

Preface

This document represents the first attempt to synthesize and report on all the endangered resources activities of the Texas Parks and Wildlife Department. It is intended to both convey information to the public and to solicit public input into the Department's Endangered Resources Program. It will be produced annually and hopefully its effectiveness as well as the story it tells of our success in protecting the endangered resources of this State will improve over time; therefore, any criticisms or questions you may have regarding its content and structure are welcome. Please direct any comments to:

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I. INTRODUCTION

A. Status of Endangered Resources in Texas

Species extinction is sometimes a natural evolutionary process, but the primary immediate threat to the rare species and significant natural communities of Texas is wide-scale habitat destruction and fragmentation that is uniquely caused by modern civilization. Major impacts include urbanization, cultivation, timber production, overgrazing, reductions in water quality and supply, and water development. For example, all but a fraction of the grasslands of the Blackland Prairie and Coastal Prairie have been converted to row crops, and as a result the Attwater's Prairie Chicken is on the brink of extinction and the once common three-flowered thurrovia is now rare. Only one near-climax stand of beech-magnolia forest remains un-cut in East Texas, bottomland hardwoods have been reduced from 16 million to 6 million acres, longleaf pine woodlands have essentially been entirely cut over. As a result of these changes in East Texas, Texas trailing phlox and many other plants are rare, the Ivory-billed Woodpecker has been extirpated from Texas, the Red-cockaded Woodpecker is threatened with the same fate. The original grasslands of South Texas have been converted to shrublands by overgrazing, the grassland-dependent Aplomado Falcon has been extirpated, the slender rush pea is endangered, and South Texas ragweed has become rare. Sub-tropical thorn woodlands of the Rio Grande Valley have been converted to row crops and citrus plantations, resulting in the near-extinction of the Ocelot in Texas and increasing rarity for many plants such as Bailey's ballmoss. Reservoir construction and ground water pumping in West Texas have reduced or modified spring runs and stream flows so that species such as the Amistad Gambusia and Phantom Shiner are extinct and many other endemic species, such as the puzzle sunflower, are rare. Urbanization, land clearing, and other land management practices in central Texas have destroyed and fragmented woodland habitat of the endangered Golden-cheeked Warbler.

Many impacts to endangered resources can be minimized or mitigated if information on their status and ecology is available, and if an effective framework for conservation action is in place. Conservation of these unique natural resources has been limited in the past for a variety of reasons, including lack of information on their status, lack of funding for research on status and on management techniques, lack of funding for preservation of natural areas and habitat required for their existence, and lack of awareness of the nature and extent of the problem on the part of the general public and policy makers.

Only in the past several years have some of these impediments been lessened. A cooperative agreement with the U.S. Fish and Wildlife Service provided for by the federal Endangered Species Act greatly increased the money available to Texas for endangered species work. A recent survey of the general public conducted cooperatively by the Texas Parks and Wildlife Department (TPWD) and Texas A & M

University revealed a high level of concern for endangered resources. It is the goal of the Texas Parks and Wildlife Department's Endangered Resources Branch to build upon these steps and move forward in the development of a comprehensive program designed to address the whole context of the endangered resources management issue. This document represents an attempt to assess the current status of the Department's programs and to begin to proactively address future needs.

B. Purpose of the Endangered Resources Annual Status Report

The Endangered Resources Annual Status Report, or ERASR, is intended to serve as both a planning and reporting document for Department-wide Endangered Resources efforts. It will summarize Department endangered resources activities in light of stated goals and thus serve as an instrument against which progress can be measured. The specific purposes of the ERASR are to:

- * declare agency goals and objectives regarding endangered resources,
- * describe the organizational structure to meet those goals,
- * identify plants, animals, and communities of priority concern,
- * summarize ongoing efforts to meet the stated goals and protect endangered resources,
- * outline proposed actions to be undertaken, and
- * identify future needs and concerns.

C. Goals of the Department's Endangered Resources Efforts

The Texas Parks and Wildlife Department (TPWD) expanded its endangered resources efforts in 1989 to focus increased attention and energy on protecting these most vulnerable of Texas natural resources. At its simplest, the Department's goal for endangered resources is to protect and facilitate recovery of plants and animals listed as threatened and endangered and the natural communities on which they depend. It is recognized that this goal is an optimistic one; nonetheless, it is the focus around which goals and objectives of the Department's efforts will be developed. These goals will be designed to be realistic and achievable in order to provide some standard by which to measure progress.

The following goals represent the goals of the Department's Endangered Resources efforts for the coming year. In this initial ERASR they focus on organizational needs and characterizing problems. The annual goals depicted in future ERASRs will likely focus more on actual resource management needs.

Goal 1: Develop an effective infrastructure to incorporate both TPWD and other expertise into a program planning process.

Objective One - Establish internal TPWD review process to identify potential impacts upon endangered resources and ensure their consideration in all Department actions.

Objective Two - Establish an external advisory committee for policy and program guidance and a peer review process for research activity design and reporting.

Goal 2: Identify and prioritize endangered resources based upon rarity and threat.

Objective One - Build on The Natural Heritage Program methodology to develop a standard procedure for timely and effective review of the status of Texas plants, animals, and natural communities.

Objective Two - Prepare an updated list of endangered plants, animals and natural communities based on the review process.

Goal 3: Develop a comprehensive, Department-wide strategy to protect and manage endangered resources.

Objective One - Identify protection, information, and management needs of endangered resources.

Objective Two - Produce a long-range plan for endangered resources that provides a time frame for addressing their protection, information, and management needs.

Objective Three - Assess current TPWD programs that directly address endangered resources, including a summary of goals and objectives, activities, staff time, and funding.

Objective Four - Develop a priority listing of projects to be proposed for funding through Section 6 of the Endangered Species Act and other potential sources.

Objective Five - Develop a list of projects and activities to be initiated (or continued) by TPWD.

Goal 4: Evaluate and propose revision of regulations and statutes to better protect endangered resources.

Objective One - Review existing rules and recommend revisions to rules or Commission policy to meet identified needs.

Objective Two - Review the Texas Parks and Wildlife Code pertaining to endangered and threatened species and recommend revisions as needed to make it more effective in protecting those resources.

II. STATUS OF ENDANGERED RESOURCES EFFORTS

A. Department Responsibility and Authority

Parks & Wildlife Code (Appendix A).

The first endangered species legislation in Texas was passed in 1973 and subsequently amended in 1981, 1985, and 1987. Chapter 68 of the Parks and Wildlife Code provides for the establishment of a list of fish or wildlife threatened with statewide extinction, sets up the procedure to allow the Executive Director of the Department to designate species for inclusion on the list following public notice, and authorizes permitting procedures for the handling and propagation of endangered species. The statutory definition of fish and wildlife excludes most terrestrial invertebrates from designation as state endangered species.

Legislative authority for the designation of threatened animal species is embodied in Chapter 67 of the Code pertaining to nongame species. This legislation authorizes the Parks and Wildlife Commission to adopt a list of protected nongame wildlife following public notice and to regulate the taking and possession of such wildlife. The statutory definition of nongame wildlife does permit the designation of invertebrates as threatened species; however, none have been listed to date.

Chapter 88 of the Code, adopted in 1981 and amended in 1985, set up the designations of endangered, threatened, and protected plants. The Act authorizes the Executive Director to designate plants for inclusion on any of the three lists following public notice and prohibits commercial collection or sale of any listed plant without Department permits.

Department Regulations (Appendix B).

Regulations in Sections 65.171 - 65.184 of Title 31 of the Texas Administrative Code (T.A.C.) adopted by the Parks and Wildlife Commission further specify rules governing the listing and protection of threatened and endangered species of animals. Take, possession, or transportation of either category of animal is prohibited except by permit. The list of species classified as threatened or endangered is also adopted under Commission rules.

Sections 69.01 - 69.14 of the T.A.C. adopted by the Parks and Wildlife Commission regulate endangered, threatened, and protected plants as provided by the Parks and Wildlife Code. The regulations set up a system for issuing permits for the handling of listed plants from public and private land and specify procedures for listing plant species.

Neither the plant nor animal statutes nor regulations spell out criteria for the listing of species nor do they provide protection from indirect take (e.g. destruction of habitat or unfavorable management practices). First-time offenses constitute a class C misdemeanor, punishable by fines of \$25 to \$500.

Federal Endangered Species Act

Section 6 of the federal Endangered Species Act requires that the Secretary of the Interior "cooperate to the maximum extent practicable with the States." It provides for the federal government to enter into a cooperative agreement with any State "which establishes and maintains an adequate and active program for the conservation of endangered species and threatened species." The state is required to provide a plan for conservation of threatened and endangered species to the U.S. Fish and Wildlife Service (USFWS). The Texas Parks and Wildlife Department entered into a cooperative agreement with the U.S. Fish and Wildlife Service under the Endangered Species Act in December, 1987. In 1988 Congress appropriated money to Section 6 to be provided annually to the states for carrying out specific projects. In 1988 Texas received its first appropriation of money under these provisions. These Section 6 projects are detailed in the Current Department Activities Section.

USFWS Cooperative Agreements

Soon after the formation of the Texas Parks and Wildlife Department in 1939 (then the Texas Game and Freshwater Fish Commission), the Department began a cooperative agreement with the U.S. Fish and Wildlife Service (then the Bureau of Sport Fisheries and Wildlife) to receive funding from the Pittman-Robertson Federal Aid in Wildlife Restoration Act. In 1969 the first endangered species/nongame job was conducted with Pittman-Robertson (P-R) funding. The history of these endangered species activities funded by P-R is detailed in the Wildlife Division Activities section. Several Wildlife Division projects dealing with endangered resources continue to be funded with P-R funds today.

Prior to the Section 6 Agreement between the Department and the USFWS, Texas Natural Heritage Program staff were working on 16 projects funded through an agreement between the General Land Office and the USFWS in 1986. These projects dealt primarily with USFWS Category 1 and 2 species (those species of plants and animals which are being considered for listing by the USFWS). This agreement was transferred to the Department in September of 1987 when the Natural Heritage Program transferred from the General Land Office. Status reports and updates, Endangered Species Information System Workbooks, Recovery Plans, and specific biological, geological, and hydrological studies have been undertaken by staff and contracted to private consultants. Several of the projects are ongoing.

B. TPWD Endangered Resources Operational Framework

Department Organization

The organization of the Texas Parks and Wildlife Department was restructured in January, 1991. Department activities as reported in the ERASR reflect the Department structure during 1990. Appendix C depicts the current and previous Department organization.

Resource Protection Division

Since 1989 overall responsibility for planning, administration, and review of endangered resources activities has been the charge of the Resource Protection Division. As the Division charged with primary responsibility for environmental review and with a scope encompassing plants, animals, and natural communities, the Resource Protection Division seeks to give a statewide, resource-wide perspective to endangered resources planning. The Endangered Resources Branch of the Division is comprised of the Endangered Species Program and the Natural Heritage Program (Appendix C). Endangered Species Program staff are responsible for administration of the Section 6 Cooperative Agreement with the U.S. Fish and Wildlife Service and for listing, regulating, and planning for recovery of threatened and endangered species. Natural Heritage Program staff are responsible for cataloging and monitoring rare species and communities of concern within the state and providing information on these elements of natural diversity. These two programs work closely together to review potential impacts to endangered resources and to inform the Texas public about the conservation needs of these significant natural resources. In addition, many of the endangered resources responsibilities and activities are carried out through cooperation with the other TPWD Divisions.

Endangered Resources Coordinating Committee (ERCC)

While primary responsibility for endangered resources planning and administration has been placed in the Resource Protection Division, responsibilities for tasks concerning endangered resources span all Divisions. In order to coordinate the resources and expertise of the entire Department in accomplishing goals for protecting and recovering endangered resources, an Endangered Resources Coordinating Committee was formed in 1989, consisting of representatives from each of the Divisions with endangered species interests and responsibilities. The purpose of the Committee is to solicit input on endangered species concerns, coordinate responsibilities for endangered species projects, and serve as a board of review for assessing Department activities in light of endangered species responsibilities.

Advisory Committees

The most effective long-term planning for resource conservation in Texas will necessitate that the Texas Parks and Wildlife Department rely upon and coordinate with non-TPWD persons and organizations having interest and expertise in endangered resources. To this end, two additional contact groups have been proposed. The first is a network of Technical Advisors consisting of persons having expertise in individual endangered species or natural systems. They will serve as a ready reference system in planning and designing endangered resources projects and will be involved in carrying out some of these projects. They may also provide peer review of proposed projects and the ERASR.

A second group, the Endangered Resources Advisory Committee, will provide input to the TPWD Endangered Resources Branch in the development of long-term priorities and planning for endangered species management. It will consist of representatives from several groups having active involvement in endangered resources-related issues, including conservation organizations, universities, industry, and private landowners. The Director of the Resource Protection Division will solicit recommendations from Department staff and propose advisory committee members to be approved by the Executive Director. The Endangered Resources Coordinating Committee may propose additional contact groups in the future.

Endangered Resources Forum

An additional effort to solicit peer review and public comment regarding the current and future status of the Department's endangered resources program resulted in the first annual Endangered Resources Forum. This forum, cosponsored by the Texas Organization for Endangered Species, was held at Department headquarters on February 24, 1990. It was designed to inform the public of the Department's plans for addressing endangered resources, to assess the public's endangered resources concerns, and to develop a network of individuals interested in and involved in endangered species work. Many of the state's leading endangered species experts were invited. Approximately 240 persons attended this initial meeting. Officials from federal agencies, including the U.S. Fish and Wildlife Service, U.S. Forest Service, National Park Service, and Environmental Protection Agency, and state agencies, including the General Land Office and Texas Department of Agriculture, addressed those in attendance about their agencies' roles in dealing with endangered resources. A panel of conservation, agriculture, and industry representatives questioned the agency representatives on issues of listing, protection, management, and education. As a follow-up to the first forum, attenders were mailed a copy of the draft ERASR for their review. The 1991 forum will be held April 12 and 13 in Austin.

Coordination with Other Entities

In addition to cooperative work with the U.S. Fish and Wildlife Service, the Department regularly interacts with other entities involved in endangered resources work. The Department's responsibility for environmental review provides opportunity for the endangered resources staff to review projects by public and private entities potentially affecting endangered resources.

In 1982, the Department entered into a Memorandum of Understanding with the U.S. Forest Service - National Forests in Texas to cooperate in a variety of efforts. The M.O.U. allows the Department to comment on all management actions proposed on National Forests in Texas and sets up procedures for consultations between the two agencies. The Department also participates in reviews of operational plans developed by the U.S. Forest Service Southern Experiment Station in Nacogdoches.

Staff participates in other meetings of interest. Department staff from three Divisions joined representatives of universities, conservation organizations, and other government agencies in participating in an endangered species symposium sponsored by the Fossil Rim Foundation in Glen Rose, Texas, during April, 1990.

III. Endangered Resource Priorities of Texas

The following species and natural communities are considered by the Endangered Resources Branch to be the Texas endangered resources of highest concern. This determination is based primarily on two factors: rarity (i.e. the number of known populations worldwide) and perceived threat. This is not intended as a complete listing of concerns. These are but a few of the more threatened and endangered of Texas' native fauna, flora, and terrestrial natural communities. Please consult Appendices E, F, and G for more complete listings of animals, plants, and natural communities of concern. Neither does this list of endangered resources of highest concern represent any legal protection status. These are those that require immediate attention by conservation agencies and organizations and the citizens of Texas. Many of the species have received much attention in the form of publicity and funding for research and management. Others have only recently been found to be of highest priority and have not received the degree of attention needed to begin recovery or fully explain their biological role to the citizens of Texas. This annual assessment of concern will help in setting the program's research and management priorities, and data gathered will be used to redetermine priority species and natural communities each year.

Animals are listed taxonomically followed by plants listed alphabetically according to scientific name. Natural communities are listed alphabetically according to series common name. Scientific name, common name, state legal status, federal legal status, and a rank assigned by the Texas Natural Heritage Program are given, followed by a summary of present occurrences and a discussion of status. Heritage ranks are explained in Appendix E and are a dynamic assessment of the current biological status of each species or natural community.

The following format is employed:

Scientific Name	Common Name
State Status, Federal Status, Heritage Rank	
Occurrence Summary and Discussion of Threats	
Research and Management Considerations	

A. Priority Listing for Animal Species of Concern

INVERTEBRATES

<u>Texella reddelli</u>	Bee Creek Cave Harvestman
No State status, Federal endangered, G1S1	
<u>Microcreagris texana</u>	Tooth Cave Pseudoscorpion
No State status, Federal endangered, G1S1	

<u>Neoleptoneta myopica</u>	Tooth Cave Spider
No State status, Federal	endangered, G1S1
<u>Rhadine persephone</u>	Tooth Cave Ground Beetle
No State status, Federal	endangered, G1S1
<u>Texamaurops reddelli</u>	Kretschmarr Cave Mold Beetle
No State status, Federal	endangered, G1S1
<u>Cylindropsis sp. 1</u>	Tooth Cave Rove Beetle
No State status, Federal	endangered, G1S1

Each of these invertebrate species is restricted to isolated karst remnants of the Jollyville Plateau; threatened by habitat loss due to urbanization of the Austin region.

Research needs include clarification of the taxonomy, biogeography, distribution, and ecology of each species. Ecological questions to be answered include amount, quality, and extent of surface vegetation needed to support the nutrient inflow to these karst systems, temperature, humidity, and moisture conditions required, and the extent that the invertebrates use smaller openings than humanly accessible, particularly smaller soil openings off of larger voids or between voids. Life history is virtually unknown for each of these species. Prey type, availability, and populations needed to support these species need to be determined.

Management needs include design of preserves to provide protection from nearby development and human activity and control of introduced fire ant populations.

FISH

<u>Cyprinodon bovinus</u>	Leon Springs Pupfish
State endangered, Federal	endangered, G1S1

Currently restricted to one cienega (spring) system; threatened by aquifer depletion and water pollution.

Research and management needs include protection from introduced exotic fish, particularly congeners; provision of a reliable water supply; protection of water quality; and elucidation of ecological and life history parameters.

<u>Cyprinodon elegans</u>	Comanche Springs Pupfish
State endangered, Federal	endangered, G1S1

Restricted to one spring system; threatened by aquifer depletion and habitat loss aggravated by land-use practices.

Research and management needs include protection from introduced exotic fish, particularly congeners; provision of a reliable water supply; protection of water quality; and elucidation of ecological and life history parameters.

Cyprinodon pecosensis Pecos River Pupfish
State threatened, Federal Category 1, G1S1

Formerly ranged throughout the Pecos River, now restricted to one tributary and an isolated man-made gravel pit. Threatened by hybridization with introduced exotic congeners and decline in habitat quality caused by land use changes.

Research and management needs include use of barriers to protect genetically pure populations from introduced exotic fish, particularly congeners; provision of a reliable water supply; protection of water quality; and elucidation of ecological and life history parameters.

Gambusia heterochir Clear Creek Gambusia
State endangered, Federal endangered, G1S1

Restricted to one spring run; threatened by aquifer depletion and hybridization with introduced Gambusia.

Research and management needs include protection from introduced exotic fish, particularly congeners; provision of a reliable water supply; protection of water quality; and elucidation of ecological and life history parameters.

Etheostoma fonticola Fountain Darter
State endangered, Federal endangered, G1S1

Restricted in range to upper San Marcos River with a reintroduced population in upper Comal River; threatened by aquifer depletion.

Current distribution and status of the two populations needs to be determined. Genetic studies on the Comal population are needed to determine population viability from the reintroduction effort. Management needs include protection of water quality and non-interrupted spring flow and establishment of a refugium not dependent on spring flow.

Dionda diaboli Devil's River Minnow
State threatened, Federal Category 2, G2S1

Reduced and restricted range, endemic to the Devil's River drainage. Threatened by drought exacerbated by land use practices, introduced predators, and habitat destruction.

Research and management needs include protection from introduced exotic fish; provision of a reliable water supply; protection of water quality; and elucidation of ecological and life history parameters.

Notropis buccula Smalleye Shiner
No State status, Federal Category 2, G2S2

Endemic to the upper and middle Brazos River, now apparently much reduced in range. Threatened by habitat modification and changes in stream ecology.

Continued investigation of the status of the smalleye shiner is needed. No specimens have been identified in the latest attempts by Department staff to locate an extant population. Life history and habitat requirements need to be researched whenever an extant population is located.

AMPHIBIANS

Eurycea nana San Marcos Salamander
State threatened, Federal threatened, G1S1

Restricted to upper San Marcos and Comal Rivers; threatened by aquifer depletion.

Current status and distribution needs to be documented. Life history information is required to develop techniques for maintaining captive stock within refugia. Management needs include provision of a reliable water supply, protection of water quality, and protection from introduced predatory fish.

Bufo houstonensis Houston Toad
State endangered, Federal endangered, G1S1

Apparently restricted to a specific type of geologic substrate. Threatened by habitat modification, hybridization, and competition with congeners.

Research and management needs include autecological studies of a well-established population; surveys of former and potential habitats to document historic or new population and assessment of their status; investigation of the phylogenetic relationship to closely-related congeners, and development of management plans as needed to protect known populations.

REPTILES

Lepidochelys kempi Kemp's Ridley Sea Turtle
State endangered, Federal endangered, G1S1

Ranges in the tropical Atlantic including Gulf of Mexico, formerly nested on Texas Gulf beaches. Threatened by overharvesting, incidental mortality, and disruption of nesting activities.

Research and management needs include establishment of a network to report individual sightings and nesting attempts, regular monitoring of South Padre Island beaches during the nesting season to determine if head-started turtles return, and installation of Turtle Excluder Devices in all commercial shrimping trawls.

Graptemys caglei Cagle's Map Turtle
No State status, Federal Category 2, G3S3

Restricted to the Guadalupe River. This habitat specialist is threatened by habitat alteration and loss.

Research and management needs include continued studies of ecological requirements and population demographics, range-wide status surveys, and development and implementation of a monitoring scheme to assess the impacts of potential habitat loss or modification.

Nerodia harteri paucimaculata Concho Water Snake
State endangered, Federal threatened, G2T1S1

Restricted to the upper Colorado River, a habitat specialist. Threatened by habitat loss.

Research and management needs include continued studies of ecological requirements, population demographics, and assessments of the impacts resulting from habitat loss or modification.

BIRDS

Grus americana Whooping Crane
State endangered, Federal endangered, G1S1

Restricted winter range on the Texas Gulf Coastal prairies and marshes. Threats include: low population size, long distance migration through fragmented habitats, and habitat modification.

Research needed includes determining the effects of increasing human intrusion into wintering habitat areas and of other human uses of essential winter habitat and impacts of various land management strategies. Management needs include increasing the available high quality wintering habitat for the growing population of cranes.

Tympanuchus cupido attwateri Attwater's Prairie Chicken
State endangered, Federal endangered, G4T1S1

Former range on Gulf coastal prairies now reduced to isolated, small remnants. Threatened by habitat loss, low numbers, fragmented populations, and reduced range.

Research needs include a determination of habitat quality, concentrating on the species' area requirements and patch heterogeneity. Minimum viable population sizes need to be modeled to assist with management. Effectiveness of translocation and propagation needs to be studied. Management needs include habitat improvement, primarily through control of brush invasion and application of appropriate livestock stocking rates and rotations, and habitat acquisition or leasing.

Picoides borealis Red-cockaded Woodpecker
State endangered, Federal endangered, G2S2

Specialized for old-growth, southern pine forests, now found in relict stands. Threatened by habitat destruction and fragmentation by short rotation timber harvest.

Research needs include an assessment of foraging habitat requirements in terms of tree species, acreage and timber age; habitat fragmentation effects; reproductive success in colonies on state and private land; effectiveness of cavity repair and construction and population augmentation; and response of populations to habitat management practices.

Management needs include a need for more fire-managed old growth pine communities and integrated pest management to control threats from southern pine beetle.

Dendroica chrysoparia Golden-cheeked Warbler
State threatened, Federal endangered, G2S2

Restricted breeding distribution in old-growth deciduous oak/Ashe juniper (Juniperus ashei) woodlands of the Edward's Plateau and Lampasas Cut-Plain. Threats include habitat clearing and fragmentation, especially as a result of urbanization in the Austin and San Antonio area.

Research needs include an assessment of density in suitable habitat through-out the range and determination of effects of patch size, fragmentation, urbanization, and land management practices on habitat occupancy and breeding success. Management needs include protection of known habitat from clearing and enhanced recruitment of deciduous species within known habitat.

B. Priority Listing for Plant Species of Concern

Abronia macrocarpa large-fruited sand verbena
State endangered, Federal endangered, G1S1

Restricted to limited habitats and occurring in low fluctuating populations; threatened by grazing, ORV use, residential and oil development, and invasion of exotics.

Research considerations include studies on reproductive biology, population age structure, and seed biology.

Ayenia limitaris Texas ayenia
No State status, Federal Category 2, G2S1

Restricted to a single site with six plants; threatened by habitat destruction from agricultural practices.

Research is currently restricted to one site. A need exists to examine characteristics of other populations. In addition, cultivated populations should be established.

Echinocactus asterias star cactus
No State status, Federal Category 2, G2S1

Only known U.S. population was originally threatened by habitat destruction and overcollection. Landowner contact has resulted in protection from habitat destruction; however, overcollection remains a problem.

Research and management needs include establishment of a cultivated population and research concerning reproductive biology, seed bank, and demographic characteristics.

Genistidium dumosum brush-pea
No State status, Federal Category 2, G1S1

Only known U.S. population is threatened by erosion and habitat deterioration.

Research needs include habitat profile identification (including Mexican populations), habitat status assessment, and establishment of cultivated populations. Management needs include cooperative efforts with Texas Department of Highways and Public Transportation to prevent erosion at known population.

Helianthus paradoxus puzzle sunflower

No State status, Federal Category 1, G1S1

Known from one site threatened by hydrologic alteration, pollution, and overgrazing. This specialized habitat in the midst of oil development and agricultural use is threatened by aquifer depletion. Hybridization is a possible threat.

Research and management needs include identification of pollinators, assessing effects of grazing on viability and seed production, and removal of other annual sunflowers from within pollination distance.

Lesquerella pallida white bladderpod
State endangered, Federal endangered, G1S1

Low fluctuating populations occurring in specialized and limited habitat; deterioration of present habitat by grazing and fire suppression threaten this plant.

Research considerations include studies into seed biology, reproductive biology, and effects of competition and grazing.

Manihot walkerae Walker's manioc
No State status, Federal Category 1, G1S1

Thought to be extirpated from the U.S., this plant has only recently been rediscovered in Texas. Habitat destruction from agriculture continues to threaten this extremely rare species.

Research and management needs include elucidation of habitat profile, survey of potential habitat, seed biology studies, and establishment of cultivated populations.

Phlox nivalis ssp. texensis Texas trailing phlox
No State status, Federal Category 1, G4T2S2

Few populations and alteration of habitat conditions, especially suppression of natural fire regime, contribute to this plant's plight.

Research and management needs include effects of fire management, seed biology, and establishment of cultivated populations.

Quercus hinckleyi Hinckley's oak
State threatened, Federal threatened, G1S1

Few isolated populations of this Pleistocene relict are threatened with possible genetic swamping. Reproduction has been low.

Research considerations include isozyme studies, pollen viability analyses, and surveys of sites near historical localities.

Styrax texana Texas snowbells
State endangered, Federal endangered, G1S1

Down to critically low population levels exhibiting little reproduction, habitat deterioration threatens this species.

Research and management needs include effects of seed predation and establishment-phase biology.

Zanthoxylum parvum Shinner's tick-tongue
No State status, Federal Category 2, G1S1

Reduced to low numbers of populations without sexual reproduction, this plant is vulnerable to browsing.

Research and management needs include reproductive biology, surveys of additional habitat, and establishment of cultivated populations.

Zizania texana Texas wild-rice
State endangered, Federal endangered, G1S1

Known from one population within the San Marcos River with no sexual reproduction in the wild. Hydrologic alteration, aquifer depletion, recreational pressure, pollution, exotic plant and animal species (competition and herbivory), and further development and habitat alteration threaten the continued existence of this plant.

Research considerations include studies on reproductive biology, seed biology, establishment, and cultivation. There is a need to assure a dependable supply of water and possibly to establish refugia not dependent upon the Edwards Aquifer.

C. Priority Listing of Natural Communities of Concern

Series Common Name	Heritage Rank
Series Name	
Series Description	
Occurrence Summary and Discussion of Threats	

American Beech-Southern Magnolia Series	G3S2
<u>Fagus grandifolia</u> - <u>Magnolia grandiflora</u>	

This forest community type is restricted to the southern portion of the East Texas Pineywoods. Soils are usually well-drained but mesic, and the topography is often rolling. The topographic position is generally a mesic slope or shallow creek bottom. Loblolly pine (Pinus taeda), American holly (Ilex opaca), laurel oak (Quercus laurifolia), sweetgum (Liquidambar styraciflua), and white oak (Quercus alba) are often present. Upslope this type often grades into pine-oak communities, while downslope it usually grades into oak-dominated bottomlands or seepy creek bottoms with sweetbay magnolia (Magnolia virginiana). Most occurrences of this community have been destroyed by logging, which is the greatest threat to remnant examples.

Cottonwood-Tallgrass Series	G2S2
<u>Populus deltoides</u>	

This tallgrass community type inhabits sub-irrigated creek bottoms and swales, usually between dunes, in the panhandle of Texas. Big bluestem (Andropogon gerardii), switchgrass (Panicum virgatum), gammagrass (Tripsacum dactyloides), Indiangrass (Sorghastrum nutans), and alkali sacaton (Sporobolus airoides) are variously important. Seeps and marshes may be included, and surrounding dunes are Havard shin oak (Quercus havardii)-little bluestem or sand sage (Artemisia filifolia)-midgrass grasslands or shrublands. This type historically had a restricted distribution, and the greatest current threats to the 20 to 40 viable remnants include over-grazing and cultivation.

Gammagrass-Switchgrass Series	G2S1
<u>Tripsacum dactyloides</u> - <u>Panicum virgatum</u>	

This tallgrass grassland is found primarily in lowlands or poorly-drained uplands over clayey soils in the Blackland, Fayette, and Upper Coastal Prairies. Indiangrass (Sorghastrum nutans), little bluestem (Schizachyrium scoparium), tall dropseed (Sporobolus asper), heath aster (Aster ericoides), Maximilian sunflower (Helianthus maximiliani), and other grasses and forbs may be important. This type occurs as isolated remnants, often surrounded by cropland. Almost all examples of this type in Texas have been lost to

cultivation, which is the greatest threat to the 10 to 20 viable remnants.

Little Bluestem-Brownseed Paspalum Series G2S2

Schizachyrium scoparium-Paspalum plicatulum

This tallgrass grassland occupies uplands of the Coastal Prairie and loamy soils of the Fayette Prairie. Indiangrass (Sorghastrum nutans), tall dropseed (Sporobolus asper), Setaria spp., big bluestem (Andropogon gerardii), hairyawn (gulf coast) muhly (Muhlenbergia capillaris), fimbry (Fimbristylis puberula), and a variety of forbs and sedges may be important. To the north similar habitats are occupied by Blackland Prairie tallgrass communities, while gulfward the type contacts coastal marshes, especially the gulf cordgrass (Spartina spartinae) series. Most of the original three million hectares of this type have been cultivated or over-grazed, as revealed by the endangered status of Attwater's Prairie Chicken. Current threats include conversion of the remnants to cropland and continued over-grazing.

Little Bluestem-Indiangrass Series G2S2

Schizachyrium scoparium-Sorghastrum nutans

This broadly-defined upland tallgrass grassland once occurred on about 6.8 million hectares throughout the Blackland, Fayette, and Grand Prairies, but is now restricted to small, isolated relicts. Composition of secondary species varies rather distinctly with soil type (clayey Vertisols versus loamy Alfisols). Tall dropseed (Sporobolus asper), big bluestem (Andropogon gerardii), sideoats grama (Bouteloua curtipendula), fimbry (Fimbristylis puberula), Carex microdonta, Florida paspalum (Paspalum floridanum), and other grasses and sedges may be important, along with a variety of forbs such as Maximilian sunflower (Helianthus maximiliani), heath aster (Aster ericoides), and Mexican hat (Ratibida columnaris). Bottomlands of the prairies are wooded or support a gammagrass-switchgrass (Tripsacum dactyuloides-Panicum virgatum) community type. Over 98% of this once extensive type has been destroyed, and the greatest threat to the 10 to 30 remaining viable remnants is conversion to cropland.

Longleaf Pine-Little Bluestem Series G3S2

Pinus palustris-Schizachyrium scoparium

This upland, mainly evergreen woodland occurs in southeast Texas, primarily over loamy or sandy, low pH soils. Loblolly and shortleaf pines (Pinus taeda, P. echinata) and species such as bluejack, blackjack, post, and southern red oaks (Quercus incana, Q. marilandica, Q. stellata, Q. falcata) and sweetgum (Liquidambar styraciflua) may occur in the overstory. The shrub layer may contain

flowering dogwood (Cornus florida), American beautyberry (Callicarpa americana), wax-myrtle (Myrica cerifera), and Vaccinium spp. The well developed herbaceous layer contains grasses such as little bluestem (Schizachyrium scoparium), pineywoods dropseed (Sporobolus junceus), Carolina jointtail (Coelorachis cylindrica), switchgrass (Panicum virgatum), Panicum spp., Paspalum spp., sedges (Carex spp., Rhynchospora spp., Scleria spp., Fimbristylis spp.), and yellow-eyed grass (Xyris spp.) To the south this type generally grades into the longleaf pine-beakrush series, on xeric sands into the bluejack oak-pine series, and on more mesic soils to pine-oak or American beech (Fagus grandifolia) dominated communities. Most of the original longleaf forests vanished during the timber boom between 1880 and 1920. Remnants are threatened by harvest of old-growth pine without replacement, severe site preparation techniques, fire suppression, and conversion to other pine types.

Silveanus Dropseed Series
Sporobolus silveanus

G2S2

This tallgrass community type occupies loamy, low pH upland soils in the northeastern Blackland Prairie. Important species include sedges (Carex meadii, Fimbristylis puberula, Scleria spp.), thick-spiked tridens (Tridens strictus), Indiangrass (Sorghastrum nutans), switchgrass (Panicum virgatum), and eastern gammagrass (Tripsacum dactyloides) along with a diversity of forbs. On clayey soils in this region relict communities are dominated by gammagrass and switchgrass. This type is perhaps the most unique grassland of the tallgrass prairie region that extends from Manitoba to the Gulf of Mexico. Most of the original 1.5 million hectares of the type has been converted to cropland or tame pasture. Conversion to cropland is the primary current threat to the 15 to 30 viable remnants.

Sphagnum-Beakrush Series
Sphagnum spp.-Rhynchospora spp.

G4S2

This herb-dominated community type includes various types of seepage bogs which occur primarily in east Texas. Sphagnum spp. may or may not be abundant, and beakrushes (Rhynchospora spp.) along with yellow-eyed grass (Xyris scabrifolia, Xyris spp.), grasses, pitcher plant (Sarracenia alata), and sedges may be dominant. Occurrences of this community type are usually small and isolated within a matrix of upland pine or pine-oak forest, and the herbaceous flora is diverse, with numerous restricted species. Small trees and shrubs such as sweetbay magnolia (Magnolia virginiana) and evergreen bayberry (Myrica heterophylla) invade many bogs in the absence of fire. Surrounding uplands often occur over a sandy substrate, on which open oak or pine woodlands are common. This type was never extensive, and timber management, especially severe site preparation methods that disrupt hydrologic regimes, along with fire suppression are the main current threats to remnants.

Texas Ebony-Anacua Series

G2S2

Pithecellobium flexicaule-Ehretia anacua

This evergreen subtropical forest occurs primarily on well-drained but moist river or resaca terraces in the lower Rio Grande valley. Snake-eyes (Phaulothamnus spinescens), coma (Bumelia celastrina), Tenaza (Pithecellobium pallens), tepeguaje (Leucana pulverulenta), colima (Zanthoxylum fagara), brasil (Condalia hookeri), granjeno (Celtis pallida), lotebush (Zizphus obtusifolia), and mesquite (Prosopis glandulosa) may be important. This type is similar to subtropical shrubland (Texas Ebony-Snake-eyes Series), which occupies drier sites. Most of the area of this type has been converted to cropland, and cultivation and brush clearing are the main threats to remnants. Together with the Texas ebony-snake-eyes Series (below), this type provided habitat to subtropical fauna and flora at the northern end of their range, including rare species such as the Ocelot (Felis pardalis) and Jaguarundi (Felis yagouaroundi)

Texas Ebony-Snake-eyes Series

G2S2

Pithecellobium flexicaule-Phaulothamnus spinescens

This subtropical evergreen shrubland or low forest occurs primarily over heavy soils in the lower Rio Grande valley. There is considerable variation with soil type and location, and shrublands on lomas in South Bay are also included as a variant of this series. Coma (Bumelia celastrina), brasil (Condalia hookeri), lotebush (Ziziphus obtusifolia), colima (Zanthoxylum fagara), mesquite (Prosopis glandulosa), and granjeno (Celtis pallida) may be important. This type is closely related to taller ebony-anacua forests on wetter sites, but contains a greater complement of xeromorphic shrubs. It grades into non-subtropical shrublands to the north and west. Threats are similar to those listed above for the Texas ebony-anacua series.

Texas Palmetto Series

G4S2

Sabal mexicana

This evergreen subtropical woodland or forest is limited to a few sites along the Rio Grande south of Brownsville. It was probably never widespread in Texas, and may be dependent on frequent flooding and fire. Texas ebony (Pithecellobium flexicaule), brasil (Condalia hookeri), cedar elm (Ulmus crassifolia), anacua (Ehretia anacua), Tenaza (Pithecellobium pallens), tepeguaje (Leucana pulverulenta), and coma (Bumelia celastrina) are present. This type is closely related to the Texas ebony-anacua series, and threats are similar, although they also include interruption of natural flooding regime due to upstream dams on Rio Grande.

D. Changes in Priority Listings

This segment is reserved for future years so that a comparison of priority species and communities may be used to assess progress and continuing needs.

IV. Status of Current Department Activities

A. Special Nongame and Endangered Species Conservation Fund

Established by the Texas Legislature in 1983, the Special Nongame and Endangered Species Fund is designed to support nongame and endangered species research and management. Private donations, royalties from the sale of prints, and proceeds from endangered species propagation permits and endangered species fines, as well as from the sale of stamps and decals support the fund, currently at an approximate balance of \$550,000. The fund is administered on a reimbursable basis. Monies provided by the fund to support nongame and endangered species activities or habitat acquisition are reimbursed by Pittman-Robertson or Section 6 monies.

Several activities supported by the fund include research projects on endangered felines, Black-footed Ferret, Houston Toad, Brown Pelican, Piping Plover, Black-capped Vireo, Attwater's Prairie Chicken, Red-cockaded Woodpecker, and Eskimo Curlew. (These activities are described in more detail in later sections.) The first habitat acquisition was made in January 1990 with the purchase of a tract on Smith Point in Chambers County. The purchase was made possible with an inkind donation from Oryx Energy and serves as an important rest area for spring and fall migrants.

Promotion and public awareness of the fund should foster public commitment to the State's natural resources and provide financial support of nongame and endangered resources needs.

B. Section 6 Projects

Much of the expansion of Department endangered species activities since 1989 has been supported by Endangered Species Act Section 6 funds. The Department submits a list of priority projects to the USFWS each year. The USFWS decides which projects will receive funding. The State of Texas covers the cost of conducting the projects and is then reimbursed for up to 75% of the costs.

After initially receiving \$33,000 in fiscal year 1988 federal funding to conduct two projects, Texas has been allocated over \$300,000 from the Fish and Wildlife Service for the past two years, expanding the number of projects to 36. Section 6 work has been conducted by the Fisheries, Parks, Resource Protection, and Wildlife Divisions within the Department. In addition, Universities and other research organizations have performed some of the work under contract. Summaries of the projects currently underway follow.

Ashy Dogweed Habitat Profile

Until recently, the ashy dogweed was known from only one site. Efforts began in 1989 to develop a habitat profile and to use this profile to identify other potential sites of occurrence for

the species. The soil series and vegetative assemblages associated with three known ashy dogweed communities were investigated, associated land use practices noted, and other potential habitat locations identified. Further ground-truthing of these locations and baseline studies of the plant's reproductive biology are scheduled for 1991.

Attwater's Prairie Chicken Captive Propagation

Dramatic recent declines in the Attwater Prairie Chicken population (down 53% from 1988 to 1989) led to initialization of a captive propagation and translocation program in 1989 designed to reintroduce this subspecies to areas of historical, but presently unoccupied, suitable habitat. Research has concentrated on design of facilities and refinement of propagation and release methods. In addition, efforts to enhance and manage habitat on private lands through contracts, leases, and other incentives such as brush removal are ongoing.

Black-capped Vireo Dispersal

This work, being done on the Kerr and Walter S. Buck Wildlife Management Areas during 1990, will assess the reproductive success of vireos and provide removal of Brown-headed Cowbirds (*Molothrus ater*). Vireos will be banded, and lands surrounding the Kerr WMA will be searched to determine dispersal distances for birds banded in previous years.

Black-capped Vireo Management on Department Lands

Begun in 1989, the objectives of this project are to map nesting territories of the Black-capped Vireo on Department lands, determine nesting success, control Brown-headed Cowbirds at sites where they are problematic as a nest parasite, and gather baseline vegetation data where the vireo is found. Current (1990) work focuses on the larger populations on state-owned land and is gathering information to develop a management plan for this endangered songbird.

Black-footed Ferret Reintroduction

Texas is currently assessing the status of its potential Black-footed Ferret (*Mustela nigripes*) habitat in cooperation with the U. S. Fish and Wildlife Service's black-footed ferret reintroduction efforts. Plans for 1990 call for the mapping of prairie dog towns from aerial photography. Ground-truthing during 1991 will provide further information on the sites considered as most likely candidates for reintroduction.

Cactus Ferruginous Pygmy Owl Habitat Status

Little is known about the status of the Cactus Ferruginous Pygmy Owl (*Glaucidium brasilianum cactorum*) in South Texas and Northeastern Mexico. The goal of this project initiated in 1990 is to survey its population and habitat status. Maps will be produced of existing habitat, and species abundance will be estimated in several sample areas.

Cactus Trade and Collection Impact Monitoring

This one-year project, scheduled for completion in 1990, is designed to determine the species and volume of Texas cacti that are in the commercial cactus trade. A botanist is currently surveying commercial dealers as well as publications and other knowledgeable individuals in order to assess the scope and magnitude of trade in Texas cacti. *Completed 1991*

Candidate Monitoring

Amendments to the Endangered Species Act in 1988 required the U.S. Fish and Wildlife Service to routinely monitor species which are classified as candidates for listing. Texas is currently developing the first state procedure in USFWS region 2 to track its candidate species or their habitats.

Central Texas Salamander Studies

The geologic features of Central Texas result in isolation of several genetically similar populations of salamanders. Initial efforts began in 1989 to review the distribution and taxonomy of salamanders in central Texas. The University of Texas at Austin is contracted to perform the laboratory taxonomic work. Field sampling efforts are scheduled for 1990.

Comal Spring Vegetation Loss

Concern has arisen recently about a loss of vegetation in this spring system which harbors several endangered and rare species. Work began in 1990 to assess the impact of the introduced tropical ram's horn snail (*Marisa cornuarietis*) on vegetation. Distribution and abundance of the snail in the spring system will be measured, and enclosure experiments will measure feeding rates and preferences.

Comanche Springs Pupfish Status Survey

Begun in 1989, the goal of this survey is to assess the status of this desert fish. Information on two populations has been gathered to identify current and potential threats. A habitat monitoring plan has been prepared for the species.

Devil's River Minnow Status Survey

The goal of this study is to determine the distribution and abundance of this minnow and to determine threats to the species. Sampling in the Devil's River drainage, initiated in 1989, helped to determine species associations, relative abundance, and habitat requirements. The feasibility of construction of a refuge on the Devil's River State Natural Area was assessed.

Endangered Feline Habitat Restoration

This project continues an effort in conjunction with white-winged dove management to restore Rio Grande woodlands through planting of native brush species on sites representing potential habitat or corridors for endangered cats. In addition,

information on sightings of Ocelots and Jaguarundi is being collected to assess the habitat suitability of reforested areas and to identify potential new reforestation sites.

Endangered Plant Education Program

Begun in 1988, this project was developed to provide information to the public and to law enforcement personnel on how to identify rare Texas plants and to increase the awareness of the plight of endangered plants. A plant identification handbook has been printed, and a thirty minute broadcast video has been produced.

Eskimo Curlew Habitat Assessment

Work began in 1989 to compile all the verified and plausible sightings of Eskimo Curlews (*Numenius borealis*) in Texas. From these sightings, a model of predictive habitat characteristics is being evaluated. Ground-truthing scheduled for 1990 will provide further opportunity for characterizing use areas and predicting possible sighting locations.

Golden-cheeked Warbler Breeding Status and Habitat Assessment

Studies, begun in 1987 prior to the Section 6 Cooperative Agreement, mapped the available habitat for the Warbler and gathered descriptive information on its breeding habitat. Habitat loss and fragmentation were identified as significant threats to the breeding warbler population. Continuation of the project resulted in authorship of a draft status report on the species submitted to the USFWS in early 1990. Studies in 1990 will include further refinement of the vegetation habitat component and habitat area requirements, and research on fragmentation effects.

Golden-cheeked Warbler Wintering Habitat Status

The goal of this study is to examine the extent and conservation status of golden-cheeked warbler winter habitat. The scope of the study in 1989-90 attempted to document the known wintering range and to examine the status of habitat in Guatemala. Habitat areas were located, and threats to habitat were identified through conversations with local biologists.

Highway Right-of-Way Rare Plant Survey

The goal of this five-year project, begun in 1991, is to verify known populations of listed and category plants on Texas Department of Highways and Public Transportation rights-of-way. Management plans compatible for both the highway department and rare plant species will be developed, and populations will be monitored annually to assess management effects.

Hinckley Oak Reproduction

Goals of this study, begun in 1989, are to study reproductive factors associated with the Hinckley oak. Monitoring of wild plants has provided information on reproductive phenology;

however, several factors, including drought, predation, and collection, create a shortage in acorns and young plants available for study. Efforts in 1991 will examine hybridization as another potential reproductive problem in this West Texas endemic species.

Houston Toad Population Assessment

In 1990 Texas A&M joined this continuing Department effort to determine the current and potential breeding distribution of the toad, assess known and suspected threats to the species, and develop a comprehensive resource stewardship plan for the population in the Bastrop area. Staff developed a habitat characterization profile in 1989 and refined techniques that will be used to search for new populations. Marking of toads with Passive Internal Transponder (PIT) tags will enable the determination of population size and structure, over-wintering mortality, recruitment, growth, and other life history parameters essential to development of the stewardship plan.

Houston Toad Taxonomy

This additional Houston Toad project will examine the taxonomic relationship between Bufo houstonensis and two closely related congeners, the Dwarf American Toad (B. americanus charlesmithii) and the Southern Toad (B. terrestris).

Jollyville Plateau Cave Ecology

This two-year project is designed to measure ecological parameters of the cave microhabitat. Several caves with and without cave gates will be selected for study. Seasonal variations in invertebrate populations, organic inflow, temperature, and humidity will be determined. Results will be used to develop recommendations for the structure and use of cave gates.

Ocelot Habitat Mapping

This two-year project, begun in 1990, will seek to identify potential ocelot habitat throughout the South Texas ecoregion through examination of aerial photography. Selected ground-truthing, field surveys, identification of threats, and landowner contacts will help to identify important areas for conservation.

Karst Biogeography

This project, begun in early 1991, will overlay geologic and hydrologic maps of the Jollyville Plateau and surrounding areas with maps of known distribution of endemic cave invertebrate species. The resulting matrix will be used to identify potentially significant karst features to search for invertebrate populations. Results will help further determine the status of these rare invertebrate species and in planning for the Balcones Canyonlands Habitat Conservation Plan.

Piping Plover Habitat Use Monitoring

Surveys began in 1988-89 to identify bayside habitat used by wintering and migrating Piping Plovers (Charadrius melodus). Middle coast areas have been covered, with plans to complete the survey on the upper and lower coast during 1990-91. Once use areas have been identified, habitat characteristics, such as soil types and benthic organisms, will be studied to determine parameters that limit distribution of Piping Plovers along the coast. Concurrent with the plover surveys, sightings of peregrine falcons and their habitat use have been noted.

Puzzle Sunflower Status Report Update

Begun in 1989, the objective of this study is to identify potential habitat for the puzzle sunflower. Work at the Diamond Y Spring in Pecos county, a perennial salty spring and site of the largest known population of the puzzle sunflower, identified soils, geology, topography, plant associates, and natural community features associated with that population. Potential habitat in Culberson, Jeff Davis, Pecos, and Reeves counties has been identified based on soils surveys and will be investigated in further detail in upcoming segments.

Recovery Plans for Hinckley Oak, Large-fruited Sand Verbena, and Chisos Mountain Hedgehog Cactus (Echinocereus chisosensis var. chisosensis)

Efforts began in 1990 to prepare recovery plans for these three federally listed species. All three species are Texas endemics. Recovery plans following USFWS formats will be based on status surveys and on other work performed by the Texas Natural Heritage Program and others.

Red-cockaded Woodpecker Management

Goals of this project begun in 1988 are to census colonies, to monitor reproductive success, and to recommend and conduct appropriate forest management practices on state and private forest lands. Some historical and most currently known colonies were surveyed in 1988, cavity restrictors were installed at two sites, habitat conditions were evaluated at all known colony sites and priorities were established for management work, and habitat management recommendations were implemented for a TPWD holding and one private tract. Work in 1990 sought to gather specific information on several colonies in two State Forests, including size of colonies, reproductive success, numbers and locations of cavity trees, and size and fragmentation of foraging areas, and initiate midstory control on two colonies on private land.

Reddish Egret and Brown Pelican Colony Monitoring

Started in 1989, the primary purpose of this project is to monitor nesting and to minimize human disturbance at Reddish Egret (Egretta rufescens) and Brown Pelican (Pelecanus occidentalis) breeding sites. Signs have been placed at all

nesting islands and most islands are patrolled to discourage human disturbance. Priorities during 1990 will shift to assessing the status and threats to Reddish Egret populations.

San Marcos River Conservation Management Plan

Designed to gather information for the development of a river management plan, work in 1989 revolved around mapping and monitoring stands of Texas wild-rice. A map has been constructed that will assist interested parties in making decisions about potential effects of proposed actions on this endangered plant. Work in 1990 will include a survey for Fountain Darters, studies on the natural history of the San Marcos Salamander, and the drafting of a river management plan by staff at the Edwards Aquifer Research and Data Center.

Small-eye Shiner Status Survey

This little known shiner is endemic to the Brazos River drainage. Recent attempts to collect specimens from two thirds of its known range have proven unsuccessful, perhaps indicating extinction or at least substantial population decline. Efforts continue to locate a population of this small fish. Should a population be found, studies of its life history and habitat requirements will be made.

Texas Horned Lizard Investigations

Researchers are currently collecting and summarizing qualitative and quantitative information on the current and historical distribution of Texas Horned Lizards (Phrynosoma cornutum). This information will be used to recommend future research needs to learn more about the status and trends of this species.

Texas Kangaroo Rat Habitat Mapping

Limited field work in 1986 and 1987 resulted in the addition of two counties to the known distribution of the Texas Kangaroo Rat (Dipodomys elator). Work underway in 1990 is designed to use known occurrences of Texas Kangaroo Rats to develop a predictive model, using geographic information system technology, to identify current potential habitat, as well as land use changes contributing to a loss of habitat. Plans for expansion of the study include ground truthing of the model by sampling for kangaroo rats.

Texas Snowbells Reproduction Study

Work begun in 1989 was designed to assess whether herbivory by mammals is precluding the establishment of young Texas snowbell plants. Wire cages designed to exclude mid-to-large sized mammals were placed downslope from three populations of Texas snowbells. No seed germination and seedling development took place during 1989; however, several newly established plants were monitored during 1990. Efforts will continue during 1991.

Tobusch Fishhook Cactus Reproductive Biology

The goal of this five-year project, begun in early 1991, is to examine the unknown reproductive biology of this endangered cactus. Information gathered on pollination mechanisms, reproductive success, dispersal, and longevity will be used in the development of appropriate management strategies.

White Bladderpod Management Experiments

Initiated in 1989, the goal of this project is to define the reproductive phenology of white bladderpod and analyze the experimental effects of several management schemes on this East Texas plant. Several experimental plots have been established and are being subjected to simulated grazing and shading effects. This project is ongoing.

C. Division Activities

Fisheries Division

Paddlefish Restoration and Management

The Paddlefish (Polyodon spathula) is listed an endangered species in Texas and is under active consideration for listing as a Federal Endangered Species. Once common in the eastern third of Texas, numbers of Paddlefish have declined dramatically. This reduction is presumed to be related to reservoir construction, habitat alteration and overharvest. In 1989, 30,000 Paddlefish were reared by the Fish Hatcheries Branch and stocked into the State Scientific Area #1 located at the confluence of the Angelina and Neches Rivers. In 1990, approximately 180,000 Paddlefish were released into east Texas rivers and reservoirs. A Texas Paddlefish Fishery Management Plan is currently in review by Fisheries Division personnel and will serve as a blueprint for the recovery and restoration of Paddlefish in the state. Studies aimed at determining the distribution and migration of Paddlefish have already begun with the radio tagging of 14 individuals. Adult Paddlefish have been captured in the Red River and Neches River drainages for development of a captive Texas broodstock.

Red-cockaded Woodpecker

Red-cockaded Woodpecker (RCW) management on the Huntsville hatchery has proceed in accordance with the management plan approved by the USFWS as part of the section 7 consultation. Hatchery design has been significantly modified to minimize impact on the colony. Design of the reservoir spillway was modified to widen the spillway from 100 ft. to 180 ft. to avoid inundation of RCW cavity trees. Location of the hatchery building and several ponds was changed to minimize the loss of wooded areas. In the fall of 1989 timber stands on hatchery property were thinned to 80 sq. ft. basal area, the reservoir basin was cleared, and midstory hardwood control was implemented in accordance with USFWS biological opinion.

Other Activities

Those species of fish which are listed as threatened or endangered are routinely monitored by Fisheries Division personnel independent of Section 6 funding. Fisheries Division staff members were involved in several other projects involving the status and distribution of endangered and threatened species. These include:

Study of the distribution and abundance of the Mexican stoneroller (Campostoma ornatum) in the Big Bend Ranch State Natural Area.

Development of a status report on the Devil's River minnow (Dionda diaboli). (Part of Section 6 project)

Study of the distribution and abundance of the Comanche Springs pupfish (Cyprinodon elegans). (Part of Section 6 project)

Assessment of the status of the San Marcos gambusia (Gambusia georgei).

Assessment of the status of the Clear Creek gambusia (Gambusia heterochir).

Participation as a member of the San Marcos Recovery Team and the Rio Grande Fishes Recovery Team.

Law Enforcement Division

The Parks and Wildlife Commission established law enforcement priorities as education first, prevention second, and apprehension third in endangered species and all other game, fish, and water safety enforcement efforts. These actions were approved in the six-year plan for the Parks and Wildlife Department in 1982 and have remained in the plan through subsequent revisions.

Efforts to comply with priorities include dissemination of information related to endangered species to interested groups and individuals, high profile patrol, and apprehension of violators.

Routine law enforcement patrols include surveillance for violations of endangered species laws. Violations detected and information received from the public related to those species are provided special attention, including coordination with other appropriate agencies and sharing of information with concerned departmental personnel.

During the period from September 1, 1989, through August 31, 1990, Texas Games Wardens filed 73 endangered or threatened species cases in state court. Numerous other cases have been jointly investigated

by state and federal game wardens which were filed in federal courts. One such case involved the killing of a whooping crane in which the violator paid a \$15,000 fine in federal court and \$7,100 to the state for civil restitution. Another recent investigation was initiated by state game wardens and concluded with cooperation of federal wardens that resulted in arrest for smuggling sea turtle boots for commercial purposes. Eleven (11) pairs of sea turtle boots, one (1) sea turtle belt, and a 1990 Ford pickup truck were confiscated. Cases are pending in federal court.

The Law Enforcement Division provides an annual report reflecting all endangered species handled by game wardens. This report includes sick or injured animals as well as those confiscated for law violations. The Division also reports and assists in monitoring those species in the wild.

Efforts are in progress to correct deficiencies in the endangered species regulations. Assuming the adoption of new rules, the game warden's ability to enforce these laws through education, prevention, and apprehension would be enhanced.

Parks Division

Habitat Acquisition

Land holdings within the Division provide protection for numerous endangered resources and community remnants of concern. These Department lands form the basis for a statewide system of habitat preserves. Among the most significant resource parcels are Devil's River State Natural Area, Kickapoo Caverns State Park, Bastrop State Park, Lost Maples State Natural Area, Franklin Mountains State Park, and Big Bend Ranch State Natural Area.

Ongoing Resource Investigations

In cooperation with other investigators and other Divisions, parkland natural resources continue to be investigated with emphasis on endangered and threatened resources. Data are incorporated into management plans as well as integrated into planning and operational phases of Division activities. The Division is also supporting a Department lands inventory in an effort to consolidate as well as supplement endangered resources data into a format suitable for informational and administrative purposes.

Habitat Restoration and Community Based Management Plans

Long term stewardship and assurance of habitat integrity of resources in Division landholdings are provided through holistic community-based management efforts. Management is directed at maintaining natural community processes or towards restoration of community integrity. Currently, major emphasis is on restoration of grassland communities on the Gulf Coastal Plain,

the Balcones Escarpment, and in desert grasslands. In conjunction with other Section 6 funded projects a major effort will be development of a management plan for the "Lost Pines" Bastrop State Park.

Monitoring/Mitigation

Division staff monitor all management and construction projects with potential for special resource impacts. Considerable effort is also expended to minimize, monitor and mitigate third party impacts on Division lands. Such impacts may occur from oil, gas, or mineral exploration or from easements requested across Department administered lands.

Public Information/Environment Awareness

The Division publishes brochures and produces park exhibits that elucidate endangered resource issues. At least two park units have full time interpreters dedicated to natural resource interpretation.

Direct Participation in Section 6 Projects

Division staff have participated directly in implementation of Section 6 projects, including monitoring of Black-capped Vireo populations and assessments of Devil's River Minnow, Comanche Springs Pupfish, and Houston Toad, as well as in the preparation of the book, Endangered, Threatened, and Protected Native Plants of Texas.

Resource Protection Division

Big Bend National Park Sensitive Plant Work

Four trails in the Chisos Basin area of Big Bend National Park were slated for renovation, rerouting, or obliteration. Several rare plants are known from the vicinity of these trails. In order for trail work to proceed without harming these sensitive species, precise locations were mapped. A report on the sensitive plants found along these trails was produced. Maps showing exact locations of the plants in relation to the trails were provided to the park staff and sensitive plants are being protected.

Bog Ecological Study

In cooperation with the Southern Forest Experiment Station, Natural Heritage Program staff have designed and implemented sampling of Sphagnum-Beakrush hillside seepage bogs within the Angelina National Forest to determine the effects of shading on the species composition of these plant associations. A total of 21 stands in six bogs have been sampled for species composition. Staff at the Southern Forest Experiment Station have taken samples of groundwater at each of these stands in order to relate vegetation to soil water availability. These stands represent areas of diverse habitat in different types of bogs.

Data analyses will be completed by the fall of 1990. Results will help determine the appropriate management of these highly diverse and botanically significant natural communities.

Highway Department Rare Plant Management Agreement

In cooperation with the State Department of Highways and Public Transportation, staff have worked to protect and manage endangered and threatened plants occurring along highway right-of-way. Altered mowing regimes and restricted use of herbicides within the right-of-way have benefitted Texas poppy-mallow and big red sage populations growing along state highways.

USFWS Cooperative Agreement

A few projects begun under the cooperative agreement prior to Section 6 funding are still ongoing. A status survey for the Palo Duro Mouse and additional Texas Kangaroo Rat status work are mammal projects funded through this agreement. The status survey for the Golden-cheeked Warbler has been completed and funding for the species recovery plan has been accepted. The beginning of the status work on the Smalleye Shiner was funded through this agreement. Field work has been completed for the following plants: Texas poppy-mallow, star cactus, prostrate milkweed, Texas ayenia, bushy whitlow-wort, Runyon's huaco, bracted twistflower, Neches River rose-mallow, and large fruited sand verbenas. Reports not yet submitted to the USFWS will be completed in 1990.

Red-cockaded Woodpecker Nest Cavity Competition

The Division is currently providing a cost-share for a study underway by the Southern Forest Experiment Station to examine the effect of forestry management practices on cavity competition between Red-cockaded Woodpeckers and Southern Flying Squirrels (Glaucomys volans). Results of the study are anticipated to provide valuable management information for Red-cockaded Woodpeckers in Texas.

U. S. Forest Service Inventory

In cooperation with the U. S. Forest Service National Forests in Texas, the Texas Natural Heritage Program has inventoried the four National Forests and two National Grasslands of Texas for sensitive plants and natural communities. More than 450 sites were selected for survey in initial review of aerial photography and soil maps. A list was compiled of 66 rare, endangered and sensitive plants based on extensive field studies. Seven of the sensitive plants are under federal review for possible listing as federally protected, and one is currently listed as endangered. Four plants were previously not known to occur in Texas. At least 100 sites were identified as having significant plant communities or sensitive plants. Beech-Magnolia and Longleaf-Little Bluestem communities have been nominated for inclusion in the USFS Research Natural Area program. Hillside

seepage bogs were mapped and recommendations for their management have been drafted. Rare and sensitive plants were documented with lists for areas found to be of special interest. Sensitive plant workshops were conducted during the fall of 1989 by Department botanists to assist USFS personnel in the identification of plants. A draft report on the four year project was sent to the Forest Supervisor in late spring of 1990.

Wildlife Division

Historical Activities

The Wildlife Division has been conducting research on endangered resources since 1969, and created a formal endangered species program in 1975. Although coordination responsibility for endangered resources activities within the Department was transferred to the Resource Protection Division in 1989, almost half of the projects currently conducted by the Nongame Resources Program within the Wildlife Division concerns endangered or threatened resources.

Night spotlight surveys of the American Alligator (Alligator mississippiensis), listed as state and federal endangered in 1973, began in 1971 and continue today. Data gathered from this counts, along with aerial nest surveys initiated in 1973, led to the reclassification of the Texas population to Threatened Due to Similarity of Appearance in 1983.

The Osprey (Panion haliaetus), formerly listed as an endangered species by the state, was the subject of a statewide survey from 1971 to 1976. Sightings were compiled to determine its distribution and a single known nesting attempt was documented during the survey period. The Arctic Peregrine Falcon (Falco peregrinus tundrius), a threatened migratory species, was surveyed along the Texas coast from 1973 to 1979 in an effort to determine population trends of the species during migration in Texas. Nesting surveys of the American Peregrine Falcon (Falco peregrinus anatum) were conducted between 1974 and 1985 to determine the location and annual activity status of the species in the Trans-Pecos region.

During 1977 and 1978 aerial surveys were conducted in the Trans-Pecos region to determine the distribution and density of the Mexican Duck (Anas diazi), which was previously classified as an endangered species. From 1984 to 1986, research on the Golden-cheeked Warbler was conducted on the Kerr Wildlife Management Area to assess population status and habitat use. During 1983 to 1986, the Interior Least Tern (Sterna antillarum athalassos) was the subject of an intensive study designed to determine the distribution of nesting areas and to analyze morphometric and

biochemical data for indications of differences between subspecies of least terns occurring in Texas.

American Swallow-tailed Kite Survey

This job was begun during 1990 to determine the distribution and status of the state threatened American Swallow-tailed Kite (Elanoides forficatus) in Texas during the breeding season. On-going work includes a survey of the lower Sabine River and Taylor Bayou floodplain for evidence of nesting and a mail survey to interested and potential kite observers.

Bald Eagle Surveys and Nesting Studies

Begun in 1971, the goals of these projects are to determine Southern Bald Eagle (Haliaeetus leucocephalus) nesting and reproductive success in Texas, monitor the survival and dispersal of eaglets, and to assess trends in the number of wintering bald eagles. Aerial surveys initiated in 1976 are used to locate and track chronology of eagle nests. Since 1985, eaglets have been banded and color-marked and blood samples taken to determine sex, genetic variation, and toxin levels. A winter survey, begun in 1985, provides a count of eagles on most water bodies in the State.

Black Bear Status

This project continues the long-term monitoring of reports of Black Bear (Ursus americanus) sightings or signs in Texas. Most reports originate from Big Bend National Park and Guadalupe Mountains National Park. Selected sightings outside these parks are investigated by Department personnel. A one-day forum of agencies and individuals involved in bear work in Texas was held in May, 1990, to assess perceived management and research needs for Black Bear in the state. Division staff will cooperate with researchers in Mexico to determine movements of bears across the U.S.-Mexico border.

Black-capped Vireo Management

Division staff are involved in Department Section 6 activities to research and manage Black-capped Vireos on the Kerr and Walter S. Buck Wildlife Management Areas. Section 6 efforts are being supplemented with additional staff funded with Pittman Robertson funds.

Brown Pelican Restoration

The primary effort of this project in 1989 was to assess pelican mortality at a causeway bridge on the South Texas coast. This study helped to identify weather and flight patterns of resident pelicans which contributed to a large number of the birds being hit by cars on the causeway. Study results may help to propose bridge structures to alleviate this problem.

Houston Toad Distribution and Habitat Status

In addition to participating cooperatively with the Resource Protection Division in this Section 6 project, Division staff have conducted surveys within the potential range of this species. As a result of these surveys, three new populations have been identified.

Red-cockaded Woodpecker Colony Site Management

From 1969 to 1974, studies investigated nest/roost tree mortality rates, quality and quantity of habitat use by color-marked woodpeckers, species population dynamics, and suitable habitat management practices. From 1975 to 1984, work emphasized monitoring of existing colonies and investigating reports of new colonies. Since 1984, monitoring efforts have continued and efforts to identify new colonies have increased. All suitable Department lands have been searched, but only one colony was identified. Colonies located on private lands and other regulatory agency lands were identified to the landowners to initiate appropriate conservation measures.

Staff continues to participate in meetings to develop appropriate management recommendations and work with the National Forests in Texas (NFT) to implement those recommendations under the 1982 Memorandum of Understanding. From 1988 to 1990, a challenge grant with the NFT enabled the repair of 100 damaged roost/nest tree cavities with steel restrictor plates and the augmentation of five bachelor sites with the release of five subadult females. In 1989, a management plan for the only identified RCW colony on Department-managed land was initiated and is an ongoing activity.

Whooping Crane Survey

Initiated in 1980, this project monitors the presence of whooping cranes relative to possible hazardous conditions during the wintering period. Survey results have indicated an expansion of wintering areas, including Matagorda Island. This project included a study of winter recreational activities in a portion of the cranes' wintering area and the effects of some of these disturbances relative to behavior patterns observed among crane family groups. Aerial data collected since 1976 indicates that human recreational activity at current levels, especially hunting, had not caused substantial within season or season-to-season alteration of habitat use by the cranes. This job provides for Department compliance with the State-Federal Contingency Plan for Protection of Whooping Cranes.

E. Review of Other Departmental Activities

Balcones Canyonlands Habitat Conservation Plan (Austin Regional Habitat Conservation Plan)

Section 10 of the federal Endangered Species Act provides for a process of permitting development within an area that contains endangered species habitat whenever a habitat conservation plan is submitted to and accepted by the Service detailing how development will proceed with the permitted incidental take of endangered species. Such a plan is in the process for the Austin area, and the Department is one of the principal participants in its development. Commissioner Bob Armstrong serves on the Executive Committee. In 1989, the Resource Protection Division provided considerable assistance as zoology, botany, ecology, and legal staff provided technical assistance, specialist committee membership, supervision and direction of field work, contract administration, and other state support to the multi-level government and private planning effort. The planning effort continues, now focusing on funding and habitat plan drafting. Staff are administering several section 6 projects with relevance to the planning effort and permit application.

Department Lands Inventory

This ongoing project is designed to describe habitats and communities on Texas Parks and Wildlife Departments lands, including state parks, wildlife management areas, natural areas, and other holdings. Known occurrences of rare species are also recorded. Future conservation goals will be established by comparing a list of communities represented on state lands with a list of all communities present within Texas. Reports on 41 parks have been completed, and field work has been conducted on 63 parks determined to be of highest priority. Field work will continue through the 1990 season on Parks Division holdings. Plans are underway to begin surveys on Wildlife Division lands.

V. PROPOSED DEPARTMENT ACTIVITIES

A. Section 6 Project Proposals

Each year the Endangered Resources Branch, with the help of the ERCC, compiles a prioritized set of proposals for federal Section 6 funding. Priorities are determined based on the identified species of concern, and proposals usually conform to needs identified in the conservation plan submitted to the U.S. Fish and Wildlife Service.

One purpose of the ERASR is to address a perceived need for more peer review in developing these proposals for funding. Proposals are submitted to the Fish and Wildlife Service by September 1. Proposed projects to be funded by Section 6 monies were solicited in the draft of this document. Proposals received from within and outside the Department were ranked based on several criteria, including resource status, threat to resource, proposed project benefit, and cost effective. Following the ranking, a list of 38 projects were selected for submission to the U.S. Fish and Wildlife Service (Appendix I). The format for Section 6 proposals, which are due to be received by TPWD by July 1 of each year, is also shown in Appendix I.

B. Habitat Conservation Plans

This section is reserved to describe upcoming Habitat Conservation Plans. At this time the Balcones Canyonlands HCP is the only one anticipated to be ongoing during 1990-91.

C. Proposed Listings

The Golden-Cheeked Warbler was recently classified by the U.S. Fish and Wildlife Service as endangered. Listing as endangered on the state list is now in progress. Other Texas species, the Mexican spotted owl (Strix occidentalis lucida), Louisiana Black Bear (Ursus americanus luteolus), Devil's River Minnow (Dionda diaboli), Pecos Pupfish (Cyprinodon pecosensis), Little Aguja Creek pondweed (Potamogeton clystocarpus), Terlingua Creek cat's eye (Cryptantha crassipes), Texas trailing phlox (Phlox nivalis texensis), and Walker's manihot (Manihot walkerae) are some of the species currently under consideration for listing by the Fish and Wildlife Service. Texas actions may be determined by the outcome of these federal listing procedures.

In addition to these three species, a broader review of potential listing/reclassification of species is planned 1991. The last comprehensive review of state-listed animal species was initiated in 1983. Since that time, the status of several species has changed, and new information is available for other species. Another complete review, including both plant and animal species, is needed.

VI. FUTURE NEEDS AND CONCERNS

A. Trends in Resource Status

Long-term trends for endangered resources in Texas are difficult to quantify. The wide-sweeping land use changes that began in the mid-19th century began the process that continues to most threaten rare species; however, only rudimentary biological inventories, primarily of vertebrates, had begun at that time. It is likely that many species were lost before they were ever identified. The problem of limited inventories continues to limit our understanding of the extent of the endangered resources problem today.

What can be said is that the known rate of extirpation of animal species from Texas has increased dramatically since the turn of the century. Prior to 1900, three species were known to be extirpated from Texas. During the period 1901 to 1958, four species are known to have disappeared from Texas. In contrast, since 1959 ten species or subspecies are known to have become extirpated from the state. Of the above 17 species, six are globally extinct. Today several species, such as the Attwater's Prairie Chicken, hang on the brink of extinction. Others, such as the Small-eye Shiner, may already be gone.

In contrast to earlier extinctions, where overharvest was often the man-induced cause for eradication, recent extirpations have usually resulted from man-induced habitat alteration or destruction. The status of natural area protection within the natural regions of Texas tells the story of this loss of habitat. Of the eleven ecological regions in Texas only two, the Trans-Pecos and the Gulf Coast Prairies and Marshes, have more than one percent of their area in managed natural areas (i.e. state parks, national parks, national wildlife refuges, state wildlife management areas, or privately-owned natural areas). In the Gulf Coast Prairies and Marshes, where 2.7 percent of the region is in managed natural areas, rate of loss of wetland habitat from 1956 to 1980 was 35%. Conservation easements and other private actions may somewhat increase the total acreage in protected natural communities; however, the scope and trend of habitat loss still continues to be the greatest barrier to recovery of endangered resources.

The trends for rare plant species are more difficult to ascertain. While extinction of animal species has received attention for well over a century, it is only in the last several decades that this concern has extended to plant species on a broad scale. Recent studies have shed light on several species of plants, such as Texas wildrice and Hinckley oak, which may be at threshold levels for survival. On the other hand, the status and trends of many plant species are unknown due to limited inventories. At the least, many plant species face vulnerability due to the destruction of natural communities in ecoregions throughout the state. The ability to

provide for the future of many rare plants is limited by statutes which are weaker than those protecting animals.

Progress in the recovery of endangered resources in Texas is only beginning. While some endangered species have been reclassified as threatened, the American alligator is the only species ever removed from the Texas endangered list because its population actually recovered. For a few other species, including the bald eagle (both Southern and Northern) and brown pelican, the outlook is improving, primarily due to the reduction in environmental contaminants. Other species which had at one time disappeared from the state have been or are being reintroduced, including the desert bighorn, bison (in managed areas only), and Aplomado falcon. The success of most of these reintroductions is yet to be determined. The majority of species listed as endangered and threatened continue to face a complex problem of habitat protection and restoration if their future is to be secure.

B. Regulatory Status

Current State threatened and endangered species statutes are ambiguous and, in some instances, virtually unenforceable. These statutes need revision and amendment to correct these deficiencies. In addition, the issues of habitat protection and civil penalty provisions should be considered. Statutory amendments will be required to ensure that endangered resource locality information can be collected and made available to individual landowners and planning entities making decisions about siting public facilities without endangering the resources. Release of specific locality information has in the past led to collection and destruction of extremely sensitive resources as well as trespass and violation of private landowner rights. A mandatory review process for state projects and programs should be considered in any review of state legislation concerning endangered resources. As enforcement capabilities are enhanced in State statutes, Department regulations which provide clear guidelines and enforceability for Law Enforcement personnel need to follow.

C. Potential Listings

A set of listing criteria and procedures for their implementation needs to be developed and adopted by the Department to assure that an objective review and proper decision will be made about listing or delisting animal and plant species. The current animal lists need review against such a set of criteria. Threatened and endangered plants have thus far only been listed following federal actions. Several dozen plant species are in need of protection through listing by the State and many more need to be reviewed for inclusion on the lists of endangered, threatened, or protected native plants of Texas. No formal listing of communities has ever been addressed by the State of Texas. The possibility of adopting the Natural Heritage Program's

current rare natural community list as the officially recognized state list should be explored.

D. Funding Needs

The Section 6 funding provided by the 1988 amendments to the Endangered Species Act greatly expanded the financial resources available for endangered resources work within the State; however, several critical needs continue to exist. The U.S. Fish and Wildlife Service determines which projects proposed by the State will receive Section 6 funding. In some instances the federal funding priorities coincide with the State priorities; however, in other instances, no federal funding has been granted for activities which are high State priorities. It is for this reason that the Department's Current Activities do not address all the endangered resources of priority concern. An alternate source of funding State priority concerns must be available.

Additionally, funding for endangered resources must increase if effective avenues of long-term resource protection are to be available. Current funding levels and mechanisms cannot support an active land acquisition program. Funding should be provided to support a more extensive system of natural areas devoted to these priorities.

E. General Problems and Needs

The underlying framework around which protection of endangered resources must ultimately be fashioned needs restructuring. The significant role in protecting these resources played by private landowners in Texas cannot be overlooked. The concerns, needs, and motivations of these landowners must play a guiding role in addressing this need. We must devise a listing, regulatory, and management scheme that is mindful of that role. The citizens of Texas have indicated strong support for conservation efforts that protect endangered resources and actions of the State of Texas must reflect that popular support. The fate of the natural heritage of the State is at stake and now is the time to make critical decisions about its future.

State agencies need an effective mechanism for ensuring that their actions do not cause undue and adverse impacts to sensitive species or natural communities, including those currently protected and those deserving of protection because of long-term threats. Coordination with the Department in the planning phases of projects and programs on the potential for impacting endangered resources would influence decisions prior to commitments that might be difficult to alter once initiated. A multi-agency review process would be beneficial to the resources as well as the proposing agency as it would allay conflicts in the early stages of development. At present there is insufficient staff to undertake such a massive review process, therefore a mandate

to begin such an endeavor should be accompanied by increased budgetary support.

Regional, holistic solutions to endangered resource issues are needed. As development continues in the State, additional conflicts between development activities and these resources are inevitable. An equitable, statewide funding mechanism could assist in facilitating effective regional solutions to these conflicts. More thorough surveys and ecological studies should be conducted wherever development is anticipated prior to development planning. Integrating these studies into the planning process will avoid "project-stopping" conflicts through advance knowledge of the potential for conflict. Natural communities need to receive some form of protection through both regulatory methods and by conventional conservation methods, including acquisition or management agreements.

VIII. CONCLUSION

The magnitude of the task of endangered resources conservation is only beginning to be appreciated in Texas, as well as on a nation-wide basis. A directive to not only preserve, but to ultimately attempt to recover, a varied assemblage of animals, plants, and communities facing a wide array of pressures cannot be accomplished by a piecemeal, species by species approach. The goal of the Endangered Resources Branch is to pull together the expertise and knowledge on endangered resources in Texas, identify and address the gaps in that knowledge, and organize efforts to tackle the tasks of endangered resources recovery based on a set of priorities that identify the resources in greatest peril. The ERASR is intended to serve as a status report on each of these efforts. Any comments or questions regarding the effectiveness of this document in accomplishing that purpose are welcome.

Ultimately, the task cannot be accomplished by one agency or even a consortium of organizations. The conservation of the full diversity of Texas' resources depends upon a recognition of its importance by all Texas citizens. The Endangered Resources Branch and the Endangered Resources Coordinating Committee have identified education as one of the primary concerns in an approach to comprehensive endangered species management. This document is one of the steps to be taken in disseminating information on the welfare of Texas' endangered resources.