DRAFT

Determining Species of Concern in Pima County, Arizona

A discussion paper for the Sonoran Desert Conservation Plan

Illustration by Bill Singleton
Pima County Illustration Section

April 1999

MEMORANDUM

Date: April 30, 1999

To: The Honorable Chair and Members
Pima County Board of Supervisors

From: C.H. Huckelberry
County Administrator

Re: **Attached Discussion Paper Entitled *Determining Species of Concern in Pima County***

Background:

The attached paper entitled *Determining Species of Concern in Pima County* was drafted by County staff along with Dr. Bill Shaw from the University of Arizona in order to facilitate discussion about which species might be considered for protection under the Sonoran Desert Conservation Plan. During the past months, a series of in-depth interviews were conducted with members of the local science community who have expertise in the areas of birds, fish, invertebrates, mammals, plants and plant communities, and reptiles and amphibians. The results of the interviews are compiled within the report.

Report:

This report describes the status, location, distribution and habitat needs of species already recognized by the federal government as imperiled, extirpated species, and a much larger number of species that are in decline, and potentially on the way toward listing if conservation measures are not put in place.

Federally recognized: There are 25 animals and plants within Pima County that are federally recognized as listed, proposed, candidates, or petitioned for threatened or endangered status. (Table 1, pages 1-2 to 1-5)

Extirpated: A dozen species that are not federally listed have been extirpated in Pima County. A disproportionate number of these missing natives to the area were dependent on aquatic habitat which is now lost. (Table 3, page 3-2)

Species of concern: An additional 49 species have been identified by local scientists as species of concern. These are divided into categories based on the criteria below. (Table 4 pages 4-2 to 4-8)

A) 12 species are considered to be in jeopardy in Pima County, and are species for whom habitat in Pima County is critical for their overall existence (Status 1);

B) 18 species are considered to be in jeopardy in Pima County, and are generally declining throughout their range (Status 2);

C) 13 species are believed to be in jeopardy in Pima County, but are not considered to be at risk overall (Status 3);

D) 6 species are not believed to be at risk in Pima County, but should be considered for conservation by the County plan because of their ecological or social importance (Status 4).

Habitats of Concern: In addition to the identification of specific species, the report describes habitats of concern, and target habitats for conservation. (Table 5, pages 5-1 to 5-2)

Other Species: Over 100 other species are described in the report. More than half are believed to be commonly found in Pima County, or are commonly found elsewhere, and were never common in Pima County. The report finds that most of these species would benefit from a conservation plan that protected listed species and species of concern. (Page 6-1, Appendix B, pages B-1 to B-6) Fifty non-native species are described to highlight the need for proper management of native species and natural resources. (Page 7-1, Appendix C, pages C-1 to C-6)

Summary:

On May 11, 1999, the Science Technical Advisory Team to the Sonoran Desert Conservation Plan will meet for the first time to begin discussions about the biological underpinnings for our regional multi-species conservation plan. The attached report provides an initial frame of reference for the Science Team. It will likely undergo numerous changes before recommendations are made to the Steering Committee about what species should be covered by the Sonoran Desert Conservation Plan. I will forward all reports to the Board as they are produced by staff.

Attachment

DRAFT

Determining Species of Concern Within Pima County, Arizona

A Discussion Paper For The

Sonoran Desert Conservation Plan

April 29, 1999

Presented to:

Members of The Sonoran Desert Conservation Program's
Science Technical Advisory Team (STAT)

Prepared by:

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1.0 INTRODUCTION

1.1 Background

In October of 1998, the Pima County Board of Supervisors directed staff to develop the Sonoran Desert Conservation Plan. The Sonoran Desert Conservation Plan (SDCP) is a major conservation planning effort with the following goals: (1) define urban form and prevent urban sprawl though protection of natural and cultural resources; (2) provide the basis of a natural resource protection and environmental element for the Comprehensive Plan; (3) protect habitat for and promote recovery of the endangered cactus ferruginous pygmy-owl; (4) preserve an interconnected system comprised of the range of native vegetative communities needed to provide habitat for the diverse array of species native to Pima County and thereby prevent the need for future listings; and (5) obtain a Section 10 permit under the Endangered Species Act for a regional, multi-species conservation plan.

The regulatory backdrop for the SDCP is provided by the federal Endangered Species Act (ESA). Section 9 of the ESA prohibits the "take" (harm, harassment, significant alteration of habitat, etc.) of any federally listed animal species. Section 10 of the ESA allows permits to be granted for incidental take of a listed species if an adequate conservation plan is developed. Applications for these permits are submitted to the U. S. Fish and Wildlife Service, which is responsible for reviewing and approving, or denying, species conservation plans.

In Pima County, there are eighteen species which have been federally listed as threatened or endangered under the Endangered Species Act. These are described within Table 1, along with four additional species which are considered candidates for federal listing, two species proposed for listing, and one species which has been petitioned for listing under ESA. At a minimum, we assume that the protection of these species will be addressed by the SDCP.

Another goal of SDCP is to provide protection to species and habitats, not covered by ESA, whose existence in Pima County may be in jeopardy or should be considered because of their ecological or social importance. To accomplish this goal, the SDCP is being designed as a regional program with six elements that reflect a wide range of community values including:

1. **Riparian Restoration** - Historically, many of the major rivers in and around Tucson flowed year-round. High water tables along parts of the Santa Cruz River, Tanque Verde Creek, Agua Caliente Wash and Canada Del Oro Wash supported extensive riparian forests of cottonwood, willow and mesquite. Floodplain development and groundwater pumping have since lowered these water tables, which has significantly altered the biologically rich and diverse riparian corridors of Eastern Pima County. Today, Pima County actively promotes riparian restoration of our river corridors and floodplains through land acquisition and development of river parks. In addition, opportunities exist to introduce Central Arizona Project (CAP) and reclaimed water

TABLE 1
FEDERALLY LISTED, PROPOSED AND CANDIDATE SPECIES FOR PIMA COUNTY

SCIENTIFIC NAME	COMMON NAME	STATUS	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
Panthera onca	Jaguar	Endangered	Eastern/Western	Widely distributed south of Arizona	Range throughout a variety of habitats from Sonoran Desert to conifer forests	Sightings near Mexico/Arizona border and south central AZ (confirmed with photographs)
Felis yagouaroundi tolteca	Jaguarundi	Endangered	?	Widely distributed south of AZ	Variety of habitats: deciduous forests, riparian areas, swampy grasslands, upland dry savannahs, etc.	Sightings in southern AZ (unconfirmed)
Felis pardalis	Ocelot	Endangered	Eastern	Widely distributed south of AZ	Humid tropical and sub-tropical forests, savannahs and semi-arid thorn scrub (dense cover)	Sightings in southern Az (unconfirmed)
Canis lupus baileyi	Mexican Gray Wolf	Endangered	Eastern (historically)	May still persist in Mexico; was formerly wide in distribution	Chapparal, woodland, and forested areas; may cross desert areas	Unconfirmed reports of individuals in southern AZ; experimental nonessential population introduced in Blue Primitive Area
Antilocapra americana sonoriensis	Sonoran Pronghorn	Endangered	Western	Also occurs in Mexico in Pinacate Biosphere Reserve	Broad, Intermountain alluvial valleys with Creosote-Bursage & Palo Verde-Mixed Cacti Associations	Historic range probably larger than exists today; formerly ranged east to near Tucson
Leptonycteris curasoae yerbabuenae	Lesser Long-nosed Bat	Endangered	Eastern/Western	Widely distributed	Desert scrub habitat with agave and columnar cacti present as food plants; day roosts in caves and abandoned tunnels	Species is migratory

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FEDERALLY LISTED, PROPOSED AND CANDIDATE SPECIES FOR PIMA COUNTY

SCIENTIFIC NAME	COMMON NAME	STATUS	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
Falco peregrinus anatum	American Peregrine Falcon	Endangered	Eastern/Western	Widely distributed in United States	Cliffs and steep terrain usually near water or woodlands with abundant prey	Breeding birds are year-round residents; other birds winter and migrate through AZ; species endangered due to pesticides
Haliaeetus leucocephalus	Bald Eagle	Threatened	Eastern	Widely distributed	Large trees or cliffs near water (reservoirs, rivers and streams) with abundant prey	Some birds are nesting residents while a larger number winters along rivers and reservoirs
Glaucidium brasilianum cactorum	Cactus Ferruginous Pygmy-Owl	Endangered	Eastern/Western	Widely distributed south of AZ	Mature Cottonwood/Willow, mesquite bosque, and sonoran desert scrub	Few documented sites; surveys are needed
Colinus virginianus ridgewayi	Masked Bobwhite	Endangered	Eastern	Limited distribution in Mexico	Desert grasslands with diversity of dense native grasses, forbs and brush	Presently only known from reintroduced population in Buenos Aires
Strix occidentalis lucida	Mexican Spotted Owl	Threatened	Eastern/Western	Specific habitat needs	Nests in canyons and older forests with multi-layered foliage structure	Saguaro National Park; Coronado National Forest
Empidonax traillii extimus	Southwestern Willow Flycatcher	Endangered	Scattered	Distribution restricted to riparian corridors	Cottonwood/Willow and tamarisk vegetation communities along rivers and streams	Migratory riparian obligate species that occupies breeding habitat from late April to September
Charadrius montanus	Mountain Plover	Proposed threatened	?	?	Open arid plains, short grass prairies and scattered cactus	Listed proposed/threatened in February 1999
Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo	Petitioned	Eastern	?	Riparian areas	Petitioned for endangerment; declining throughout its range

TABLE 1
FEDERALLY LISTED, PROPOSED AND CANDIDATE SPECIES FOR PIMA COUNTY

SCIENTIFIC NAME	COMMON NAME	STATUS	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
Kinosternon sonoriense longifemorale	Sonoyta Mud Turtle	Candidate	Western	Also found in Rio Sonoyta, Sonora, Mexico	Ponds and streams; prefers mud or sandy bottoms	Known only from Organ Pipe Cactus National Monument
Rana chiricahuensis	Chiricahua Leopard Frog	Candidate	Eastern		Streams, rivers, backwaters, ponds and stock tanks that are free from introduced fish, bullfrogs and crayfish	
Cyprinodon macularius	Desert Pupfish	Endangered	Western	Formerly occurred in Santa Cruz River	Shallow springs, small streams, and marshes; tolerates saline and warm water	Two subspecies are recognized: Desert Pupfish and Quitobaquito Pupfish
Poeciliopsis occidentalis occidentalis	Gila Topminnow	Endangered	Eastern	Upper Cienega Creek; Santa Cruz River near Tubac	Small streams, springs and cienegas with vegetated shallows; backwaters of large rivers	Historically occurred in backwaters of large rivers
Gila intermedia	Gila Chub	Candidate	Eastern	Scattered Statewide; also found in Sonora, Mexico	Pools, springs, cienegas and streams	Multiple private landowners including TNC, Audoubon Society, BLM and others
Sonorella vespertina	San Xavier Talusnail	Proposed endangered	Eastern	Only one known population	Talus slopes	Petition to be removed from listing due to conservation agreement still pending
Lilaeopsis schaffneriana ssp recurva	Huachuca Water Umbel	Endangered	Eastern	Populations in adjacent Sonora, Mexico and Fort Huachuca Military Res.	Cienegas, perennial low gradient streams; wetlands	Found in Pima County in Empire Ranch; formerly in Santa Cruz River at Sentinel Peak

TABLE 1
FEDERALLY LISTED, PROPOSED AND CANDIDATE SPECIES FOR PIMA COUNTY

SCIENTIFIC NAME	COMMON NAME	STATUS	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
Amsonia Kearneyana	Kearney's Blue Star	Endangered	Western	Narrowly distributed	West-facing drainages in the Baboquivari Mountains; grow in stable, partially shaded, coarse alluvium	Protected by Arizona Native Plant Law
Echinocactus horizonthalonius var nicholii	Nichol's Turk's Head Cactus	Endangered	Western/Eastern?		Found in unshaded microsites in Sonoran desert scrub on dissected alluvial fans at the foot of limestone mountains and on inclined terraces and saddles on limestone mountainsides	
Coryphantha scheeri var. robustispina	Pima Pineapple Cactus	Endangered	Eastern (Santa Rita Exp. Range, flanks of the Santa Rita Mountains)	Narrow distribution	Sonoran Desertscrb or semi-desert grassland communities; alluvial valleys or on hillsides in rocky, sandy or silty soils	Impacted by grazing and loss of habitat (urban development); Lehmann's Lovegrass is a major problem; recovery in the initial planning stage
Echinomastus erectocentrus acunensis	Acuna Cactus	Candidate	Western		Well drained knolls and gravel ridges in Sonoran Desertscub	

to the major river systems to help bring water tables up to sustainable levels to promote riparian vegetation.

2. **Ranch Conservation** - Ranch conservation helps provide a boundary between the natural environment and the metropolitan area and preserves the heritage and culture of the West. Today, many ranches are faced with rising land prices, changing livestock markets, climatic variability and increasing political uncertainty over access to public grazing land. This has led to the sale of their private land holdings to developers, thus creating urban sprawl. Pima County has participated in a number of ranch conservation efforts such as Empire, Cienega, Empirita and Posta Quemada ranches, which have been successful in reducing urban sprawl.

3. **Historical and Cultural Preservation** - Pima County has a long and complex multi-cultural heritage, beginning about 10,000 B.C., which has left us a rich legacy of cultural and historic sites and buildings. At present, there are more than 4500 recorded prehistoric and historic sites within eastern Pima County and nearly 100 individual properties and districts listed on the National Register of Historical Places. Bond funds will be used to acquire and interpret some of these sites.

4. **Biological and Ecological Corridor Conservation** - In order to maintain healthy and diverse plant and animal populations, it is essential to keep habitats from becoming isolated or fragmented. Biological corridors will be needed to link areas of public land reserved as national parks, forests, monuments to other areas such as mountain parks and riparian areas to maintain biological diversity throughout the region.

5. **Mountain Parks** - The establishment and enhancement of County mountain parks serves to protect our invaluable natural, cultural and scenic resources as well as providing critical wildlife habitat and migration corridors. Tucson Mountain Park, Pima County's first mountain park, was established in 1929 and is one of the County's most popular public attractions. Two other mountain parks, Colossal Cave and Tortolita, have been established since and others are under consideration.

6. **Critical and Sensitive Habitat** - To date, limited success has been achieved in resolving the challenge that resource development poses to threatened and endangered species within Pima County. A more comprehensive approach is necessary to identify and understand the interactions of individual species within the various ecosystems to determine how conservation and protection of these ecosystems can help the recovery of threatened and endangered species.

Implicit within all of these elements is the tangible objective of developing a natural, open space and preserve system capable of protecting the full spectrum of biological diversity that characterizes this region. Adopting a region-wide perspective covering a variety of elements of natural resource planning will allow Pima County to avoid the fragmentation resulting from piecemeal efforts. The

SDCP will also reduce or eliminate the expense and disruption that is occurring nationwide, when communities do not put species protection into effect until the point of listing under ESA.

1.2 Setting

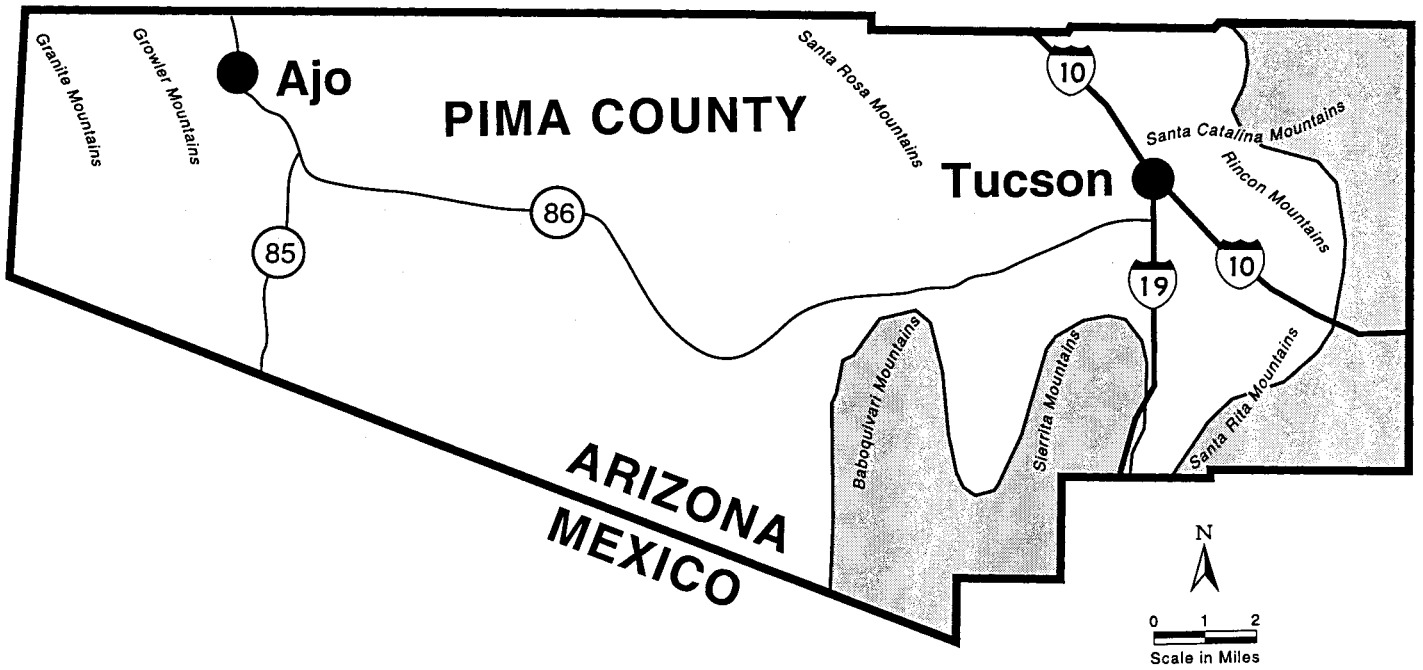
Pima County can be divided into two eco-regions as defined by Omernik (1987) (Figure 1). The central and western portions of Pima County are lower in elevation and are characterized by Sonoran desert vegetation, while the eastern portion of the county possesses a number of high, forested areas surrounded by either desert or grassland vegetation.

To understand the biologic diversity of Pima County, we must understand the broader geographic and evolutionary setting in which our county is situated. Pima County is located between the subtropics and temperate climatic zones of North America. As a result of this location, and evolutionary happenstance, Pima County spans two of the world's floristic realms, the Neotropic and the Holarctic (Warshall 1995). Our coniferous forests and broad-leafed deciduous riparian woodlands are part of our temperate heritage, while our desert and oak woodland vegetation is a legacy of the tropics (Brown 1982). Pima County's position at the edge of the tropics is also reflected in the fauna, as many species are at the northern limits of their range within this region (Felger 1995). Relatively few animals and plants are at their southern limits here because of the presence of high elevations farther south in Mexico.

Elevations in Pima County range from a low point of 660 feet west of Ajo, to a high point of 9157 feet above mean sea level in the Santa Catalina Mountains north of Tucson (Figure 1). The Santa Catalina, Santa Rita, Rincon Mountains, and, to a lesser degree, other ranges in the County have served as a refuge for animals and plants that would have otherwise disappeared during warm, inter-glacial periods such as that which has prevailed the last 10,000 years. These mountain ranges, known as "sky islands," also nurture perennial streams with a unique fish fauna. During glacial periods, the floral and faunal constituents of the mountains and streams extended farther down into the valleys.

Pima County's biological diversity is attributable in part to its physical proximity to the Sierra Madre Occidental of Mexico, and indeed the sky islands are considered its northern outlier. The Sierra Madre has been identified as one of the three "megadiversity" centers of the planet (Warshall 1995).

Pima County experiences great variation in weather patterns. Average annual rainfall generally increases from west to east, as does the amount of summer rainfall, but annual rainfall totals vary greatly from year to year and place to place. The summer monsoonal rains reduce water stress during the hottest portion of the growing season, which is one reason why the Sonoran Desert is more diverse than the Mohave Desert, which is dominated by winter rainfall alone. In the warmest



Ecoregions as defined by Omernik (1987)

Southern Basin and Range
(Sonoran Desert)

Southern Deserts
(Sky Islands)

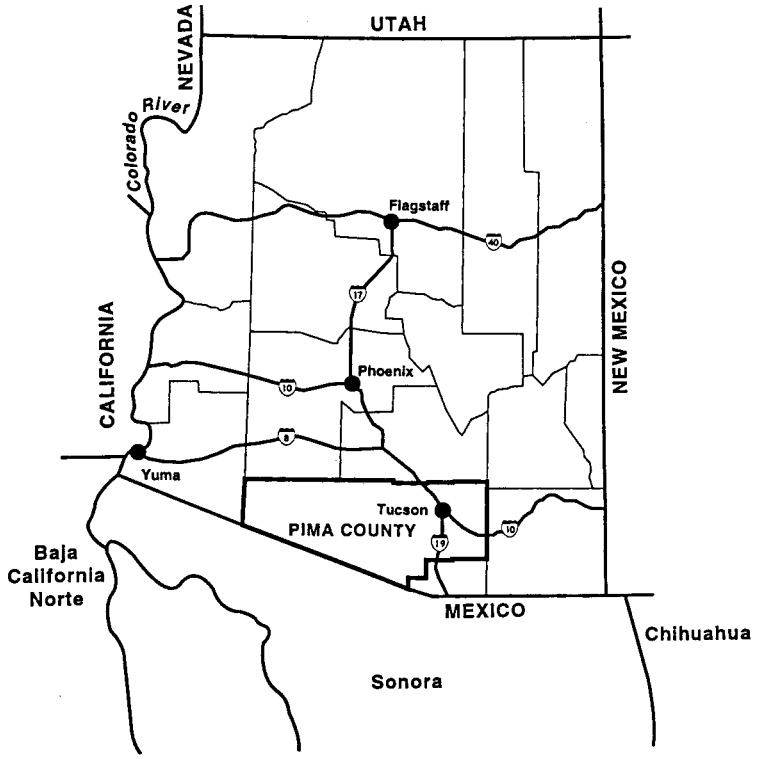


Figure 1

LOCATION MAP

region, southwestern Pima County, nearly frost-free conditions permit the growth of tender plants found nowhere else in the United States, such as the organ pipe cactus.

Pima County is also geologically diverse. Rock types run the gamut from acidic volcanic and intrusive rocks, to limestone, basalt, andesite and metamorphic schists. Wide, sloping, alluvial piedmonts derived from erosion of the mountains are a dominant landform. Substrate diversity on these alluvial slopes is enhanced by great variation in the type and degree of soil formation. Over time, dust accumulating on these surfaces creates distinctive subsurface zones of clay and calcium carbonate which profoundly affect the character of the vegetation. Associated with the valley floors are extensive bottomlands of deep, fine soils. Where bedrock outcrops occur in present-day valleys, sites are created for high groundwater tables to persist during long periods of aridity.

1.3 Information Needs

To accomplish the goal of protecting biological diversity under the SDCP, we must first determine which species are in danger of being lost from Pima County and understand the habitats and efforts needed to protect them. In addition, it is important to note those native species which have already been lost from Pima County and which could potentially be restored. This report presents a guide to assist the Science and Technical Advisory Team (STAT) in determining plant and animal species which should be addressed by the SDCP. Combined with data on the federally listed species mentioned in Table 1, this information will provide the basis for future biological investigations, which will be guided by STAT and planned for by the SDCP Steering Committee.

1.4 Purpose

The purpose of this report is to make preliminary recommendations for unlisted species, plant communities and habitats for conservation in Pima County. The assumption that listed species will be accorded highest priority for conservation led us to focus on prioritizing unlisted species during our interviews with species experts. This report summarizes information obtained regarding species of concern for Pima County. The Science Technical Advisory Team will review and adopt a revised set of focal species, plant communities and habitats for the Sonoran Desert Conservation Plan. These species will be protected under the conservation plan in addition to the federally listed threatened and endangered species, candidate species and species currently petitioned for listing under the Endangered Species Act.

2.0 METHODS

2.1 Previous Studies

Three previous investigations provided a basis for our interviews. The Nature Conservancy's (TNC) 1998 eco-regional workshop materials identified sensitive plants, animals and plant communities for the Sonoran desert, as did The Wildlands Project's "State of the Biome" report (Nabhan and Holdsworth 1998). Both these efforts treat a broad area which includes part of Pima County, excluding the Sky Islands eco-region. The Coalition for the Sonoran Desert Protection Plan compiled a preliminary list in July 1998 specifically for Pima County. Their list was based on an evaluation of sensitive species lists from Arizona Game and Fish Department (AGFD) and the Coronado National Forest (Andy Holdsworth, personal communication).

A fourth source of information was used only for our final interview concerning plants. Ms. Sabra Schwartz generated a list of plant species in the AGFD Heritage Data Management System for Pima County. Ms. Sue Rutman reviewed this list during the course of her interview.

2.2 Interview Process

Interviews of biological experts were conducted to obtain information on various species of concern within Pima County. Personal interviews were conducted in lieu of holding a workshop for several reasons. First, an experts workshop had been recently conducted by The Nature Conservancy to identify conservation priorities for the Sonoran Desert eco-region, which includes a large portion of Pima County (see section on Previous Studies). This workshop included developing an extensive list of species and habitats considered to be threatened within the study area. Holding another workshop to go over these same issues would be considered redundant by most experts, and they may not be interested in participating. Second, holding personal interviews streamlined the process of gathering information by allowing each individual to set a time and place to meet that was convenient to their own schedules. Finally, interviews with individual experts allowed the interview team to hold discussions in greater detail and depth than a workshop would allow.

Many of the species listed in The Nature Conservancy and The Wildlands Project reports are not found in Pima County or the United States. Those that do range into Pima County were generally discussed during our interviews. On a number of occasions, we asked the experts about certain species mentioned in previous investigations. This was particularly true of species in the Coalition list, since this was the only previous list focused on this county's biodiversity.

Interviews were conducted with thirteen people based on their knowledge and expertise regarding six different taxa of animals including mammals, birds, herpetofauna (reptiles and amphibians), fish, invertebrates and plants/plant communities. A list of those interviewed is displayed in Table 2. A

TABLE 2
PEOPLE INTERVIEWED FOR SPECIES OF CONCERN
IN PIMA COUNTY

NAME	AFFILIATION	DATE	SPECIES
Mr. Phil Rosen	University of Arizona School of Renewable Natural Resources	3/4/99	Reptiles & Amphibians
Mr. Jeff Simms	Bureau of Land Mgmt.	3/15/99	Fish
Dr. Carl Olson	University of Arizona Dept. of Entomology	3/12/99	Invertebrates
Dr. Bill Mannan	University of Arizona School of Renewable Natural Resources	3/12/99	Birds
Dr. Peter Warren	The Nature Conservancy	3/18/99	Plants & Plant Communities
Dr. Lendell Cockrum	University of Arizona Dept. Of Ecology and Evolutionary Biology	3/19/99	Mammals
Mr. Steve Prchal	Sonoran Arthropod Studies Institute	3/19/99	Invertebrates
Dr. Robert McCord	Mesa Southwest Museum	3/22/99	Invertebrates
Dr. Steve Russell	University of Arizona Dept. Of Ecology and Evolutionary Biology	3/22/99	Birds
Dr. Wendell Minckley (faxed materials only)	Arizona State University Department Of Biology	3/24/99	Fish
Dr. Yar Petrszyn	University of Arizona Dept. Of Ecology and Evolutionary Biology	3/24/99	Mammals
Mr. Jeff Howland	U. S. Fish and Wildlife Service	3/29/99	Reptiles & Amphibians
Ms. Sue Rutman	Organ Pipe National Monument	4/2/99	Plants & Plant Communities

series of forms were mailed to each individual for them to fill out prior to the interview (see Attachment A in Appendix A). The forms were designed to obtain basic information on species such as common and scientific names, current State or Federal status, habitat and management needs, and the general location and distribution of the species within Pima County.

These forms were useful in helping staff organize and prioritize each individual species described during the interviews. Since the SDCP has been broken into two regions, Eastern and Western Pima County[1], it is necessary to identify the location or locations where the plants and animals can be found. This way, each species will be planned for within the proper phase of the SDCP. Distribution within its range is useful to determine the status of each individual species and direct conservation planning activities. Species which are narrowly distributed will have different protection and recovery needs than those that are more widely distributed.

Interviews were held on an individual basis. Dr. William Shaw from the University of Arizona and Julia Fonseca and David Scalero from the Pima County Flood Control District were responsible for conducting the interviews of each biological expert. Interviews were performed in person, when possible, or over the phone. Information gathered was placed on the form shown in Attachment B, located in Appendix A.

2.3 Supplemental Information

After completion of the interviews, supplementary information was gathered to help fill in some of the data gaps. Scientific and common names of plants and animals were determined using the Heritage Data Management System database (AGFD), faxed data sheets from people interviewed and other references. Plant communities were identified using "Biotic Communities of the American Southwest" (Brown, 1982) and information provided during the interviews. Draft tables were reviewed for accuracy by the U. S. Fish and Wildlife Service.

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[1] Eastern Pima County is defined as all land located to the east of the Tohono O'Odham Nation. Sixty-four percent of Eastern Pima County is in private or State (and therefore potentially private) ownership, making this area a top priority for conservation efforts. Western Pima County includes the Tohono O'Odham Nation, and substantial federal land along with private holdings to the west of the Nation. Western Pima County federal land is considered more protected from development, making it a lower priority for conservation. Eastern and Western Pima County landscapes also reflect largely different eco-regions, with the transition from Sonoran Desert vegetation to grassland vegetation occurring across the eastern third of the County.

3.0 SPECIES EXTIRPATED FROM PIMA COUNTY

As many as 13 species are believed to have been extirpated from Pima County (see Table 3). Most of these species no longer exist in Pima County due to the loss of habitat which they depended upon for survival. The Mexican Gray Wolf and Grizzly Bear are exceptions, because they were purposefully extirpated in Pima County through bounty hunting and government trapping programs The Mexican Gray Wolf and Grizzly Bear are the only species in this table which are listed under the Endangered Species Act.

A disproportionate number of species were extirpated through loss of aquatic habitat. In Pima County, several streams have entirely ceased to flow during much of the year, most notably the Santa Cruz River and Rillito Creek. In addition, many other streams and springs have been diverted or developed for human or livestock use in a manner incompatible with the existence of native species.

TABLE 3
SPECIES THAT HAVE BEEN EXTIRPATED IN PIMA COUNTY

SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	HABITAT NEEDS	COMMENTS
Canis lupus baileyi	Mexican Grey Wolf	Eastern	Large areas of mountain and grassland terrains	Last record in 1952 on southern side of Catalina Mountains
Ursos arctos	Grizzly Bear	Eastern	Large upland montane areas with riparian habitat	Last seen in the 1920's in Catalina and Rincon Mountains
Castor canadensis	Beaver	Eastern	Aquatic	Formerly at Ft. Lowell
Ondatra zibethicus	Muskrat	Eastern	Aquatic	
Falco femoralis	Aplomado Falcon			
Rana tarahumarae	Tarahumara Frog	Eastern (Santa Rita Mtns.)	Canyons	Last record in 1983
Catostomus insignus	Sonoran Sucker	Eastern	Aquatic	May occur periodically in the Santa Cruz River outside Pima County
Catostomus clarki	Desert Sucker	Eastern	Aquatic	May occur periodically in the Santa Cruz River outside Pima County
Rhinichthys osculus	Speckled Dace		Aquatic (bottom)	Taxonomic uncertainties: surveys needed in Buehman Canyon, etc.
Speyeria nokomis caerulescens	Blue Silverspot Butterfly	Eastern	Mountain Cienegas; violets as food source	Extirpated in the U. S.; Mt. Lemmon population extirpated due to water diversion
Anodonta californensis	California Floater (clam)			Possibly extirpated
Tryonia protea	Snail			Possibly extirpated
Dalea tentaculoides	Gentry Indigobush	Western (Baboquivari & Tohono O'Odham)	Mountain Riparian	

4.0 SPECIES OF CONCERN

Based on the interviews, a list was developed for species of which there is some concern regarding their status in Pima County. This list was divided into four groups according to the following criteria:

A. Species considered to be in jeopardy in Pima County and are species for whom habitat in Pima County is critical for their overall existence (Status 1);
B. Species considered to be in jeopardy in Pima County and are generally declining throughout their range (Status 2);
C. Species believed to be in jeopardy in Pima County, but are not considered to be at risk overall (Status 3); and
D. Species not believed to be at risk in Pima County, but should be considered for conservation by the SDCP because of their ecological or social importance (Status 4).

Information for each species is displayed in Tables 4A, 4B, 4C or 4D according to the criteria above. This list provides the focal point for discussions on species to be included within the Sonoran Desert Conservation Plan.

TABLE 4A
SPECIES OF CONCERN IN PIMA COUNTY
(NOT FEDERALLY LISTED)

SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
Pipilo aberti	Abert's Towhee	Eastern/Western	Limited distribution in Mexico; Found along Santa Cruz, Gila & Western Colorado River	Riparian habitat along surface water	High priority since range exists mostly within Pima County
Melospiza melodia	Songsparrow (subspecies)	Eastern/Western	Limited distribution in Mexico; range mostly within Pima County	Riparian communities along water	High priority for subspecies; subspecies has lighter shading
Aimophila carpalis	Rufous-winged Sparrow	Eastern	Northern edge of its range; distribution limited in Mexico	Desert grasslands (2400-3200 ft elevation)	Santa Rita Experimental Range has greatest populations
Chionactus occipitalis klauberi	Tucson Shovel-nosed Snake	Eastern	Formerly in Avra Valley	Upland valley floors at low elevation	Subspecies of Western Shovel-nosed Snake; last record in 1981
Sonora semiannulata	Ground Snake (valley form)	Western	Tobosa Grassland on Tohono O'Odham Nation	Desert grassland with clay loams or heavy silty clay loams	May be a subspecies; small numbers in Pima County occur with more common forms
Chionactus palarostris	Organ Pipe Shovel-nosed Snake	Western (Organ Pipe National Monument)	Very local in distribution		Subspecies of Sonoran Shovel-nosed Snake
Tryonia quitobaquitae	Quitobaquito Tryonia	Western (Quitobaquito and a few nearby springs)	Narrow distribution	Aquatic	
Sonorella xanthenes	Talus Snail	Western (Tohono O'Odham Nation)	Narrow distribution	Talus slopes	
Sonorella papagorum	Papago Talus Snail			Talus slopes	

TABLE 4A
SPECIES OF CONCERN IN PIMA COUNTY
(NOT FEDERALLY LISTED)

SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
Sonorella baboquivariensis berryi	Talus Snail	Eastern	Narrow distribution (1 known site)		More surveys and better taxonomy is required to better understand status
Zaitzevia parvula	Santa Rita Water Beetle	Eastern	Narrow distribution	Aquatic	Family Elmidae
Argia sabino	Sabino Creek Damselfly	Eastern	Narrow distribution	Aquatic	Family coenagrionidae

TABLE 4B
STATUS 2 SPECIES OF CONCERN IN PIMA COUNTY
(NOT FEDERALLY LISTED)

SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
Lasiuris borealis	Red Bat	Eastern	Broad range, but not very common	Foothills Riparian	Always has been low in numbers
Peromyscus merriami	Merriam's Mouse (Mesquite Mouse)	Eastern/Western (Papago & Quitobaquito)	Small range in Pima County; widespread elsewhere	Mesquite bosque	Numbers have plummeted in Pima County; more common in Mexico
Dasypterus egaxanthinus	Yellow Bat	Eastern/Western		Palm fronds	Little is known; some concern due to low #'s
Sorex arizonae	Arizona Shrew	Eastern (Santa Rita Mountains)	Very localized	Arizona springs in mountain ranges (5000-7000 ft)	Santa Rita population is gone, Very small numbers
Athene cunicularia	Burrowing Owl	Eastern	Widespread in range; local in distribution	Agricultural areas; Levees and Dikes	Declining numbers in Pima County
Buteo swainsoni	Swainson's Hawk	Eastern	Widespread; migratory	Grasslands for nesting	
Rana yavapaiensis	Lowland Leopard Frog	Eastern	Range has been reduced	Streams and ponds	AGFD sensitive and protected by State; threatened by loss of habitat, disease, and exotic species (bullfrogs)
Terrapene ornata luteola	Desert Box Turtle	Eastern		Desert Grasslands/Chihuahuan Desert Scrub	Still present at Buenos Aires National Wildlife Reserve and Empire Cienega Ranch as far north as I-10
Cnemidophorus burti stictogrammus	Giant Spotted Whiptail Lizard	Eastern	Formerly abundant in Sabino Canyon; extirpated from Santa Cruz	Riparian areas on flanks or flats	AGFD sensitive list
Cnemidophorus burti xanthonotus	Red-backed Whiptail Lizard	Western	Ajos, Tabletop and Javelina Mountains	Rocky slopes from 2000 to 4000 feet elevation	AGFD sensitive list

TABLE 4B
STATUS 2 SPECIES OF CONCERN IN PIMA COUNTY
(NOT FEDERALLY LISTED)

SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
Thamnophis eques	Mexican Garter Snake	Eastern		Perennial aquatic habitat with dense vegetation (cienegas and riverine marshes)	Likely to be listed as endangered; Extirpated from Colorado River and Yuma area; threats include loss of habitat and introduction of exotics
Pantosteus clarki	Desert Sucker		Eastern (formerly)	Aquatic	Occurred in Pima County in Santa Cruz River
Sonorella bagnarai	Bagnara's Talus Snail	Eastern (Rincon Mountains)		Talus slopes	
Sonorella pupela	Talus Snail	Eastern (Whetstones)			More surveys and better taxonomy is required to better understand status
Sonorella pyrgulopsis	Talus Snail				More surveys and better taxonomy is required to better understand status
Echinomastus erectocentrus var. erectocentrus	Needle-spined Pineapple Cactus	Eastern		Ls rock outcrop or alluvium derived from Ls	Rare, but not likely to be listed
Muhlenbergia dubioides	Box Canyon Muhly	Eastern (Box Canyon)	"Sky islands" (mountains)		Very rare plant; also found in Huachuca Mountains
Tumamoca macdougalii	Tumamoc Globeberry	Western; Tohono O'Odham Nation; Eastern		Bajadas with fine sandy or clayey loams; needs good summer rainfall	Delisted species; reduced habitat due to introduction of exotics (fountain grass, lovegrass); 5 year monitoring period

TABLE 4C
STATUS 3 SPECIES OF CONCERN IN PIMA COUNTY
(NOT FEDERALLY LISTED)

SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
Choeronycteris mexicana	Mexican Long-tongued Bat	Eastern	Northern end of its range	Roost and maternity sites along perennial and intermittent streams	Not very common, low numbers
Buteo nitidus	Grey Hawk	Eastern	Widespread; Northern edge of range	Riparian areas	15 to 20 pairs in Pima County
Caracara cheriway	Crested Caracara	Western/Eastern	Northern edge of range; widespread south of Az; also common in Texas	Sonoran Desert uplands	Breeding sites in Sells and Tohono O'Odham Nation
Buteo albonotatus	Zone-tailed Hawk	Eastern	Northern edge of range	Canyon Riparian areas	
Caprimulgus ridgwayi	Buff-colored Nightjar	Eastern (Catalina Foothills; CDO; TV)	Widespread	Riparian and riparian uplands	Abundant elsewhere
Progne subis	Purple Martin	Eastern	Widespread	Saguaro/Pinyon Pine communities	Cavity nests needed; at risk in Pima County
Trogon spp.	Trogon	Eastern/Western	Northern edge of range	Canyon riparian areas	
Senticolis triaspis (Elaphe triaspis)	Green Rat Snake		Widespread; common in Mexico and farther south	Productive riparian areas in mountains	
Lampropeltis getulus nigritus	Black Kingsnake	Eastern			
Neovansia striata	Dahlia Rooted Cereus				
Stenocereus thurberi	Organ Pipe Cactus	Western (Organ Pipe National Monument)	Widely distributed south of Pima County		

TABLE 4C
STATUS 3 SPECIES OF CONCERN IN PIMA COUNTY
(NOT FEDERALLY LISTED)

SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
Lophocereus schottii	Senita	Western (Organ Pipe National Monument)	Widely distributed south of Pima County		Less common in U. S. than the Organ Pipe Cactus; easy to cultivate; provides food for Long-nosed Bats
Triteleiopsis palmeri	Blue Sand Lily	Western (Cabeza Prieta; Pinta Sands)	Very narrow distribution; more common in Mexico	Sand dunes	Habitat invaded by exotics (Sahara Mustard); important culturally

TABLE 4D
STATUS 4 SPECIES OF CONCERN IN PIMA COUNTY
(NOT FEDERALLY LISTED)

SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
Colaptes auratus	Gilded Flicker	Eastern/Western	Endemic	Saguaro communities (needed for breeding)	Must use saguaro cavities created by others
Toxostoma lecontei	LeConte's Thrasher	Western	Local in distribution (Avra Valley & Cabeza Prieta)	Creosote flats; lower bajadas and desert lowlands with fine grained soils	Status is unknown due to no recent observations
Gopherus agassizii	Desert Tortoise	Eastern/Western	Widespread	Thermally buffered Sonoran Desert bajadas	Protected by State of Arizona; major problem is collection and release by humans; public education is recommended
Heloderma suspectum	Gila Monster	Eastern/Western	Widespread		Same as Desert Tortoise
Capsicum annuum var. glabriusculum	Chiltepin	Eastern		Riparian overstory of mesquite and hackberry	Foodplant; cultural importance
Agave murpheyi	Hohokam Agave	Western (Tohono O'Odham)			Found in gardens within Tohono O'Odham Nation; food-plant; cultural importance

5.0 HABITATS OF CONCERN & TARGET PLANT COMMUNITIES

Table 5 displays a list of habitats of concern and target plant communities for conservation within Pima County. Target habitats were determined though discussions during the interviews. Target plant communities were based on supplemental information provided by the Coalition for the Sonoran Desert Protection Plan with additions made by Pima County staff.

Aquatic habitats, wetlands and riparian woodlands are considered to be a high priority for conservation planning based on discussions during the interviews. These ecosystems are rapidly disappearing throughout the United States, including Pima County. Diversion of water and desiccation of these habitats has caused extirpation of at least five fish species in Pima County. A large number of species listed within this report either live in aquatic or riparian habitats, or utilize them in some way. Primary threats include groundwater pumping, which has reduced water tables needed to sustain these ecosystems, and the establishment of exotics or "invader species" which inhibit growth of native species.

Native grasslands were also mentioned by our informants as important to protect within Pima County. Grassland communities are rapidly disappearing throughout Pima County due to development pressures and poor land and fire management. Development causes fragmentation throughout these communities which depend on large tracts of undeveloped land to maintain a healthy existence. Introduction of exotics, lack of fire, and other activities (e.g. grazing livestock) have degraded grasslands and reduced species diversity. One specific grassland type mentioned by our informants as a conservation target is the big galleta grass (Hilaria rigida) association.

Although common in many areas of the Southwest, saltbush communities are another important habitat within Pima County which is gradually disappearing due to development pressures and agriculture. Saltbush (Atriplex polycarpa and A. canescens) occur within valley floors, where silty soils prevail. They provide good cover for small animals such as the shovel-nosed snake, and are a palatable browse for larger animals like the Sonoran Pronghorn.

Some habitats contain "indicator species" which identify climates, soil conditions, etc. that are favorable to listed and unlisted species mentioned within this report. Ironwood and Saguaro are two examples of indicator species mentioned in Table 7. Ironwood communities indicate areas that are thermally buffered, providing a suitable climate and habitat for species such as the desert tortoise. Saguaro communities indicate areas suitable for cavity nesters such as the Cactus Ferruginous Pygmy-owl and Gilded Flicker. Several informants recommended that attention should be focused on these indicator species and communities when determining critical habitat for listed and unlisted species in the SDCP.

TABLE 5
HABITATS OF CONCERN IN PIMA COUNTY

Target Plant Communities (Brown, Lowe and Pase Classification)[1]

- Sonoran Savanna Grassland (Mixed-root Perennial Grass) 144.31
- Sonoran Savanna Grassland (Grama Series) 144.32
- Sonoran Desertscrub (Creosotebush - Hilaria Series) 154.11
- Sonoran Desertscrub (Palo Verde - Mixed Cacti) 154.12
- Sonoran Desertscrub (Brittlebush - Ironwood) 154.17
- Sonoran Desertscrub (Saltbush Series) 154.17
- Int SW Riparian Deciduous Forest & Woodlands (Cottonwood - Willow) 223.21
- Int SW Riparian Deciduous Forest & Woodlands (Broadleaf) 223.22
- Sonoran Riparian/Oasis Forests (Mesquite Series) 224.52
- Sonoran Riparian/Oasis Forests (Cottonwood - Willow Series) 224.53
- Sonoran Deciduous Swamp/Riparian Scrub (Mixed Scrub) 234.71
- Sonoran Interior Marshland (Cattail Series) 244.71
- Sonoran Interior Marshland (Giant Reed Series) 244.72
- Sonoran Interior Marshland (Bulrush Series) 244.73
- Sonoran Interior Marshland (Threesquare Series) 244.74
- Sonoran Interior Strand (Mixed Scrub Series) 254.71
- Sonoran Interior Strand (Annual Series) 254.72
- Sonoran Inland Submergents (Pondweed Series 264.71)
- Sonoran Inland Submergents (Milfoil Series) 264.72
- Warm Temperate Grasslands (Tobosa Grass-Scrub Series) 143.12

Target Habitats for Conservation[2]

- Aquatic habitat/wetlands
- Valley floors at low elevations
- Grassland "islands" surrounded by desert scrub
- Grasslands
- Saguaro/palo verde habitats
- Riparian habitats
- Big galleta grass (Hilaria rigida); galleta-creosote
- Salt bush (Atriplex polycarpa and A. canescens)
- Cave habitats
- Roadside habitat
- Ironwood communities

1. This list based on Ecoregion Workshop (TNC, 1998), Coalition for Sonoran Desert Protection Plan and additions made by Julia Fonseca

2. Based on interviews

6.0 OTHER SPECIES DISCUSSED

Appendix B contains a list of a number of species which were discussed in the interviews, for which those interviewed had little concern regarding their status in Pima County. Most of the species on this list are commonly found in Pima County or are commonly found elsewhere and were never common in Pima County. A majority of these species would benefit under a conservation plan designed for threatened and endangered species (Table 1) and species of concern (Table 4).

7.0 EXOTIC SPECIES

A list of exotic species which occur in Pima County is located in Appendix C. This information is included within the report to highlight the need for proper management practices of our natural lands and for public education regarding the potential harm of introducing exotics to native ecosystems. Many of these species are associated with humans and human modified environments. Some of them can take over environments, creating monocultures which are very harmful to natural settings (i.e. Buffel Grass, Red Brome and Lehmann's Lovegrass are capable of changing fire frequency). Efforts such as cargo inspections of imported agricultural products, investigations of methods to reduce introductions through CAP water usage, and public education on the harms created by release of pets can help combat the invasion of exotics into Pima County's natural environment.

8.0 DISCUSSION

8.1 ESA Conservation vs. Unlisted Species Conservation

By adopting a broad conservation plan designed to protect unlisted species, not just those who are federally listed, Pima County would help prevent the need for future listings under the ESA. Many of Pima County's rare and unique habitats are slowly disappearing due to pressures by development and poor land management. Although some of these natural communities would be protected through the ESA, a majority would be left unprotected due to the lack of endangered species present. Planning for a wide range of plant and animal species will help insure protection of these other habitats and preserve the biological diversity which makes Pima County a unique place to live.

8.2 Conservation of Species vs. Habitat Conservation

The best way of protecting individual plant and animal species is by preserving the habitats upon which they depend. Interactions between the various plant and animal species that make up each specific ecosystem play a vital role in the health of those ecosystems. The loss or reduction of one species could greatly impact others in one way or another, thus changing the character of the environment in which they live. When species also depend on certain processes such as fire or floods to maintain their habitats, maintaining these processes or managing habitats will also be necessary.

8.3 Species vs. Subspecies

Some of the animals considered for protection under the SDCP are subspecies. Subspecies represents a taxonomic group below species which have developed some morphological or behavioral attributes that differ from the species due to geographical isolation. In many cases, the overall species is doing quite well, but the subspecies is in jeopardy of extirpation due to a smaller range and distribution. The ESA provides for protection of subspecies of plants and animals and even distinct population segments of vertebrate species. This brings up an important question of whether or not we should protect unlisted subspecies.

As mentioned above, subspecies have some different characteristics based on their isolation from other populations of the same species. These changes have evolved to allow the particular population of the species to adapt to the area in which it inhabits. Without the adaptations, the species could no longer exist in these isolated areas. By including subspecies within conservation planning, we not only protect these unique groups of plants or animals, but we also provide protection for the diversity that is the essential building block for evolutionary processes.

8.4 Taxonomic Uncertainties

For some species and subspecies, determining the status can be difficult due to the lack of current information available. This is especially true for snails, which were last known to be extensively collected for genus studies in the 1930's. Most of the records are considered to be poor, since the standards used then are inferior when compared to current methods. The lack of quality information has provided uncertainties when trying to distinguish between one particular genus and the other. For example, the San Xavier Talusnail is found to exist on one particular hillslope in Eastern Pima County. Another hillslope close by contains a population of talusnail which could be the same genus or might be a different one. (Bob McCord, personal communication).

8.5 Other Issues

Under Section 9 of the Endangered Species Act, the "take" of any federally listed animal is prohibited. However, there are no such protections for plant species listed under ESA. Outside federal lands, plants such as the Pima Pineapple Cactus can be removed or harmed without any penalty by federal law. For this reason, plant species could be given high priority under the Sonoran Desert Conservation Plan. Taking measures to conserve these plant species under SDCP will help provide the protection to them which is absent under the ESA. These measures might include local ordinances, changes to the Arizona Native Plant law, pre-listing agreements and changes to local, state or federal management.

In some cases, regulations brought forth by the ESA have hampered the recovery of federally listed animal species. This is especially true for the fish species, where reintroduction of unlisted species is easier than listed species which are less commonly found in the wild (Jeff Simms, personal communication). Provisions could be made within the SDCP to help insure and quicken the process of recovery of our threatened and endangered species, and to recover unlisted species though pre-listing agreements or local or federal management activities.

Exotics or "invader species" are of great concern when developing conservation measures designed to protect listed and unlisted species. Many invader species which establish themselves in the wild provide strong competition to native populations and, in many cases, completely take over the natural habitat. This can change ecosystems which are rich and diverse in plant and animal life to a sterile monoculture containing very few species and very little diversity. A majority of these invaders are established in developed areas (i.e. roadsides, urban ponds, agriculture, etc.) and expand into natural settings. Proper land management practices and public education would be key components added to the SDCP which could help combat problems associated with exotic species.

9.0 RECOMMENDATIONS

[Reserved for the STAT]

10.0 REFERENCES

Brown, D.E., 1982. The biotic communities of the American Southwest--United States and Mexico. Desert Plants (14): 1341.

Brown, D. E. and R. Davis, 1995. "One Hundred Years of Vicissitude: Terrestrial Bird and Mammal Distribution Changes in the American Southwest, 1890-1990" in Debano, L. F. et al., Biodiversity and management of the madrean archipelago: the sky islands of southwestern United States and northwestern Mexico. Sept. 19-23, 1994, Tucson, AZ. Gne. Tech. Rep. RM-GTR-264. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, 669 p.

Felger, R.S. and M.F. Wilson, 1995. "Northern Sierra Madre Occidental and Its Apachian Outliers: A Neglected Center of Biodiversity" in DeBano, L.F. et al., Biodiversity and management of the madrean archipelago: the sky islands of southwestern United States and northwestern Mexico. Sept. 19-23, 1994, Tucson, AZ. Gne. Tech. Rep. RM-GTR-264. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, 669 p.

Nabhan, G.P. and A.R. Holdsworth, 1998. State of the Desert Biome: Uniqueness, Biodiversity, Threats and the Adequacy of Protection in the Sonoran Bioregion. The Wildlands Project, Tucson, Arizona.

Omernik, J.M., 1987. Ecoregions of the conterminous United States. Map suppl. Annals of the Assoc. Fo Amer. Geographers (77): 118-125.

The Nature Conservancy and Instituto del Medio Ambiente y el Desarrollo Sustentable del Esado de Sonora (IMADES), 1998. Sonoran Desert Experts Workshop.

Warshall, Peter 1995. "The Madrean Sky Island Archipelago: A Planetary Overview," in DeBano, L.F. et al., Biodiversity and management of the madrean archipelago: the sky islands of southwestern United States and northwestern Mexico. Sept. 19-23, 1994, Tucson, AZ. Gne. Tech. Rep. RM-GTR-264. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, 669 p.

APPENDIX A

Attachment A

SONORAN DESERT CONSERVATION PLAN
GROUP 3 SPECIES FORM

Contributor's Name:_____ **Date:**_____

Additions to the List:

Species Name (English):_____

Linnaean Classification:_____

Briefly describe its range outside of Pima County: _____

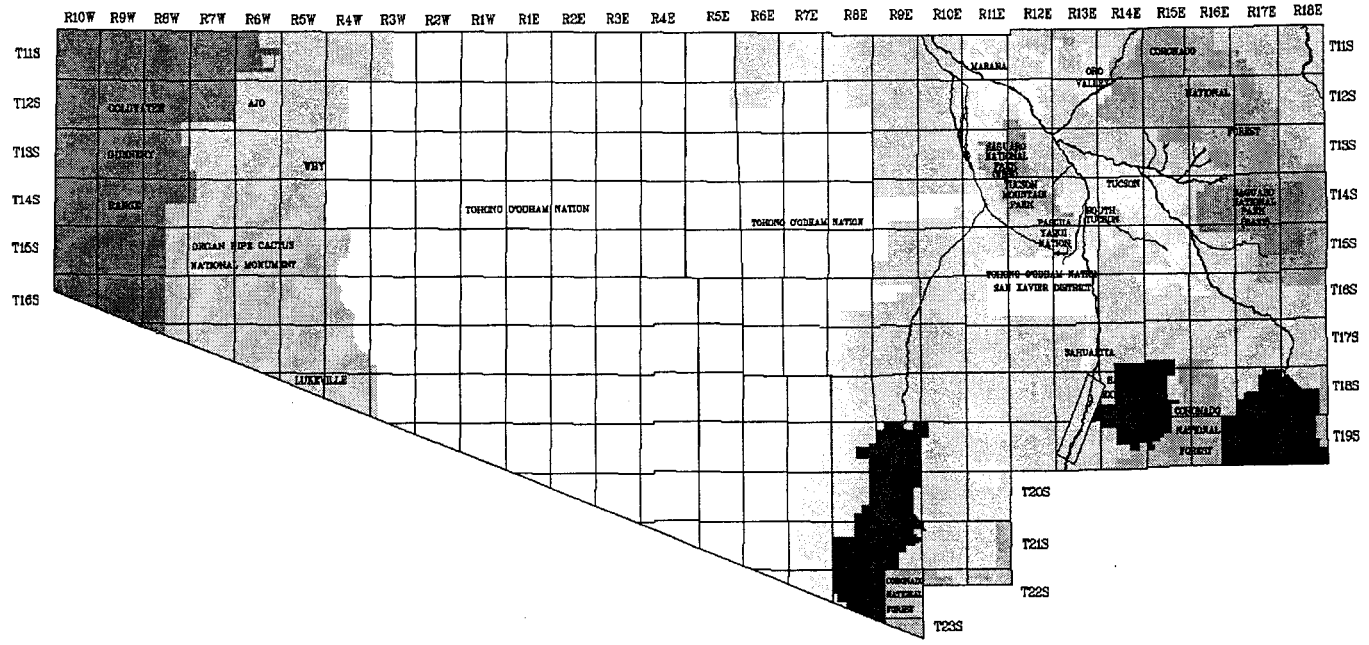
_____

_____

Please mark the map below to indicate the General Location in Pima County.

Many or few sites?

Western vs. Tohono vs. Eastern?



Attachment B
SONORAN DESERT CONSERVATION PLAN

TAXONOMY (LINNAEAN)	COMMON NAME	STATUS (IN PIMA COUNTY)				HABITAT NEEDS	COMMENTS
		Extirpated	At Risk of Being Extirpated	Discussed but Not at Risk	Exotic Species of Special Concern		

Other issues:

Environments in need of conservation:

APPENDIX B

APPENDIX B
OTHER SPECIES DISCUSSED

SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
Perognathus flavus		Eastern (Santa Rita Mountains)	Eastern edge of range		More common elsewhere
Perognathus amplus					
Perognathus longimethoris					
Sorex palustris	Water Shrew	Not in Pima County		Mountains near water	Found in White Mountains
Dipodomys spectabilis	Banner-tailed Kangaroo Rat	Eastern/Western	Scattered throughout Pima County		Very common
Antiloocapra americana chihuahuensis	Chihuahuan Pronghorn Antelope	Eastern	Introduced to Empire-Cienega	Grasslands (upland)	May have historically existed in Empire-Cienega
Thomomys spp.	Pocket Gophers	Eastern/Western			Not sure about status of subspecies within this genus, but overall they are very common
Lepus callotis	White-sided Jackrabbit				Not common in AZ
Macrotis californicus	California Leaf-nosed Bat	Eastern/Western			Very common in Pima County; roost in small clusters; move from site to site
Eumops perotis californicus	Greater Mastiff Bat		Widespread in range		Very common; roost in small numbers
Eumops underwoodii	Underwoods Mastiff Bat		Very localized; northern edge of its range		Few records in Mexico
	Southwestern Cave Bat		Localized		Very common

APPENDIX B
OTHER SPECIES DISCUSSED

SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
Vulpes macrotis	Kit Fox				At risk of significant reduction, but not extirpation
Sigmodon arizonae	Cotton Rat	Eastern		Weedy patches; grassland	Never was common
Neotoma mexicana	Santa Catalina Mountain Woodrat	Eastern			
Perognathus spp.	Silky Pocket Mouse			Grassland	Was much more common historically
Rallus limicola	Virginia Rail	Eastern/Western	Widespread	Cattail marshes (mostly man-made in Pima County)	Common elsewhere
Porzana carolina	Sora	Eastern/Western	Widespread	Cattail marshes (mostly man-made in Pima County)	Common elsewhere
Dendroica petechia	Yellow Warbler	Eastern	Widespread	Tall riparian habitat (Cottonwoods)	Abundant elsewhere
Passerina vericolor	Varied Bunting	Eastern (Tanque Verde, Cienega Creek)	Northern edge of its range	Higher elevation washes	
Melanerpes uropygialis	Gila Woodpecker	Eastern/Western	Endemic	Saguaro communities	
Polioptila melanura	Black-tailed Gnatcatcher				Very common
Amphispiza bilineata	Black-throated Sparrow				Very Common
Vireo bellii	Lesser Bell's Vireo	Not in Pima County			Found in California
Tyrannus malancholicus	Tropical Kingbird	Eastern	Northern edge of range	Tall riparian growth (thick cottonwoods)	Less common than Thick-billed Kingbird; very common south of Pima County

APPENDIX B
OTHER SPECIES DISCUSSED

SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
Tyrannus crassirostris	Thick-billed Kingbird	Eastern (San Pedro River near Reddington)		Tall riparian growth (thick cottonwoods)	Very common south of Pima County
Camptostoma imberbe	Beardless Tyrannulet	Eastern	Northern edge of range; limited distribution in Pima County	Dense riparian growth	Not a very common bird
Butorides striatus	Green Heron			Wetlands	Do not nest in Pima County
Dendrocygna bicolor	Black-bellied Whistling Duck		More common in Mexico	Wetlands	Nest in Santa Cruz County
Vireo vicinior	Gray Vireo	Eastern (near Reddington Pass)	Very local in distribution; southern edge of range	Oak and Pinyon Pine communities	No more than 4 to 5 breeding pairs in Pima County
Eumeces callicephalus	Mountain Skink	Eastern		Madrean canyons	
Bufo alvarius	Colorado River Toad				
Gastrophryne olivacea	Great Plains Narrow-mouth Toad	Eastern/Western	Northwestern edge of range	Temporary ponds required for breeding; adult habitat requirements are poorly known	Doing well in Pima County; very limited in Pinal and Maricopa
Bufo retiformis	Sonoran Green Toad	Eastern/Western	Northern edge of range	Temporary ponds required for breeding; adult habitat requirements are poorly known	Doing well in Pima County, but not as well in Maricopa and Pinal; not many records
Lampropeltis spp.	Desert Kingsnake	Does not occur in Pima County			

APPENDIX B
OTHER SPECIES DISCUSSED

SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
Pternohyla fodiens	Lowland Burrowing Treefrog	Eastern/Western	Less distribution than Sonoran Green and Narrow-mouth Toads	Temporary ponds required for breeding; adult habitat requirements are poorly known	Limited records; probably occur outside of Pima County but no records
Crotalus lepidus klauberi	Banded Rock Rattlesnake	Eastern (Santa Ritas)	Widely distributed East of Pima County	5000 ft elevation	Numbers are stable; also found in New Mexico and Mexico
Charina trivirgata trivirgata	Mexican Rosy Boa	Western (Organ Pipe, Tohono O'Odham)			Main problem is collection by humans and associated habitat loss
Oxybelis aeneus	Brown Vine Snake	Eastern (Arivaca Lake, Agua Caliente Cave in Sta Ritas)	Widely distributed south of Pima county	Normally found near water (Arboreal); also found in oak woodlands	Unknown status due to small number of records
Phrynosoma cornutum	Texas Horned Lizard	Eastern?	Widely distributed East of Pima County		1 record north of Whestone Mtns.
Sceloporus scalaris	Bunch Grass Lizard	Eastern (possibly near Empire Ranch)	Widely distributed East of Pima County	Very dependent on bunch grass in mountains or lower grasslands	Recent declines reported in Santa Cruz County, possibly due to overgrazing which removes bunch grasses necessary for healthy populations
Tantilla wilcoxi	Huachuca Black-headed Snake; this is the common name for subspecies T. w. wilcoxi	Eastern (Santa Ritas-Madera and Gardner Canyons)			Very poorly known

APPENDIX B
OTHER SPECIES DISCUSSED

SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT NEEDS	COMMENTS
Tantilla chiricahuensis	Chihuahuan Black-headed Snake; this is a common name for T. wilcoxi as a species	Eastern	May be more widely distributed south of Pima County		Very little is known
Ficimia cana	Western Hook-nosed Snake	Eastern (Empire Mtns and Santa Ritas)		Grassland (lowland)	Poorly known
Gydoyion quadrangulare	Thornscub Hook-nosed Snake	Not in Pima County	May be more widely distributed south of Pima County		Found in Santa Cruz County
Kinosternon flavescens	Yellow-bellied Mud Turtle	Western (Altar Valley, Tohono O'Odham)	Narrow distribution	Aquatic	Appears to be doing well
Agosia chrysogaster	Longfin Dace	Eastern (Cienega Creek)	Widely distributed	Aquatic	Very common
Perdita versis	Bee	Eastern (Baboquivari)			
Stinga morrisoni		Eastern (Empire Mountains, Baboquivari)	Edge of its range		
Cicindela oregona maricopa	Maricopa Tiger Beetle	Not in Pima County			
Heterelmis stephani	Stephan's Heterelmis Riffle Beetle	Eastern (Santa Ritas- Bog Spring)		Aquatic	
Ascia howarthii	Sulfur Butterfly	Western			Protected population in Organ Pipe
Chlorochroa rita	Santa Rita Mountain Chlorochroan Bug		May be at northern edge of range	Mountain riparian	Few collections
Castela emoryi (Holocantha)	Crucifixion Thorn		Widely distributed, but patchy	Floodplains and edge of floodplains	
Sophora arizonica	Arizona Necklace				

APPENDIX C

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EXOTIC SPECIES IN PIMA COUNTY

SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT FOUND	COMMENTS
Didelphis marsupialis var. mexicana	Mexican Opossum	Eastern (Arivaca area)	Northern edge of range; species is expanding its range from Mexico	Various	Not a species of concern, probably a natural range expansion
Mus musculus	House Mouse	Eastern	Widely distributed in urban settings	Urban - will expand into natural settings during population explosions; Agricultural areas	Not much concern - doesn't compete with natives
Homo sapiens	Humans	Eastern/Western	Global		
Canis spp.	Dogs	Eastern (urban periphery)	Global		
Felis spp.	Cats	Eastern (urban periphery	Global		
Bos taurus	Cattle	Eastern/Western	Global		
Sus scrofa	Pig	Eastern	Global	Riparian	San Pedro River
Sturnus vulgaris	Starlings	Eastern		Saguaro cavities (mostly in developed areas)	
Pennisetum ciliare	Buffel Grass	Eastern/Western	African origin; increasing in Mexico; invades from disturbed areas along roadways	Grasslands	Very bad for bird species in grassland communities
Ctenosaura pectinata	Spiny-tailed Iguana	Eastern (records near Sonoran Desert Museum and Catalina Mtns.)	Sonora	Aquatic	Not likely to spread according to some sources

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SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT FOUND	COMMENTS
Trachemys scripta	Slider Turtle			Aquatic	Expansion from urban ponds; released by humans
Pscudemys spp.	Red-bellied Turtle			Aquatic	Known from Maricopa County, not verified in Pima County; Expansion from urban ponds; released by humans
Chrysemys picta	Painted Turtle			Aquatic	"
Pseudemys concinna	Cooters			Aquatic	"
Graptemys spp.	Map Turtles			Aquatic	"
Chelydra serpentina	Snapping Turtle			Aquatic	"
Macrodemys temmrachi	Alligator Snapping Turtle			Aquatic	"
Trionye or Apalone spinefera	Spiny Softshell Turtle			Aquatic	Bad for native fish
Xenopus laevis	African Clawed Frog			Aquatic	Bad for native fish
Rana berbudieri	Rio Grande Leopard Frog			Aquatic	May arrive in Pima County via CAP Canal; may outcompete native leopard frogs
Rana catesbeiana	Bullfrog	Eastern		Aquatic	Efforts are underway to combat problem

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SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT FOUND	COMMENTS
Ambystoma tigrinum	Tiger Salamander	Eastern		Aquatic	No natives to compete with; may cause damage to pupfish and topminnow populations
Gambusia affinis	Mosquito Fish	Eastern			
Orconecta virilus and others	Crayfish	Eastern		Aquatic	Jeanette Carpenter (USGS) is studying these
	Yellow Bullhead		Found in isolated water bodies	Aquatic	
	Black Bullhead			Aquatic	Check with Will Hayes AGFD
Lepomis cyanellus	Green Sunfish	Eastern (Sabino Canyon)		Aquatic	
Corbicula	Asian Clam				
Helix aspersa	Escargot Snail	Eastern	Widely distributed in residential areas		
Viviparus chinensis	Mystery Snail	Southeastern		Aquatic (cold water); does not like warm water	Introduced in aquarium trade
Otala Lactea	snail			Gardens	
Rumina decollata	snail			Gardens	
Lamellaxis gracilis	snail			Gardens	
Oxychilus draparnaldi	snail			Gardens; Plant Nurseries	

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SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT FOUND	COMMENTS
Limax valentianus	snail			Aquatic	
Vallonia pulchella	snail			Land	
Radix auricularia	snail			Aquatic	
Pseudosuccinea columella	snail			Aquatic	
Biophalaria havanensis	snail			Aquatic	
Succinea campestris	snail	Western	Very isolated		
Apis melliflera	Honey Bee	Eastern/Western	Widespread	Desert; riparian	Includes Africanized and European bees
Tamarix chinensis	Tamarisk	Eastern/Western		Riparian	
Eragrostis lehmaniana	Lehman's Lovegrass	Eastern		Grasslands	Abundance of this grass depresses natives; affects fires
Brassica tournefortii	Sahara Mustard	Western (Cabesa Prieta, Pinta Sands)	Widely		
	African Daisy	Eastern (Tucson Mtns and Santa Cruz River)			Displaces native annuals; plant to watch out for
Euryops multifidus	Sweet Resin Bush	Santa Rita Experimental Range			
Pennisetum setaceum	Fountain Grass				
Erodium cicutorium	Filaree				
Bromus rubens	Red Brome				

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SCIENTIFIC NAME	COMMON NAME	LOCATION IN PIMA COUNTY	DISTRIBUTION	HABITAT FOUND	COMMENTS
Salvinia				Aquatic	Exotic that displaces native aquatic ecosystems