localized substrate disturbance associated with limited vehicular access and the placement of traps, protective fencing, blinds, and stands. The minimization and avoidance of impacts that promote non-native species have been addressed for these activities through mitigation measures, as described in section 2. This alternative is intended to reduce impacts from non-native species, specifically by targeted removal of the non-native feral hog, and indirectly by reducing the impacts of hog activities that introduce or promote non-native species. The preferred alternative would result in widespread moderate positive effects and a net positive impact on native communities over the long-term.

3.8.4.1 Cumulative Impacts, Alternative B

Impacts from past, present, and foreseeable actions would be identical to those identified for Alternative A. Alternative B, the preferred alternative, would contribute negligibly to cumulative negative impacts on native communities (with regards to non-native species) in BTNP, as discussed above, but would provide moderate positive effects by reducing the negative impacts of feral hogs on BTNP resources. Cumulative positive effects over the long-term are expected under the preferred alternative because of protections provided for native communities and the prevention of non-native species introduction and spread in the Preserve.

3.8.4.2 Conclusion, Alternative B

Negative impacts to native communities from introduction or promotion of non-native species under this alternative would be negligible, short-term, and intended to reduce negative impacts to other Preserve resources caused by feral hogs. The preferred

alternative would result in moderate positive effects and a net positive impact on native communities, compared to the no action alternative, through the removal of feral hogs. As such, the preferred alternative would contribute negligible negative and moderate positive effects to cumulative impacts on native communities in BTNP.

4.0 CONSULTATION AND COORDINATION

A Notice of Availability for the Feral Hog Management Plan and EA will be published in the Federal Register, announcing the availability of these documents for a 30-day public review and comment period.

Following the 30-day public review and comment period, NPS will consider written comments received. Additional mitigation measures resulting from the public involvement process may be applied by NPS as conditions of approval of the Plan of Operations. Copies of the decision document will be sent to those who comment on the Plan of Operations, EA, and/or draft Wetlands Statement of Findings during the public review period, or request a copy.

4.1 INTERNAL SCOPING

Prior internal scoping was conducted by Big Thicket National Preserve under several previous planning efforts addressing feral hog concerns and possible management approaches. In addition, a great deal of scoping, management plan development, NEPA analyses, and management plan implementation has been conducted by other national park units on this topic, which contributed to internal scoping herein. Internal scoping for this document was conducted by an interdisciplinary team of professionals from Big Thicket National Preserve and a consultant experienced with feral hog management plan development, environmental assessment, and supporting research and monitoring. Interdisciplinary team members met on October 10, 2012 and November 13, 2012 to discuss the purpose and need for the project; various alternatives; potential environmental impacts; past, present, and reasonably foreseeable projects that may have cumulative effects; and possible mitigation measures. Additional internal scoping was finalized over the next several weeks.

4.2 EXTERNAL SCOPING

A scoping brochure was sent out to several federal and state agencies, the Alabama Coushatta Tribe of Texas and other interested parties on January 9, 2013, initiating a 30-day public scoping period, which ended on February 10, 2013. Public meetings were also held in Woodville Texas on January 23, 2013, and in Beaumont, Texas on January 24, 2013.

Comments in response to the scoping brochure were received from the individuals in Dallas and Spurger, Texas, and the Sierra Club. The comments were in support of varying aspects of the proposed alternative. One commenter requested clarification of the term “authorized agent”, which is described in this document. Sierra Club comments were varied, and indicated support for a 2-4 week non-professional hunting season, professional year-round trapping, responsible, professional use of dogs, aggressive cooperation with neighboring landowners and agencies, prioritization of

efforts, reintroduction of native predators, and the disposal of taken hogs in the field. The Sierra Club also expressed concern about the potential use of ATV's or management of the hog population as a hunting stock. They also commented about the addition of solitude as an impact topic and a concern for bias towards a proposed alternative (i.e. choosing a preferred alternative before scoping). These comments have been addressed throughout the body of the EA.

Persons and agencies contacted via scoping, or that assisted in identifying important issues, developing alternatives, or analyzing impacts are listed below:

Federal Government

U.S. Congressman Steve Stockman
U.S. Congressman Randy Weber
U.S. Senator John Cornyn
U.S. Senator Ted Cruz
USDA Natural Resources Conservation Service,
 Livingston Field Office
 Liberty Field Office
Beaumont Field Office
USDA Forest Service,
 Southern Research Station
 National Forests and Grasslands of Texas
US Fish and Wildlife Service,
 Clear Lake Ecological Services Office
 Trinity River National Wildlife Refuge
 Anahuac National Wildlife Refuge
 McFaddin National Wildlife Refuge
 Texas Point National Wildlife Refuge
US Geological Survey,
 National Spatial Data Infrastructure Partnership Office
US Army Corps of Engineers

Alabama-Coushatta Tribe of Texas

Tribal Historical Preservation Office
Tribal Chair
Tribal Administrator

State Government

Governor Rick Perry
Texas Department of Transportation
Texas Historical Commission
Texas Railroad Commission
Texas Parks and Wildlife Department,
 Regional Director
East Texas Regional Director
Director of State Parks
Village Creek State Park

Project Manager, Land Conservation Program
Texas A&M Forest Service,
Sustainable Forestry Department Head
Woodville District Office

River and Water Authorities:

Sabine River Authority
Lower Neches SWCD
Lower Neches Valley Authority
Texas Water Development Board
Upper Neches River Municipal Water Authority

State House of Representatives:

Representative Joseph Deshotel
Representative Chuck Hopson
Representative Lois Kolkhorst
Representative Allan Ritter

State Senate:

Senator Robert Nichols

Local Government

Hardin County Commissioners, Judges, Sheriff, Floodplain Commissioner, Extension Office

Jasper County Commissioners, Judges, Sheriff

Jefferson County Commissioners, Judges, Sheriff,

Liberty County Commissioners, Judges, Sheriff

Orange County Commissioners, Judges, Sheriff

Polk County Commissioners, Judges, Sheriff

Tyler County Commissioners, Judges, Sheriff

Mayors of the Following Cities:

Beaumont

Jasper

Kountze

Liberty

Lumberton

Silsbee

Sour Lake

Vidor

West Orange

Woodville

Independent School Districts:

Beaumont ISD

Kountze ISD

Chambers of Commerce and Visitors Bureaus:

Beaumont Convention and Visitor Bureau

Jasper-Lake Sam Rayburn Chamber of Commerce

Ben J. Rogers Regional Visitor Center

Greater Beaumont Chamber of Commerce

Orange Chamber of Commerce

Texas Travel Information Center
Kirbyville Chamber of Commerce
Greater Cleveland Chamber of Commerce
Southeast Texas Regional Planning Commission
Port Arthur Chamber of Commerce
Silsbee Chamber of Commerce
Tyler County Chamber of Commerce
Liberty-Dayton Chamber of Commerce
Vidor Chamber of Commerce
Houston-Galveston Area Council
Livingston-Polk County Chamber of Commerce
Lumberton Chamber of Commerce
Kountze Chamber of Commerce
Wildwood Board of Directors

Nongovernmental Organizations

Natural and Cultural Resources

Texas Folklore Society
Big Thicket Association
Texas Conservation Alliance
Houston Audubon Society
National Parks Conservation Association
Art Museum of Southeast Texas
Heritage Museum
The Conservation Fund
The Lone Star Chapter of the Sierra Club
National Heritage Society
Texas Energy Museum
The Nature Conservancy
Hardin County Historical Society
Golden Triangle Audubon
Houston Wilderness Society
McFaddin Ward House
Big Thicket Natural Heritage Trust

Other Organizations

Deep East Texas Council of Governments
Texas Travel Industry Association

Other Entities

Universities and Research Organizations

Northwestern University Department of Environmental Policy and Culture
Lamar University Biology Department
Rice University
Texas A&M University Department of Wildlife and Fisheries Sciences
Houston Advanced Research Center

News Outlets

Guidry News Service

The Vidorian
Beaumont Enterprise
Wiley Mae Community Church
Cleveco
Entergy
Hancock Forest Management
Hearst Paper, Texas Group

4.3 AGENCY CONSULTATION

In accordance with the Endangered Species Act, NPS contacted the USFWS with regards to federally listed special status species, and in accordance with NPS policy, BTNP also contacted Texas Parks and Wildlife Department with regards to state-listed species. Both agencies were contacted via scoping notice on January 9, 2013.

In accordance with Section 106 of the National Historic Preservation Act, NPS provided the Texas State Historic Preservation Officer an opportunity to comments on the effects of this project. NPS found in their Assessment of Effect that the proposed project would have *no potential to cause effects* on Cultural Properties. This determination was shared with the Texas Historical Commission in a letter dated 12/18/2013.

4.4 NATIVE AMERICAN CONSULTATION

The Alabama-Coushatta Tribe of Texas was sent a scoping notice on January 9, 2013. In a letter dated 12/11/2013, NPS summarized the scope of the proposed project and requested input on any ethnographic or cultural resources that may be impacted by the proposed action. NPS also sent the Environmental Assessment to the Tribe.

4.5 LIST OF DOCUMENT RECIPIENTS

A direct mail notice of availability of the Feral Hog Management Plan and EA will be sent to several unaffiliated individuals and the scoping list in section 4.2 above. The following organizations will also be sent a notice of availability:

Texas Wildlife Association
Defenders of Wildlife (Florida Office)
In Solidarity with Animals
Animal Connection Texas (ACT)
Society of PEACE (People for the Earth, Animals, Compassion, & Enlightenment)

4.6 PREPARERS

This EA was prepared by Big Thicket National Preserve with the assistance of a contractor. The contributions and title/affiliation of each preparer and contributor are in Table 5: List of Preparers⁶ below.

Table 5: List of Preparers

NAME	CONTRIBUTION	TITLE/AFFILIATION
Stephanie Burgess	NPS Project Manager, Primary Author	Oil and Gas Program Manager/Big Thicket National Preserve
Douglas Neighbor	Overall Direction and Review	Superintendent/Big Thicket National Preserve
Deanna Boensch	Technical Review	Ecologist/Big Thicket National Preserve
Jalyn Cummings	Technical Review	Chief of Resources Management/Big Thicket National Preserve
Angela Bulger	Atkins NEPA Oversight, Editor	NEPA Compliance Manager/Atkins
John Williamson, CE	Primary Author	Senior Ecologist/Atkins
Scott Zengel, Ph.D, PWS	Atkins Project Manager, Primary Author	Project Manager/Atkins
Pedro Chavarria	Technical Expert, Editor	Senior Wildlife Biologist/Atkins

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Appendix A
Scoping Brochure

Appendix B

**Listed Species in Hardin, Jasper, Jefferson, Liberty, Orange,
Polk, and Tyler Counties, Texas**

**The National Park Service
wants your opinion
on feral hog management.**



Please join us for a public scoping meeting.

In Woodville:

Wednesday, January 23rd
Wheat Elementary School Cafeteria
306 Kirby Dr. Woodville, Texas 75979
5:00pm-7:00pm

In Beaumont:

Thursday, January 24th
Rogers Park Community Center
6540 Gladys, Beaumont, Texas 77706
5:00pm-7:00pm



Feral Hog Management Plan/Environmental Assessment

Project Scoping for an Environmental Assessment

January 10, 2013

The National Park Service (NPS) is preparing a Feral Hog Management Plan/Environmental Assessment (EA) for Big Thicket National Preserve. The plan will describe how feral hog populations will be managed to prevent or mitigate impacts on park resources and values. The EA, prepared in compliance with the National Environmental Policy Act, will provide the decision-making framework that identifies significant issues and concerns facing park management, a presentation and analysis of a reasonable range of management alternatives and their effects, and a strategy to determine long-term management of feral hog populations at Big Thicket National Preserve.

Background on Feral Hogs Within the Preserve

Feral hogs were introduced into the Big Thicket Region by the early settlers to the area. What was once a few hogs that were used as free-range livestock have since multiplied and become a severe threat to native species and habitats throughout much of Texas, including Big Thicket National Preserve.

Current management of this non-native species is accomplished primarily by the Preserve's public hunting program during the fall and winter each year. Recent studies by Texas A&M University researchers indicate that even with the current number of feral hogs harvested by hunters, their population levels are increasing steadily. Feral hogs have rooted up large areas of vegetation and soil in many areas within the Preserve. This rooting poses a threat to many native plant and animal species, as well as posing potential harm to the integrity of subsurface cultural resources artifacts. Hog damage poses a direct obstacle to the Preserve's goals associated with federally listed species recovery and other natural resource management, such as wetland management and long-leaf pine restoration.

Objectives

Internal scoping has defined the following objectives for the Feral Hog Management Plan/EA:

- 1) Provide for safety of visitors, staff and volunteers.
- 2) Reduce current damage to native plants, animals, and the ecological processes upon which they are dependent.
- 3) Prevent irreparable damage to resources that must be preserved for future generations.

- 4) Comply with policies on endangered species, exotic species, and multiple-use recreation as specified in the Preserve's enabling legislation.

Overview of the Process

(Item in **Bold** indicates current step in planning process.)

- Step 1. Define Objectives and Issues
- Step 2. Formulate Alternatives and Identify Preferred Alternative
- Step 3. **Conduct External Scoping** (Closes February 09, 2013)
- Step 4. Refine Alternatives and Identify Environmental Impacts
- Step 5. Prepare Draft Plan/Environmental Assessment
- Step 6. Public Review of Draft Plan/Environmental Assessment
- Step 7. Analysis of Public Comments
- Step 8. Prepare Final Plan/Decision Document
- Step 9. Release Final Plan/Decision Document to the Public

Resources and Concerns

Internal scoping identified the following resources and other concerns for consideration in the Management Plan/Environmental Assessment (EA):

- | | |
|------------------------------|-----------------------|
| • Air Quality | • Cultural Resources |
| • Geology and Soils | • Visitor Use |
| • Water Resources | • Natural Soundscapes |
| • Floodplains/Wetlands | • Adjacent Landowners |
| • Vegetation | • Socioeconomics |
| • Fish and Wildlife | • Park Management |
| • Species of Special Concern | • Non-native Species |

What does the scoping period mean? Scoping is done in the beginning phases of a project to seek input from a variety of sources. The input is used to identify issues, areas requiring additional study, and topics that will be analyzed in the EA process. This is an opportunity for you to provide us with your suggestions, comments, and concerns regarding this management plan for Big Thicket National Preserve.

Is scoping my only opportunity to comment on the project? No, once the EA is developed, the document will be made available for public review for a 30-day period.

Alternatives to be Evaluated in the EA

Alternative A (No Action). Under this alternative, the Preserve would maintain the status quo with regard to feral hog management. Public hunting through issuance of hunting permits would be the primary means of reducing feral hog population numbers. Current management for control of feral hogs on the Preserve includes permitted recreational hunting during the State of Texas's white-tailed deer archery-only season through general season and a subsequent hog-only extended season (lasting up to 3 months). The Preserve staff may also euthanize individual hogs if they pose an imminent threat to public safety (e.g., charging visitors on a trail).

Alternative B (Preferred Alternative). This alternative would be a range of management measures that could be employed on a site- and season-specific basis. NPS employees and/or authorized personnel would trap and/or shoot feral hogs in target areas within the Preserve. This alternative could include radio-tracking a limited number of trapped and released hogs ("Judas hogs") to assist with the directed shooting program. Trained dogs could be used to aid in the tracking and shooting of hogs. Where necessary and appropriate, protection of important areas from hog damage could include limited and localized installation of fencing. Additional activities under this alternative would include coordination with adjacent landowners/users, public information and education concerning feral hog management, and monitoring and research.

Measures	Alternative	
	A	B
Public Hunting (General Season)	X	X
Extend Public Hog Season Until February 29 th	X	X
Directed Trapping Program implemented by NPS/authorized personnel (live-capture traps)		X
Directed Shooting Program implemented by NPS/authorized personnel		X
Use of Judas Hog Tracking Approaches by NPS/authorized personnel		X
Use of Dogs by NPS/authorized personnel		X
Limited and Localized Use of Protective Fencing		X
Coordination with Adjacent Landowners/Users		X
Public Information and Education		X
Monitoring and Research		X

Alternatives Considered but Dismissed From Evaluation

The following alternatives were dismissed from detailed analysis in the EA due to their infeasibility, illegality, or significant risk to public safety:

- Trapping by Use of Snares
- Chemical Sterilization (population level)
- Use of Poisons/Toxicants
- Aerial Gunning
- Large-Scale or Park-Wide Fencing
- Biological Controls
- Public Trapping
- Extension of Public Hog Season Past February 29th

Please let us know by February 09, 2013:

- 1) **Are there any other Issues or Concerns with the project that you think we should consider?**
- 2) **Are there any other Alternatives that you think we should consider?**
- 3) **Do you have any other comments or suggestions you think we should consider in the EA?**

If you wish to comment on the scoping brochure or on any other issues associated with the project, you may submit your comments in the following ways:

- A copy of this newsletter will be posted to the NPS's new Planning Environment and Public Comment (PEPC) system. This system allows for users to submit comments electronically. It can be accessed at <http://parkplanning.nps.gov>.
- You may submit written comments to:
 Superintendent
 Big Thicket National Preserve
 Feral Hog Management Plan
 6044 FM 420
 Kountze, TX 77625
- Or, you may hand deliver comments to Big Thicket National Preserve at the address above.

If you wish to be added to the park's mailing list for this and other announcements, please indicate that in your response.

TYLER COUNTY

AMPHIBIANS

Federal Status

State Status

Pig frog

Lithobates grylio

prefers permanent bodies of open water with emergent vegetation; active mainly at night; eats insects and crustaceans; mating and egg-laying March-September; male vocalization a pig-like grunt

BIRDS

Federal Status

State Status

American Peregrine Falcon

Falco peregrinus anatum

DL

T

year-round resident and local breeder in west Texas, nests in tall cliff eyries; also, migrant across state from more northern breeding areas in US and Canada, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Arctic Peregrine Falcon

Falco peregrinus tundrius

DL

migrant throughout state from subspecies' far northern breeding range, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Bachman's Sparrow

Aimophila aestivalis

T

open pine woods with scattered bushes and grassy understory in Pineywoods region, brushy or overgrown grassy hillsides, overgrown fields with thickets and brambles, grassy orchards; remnant grasslands in Post Oak Savannah region; nests on ground against grass tuft or under low shrub

Bald Eagle

Haliaeetus leucocephalus

DL

T

found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds

Henslow's Sparrow

Ammodramus henslowii

wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking

Peregrine Falcon

Falco peregrinus

DL

T

both subspecies migrate across the state from more northern breeding areas in US and Canada to winter along coast and farther south; subspecies (F. p. anatum) is also a resident breeder in west Texas; the two subspecies' listing statuses differ, F.p. tundrius is no longer listed in Texas; but because the subspecies are not easily distinguishable at a distance, reference is generally made only to the species level; see subspecies for habitat.

Piping Plover

Charadrius melodus

LT

T

wintering migrant along the Texas Gulf Coast; beaches and bayside mud or salt flats

Red-cockaded Woodpecker

Picoides borealis

LE

E

cavity nests in older pine (60+ years); forages in younger pine (30+ years); prefers longleaf, shortleaf, and loblolly

TYLER COUNTY

BIRDS

		Federal Status	State Status
Sprague's Pipit	<i>Anthus spragueii</i>	C	
only in Texas during migration and winter, mid September to early April; short to medium distance, diurnal migrant; strongly tied to native upland prairie, can be locally common in coastal grasslands, uncommon to rare further west; sensitive to patch size and avoids edges.			
Swallow-tailed Kite	<i>Elanoides forficatus</i>		T
lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along rivers, lakes, and ponds; nests high in tall tree in clearing or on forest woodland edge, usually in pine, cypress, or various deciduous trees			
Wood Stork	<i>Mycteria americana</i>		T
forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960			

FISHES

		Federal Status	State Status
American eel	<i>Anguilla rostrata</i>		
coastal waterways below reservoirs to gulf; spawns January to February in ocean, larva move to coastal waters, metamorphose, then females move into freshwater; most aquatic habitats with access to ocean, muddy bottoms, still waters, large streams, lakes; can travel overland in wet areas; males in brackish estuaries; diet varies widely, geographically, and seasonally			
Blue sucker	<i>Cycleptus elongatus</i>		T
larger portions of major rivers in Texas; usually in channels and flowing pools with a moderate current; bottom type usually of exposed bedrock, perhaps in combination with hard clay, sand, and gravel; adults winter in deep pools and move upstream in spring to spawn on riffles			
Creek chubsucker	<i>Erimyzon oblongus</i>		T
tributaries of the Red, Sabine, Neches, Trinity, and San Jacinto rivers; small rivers and creeks of various types; seldom in impoundments; prefers headwaters, but seldom occurs in springs; young typically in headwater rivulets or marshes; spawns in river mouths or pools, riffles, lake outlets, upstream creeks			
Paddlefish	<i>Polyodon spathula</i>		T
prefers large, free-flowing rivers, but will frequent impoundments with access to spawning sites; spawns in fast, shallow water over gravel bars; larvae may drift from reservoir to reservoir			
Western sand darter	<i>Ammocrypta clara</i>		
Red and Sabine River basins; clear to slightly turbid water of medium to large rivers that have moderate to swift currents, primarily over extensive areas of sandy substrate			

TYLER COUNTY

MAMMALS

		Federal Status	State Status
Black bear	<i>Ursus americanus</i>	T/SA;NL	T
bottomland hardwoods and large tracts of inaccessible forested areas; due to field characteristics similar to Louisiana Black Bear (LT, T), treat all east Texas black bears as federal and state listed Threatened			
Louisiana black bear	<i>Ursus americanus luteolus</i>	LT	T
possible as transient; bottomland hardwoods and large tracts of inaccessible forested areas			
Plains spotted skunk	<i>Spilogale putorius interrupta</i>		
catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie			
Rafinesque's big-eared bat	<i>Corynorhinus rafinesquii</i>		T
roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures			
Red wolf	<i>Canis rufus</i>	LE	E
extirpated; formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies			
Southeastern myotis bat	<i>Myotis austroriparius</i>		
roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures			

MOLLUSKS

		Federal Status	State Status
Creepers (squawfoot)	<i>Strophitus undulatus</i>		
small to large streams, prefers gravel or gravel and mud in flowing water; Colorado, Guadalupe, San Antonio, Neches (historic), and Trinity (historic) River basins			
Fawnsfoot	<i>Truncilla donaciformis</i>		
small and large rivers especially on sand, mud, rocky mud, and sand and gravel, also silt and cobble bottoms in still to swiftly flowing waters; Red (historic), Cypress (historic), Sabine (historic), Neches, Trinity, and San Jacinto River basins.			
Little spectaclecase	<i>Villosa lienosa</i>		
creeks, rivers, and reservoirs, sandy substrates in slight to moderate current, usually along the banks in slower currents; east Texas, Cypress through San Jacinto River basins			
Louisiana pigtoe	<i>Pleurobema riddellii</i>		T
streams and moderate-size rivers, usually flowing water on substrates of mud, sand, and gravel; not generally known from impoundments; Sabine, Neches, and Trinity (historic) River basins			
Sandbank pocketbook	<i>Lampsilis satura</i>		T
small to large rivers with moderate flows and swift current on gravel, gravel-sand, and sand bottoms; east Texas, Sulfur south through San Jacinto River basins; Neches River			
Southern hickorynut	<i>Obovaria jacksoniana</i>		T
medium sized gravel substrates with low to moderate current; Neches, Sabine, and Cypress river basins			

TYLER COUNTY

MOLLUSKS

		Federal Status	State Status
Texas heelsplitter	<i>Potamilus amphichaenus</i>		T
quiet waters in mud or sand and also in reservoirs. Sabine, Neches, and Trinity River basins			
Texas pigtoe	<i>Fusconaia askewi</i>		T
rivers with mixed mud, sand, and fine gravel in protected areas associated with fallen trees or other structures; east Texas River basins, Sabine through Trinity rivers as well as San Jacinto River			
Wabash pigtoe	<i>Fusconaia flava</i>		
creeks to large rivers on mud, sand, and gravel from all habitats except deep shifting sands; found in moderate to swift current velocities; east Texas River basins, Red through San Jacinto River basins; elsewhere occurs in reservoirs and lakes with no flow			
Wartyback	<i>Quadrula nodulata</i>		
gravel and sand-gravel bottoms in medium to large rivers and on mud; Red, Sabine, Neches River basins			

REPTILES

		Federal Status	State Status
Alligator snapping turtle	<i>Macrochelys temminckii</i>		T
perennial water bodies; deep water of rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near deep running water; sometimes enters brackish coastal waters; usually in water with mud bottom and abundant aquatic vegetation; may migrate several miles along rivers; active March-October; breeds April-October			
Louisiana pine snake	<i>Pituophis ruthveni</i>	C	T
mixed deciduous-longleaf pine woodlands; breeds April-September			
Northern scarlet snake	<i>Cemophora coccinea copei</i>		T
mixed hardwood scrub on sandy soils; feeds on reptile eggs; semi-fossorial; active April-September			
Sabine map turtle	<i>Graptemys ouachitensis sabinensis</i>		
Sabine River system; rivers and related tributaries, ponds and reservoirs with abundant aquatic vegetation; basks on fallen logs and exposed roots; eats insects, crustaceans, mollusks, and aquatic plants; breeding and egg-laying March-May, with hatchlings appearing in early fall			
Timber/Canebrake rattlesnake	<i>Crotalus horridus</i>		T
swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto			

PLANTS

		Federal Status	State Status
Chapman's orchid	<i>Platanthera chapmanii</i>		
in Texas, appears restricted to wetland pine savannas and savanna swales in hillside seepage bogs, two very restricted and declining habitats in the State; flowering July-August			

TYLER COUNTY

PLANTS

Federal Status

State Status

Florida ladies-tresses

Spiranthes brevilabris var. *floridana*

Moist to wet, relatively open sites of pine-dominated landscapes, mesic pine uplands, open scrub pinelands with saw palmetto, Catahoula sandstone barrens, meadows, open grassy lawns, pitcher plant and seepage bogs, wet prairies, wet savannahs, and flatwoods. Delicate, nearly ephemeral, orchid with winter rosette. Flowers Apr-May.

Long-sepaed false dragon-head

Physostegia longisepala

relatively open areas on poorly drained, acid loams on level terrain over Beaumont, Deweyville, and Montgomery formations; probably originally found in fire-maintained wetland pine savannas or in the transition zone between such flatwoods and adjacent coastal prairies, now found primarily in secondary habitats, such as wet borrow ditches along roadsides and moist areas in human-made clearings in pine woodlands; flowering early May-early July

Navasota false foxglove

Agalinis navasotensis

Texas endemic; relatively sparsely vegetated, shallow, sandy soils on calcareous sandstone outcrops of the Oakville Formation, with associated surrounding species more typical of Edwards Plateau, than Post Oak Savanna or Blackland Prairie; also, Catahoula Formation barrens in pine savanna; flowering September-October

Panicled indigobush

Amorpha paniculata

A stout shrub, 3 m (9 ft) tall that grows in acid seep forests, peat bogs, wet floodplain forests, and seasonal wetlands on the edge of Saline Prairies in East Texas. It is distinguished from other *Amorpha* species by its fuzzy leaflets with prominent raised veins underneath, and the flower panicles, which are 8 to 16 inches long and slender, held above the foliage.

Texas ladies'-tresses

Spiranthes brevilabris var. *brevilabris*

Sandy soils in moist prairies, incl. blackland/Fleming prairies, calcareous prairie pockets surrounded by pines, pine-hardwood forest, open pinelands, wetland pine savannahs/flatwoods, and dry to moist fields, meadows, and roadsides. Delicate, nearly ephemeral orchid, producing winter rosettes, flowers Feb-Apr. Historically endemic to SE coastal plain.

Texas screwstem

Bartonia texana

in and around acid seeps in Pine-Oak forests on gentle slopes and baygall shrub thickets at spring heads; often on clumps of bryophytes at tree bases, on roots, and on logs; flowering September-November, can be identified in mid to late October when its in fruit

Texas trailing phlox

Phlox nivalis ssp. *texensis*

LE

E

Texas endemic; relatively open fire-maintained pine or pine-hardwood forests on soils with a deep, sandy surface layer and clayey subsurface layers; flowering late March-early April (-May)

White firewheel

Gaillardia aestivalis var. *winkleri*

Texas endemic; open pine-oak woodlands and farkleberry sandhills in deep, loose, well-drained whitish sands; flowering late spring (May-June) and sporadically through early fall

POLK COUNTY

BIRDS

		Federal Status	State Status
American Peregrine Falcon	<i>Falco peregrinus anatum</i>	DL	T
year-round resident and local breeder in west Texas, nests in tall cliff eyries; also, migrant across state from more northern breeding areas in US and Canada, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.			
Arctic Peregrine Falcon	<i>Falco peregrinus tundrius</i>	DL	
migrant throughout state from subspecies' far northern breeding range, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.			
Bachman's Sparrow	<i>Aimophila aestivalis</i>		T
open pine woods with scattered bushes and grassy understory in Pineywoods region, brushy or overgrown grassy hillsides, overgrown fields with thickets and brambles, grassy orchards; remnant grasslands in Post Oak Savannah region; nests on ground against grass tuft or under low shrub			
Bald Eagle	<i>Haliaeetus leucocephalus</i>	DL	T
found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds			
Henslow's Sparrow	<i>Ammodramus henslowii</i>		
wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking			
Peregrine Falcon	<i>Falco peregrinus</i>	DL	T
both subspecies migrate across the state from more northern breeding areas in US and Canada to winter along coast and farther south; subspecies (F. p. anatum) is also a resident breeder in west Texas; the two subspecies' listing statuses differ, F.p. tundrius is no longer listed in Texas; but because the subspecies are not easily distinguishable at a distance, reference is generally made only to the species level; see subspecies for habitat.			
Piping Plover	<i>Charadrius melodus</i>	LT	T
wintering migrant along the Texas Gulf Coast; beaches and bayside mud or salt flats			
Red-cockaded Woodpecker	<i>Picoides borealis</i>	LE	E
cavity nests in older pine (60+ years); forages in younger pine (30+ years); prefers longleaf, shortleaf, and loblolly			
Sprague's Pipit	<i>Anthus spragueii</i>	C	
only in Texas during migration and winter, mid September to early April; short to medium distance, diurnal migrant; strongly tied to native upland prairie, can be locally common in coastal grasslands, uncommon to rare further west; sensitive to patch size and avoids edges.			

POLK COUNTY

BIRDS

		Federal Status	State Status
Swallow-tailed Kite	<i>Elanoides forficatus</i>		T

lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along rivers, lakes, and ponds; nests high in tall tree in clearing or on forest woodland edge, usually in pine, cypress, or various deciduous trees

Wood Stork	<i>Mycteria americana</i>		T
forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960			

FISHES

		Federal Status	State Status
American eel	<i>Anguilla rostrata</i>		

coastal waterways below reservoirs to gulf; spawns January to February in ocean, larva move to coastal waters, metamorphose, then females move into freshwater; most aquatic habitats with access to ocean, muddy bottoms, still waters, large streams, lakes; can travel overland in wet areas; males in brackish estuaries; diet varies widely, geographically, and seasonally

Creek chubsucker	<i>Erimyzon oblongus</i>		T
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tributaries of the Red, Sabine, Neches, Trinity, and San Jacinto rivers; small rivers and creeks of various types; seldom in impoundments; prefers headwaters, but seldom occurs in springs; young typically in headwater rivulets or marshes; spawns in river mouths or pools, riffles, lake outlets, upstream creeks

Orangebelly darter	<i>Etheostoma radiosum</i>		
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Red through Angelina River basins; just headwaters ranging from high gradient streams to more sluggish lowland streams, gravel and rubble riffles preferred; eggs buried in gravel and riffle raceways, post-larvae live in quiet water, move into progressively faster water as they mature, young feed mostly on copepods and cladocerans, adults on mayfly and fly larvae, spawn late February through mid-April in eastern Texas

Paddlefish	<i>Polyodon spathula</i>		T
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prefers large, free-flowing rivers, but will frequent impoundments with access to spawning sites; spawns in fast, shallow water over gravel bars; larvae may drift from reservoir to reservoir

MAMMALS

		Federal Status	State Status
Black bear	<i>Ursus americanus</i>	T/SA;NL	T

bottomland hardwoods and large tracts of inaccessible forested areas; due to field characteristics similar to Louisiana Black Bear (LT, T), treat all east Texas black bears as federal and state listed Threatened

Louisiana black bear	<i>Ursus americanus luteolus</i>	LT	T
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possible as transient; bottomland hardwoods and large tracts of inaccessible forested areas

Plains spotted skunk	<i>Spilogale putorius interrupta</i>		
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catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie

POLK COUNTY

MAMMALS

		Federal Status	State Status
Rafinesque's big-eared bat	<i>Corynorhinus rafinesquii</i>		T
roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures			
Red wolf	<i>Canis rufus</i>	LE	E
extirpated; formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies			
Southeastern myotis bat	<i>Myotis austroriparius</i>		
roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures			

MOLLUSKS

		Federal Status	State Status
Creeper (squawfoot)	<i>Strophitus undulatus</i>		
small to large streams, prefers gravel or gravel and mud in flowing water; Colorado, Guadalupe, San Antonio, Neches (historic), and Trinity (historic) River basins			
Fawnsfoot	<i>Truncilla donaciformis</i>		
small and large rivers especially on sand, mud, rocky mud, and sand and gravel, also silt and cobble bottoms in still to swiftly flowing waters; Red (historic), Cypress (historic), Sabine (historic), Neches, Trinity, and San Jacinto River basins.			
Little spectaclecase	<i>Villosa lienosa</i>		
creeks, rivers, and reservoirs, sandy substrates in slight to moderate current, usually along the banks in slower currents; east Texas, Cypress through San Jacinto River basins			
Louisiana pigtoe	<i>Pleurobema riddellii</i>		T
streams and moderate-size rivers, usually flowing water on substrates of mud, sand, and gravel; not generally known from impoundments; Sabine, Neches, and Trinity (historic) River basins			
Sandbank pocketbook	<i>Lampsilis satura</i>		T
small to large rivers with moderate flows and swift current on gravel, gravel-sand, and sand bottoms; east Texas, Sulfur south through San Jacinto River basins; Neches River			
Southern hickorynut	<i>Obovaria jacksoniana</i>		T
medium sized gravel substrates with low to moderate current; Neches, Sabine, and Cypress river basins			
Texas heelsplitter	<i>Potamilus amphichaenus</i>		T
quiet waters in mud or sand and also in reservoirs. Sabine, Neches, and Trinity River basins			
Texas pigtoe	<i>Fusconaia askewi</i>		T
rivers with mixed mud, sand, and fine gravel in protected areas associated with fallen trees or other structures; east Texas River basins, Sabine through Trinity rivers as well as San Jacinto River			
Wabash pigtoe	<i>Fusconaia flava</i>		
creeks to large rivers on mud, sand, and gravel from all habitats except deep shifting sands; found in moderate to swift current velocities; east Texas River basins, Red through San Jacinto River basins; elsewhere occurs in reservoirs and lakes with no flow			

POLK COUNTY

MOLLUSKS

Federal Status

State Status

Wartyback

Quadrula nodulata

gravel and sand-gravel bottoms in medium to large rivers and on mud; Red, Sabine, Neches River basins

REPTILES

Federal Status

State Status

Alligator snapping turtle

Macrochelys temminckii

T

perennial water bodies; deep water of rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near deep running water; sometimes enters brackish coastal waters; usually in water with mud bottom and abundant aquatic vegetation; may migrate several miles along rivers; active March-October; breeds April-October

Louisiana pine snake

Pituophis ruthveni

C

T

mixed deciduous-longleaf pine woodlands; breeds April-September

Timber/Canebrake rattlesnake

Crotalus horridus

T

swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto

PLANTS

Federal Status

State Status

Panicled indigobush

Amorpha paniculata

A stout shrub, 3 m (9 ft) tall that grows in acid seep forests, peat bogs, wet floodplain forests, and seasonal wetlands on the edge of Saline Prairies in East Texas. It is distinguished from other *Amorpha* species by its fuzzy leaflets with prominent raised veins underneath, and the flower panicles, which are 8 to 16 inches long and slender, held above the foliage.

Texas screwstem

Bartonia texana

in and around acid seeps in Pine-Oak forests on gentle slopes and baygall shrub thickets at spring heads; often on clumps of bryophytes at tree bases, on roots, and on logs; flowering September-November, can be identified in mid to late October when its in fruit

Texas trailing phlox

Phlox nivalis ssp texensis

LE

E

Texas endemic; relatively open fire-maintained pine or pine-hardwood forests on soils with a deep, sandy surface layer and clayey subsurface layers; flowering late March-early April (-May)

ORANGE COUNTY

AMPHIBIANS

Federal Status

State Status

Pig frog

Lithobates grylio

prefers permanent bodies of open water with emergent vegetation; active mainly at night; eats insects and crustaceans; mating and egg-laying March-September; male vocalization a pig-like grunt

BIRDS

Federal Status

State Status

American Peregrine Falcon

Falco peregrinus anatum

DL

T

year-round resident and local breeder in west Texas, nests in tall cliff eyries; also, migrant across state from more northern breeding areas in US and Canada, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Arctic Peregrine Falcon

Falco peregrinus tundrius

DL

migrant throughout state from subspecies' far northern breeding range, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Bald Eagle

Haliaeetus leucocephalus

DL

T

found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds

Brown Pelican

Pelecanus occidentalis

DL

largely coastal and near shore areas, where it roosts and nests on islands and spoil banks

Henslow's Sparrow

Ammodramus henslowii

wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking

Peregrine Falcon

Falco peregrinus

DL

T

both subspecies migrate across the state from more northern breeding areas in US and Canada to winter along coast and farther south; subspecies (F. p. anatum) is also a resident breeder in west Texas; the two subspecies' listing statuses differ, F.p. tundrius is no longer listed in Texas; but because the subspecies are not easily distinguishable at a distance, reference is generally made only to the species level; see subspecies for habitat.

Piping Plover

Charadrius melodus

LT

T

wintering migrant along the Texas Gulf Coast; beaches and bayside mud or salt flats

Sooty Tern

Sterna fuscata

T

predominately 'on the wing'; does not dive, but snatches small fish and squid with bill as it flies or hovers over water; breeding April-July

ORANGE COUNTY

BIRDS

		Federal Status	State Status
Sprague's Pipit	<i>Anthus spragueii</i>	C	
only in Texas during migration and winter, mid September to early April; short to medium distance, diurnal migrant; strongly tied to native upland prairie, can be locally common in coastal grasslands, uncommon to rare further west; sensitive to patch size and avoids edges.			
Swallow-tailed Kite	<i>Elanoides forficatus</i>		T
lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along rivers, lakes, and ponds; nests high in tall tree in clearing or on forest woodland edge, usually in pine, cypress, or various deciduous trees			
White-faced Ibis	<i>Plegadis chihi</i>		T
prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats			
Wood Stork	<i>Mycteria americana</i>		T
forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960			

FISHES

		Federal Status	State Status
American eel	<i>Anguilla rostrata</i>		
coastal waterways below reservoirs to gulf; spawns January to February in ocean, larva move to coastal waters, metamorphose, then females move into freshwater; most aquatic habitats with access to ocean, muddy bottoms, still waters, large streams, lakes; can travel overland in wet areas; males in brackish estuaries; diet varies widely, geographically, and seasonally			
Ironcolor shiner	<i>Notropis chalybaeus</i>		
Big Cypress Bayou and Sabine River basins; spawns April-September, eggs sink to bottom of pool; pools and slow runs of low gradient small acidic streams with sandy substrate and clear well vegetated water; feeds mainly on small insects, ingested plant material not digested			

MAMMALS

		Federal Status	State Status
Black bear	<i>Ursus americanus</i>	T/SA;NL	T
bottomland hardwoods and large tracts of inaccessible forested areas; due to field characteristics similar to Louisiana Black Bear (LT, T), treat all east Texas black bears as federal and state listed Threatened			
Louisiana black bear	<i>Ursus americanus luteolus</i>	LT	T
possible as transient; bottomland hardwoods and large tracts of inaccessible forested areas			
Plains spotted skunk	<i>Spilogale putorius interrupta</i>		
catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie			

ORANGE COUNTY

MAMMALS

		Federal Status	State Status
Rafinesque's big-eared bat	<i>Corynorhinus rafinesquii</i>		T
roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures			
Red wolf	<i>Canis rufus</i>	LE	E
extirpated; formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies			
Southeastern myotis bat	<i>Myotis austroriparius</i>		
roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures			

MOLLUSKS

		Federal Status	State Status
Creeper (squawfoot)	<i>Strophitus undulatus</i>		
small to large streams, prefers gravel or gravel and mud in flowing water; Colorado, Guadalupe, San Antonio, Neches (historic), and Trinity (historic) River basins			
Fawnsfoot	<i>Truncilla donaciformis</i>		
small and large rivers especially on sand, mud, rocky mud, and sand and gravel, also silt and cobble bottoms in still to swiftly flowing waters; Red (historic), Cypress (historic), Sabine (historic), Neches, Trinity, and San Jacinto River basins.			
Little spectaclecase	<i>Villosa lienosa</i>		
creeks, rivers, and reservoirs, sandy substrates in slight to moderate current, usually along the banks in slower currents; east Texas, Cypress through San Jacinto River basins			
Louisiana pigtoe	<i>Pleurobema riddellii</i>		T
streams and moderate-size rivers, usually flowing water on substrates of mud, sand, and gravel; not generally known from impoundments; Sabine, Neches, and Trinity (historic) River basins			
Sandbank pocketbook	<i>Lampsilis satura</i>		T
small to large rivers with moderate flows and swift current on gravel, gravel-sand, and sand bottoms; east Texas, Sulfur south through San Jacinto River basins; Neches River			
Southern hickorynut	<i>Obovaria jacksoniana</i>		T
medium sized gravel substrates with low to moderate current; Neches, Sabine, and Cypress river basins			
Texas heelsplitter	<i>Potamilus amphichaenus</i>		T
quiet waters in mud or sand and also in reservoirs. Sabine, Neches, and Trinity River basins			
Texas pigtoe	<i>Fusconaia askewi</i>		T
rivers with mixed mud, sand, and fine gravel in protected areas associated with fallen trees or other structures; east Texas River basins, Sabine through Trinity rivers as well as San Jacinto River			
Wabash pigtoe	<i>Fusconaia flava</i>		
creeks to large rivers on mud, sand, and gravel from all habitats except deep shifting sands; found in moderate to swift current velocities; east Texas River basins, Red through San Jacinto River basins; elsewhere occurs in reservoirs and lakes with no flow			

ORANGE COUNTY

MOLLUSKS

Federal Status

State Status

Wartyback

Quadrula nodulata

gravel and sand-gravel bottoms in medium to large rivers and on mud; Red, Sabine, Neches River basins

REPTILES

Federal Status

State Status

Alligator snapping turtle

Macrochelys temminckii

T

perennial water bodies; deep water of rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near deep running water; sometimes enters brackish coastal waters; usually in water with mud bottom and abundant aquatic vegetation; may migrate several miles along rivers; active March-October; breeds April-October

Gulf Saltmarsh snake

Nerodia clarkii

saline flats, coastal bays, and brackish river mouthss

Northern scarlet snake

Cemophora coccinea copei

T

mixed hardwood scrub on sandy soils; feeds on reptile eggs; semi-fossorial; active April-September

Sabine map turtle

Graptemys ouachitensis sabinensis

Sabine River system; rivers and related tributaries, ponds and reservoirs with abundant aquatic vegetation; basks on fallen logs and exposed roots; eats insects, crustaceans, mollusks, and aquatic plants; breeding and egg-laying March-May, with hatchlings appearing in early fall

Texas diamondback terrapin

Malaclemys terrapin littoralis

coastal marshes, tidal flats, coves, estuaries, and lagoons behind barrier beaches; brackish and salt water; burrows into mud when inactive; may venture into lowlands at high tide

Texas horned lizard

Phrynosoma cornutum

T

open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September

Timber/Canebrake rattlesnake

Crotalus horridus

T

swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto

PLANTS

Federal Status

State Status

Chapman's orchid

Platanthera chapmanii

in Texas, appears restricted to wetland pine savannas and savanna swales in hillside seepage bogs, two very restricted and declining habitats in the State; flowering July-August

ORANGE COUNTY

PLANTS

Federal Status State Status

Long-sepaled false dragon-head *Physostegia longisepala*

relatively open areas on poorly drained, acid loams on level terrain over Beaumont, Deweyville, and Montgomery formations; probably originally found in fire-maintained wetland pine savannas or in the transition zone between such flatwoods and adjacent coastal prairies, now found primarily in secondary habitats, such as wet borrow ditches along roadsides and moist areas in human-made clearings in pine woodlands; flowering early May-early July

LIBERTY COUNTY

AMPHIBIANS

		Federal Status	State Status
Houston toad	<i>Anaxyrus houstonensis</i>	LE	E
endemic; sandy substrate, water in pools, ephemeral pools, stock tanks; breeds in spring especially after rains; burrows in soil of adjacent uplands when inactive; breeds February-June; associated with soils of the Sparta, Carrizo, Goliad, Queen City, Recklaw, Weches, and Willis geologic formations			

BIRDS

		Federal Status	State Status
American Peregrine Falcon	<i>Falco peregrinus anatum</i>	DL	T
year-round resident and local breeder in west Texas, nests in tall cliff eyries; also, migrant across state from more northern breeding areas in US and Canada, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.			
Arctic Peregrine Falcon	<i>Falco peregrinus tundrius</i>	DL	
migrant throughout state from subspecies' far northern breeding range, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.			
Bachman's Sparrow	<i>Aimophila aestivalis</i>		T
open pine woods with scattered bushes and grassy understory in Pineywoods region, brushy or overgrown grassy hillsides, overgrown fields with thickets and brambles, grassy orchards; remnant grasslands in Post Oak Savannah region; nests on ground against grass tuft or under low shrub			
Bald Eagle	<i>Haliaeetus leucocephalus</i>	DL	T
found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds			
Henslow's Sparrow	<i>Ammodramus henslowii</i>		
wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking			
Peregrine Falcon	<i>Falco peregrinus</i>	DL	T
both subspecies migrate across the state from more northern breeding areas in US and Canada to winter along coast and farther south; subspecies (F. p. anatum) is also a resident breeder in west Texas; the two subspecies' listing statuses differ, F.p. tundrius is no longer listed in Texas; but because the subspecies are not easily distinguishable at a distance, reference is generally made only to the species level; see subspecies for habitat.			
Piping Plover	<i>Charadrius melodus</i>	LT	T
wintering migrant along the Texas Gulf Coast; beaches and bayside mud or salt flats			

LIBERTY COUNTY

BIRDS

		Federal Status	State Status
Red-cockaded Woodpecker	<i>Picoides borealis</i>	LE	E
cavity nests in older pine (60+ years); forages in younger pine (30+ years); prefers longleaf, shortleaf, and loblolly			
Sprague's Pipit	<i>Anthus spragueii</i>	C	
only in Texas during migration and winter, mid September to early April; short to medium distance, diurnal migrant; strongly tied to native upland prairie, can be locally common in coastal grasslands, uncommon to rare further west; sensitive to patch size and avoids edges.			
Swallow-tailed Kite	<i>Elanoides forficatus</i>		T
lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along rivers, lakes, and ponds; nests high in tall tree in clearing or on forest woodland edge, usually in pine, cypress, or various deciduous trees			
White-faced Ibis	<i>Plegadis chihi</i>		T
prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats			
Wood Stork	<i>Mycteria americana</i>		T
forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960			

FISHES

		Federal Status	State Status
American eel	<i>Anguilla rostrata</i>		
coastal waterways below reservoirs to gulf; spawns January to February in ocean, larva move to coastal waters, metamorphose, then females move into freshwater; most aquatic habitats with access to ocean, muddy bottoms, still waters, large streams, lakes; can travel overland in wet areas; males in brackish estuaries; diet varies widely, geographically, and seasonally			
Creek chubsucker	<i>Erimyzon oblongus</i>		T
tributaries of the Red, Sabine, Neches, Trinity, and San Jacinto rivers; small rivers and creeks of various types; seldom in impoundments; prefers headwaters, but seldom occurs in springs; young typically in headwater rivulets or marshes; spawns in river mouths or pools, riffles, lake outlets, upstream creeks			
Paddlefish	<i>Polyodon spathula</i>		T
prefers large, free-flowing rivers, but will frequent impoundments with access to spawning sites; spawns in fast, shallow water over gravel bars; larvae may drift from reservoir to reservoir			

INSECTS

		Federal Status	State Status
Gulf Coast clubtail	<i>Gomphus modestus</i>		

LIBERTY COUNTY

INSECTS

Federal Status

State Status

medium river, moderate gradient, and streams with silty sand or rocky bottoms; adults forage in trees, males perch near riffles to wait for females, larvae overwinter; flight season late Apr - late Jun

MAMMALS

Federal Status

State Status

Black bear

Ursus americanus

T/SA;NL

T

bottomland hardwoods and large tracts of inaccessible forested areas; due to field characteristics similar to Louisiana Black Bear (LT, T), treat all east Texas black bears as federal and state listed Threatened

Louisiana black bear

Ursus americanus luteolus

LT

T

possible as transient; bottomland hardwoods and large tracts of inaccessible forested areas

Plains spotted skunk

Spilogale putorius interrupta

catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie

Rafinesque's big-eared bat

Corynorhinus rafinesquii

T

roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures

Red wolf

Canis rufus

LE

E

extirpated; formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies

Southeastern myotis bat

Myotis austroriparius

roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures

MOLLUSKS

Federal Status

State Status

Creepers (squawfoot)

Strophitus undulatus

small to large streams, prefers gravel or gravel and mud in flowing water; Colorado, Guadalupe, San Antonio, Neches (historic), and Trinity (historic) River basins

Fawnsfoot

Truncilla donaciformis

small and large rivers especially on sand, mud, rocky mud, and sand and gravel, also silt and cobble bottoms in still to swiftly flowing waters; Red (historic), Cypress (historic), Sabine (historic), Neches, Trinity, and San Jacinto River basins.

Little spectaclecase

Villosa lienosa

creeks, rivers, and reservoirs, sandy substrates in slight to moderate current, usually along the banks in slower currents; east Texas, Cypress through San Jacinto River basins

Louisiana pigtoe

Pleurobema riddellii

T

streams and moderate-size rivers, usually flowing water on substrates of mud, sand, and gravel; not generally known from impoundments; Sabine, Neches, and Trinity (historic) River basins

LIBERTY COUNTY

MOLLUSKS

		Federal Status	State Status
Sandbank pocketbook	<i>Lampsilis satura</i>		T
small to large rivers with moderate flows and swift current on gravel, gravel-sand, and sand bottoms; east Texas, Sulfur south through San Jacinto River basins; Neches River			
Texas heelsplitter	<i>Potamilus amphichaenus</i>		T
quiet waters in mud or sand and also in reservoirs. Sabine, Neches, and Trinity River basins			
Texas pigtoe	<i>Fusconaia askewi</i>		T
rivers with mixed mud, sand, and fine gravel in protected areas associated with fallen trees or other structures; east Texas River basins, Sabine through Trinity rivers as well as San Jacinto River			
Wabash pigtoe	<i>Fusconaia flava</i>		
creeks to large rivers on mud, sand, and gravel from all habitats except deep shifting sands; found in moderate to swift current velocities; east Texas River basins, Red through San Jacinto River basins; elsewhere occurs in reservoirs and lakes with no flow			

REPTILES

		Federal Status	State Status
Alligator snapping turtle	<i>Macrochelys temminckii</i>		T
perennial water bodies; deep water of rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near deep running water; sometimes enters brackish coastal waters; usually in water with mud bottom and abundant aquatic vegetation; may migrate several miles along rivers; active March-October; breeds April-October			
Louisiana pine snake	<i>Pituophis ruthveni</i>	C	T
mixed deciduous-longleaf pine woodlands; breeds April-September			
Northern scarlet snake	<i>Cemophora coccinea copei</i>		T
mixed hardwood scrub on sandy soils; feeds on reptile eggs; semi-fossorial; active April-September			
Texas horned lizard	<i>Phrynosoma cornutum</i>		T
open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September			
Timber/Canebrake rattlesnake	<i>Crotalus horridus</i>		T
swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto			

JEFFERSON COUNTY

AMPHIBIANS

Federal Status

State Status

Pig frog

Lithobates grylio

prefers permanent bodies of open water with emergent vegetation; active mainly at night; eats insects and crustaceans; mating and egg-laying March-September; male vocalization a pig-like grunt

BIRDS

Federal Status

State Status

American Peregrine Falcon

Falco peregrinus anatum

DL

T

year-round resident and local breeder in west Texas, nests in tall cliff eyries; also, migrant across state from more northern breeding areas in US and Canada, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Arctic Peregrine Falcon

Falco peregrinus tundrius

DL

migrant throughout state from subspecies' far northern breeding range, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Bald Eagle

Haliaeetus leucocephalus

DL

T

found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds

Black Rail

Laterallus jamaicensis

salt, brackish, and freshwater marshes, pond borders, wet meadows, and grassy swamps; nests in or along edge of marsh, sometimes on damp ground, but usually on mat of previous year's dead grasses; nest usually hidden in marsh grass or at base of Salicornia

Brown Pelican

Pelecanus occidentalis

DL

largely coastal and near shore areas, where it roosts and nests on islands and spoil banks

Henslow's Sparrow

Ammodramus henslowii

wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking

Peregrine Falcon

Falco peregrinus

DL

T

both subspecies migrate across the state from more northern breeding areas in US and Canada to winter along coast and farther south; subspecies (F. p. anatum) is also a resident breeder in west Texas; the two subspecies' listing statuses differ, F.p. tundrius is no longer listed in Texas; but because the subspecies are not easily distinguishable at a distance, reference is generally made only to the species level; see subspecies for habitat.

Piping Plover

Charadrius melodus

LT

T

wintering migrant along the Texas Gulf Coast; beaches and bayside mud or salt flats

JEFFERSON COUNTY

BIRDS

		Federal Status	State Status
Reddish Egret	<i>Egretta rufescens</i>		T
resident of the Texas Gulf Coast; brackish marshes and shallow salt ponds and tidal flats; nests on ground or in trees or bushes, on dry coastal islands in brushy thickets of yucca and prickly pear			
Snowy Plover	<i>Charadrius alexandrinus</i>		
formerly an uncommon breeder in the Panhandle; potential migrant; winter along coast			
Southeastern Snowy Plover	<i>Charadrius alexandrinus tenuirostris</i>		
wintering migrant along the Texas Gulf Coast beaches and bayside mud or salt flats			
Sprague's Pipit	<i>Anthus spragueii</i>	C	
only in Texas during migration and winter, mid September to early April; short to medium distance, diurnal migrant; strongly tied to native upland prairie, can be locally common in coastal grasslands, uncommon to rare further west; sensitive to patch size and avoids edges.			
Swallow-tailed Kite	<i>Elanoides forficatus</i>		T
lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along rivers, lakes, and ponds; nests high in tall tree in clearing or on forest woodland edge, usually in pine, cypress, or various deciduous trees			
Western Snowy Plover	<i>Charadrius alexandrinus nivosus</i>		
uncommon breeder in the Panhandle; potential migrant; winter along coast			
White-faced Ibis	<i>Plegadis chihi</i>		T
prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats			
Wood Stork	<i>Mycteria americana</i>		T
forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960			

FISHES

		Federal Status	State Status
American eel	<i>Anguilla rostrata</i>		
coastal waterways below reservoirs to gulf; spawns January to February in ocean, larva move to coastal waters, metamorphose, then females move into freshwater; most aquatic habitats with access to ocean, muddy bottoms, still waters, large streams, lakes; can travel overland in wet areas; males in brackish estuaries; diet varies widely, geographically, and seasonally			
Smalltooth sawfish	<i>Pristis pectinata</i>	LE	E

JEFFERSON COUNTY

FISHES

Federal Status

State Status

different life history stages have different patterns of habitat use; young found very close to shore in muddy and sandy bottoms, seldom descending to depths greater than 32 ft (10 m); in sheltered bays, on shallow banks, and in estuaries or river mouths; adult sawfish are encountered in various habitat types (mangrove, reef, seagrass, and coral), in varying salinity regimes and temperatures, and at various water depths, feed on a variety of fish species and crustaceans

INSECTS

Federal Status

State Status

Bay skipper

Euphyes bayensis

apparently tidal sawgrass marsh only, probably covers same range of salinity as saw grass, nectarivore (butterfly), herbivore (caterpillar), larval foodplant is so far unconfirmed but is probably sawgrass, diurnal; two well separated broods apparently peaking in late May and in September which suggests the larvae may well aestivate in summer and the next brood hibernate

MAMMALS

Federal Status

State Status

Black bear

Ursus americanus

T/SA;NL

T

bottomland hardwoods and large tracts of inaccessible forested areas; due to field characteristics similar to Louisiana Black Bear (LT, T), treat all east Texas black bears as federal and state listed Threatened

Louisiana black bear

Ursus americanus luteolus

LT

T

possible as transient; bottomland hardwoods and large tracts of inaccessible forested areas

Plains spotted skunk

Spilogale putorius interrupta

catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie

Rafinesque's big-eared bat

Corynorhinus rafinesquii

T

roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures

Red wolf

Canis rufus

LE

E

extirpated; formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies

Southeastern myotis bat

Myotis austroriparius

roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures

MOLLUSKS

Federal Status

State Status

Creeping (squawfoot)

Strophitus undulatus

small to large streams, prefers gravel or gravel and mud in flowing water; Colorado, Guadalupe, San Antonio, Neches (historic), and Trinity (historic) River basins

JEFFERSON COUNTY

MOLLUSKS

		Federal Status	State Status
Fawnsfoot	<i>Truncilla donaciformis</i>		
small and large rivers especially on sand, mud, rocky mud, and sand and gravel, also silt and cobble bottoms in still to swiftly flowing waters; Red (historic), Cypress (historic), Sabine (historic), Neches, Trinity, and San Jacinto River basins.			
Little spectaclecase	<i>Villosa lienosa</i>		
creeks, rivers, and reservoirs, sandy substrates in slight to moderate current, usually along the banks in slower currents; east Texas, Cypress through San Jacinto River basins			
Louisiana pigtoe	<i>Pleurobema riddellii</i>		T
streams and moderate-size rivers, usually flowing water on substrates of mud, sand, and gravel; not generally known from impoundments; Sabine, Neches, and Trinity (historic) River basins			
Sandbank pocketbook	<i>Lampsilis satura</i>		T
small to large rivers with moderate flows and swift current on gravel, gravel-sand, and sand bottoms; east Texas, Sulfur south through San Jacinto River basins; Neches River			
Southern hickorynut	<i>Obovaria jacksoniana</i>		T
medium sized gravel substrates with low to moderate current; Neches, Sabine, and Cypress river basins			
Texas heelsplitter	<i>Potamilus amphichaenus</i>		T
quiet waters in mud or sand and also in reservoirs. Sabine, Neches, and Trinity River basins			
Texas pigtoe	<i>Fusconaia askewi</i>		T
rivers with mixed mud, sand, and fine gravel in protected areas associated with fallen trees or other structures; east Texas River basins, Sabine through Trinity rivers as well as San Jacinto River			
Wabash pigtoe	<i>Fusconaia flava</i>		
creeks to large rivers on mud, sand, and gravel from all habitats except deep shifting sands; found in moderate to swift current velocities; east Texas River basins, Red through San Jacinto River basins; elsewhere occurs in reservoirs and lakes with no flow			
Wartyback	<i>Quadrula nodulata</i>		
gravel and sand-gravel bottoms in medium to large rivers and on mud; Red, Sabine, Neches River basins			

REPTILES

		Federal Status	State Status
Alligator snapping turtle	<i>Macrochelys temminckii</i>		T
perennial water bodies; deep water of rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near deep running water; sometimes enters brackish coastal waters; usually in water with mud bottom and abundant aquatic vegetation; may migrate several miles along rivers; active March-October; breeds April-October			
Atlantic hawksbill sea turtle	<i>Eretmochelys imbricata</i>	LE	E
Gulf and bay system, warm shallow waters especially in rocky marine environments, such as coral reefs and jetties, juveniles found in floating mats of sea plants; feed on sponges, jellyfish, sea urchins, molluscs, and crustaceans, nests April through November			

JEFFERSON COUNTY

REPTILES

		Federal Status	State Status
Green sea turtle	<i>Chelonia mydas</i>	LT	T
Gulf and bay system; shallow water seagrass beds, open water between feeding and nesting areas, barrier island beaches; adults are herbivorous feeding on sea grass and seaweed; juveniles are omnivorous feeding initially on marine invertebrates, then increasingly on sea grasses and seaweeds; nesting behavior extends from March to October, with peak activity in May and June			
Gulf Saltmarsh snake	<i>Nerodia clarkii</i>		
saline flats, coastal bays, and brackish river mouthss			
Kemp's Ridley sea turtle	<i>Lepidochelys kempii</i>	LE	E
Gulf and bay system, adults stay within the shallow waters of the Gulf of Mexico; feed primarily on crabs, but also snails, clams, other crustaceans and plants, juveniles feed on sargassum and its associated fauna; nests April through August			
Leatherback sea turtle	<i>Dermochelys coriacea</i>	LE	E
Gulf and bay systems, and widest ranging open water reptile; omnivorous, shows a preference for jellyfish; in the US portion of their western Atlantic nesting territories, nesting season ranges from March to August			
Loggerhead sea turtle	<i>Caretta caretta</i>	LT	T
Gulf and bay system primarily for juveniles, adults are most pelagic of the sea turtles; omnivorous, shows a preference for mollusks, crustaceans, and coral; nests from April through November			
Northern scarlet snake	<i>Cemophora coccinea copei</i>		T
mixed hardwood scrub on sandy soils; feeds on reptile eggs; semi-fossorial; active April-September			
Sabine map turtle	<i>Graptemys ouachitensis sabinensis</i>		
Sabine River system; rivers and related tributaries, ponds and reservoirs with abundant aquatic vegetation; basks on fallen logs and exposed roots; eats insects, crustaceans, mollusks, and aquatic plants; breeding and egg-laying March-May, with hatchlings appearing in early fall			
Texas diamondback terrapin	<i>Malaclemys terrapin littoralis</i>		
coastal marshes, tidal flats, coves, estuaries, and lagoons behind barrier beaches; brackish and salt water; burrows into mud when inactive; may venture into lowlands at high tide			
Texas horned lizard	<i>Phrynosoma cornutum</i>		T
open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September			
Timber/Canebrake rattlesnake	<i>Crotalus horridus</i>		T
swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto			

JEFFERSON COUNTY

PLANTS

Federal Status State Status

Chapman's orchid *Platanthera chapmanii*

in Texas, appears restricted to wetland pine savannas and savanna swales in hillside seepage bogs, two very restricted and declining habitats in the State; flowering July-August

Florida ladies-tresses *Spiranthes brevilabris* var. *floridana*

Moist to wet, relatively open sites of pine-dominated landscapes, mesic pine uplands, open scrub pinelands with saw palmetto, Catahoula sandstone barrens, meadows, open grassy lawns, pitcher plant and seepage bogs, wet prairies, wet savannahs, and flatwoods. Delicate, nearly ephemeral, orchid with winter rosette. Flowers Apr-May.

JASPER COUNTY

AMPHIBIANS

Federal Status

State Status

Pig frog

Lithobates grylio

prefers permanent bodies of open water with emergent vegetation; active mainly at night; eats insects and crustaceans; mating and egg-laying March-September; male vocalization a pig-like grunt

BIRDS

Federal Status

State Status

American Peregrine Falcon

Falco peregrinus anatum

DL

T

year-round resident and local breeder in west Texas, nests in tall cliff eyries; also, migrant across state from more northern breeding areas in US and Canada, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Arctic Peregrine Falcon

Falco peregrinus tundrius

DL

migrant throughout state from subspecies' far northern breeding range, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Bachman's Sparrow

Aimophila aestivalis

T

open pine woods with scattered bushes and grassy understory in Pineywoods region, brushy or overgrown grassy hillsides, overgrown fields with thickets and brambles, grassy orchards; remnant grasslands in Post Oak Savannah region; nests on ground against grass tuft or under low shrub

Bald Eagle

Haliaeetus leucocephalus

DL

T

found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds

Henslow's Sparrow

Ammodramus henslowii

wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking

Peregrine Falcon

Falco peregrinus

DL

T

both subspecies migrate across the state from more northern breeding areas in US and Canada to winter along coast and farther south; subspecies (F. p. anatum) is also a resident breeder in west Texas; the two subspecies' listing statuses differ, F.p. tundrius is no longer listed in Texas; but because the subspecies are not easily distinguishable at a distance, reference is generally made only to the species level; see subspecies for habitat.

Piping Plover

Charadrius melodus

LT

T

wintering migrant along the Texas Gulf Coast; beaches and bayside mud or salt flats

Red-cockaded Woodpecker

Picoides borealis

LE

E

cavity nests in older pine (60+ years); forages in younger pine (30+ years); prefers longleaf, shortleaf, and loblolly

JASPER COUNTY

BIRDS

		Federal Status	State Status
Sprague's Pipit	<i>Anthus spragueii</i>	C	
only in Texas during migration and winter, mid September to early April; short to medium distance, diurnal migrant; strongly tied to native upland prairie, can be locally common in coastal grasslands, uncommon to rare further west; sensitive to patch size and avoids edges.			
Swallow-tailed Kite	<i>Elanoides forficatus</i>		T
lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along rivers, lakes, and ponds; nests high in tall tree in clearing or on forest woodland edge, usually in pine, cypress, or various deciduous trees			
White-faced Ibis	<i>Plegadis chihi</i>		T
prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats			
Wood Stork	<i>Mycteria americana</i>		T
forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960			

FISHES

		Federal Status	State Status
American eel	<i>Anguilla rostrata</i>		
coastal waterways below reservoirs to gulf; spawns January to February in ocean, larva move to coastal waters, metamorphose, then females move into freshwater; most aquatic habitats with access to ocean, muddy bottoms, still waters, large streams, lakes; can travel overland in wet areas; males in brackish estuaries; diet varies widely, geographically, and seasonally			
Blue sucker	<i>Cycleptus elongatus</i>		T
larger portions of major rivers in Texas; usually in channels and flowing pools with a moderate current; bottom type usually of exposed bedrock, perhaps in combination with hard clay, sand, and gravel; adults winter in deep pools and move upstream in spring to spawn on riffles			
Creek chubsucker	<i>Erimyzon oblongus</i>		T
tributaries of the Red, Sabine, Neches, Trinity, and San Jacinto rivers; small rivers and creeks of various types; seldom in impoundments; prefers headwaters, but seldom occurs in springs; young typically in headwater rivulets or marshes; spawns in river mouths or pools, riffles, lake outlets, upstream creeks			
Ironcolor shiner	<i>Notropis chalybaeus</i>		
Big Cypress Bayou and Sabine River basins; spawns April-September, eggs sink to bottom of pool; pools and slow runs of low gradient small acidic streams with sandy substrate and clear well vegetated water; feeds mainly on small insects, ingested plant material not digested			

JASPER COUNTY

FISHES

Federal Status

State Status

Orangebelly darter

Etheostoma radiosum

Red through Angelina River basins; just headwaters ranging from high gradient streams to more sluggish lowland streams, gravel and rubble riffles preferred; eggs buried in gravel and riffle raceways, post-larvae live in quiet water, move into progressively faster water as they mature, young feed mostly on copepods and cladocerans, adults on mayfly and fly larvae, spawn late February through mid-April in eastern Texas

Paddlefish

Polyodon spathula

T

prefers large, free-flowing rivers, but will frequent impoundments with access to spawning sites; spawns in fast, shallow water over gravel bars; larvae may drift from reservoir to reservoir

Western sand darter

Ammocrypta clara

Red and Sabine River basins; clear to slightly turbid water of medium to large rivers that have moderate to swift currents, primarily over extensive areas of sandy substrate

INSECTS

Federal Status

State Status

A mayfly

Plautidius gloveri

NY, SC, TX; mayflies distinguished by aquatic larval stage; adult stage generally found in bankside vegetation

MAMMALS

Federal Status

State Status

Black bear

Ursus americanus

T/SA;NL

T

bottomland hardwoods and large tracts of inaccessible forested areas; due to field characteristics similar to Louisiana Black Bear (LT, T), treat all east Texas black bears as federal and state listed Threatened

Louisiana black bear

Ursus americanus luteolus

LT

T

possible as transient; bottomland hardwoods and large tracts of inaccessible forested areas

Plains spotted skunk

Spilogale putorius interrupta

catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie

Rafinesque's big-eared bat

Corynorhinus rafinesquii

T

roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures

Red wolf

Canis rufus

LE

E

extirpated; formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies

Southeastern myotis bat

Myotis austroriparius

roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures

JASPER COUNTY

MOLLUSKS

Federal Status

State Status

Creeper (squawfoot)

Strophitus undulatus

small to large streams, prefers gravel or gravel and mud in flowing water; Colorado, Guadalupe, San Antonio, Neches (historic), and Trinity (historic) River basins

Fawnsfoot

Truncilla donaciformis

small and large rivers especially on sand, mud, rocky mud, and sand and gravel, also silt and cobble bottoms in still to swiftly flowing waters; Red (historic), Cypress (historic), Sabine (historic), Neches, Trinity, and San Jacinto River basins.

Little spectaclecase

Villosa lienosa

creeks, rivers, and reservoirs, sandy substrates in slight to moderate current, usually along the banks in slower currents; east Texas, Cypress through San Jacinto River basins

Louisiana pigtoe

Pleurobema riddellii

T

streams and moderate-size rivers, usually flowing water on substrates of mud, sand, and gravel; not generally known from impoundments; Sabine, Neches, and Trinity (historic) River basins

Sandbank pocketbook

Lampsilis satura

T

small to large rivers with moderate flows and swift current on gravel, gravel-sand, and sand bottoms; east Texas, Sulfur south through San Jacinto River basins; Neches River

Southern hickorynut

Obovaria jacksoniana

T

medium sized gravel substrates with low to moderate current; Neches, Sabine, and Cypress river basins

Texas heelsplitter

Potamilus amphichaenus

T

quiet waters in mud or sand and also in reservoirs. Sabine, Neches, and Trinity River basins

Texas pigtoe

Fusconaia askewi

T

rivers with mixed mud, sand, and fine gravel in protected areas associated with fallen trees or other structures; east Texas River basins, Sabine through Trinity rivers as well as San Jacinto River

Wabash pigtoe

Fusconaia flava

creeks to large rivers on mud, sand, and gravel from all habitats except deep shifting sands; found in moderate to swift current velocities; east Texas River basins, Red through San Jacinto River basins; elsewhere occurs in reservoirs and lakes with no flow

Wartyback

Quadrula nodulata

gravel and sand-gravel bottoms in medium to large rivers and on mud; Red, Sabine, Neches River basins

REPTILES

Federal Status

State Status

Alligator snapping turtle

Macrochelys temminckii

T

perennial water bodies; deep water of rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near deep running water; sometimes enters brackish coastal waters; usually in water with mud bottom and abundant aquatic vegetation; may migrate several miles along rivers; active March-October; breeds April-October

JASPER COUNTY

REPTILES

		Federal Status	State Status
Louisiana pine snake	<i>Pituophis ruthveni</i>	C	T
mixed deciduous-longleaf pine woodlands; breeds April-September			
Northern scarlet snake	<i>Cemophora coccinea copei</i>		T
mixed hardwood scrub on sandy soils; feeds on reptile eggs; semi-fossorial; active April-September			
Sabine map turtle	<i>Graptemys ouachitensis sabinensis</i>		
Sabine River system; rivers and related tributaries, ponds and reservoirs with abundant aquatic vegetation; basks on fallen logs and exposed roots; eats insects, crustaceans, mollusks, and aquatic plants; breeding and egg-laying March-May, with hatchlings appearing in early fall			
Timber/Canebrake rattlesnake	<i>Crotalus horridus</i>		T
swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto			

PLANTS

		Federal Status	State Status
Long-sepaed false dragon-head	<i>Physostegia longisepala</i>		
relatively open areas on poorly drained, acid loams on level terrain over Beaumont, Deweyville, and Montgomery formations; probably originally found in fire-maintained wetland pine savannas or in the transition zone between such flatwoods and adjacent coastal prairies, now found primarily in secondary habitats, such as wet borrow ditches along roadsides and moist areas in human-made clearings in pine woodlands; flowering early May-early July			
Navasota ladies'-tresses	<i>Spiranthes parksii</i>	LE	E
Texas endemic; openings in post oak woodlands in sandy loams along upland drainages or intermittent streams, often in areas with suitable hydrologic factors, such as a perched water table associated with the underlying claypan; flowering populations fluctuate widely from year to year, an individual plant does not flower every year; flowering late October-early November (-early December)			
Neches River rose-mallow	<i>Hibiscus dasycalyx</i>	T	
Texas endemic; open marshy habitats in seasonally wet alluvial soils, most often near standing rather than flowing water; flowering June-August			
Nodding yucca	<i>Yucca cernua</i>		
Texas endemic; openings in and margins of pine-hardwood forests on brownish acid clays of the Redco Series; flowering/fruiting June-November			
Paniced indigobush	<i>Amorpha paniculata</i>		
A stout shrub, 3 m (9 ft) tall that grows in acid seep forests, peat bogs, wet floodplain forests, and seasonal wetlands on the edge of Saline Prairies in East Texas. It is distinguished from other <i>Amorpha</i> species by its fuzzy leaflets with prominent raised veins underneath, and the flower panicles, which are 8 to 16 inches long and slender, held above the foliage.			

JASPER COUNTY

PLANTS

Federal Status State Status

Texas screwstem *Bartonia texana*

in and around acid seeps in Pine-Oak forests on gentle slopes and baygall shrub thickets at spring heads; often on clumps of bryophytes at tree bases, on roots, and on logs; flowering September-November, can be identified in mid to late October when its in fruit

Texas trillium *Trillium texanum*

in or along the margins of hardwood forests on wet acid soils of bottoms and lower slopes, strongly associated with forested seeps and baygalls; flowering March-May

HARDIN COUNTY

AMPHIBIANS

Federal Status

State Status

Pig frog

Lithobates grylio

prefers permanent bodies of open water with emergent vegetation; active mainly at night; eats insects and crustaceans; mating and egg-laying March-September; male vocalization a pig-like grunt

BIRDS

Federal Status

State Status

American Peregrine Falcon

Falco peregrinus anatum

DL

T

year-round resident and local breeder in west Texas, nests in tall cliff eyries; also, migrant across state from more northern breeding areas in US and Canada, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Arctic Peregrine Falcon

Falco peregrinus tundrius

DL

migrant throughout state from subspecies' far northern breeding range, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Bachman's Sparrow

Aimophila aestivalis

T

open pine woods with scattered bushes and grassy understory in Pineywoods region, brushy or overgrown grassy hillsides, overgrown fields with thickets and brambles, grassy orchards; remnant grasslands in Post Oak Savannah region; nests on ground against grass tuft or under low shrub

Bald Eagle

Haliaeetus leucocephalus

DL

T

found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds

Henslow's Sparrow

Ammodramus henslowii

wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking

Peregrine Falcon

Falco peregrinus

DL

T

both subspecies migrate across the state from more northern breeding areas in US and Canada to winter along coast and farther south; subspecies (F. p. anatum) is also a resident breeder in west Texas; the two subspecies' listing statuses differ, F.p. tundrius is no longer listed in Texas; but because the subspecies are not easily distinguishable at a distance, reference is generally made only to the species level; see subspecies for habitat.

Piping Plover

Charadrius melodus

LT

T

wintering migrant along the Texas Gulf Coast; beaches and bayside mud or salt flats

Red-cockaded Woodpecker

Picoides borealis

LE

E

cavity nests in older pine (60+ years); forages in younger pine (30+ years); prefers longleaf, shortleaf, and loblolly

HARDIN COUNTY

BIRDS

		Federal Status	State Status
Sprague's Pipit	<i>Anthus spragueii</i>	C	
only in Texas during migration and winter, mid September to early April; short to medium distance, diurnal migrant; strongly tied to native upland prairie, can be locally common in coastal grasslands, uncommon to rare further west; sensitive to patch size and avoids edges.			
Swallow-tailed Kite	<i>Elanoides forficatus</i>		T
lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along rivers, lakes, and ponds; nests high in tall tree in clearing or on forest woodland edge, usually in pine, cypress, or various deciduous trees			
White-faced Ibis	<i>Plegadis chihi</i>		T
prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats			
Wood Stork	<i>Mycteria americana</i>		T
forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960			

FISHES

		Federal Status	State Status
American eel	<i>Anguilla rostrata</i>		
coastal waterways below reservoirs to gulf; spawns January to February in ocean, larva move to coastal waters, metamorphose, then females move into freshwater; most aquatic habitats with access to ocean, muddy bottoms, still waters, large streams, lakes; can travel overland in wet areas; males in brackish estuaries; diet varies widely, geographically, and seasonally			
Blue sucker	<i>Cycleptus elongatus</i>		T
larger portions of major rivers in Texas; usually in channels and flowing pools with a moderate current; bottom type usually of exposed bedrock, perhaps in combination with hard clay, sand, and gravel; adults winter in deep pools and move upstream in spring to spawn on riffles			
Creek chubsucker	<i>Erimyzon oblongus</i>		T
tributaries of the Red, Sabine, Neches, Trinity, and San Jacinto rivers; small rivers and creeks of various types; seldom in impoundments; prefers headwaters, but seldom occurs in springs; young typically in headwater rivulets or marshes; spawns in river mouths or pools, riffles, lake outlets, upstream creeks			
Paddlefish	<i>Polyodon spathula</i>		T
prefers large, free-flowing rivers, but will frequent impoundments with access to spawning sites; spawns in fast, shallow water over gravel bars; larvae may drift from reservoir to reservoir			
Western sand darter	<i>Ammocrypta clara</i>		
Red and Sabine River basins; clear to slightly turbid water of medium to large rivers that have moderate to swift currents, primarily over extensive areas of sandy substrate			

HARDIN COUNTY

MAMMALS

		Federal Status	State Status
Black bear	<i>Ursus americanus</i>	T/SA;NL	T
bottomland hardwoods and large tracts of inaccessible forested areas; due to field characteristics similar to Louisiana Black Bear (LT, T), treat all east Texas black bears as federal and state listed Threatened			
Louisiana black bear	<i>Ursus americanus luteolus</i>	LT	T
possible as transient; bottomland hardwoods and large tracts of inaccessible forested areas			
Plains spotted skunk	<i>Spilogale putorius interrupta</i>		
catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie			
Rafinesque's big-eared bat	<i>Corynorhinus rafinesquii</i>		T
roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures			
Red wolf	<i>Canis rufus</i>	LE	E
extirpated; formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies			
Southeastern myotis bat	<i>Myotis austroriparius</i>		
roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures			

MOLLUSKS

		Federal Status	State Status
Creepers (squawfoot)	<i>Strophitus undulatus</i>		
small to large streams, prefers gravel or gravel and mud in flowing water; Colorado, Guadalupe, San Antonio, Neches (historic), and Trinity (historic) River basins			
Fawnsfoot	<i>Truncilla donaciformis</i>		
small and large rivers especially on sand, mud, rocky mud, and sand and gravel, also silt and cobble bottoms in still to swiftly flowing waters; Red (historic), Cypress (historic), Sabine (historic), Neches, Trinity, and San Jacinto River basins.			
Little spectaclecase	<i>Villosa lienosa</i>		
creeks, rivers, and reservoirs, sandy substrates in slight to moderate current, usually along the banks in slower currents; east Texas, Cypress through San Jacinto River basins			
Louisiana pigtoe	<i>Pleurobema riddellii</i>		T
streams and moderate-size rivers, usually flowing water on substrates of mud, sand, and gravel; not generally known from impoundments; Sabine, Neches, and Trinity (historic) River basins			
Sandbank pocketbook	<i>Lampsilis satura</i>		T
small to large rivers with moderate flows and swift current on gravel, gravel-sand, and sand bottoms; east Texas, Sulfur south through San Jacinto River basins; Neches River			
Southern hickorynut	<i>Obovaria jacksoniana</i>		T
medium sized gravel substrates with low to moderate current; Neches, Sabine, and Cypress river basins			

HARDIN COUNTY

MOLLUSKS

		Federal Status	State Status
Texas heelsplitter	<i>Potamilus amphichaenus</i>		T
quiet waters in mud or sand and also in reservoirs. Sabine, Neches, and Trinity River basins			
Texas pigtoe	<i>Fusconaia askewi</i>		T
rivers with mixed mud, sand, and fine gravel in protected areas associated with fallen trees or other structures; east Texas River basins, Sabine through Trinity rivers as well as San Jacinto River			
Triangle pigtoe	<i>Fusconaia lananensis</i>		T
mixed mud, sand, and fine gravel substrates; Neches River basin in the Angelina branch and possibly Village Creek			
Wabash pigtoe	<i>Fusconaia flava</i>		
creeks to large rivers on mud, sand, and gravel from all habitats except deep shifting sands; found in moderate to swift current velocities; east Texas River basins, Red through San Jacinto River basins; elsewhere occurs in reservoirs and lakes with no flow			
Wartyback	<i>Quadrula nodulata</i>		
gravel and sand-gravel bottoms in medium to large rivers and on mud; Red, Sabine, Neches River basins			

REPTILES

		Federal Status	State Status
Alligator snapping turtle	<i>Macrochelys temminckii</i>		T
perennial water bodies; deep water of rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near deep running water; sometimes enters brackish coastal waters; usually in water with mud bottom and abundant aquatic vegetation; may migrate several miles along rivers; active March-October; breeds April-October			
Louisiana pine snake	<i>Pituophis ruthveni</i>	C	T
mixed deciduous-longleaf pine woodlands; breeds April-September			
Northern scarlet snake	<i>Cemophora coccinea copei</i>		T
mixed hardwood scrub on sandy soils; feeds on reptile eggs; semi-fossorial; active April-September			
Sabine map turtle	<i>Graptemys ouachitensis sabinensis</i>		
Sabine River system; rivers and related tributaries, ponds and reservoirs with abundant aquatic vegetation; basks on fallen logs and exposed roots; eats insects, crustaceans, mollusks, and aquatic plants; breeding and egg-laying March-May, with hatchlings appearing in early fall			
Timber/Canebrake rattlesnake	<i>Crotalus horridus</i>		T
swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto			

HARDIN COUNTY

PLANTS

Federal Status

State Status

Chapman's orchid

Platanthera chapmanii

in Texas, appears restricted to wetland pine savannas and savanna swales in hillside seepage bogs, two very restricted and declining habitats in the State; flowering July-August

Florida ladies-tresses

Spiranthes brevilabris var. *floridana*

Moist to wet, relatively open sites of pine-dominated landscapes, mesic pine uplands, open scrub pinelands with saw palmetto, Catahoula sandstone barrens, meadows, open grassy lawns, pitcher plant and seepage bogs, wet prairies, wet savannahs, and flatwoods. Delicate, nearly ephemeral, orchid with winter rosette. Flowers Apr-May.

Long-sepaed false dragon-head

Physostegia longisepala

relatively open areas on poorly drained, acid loams on level terrain over Beaumont, Deweyville, and Montgomery formations; probably originally found in fire-maintained wetland pine savannas or in the transition zone between such flatwoods and adjacent coastal prairies, now found primarily in secondary habitats, such as wet borrow ditches along roadsides and moist areas in human-made clearings in pine woodlands; flowering early May-early July

Texas screwstem

Bartonia texana

in and around acid seeps in Pine-Oak forests on gentle slopes and baygall shrub thickets at spring heads; often on clumps of bryophytes at tree bases, on roots, and on logs; flowering September-November, can be identified in mid to late October when its in fruit

Texas trailing phlox

Phlox nivalis ssp. *texensis*

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Texas endemic; relatively open fire-maintained pine or pine-hardwood forests on soils with a deep, sandy surface layer and clayey subsurface layers; flowering late March-early April (-May)

White firewheel

Gaillardia aestivalis var. *winkleri*

Texas endemic; open pine-oak woodlands and farkleberry sandhills in deep, loose, well-drained whitish sands; flowering late spring (May-June) and sporadically through early fall